Journal of Acute Disease

Original Article

doi: 10.4103/2221-6189.330740 jadweb.org

Effect of triage on physicians´ clinical decision: A prospective, observational, single-center and cross-sectional study

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ABSTRACT

Objective: To investigate the effect of the use of color codes for patient triage on physicians' clinical decision.

Methods: This prospective study was conducted among female patients aged 18-65 years who visited the emergency department (ED) with complaints of acute abdominal pain. A 3-level of triage system [red (very urgent), yellow (urgent) and green (less urgent)] was used in our ED. All patients were green level. Half of these patients remained at the green level (the green group), and the remaining patients were re-labeled as false yellow (the false yellow group) in the order of ED visits. Ordering tests, consultation requests, intravenous treatment, length of hospital stay, and cost were compared between the two groups of patients.

Results: In total 393 patients were included with 198 patients in the green group and 195 in the false yellow group. There was no statistically significant difference between the two groups in age, temperature, systolic blood pressure, diastolic blood pressure, pulse and oxygen saturation (P>0.05). It was observed that more tests (P=0.001), consultations (P<0.001), and intravenous treatment were requested (P<0.001), and the duration of stay in the ED was longer (P<0.001) and cost (P<0.001) was higher in the false yellow group.

Conclusions: Triage do affect the decisions of physicians on female patients with acute abdominal pain.

KEYWORDS: Emergency department; Triage; Physicians; Cognitive biases

1. Introduction

Emergency departments (EDs) are an indispensible section of hospitals, which provide emergency services around the clock, and everyone can visit without an appointment, and social or economic discrimination. However, ED is always overwhelmed by the the constantly increasing visits, which has already become a big concern all over the world[1,2]. The number of ED visits in the United States increased from 128.97 million in 2010 to 144.82 million in 2016, and ED visits increased by 12.29% compared to the population growth of 4.6%[3]. From 2013 to 2017, the rate of ED visits per person increased from 1.12/year[2] to 1.26/year[4] in our country. One of the most common complaints leading the patient to the ED is acute abdominal pain (AAP), accounting for 7%-10% of all ED visits[5]. Given the challenges of differential diagnoses of AAP, it can lead to negative consequences or medico-legal litigation.

A triage system is one of the most important shields of an overcrowded ED and health system with scarce resources in the face of unlimited demand. Triage in ED benefits such as immediate evaluation of patients at the time of visit, receiving

Significance

Physicians working in the emergency department often have to make quick decisions because they have to deal with a large number of patients in a limited time. Psychologists have stated that quick decision making is supported by intuitive methods, which, however, can often mislead us. This study highlights the impact of labeling patients in triage assessment on physicians' clinical judgment.

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How to cite this article: Aydın H, Dogan H. Effect of triage on physicians' clinical decision: A prospective, observational, single-center and cross-sectional study. J Acute Dis 2021; 10(6): 227-232.

Article history: Received 7 April 2021; Revision 16 July 2021; Accepted 20 August 2021; Available online 30 November 2021

appropriate care for the patient's clinical needs and ensuring that department resources are applied in the most useful way for this purpose, relieving patient flow and infection control[6-8]. However, triage staff and doctors working in the ED often have to make quick decisions as they need to deal with a medical emergency or a large number of patients within a limited time. Psychologists have stated that quick decision making is supported by intuitive methods, but they also pointed out that these intuitive methods can often mislead us[9]. Good decision-making can become even more difficult under the influence of a variety of cognitive biases[10]. Clinical judgment is susceptible to all the flaws of human reasoning[11]. Previous studies have shown that doctors' clinical decision can be influenced by demographic characteristics[12,13], concerns about possible legal consequences[14], clinical experience[15], time pressure[15,16], working environment[12,17], ease of access to medical facilities[15,16,18] and health policies of countries/organizations[15, 19]. However, we rare data about the influence of triage on the judgement of physicians in previous studies[12-15]. The aim of this study is to examine the effect of triage on the clinical decision of physicians on patients with acute abdominal pain.

2. Participants and methods

2.1. Study design and setting

This prospective, observational, single-center and cross-sectional study was conducted in the Emergency Medicine Department, University of Health Sciences, Bakırköy Dr. Sadi Konuk Training and Research Hospital, İstanbul, Turkey between December 2019 and February 2020. This hospital is a tertiary training and research hospital, and a level 1 trauma center, STEMI center and stroke center that is host to multiple medical and surgical residency including emergency medicine residency. There are 612 beds in the hospital, and the annual number of ambulance visits to the ED is approximately 20 000, and all ED visits are approximately 300 000.

2.2. Participants

2.2.1. Triage staff

The triage of the patients is performed by nurses who have received triage training organized by the Ministry of Health and have at least 2 years of ED experience.

2.2.2. Physicians

Emergency physicians with similar age and clinical experience (1-2 years) who worked in the ED were included in this study.

2.2.3. Patients

To standardize the study, we included patients with similar demographic (specific age range, single-sex) and clinical characteristics that a chief complaint with acute abdominal pain (ICD-10 parent code R10, abdominal and pelvic pain). Only paients examined by four different predetermined emergency physicians were included in the study. The inclusion and exclusion criteria are shown as follows:

Inclusion criteria included (1) Patients classified as green during routine triage assessment; (2) Patients aged 18-65 years old; (3) Female patients (The only gender was preferred so that the study was not affected by different preliminary diagnoses, such as ovarian pathologies or pregnancy); (4) Patients who suffer from non-traumatic abdominal pain; (5) Patients without known pregnancy; (6) Patients without history of intra-abdominal operation; (7) Patients who started their complaints within 7 d; (8) Patients without nausea, vomiting and/or diarrhoea complaints; (9) Patients without pain in different parts of the body (head, chest, and legs); (10) Patients who approved for participation in the study; (11) Visual analogue score (VAS)$\leqslant$4. VAS is a scale used to determine the pain intensity experienced by individuals. Cut-off points for the VAS: no pain (0), mild pain (1-4), moderate pain (5-7), and severe pain (8-10).

Exclusion criteria included (1) Patients were categorized as yellow or red; (2) Patients with newly detected pregnancy; (3) Patients hospitalized not due to acute abdomen diagnosis; (4) Male patients; (5) Patients examined by physicians other than those we have determined; (6) Patients whose data cannot be accessed or who voluntarily left the clinic.

2.3. Ethical approval

Health Sciences University Bakırköy Dr. Sadi Konuk Training and Research Hospital Ethics Committee approved the study (Ethics Committee Decision number: 2019-23-09).

2.4. Triage processes

A 3-level (3L) triage system is applied in our ED[20]. In the triage system of 3L, patients are categorized as red, yellow and green based on their vital risks and the maximum time required for medical intervention. The red colour code refers to critical patients with life-threatening conditions that require a simultaneous evaluation and urgent treatment. The yellow colour code refers to patients with life-threatening potential, risk of limb loss, and a significant morbidity rate, but can stand by for a certain period of time. The green colour code refers to the patients with the general condition is stable and whose outpatient treatment can be provided, and who have simple health problems that do not pose morbidity or life-threatening with waiting for 1-4 hours. All patients who visited the ED of our hospital are first greeted by the medical staff in the triage area. In triage assessment, patients with red colour are taken to the red area without waiting. Other patients are categorized as yellow or green and are examined by the same physicians in the same area. Patients labelled yellow are taken to the examination room primarily, while patients categorized as green are taken to the waiting area for examination.

2.5. Grouping

Green-labelled patients who met the inclusion criteria were re-divided into two groups in order of application. One of the groups were labelled as yellow, and included into the false yellow group, and the remaining patients were included into the green group. Physicians were not informed of "true/false" yellow. Referring to blindness, it was ensured that the triage staff were not aware of the which physicians would examined the patients, and the physicians were not aware of which patients to be included in the study, the researcher collecting data was not aware of who examined the patients.

2.6. Data collection

The patient's age, hemodynamic parameters, VAS, desired blood, urine and imaging surveys, tests, consultations, treatment, cost and the duration in ED were recorded. None of the patients included in the study visited another health institution with similar complaints.

2.7. Statistical analysis

All the statistical analyses were carried out using SPSS 25.0 software. Shapiro-Wilk test was performed for the normality of the sample data, and the continuous variables were very highly skewed distributions, so standard parametric methods were not applicable. We used medians and interquartile range (IQR) to describe and estimate differences between groups. Categorical variables were expressed as frequency and percentage. Mann-Whitney *U* test was used to compare continuous data and *Chi*-square (χ^2) test was used to compare categorical data. The significant level of this test was set at α=0.05.

3. Results

Data of 424 patients who met the inclusion criteria were obtained during the study. However, 31 patients excluded from the study because 6 patients were newly diagnosed with pregnancy, 13 patients were diagnosed with acute abdomen during the ED follow-up and hospitalization, 12 patients were not available and left the clinic voluntarily. Finally, 393 patients were included in the study with 198 patients in the green group and the 195 patients in the false yellow group (Figure 1).

There were no statistically significant differences in age (P=0.272), fever (P=0.482), systolic blood pressure (P=0.144), diastolic blood pressure (P=0.264), pulse (P=0.139) and oxygen saturation (P=0.980), and VAS scores (P=0.603) in the false yellow group (Table 1).

When we evaluated the results of laboratory tests and consultations, it appeared that more tests (P=0.001) and consultations (P<0.001) were requested in the false yellow group. At the same time, the number of consultations requested from both obstetrics & gynecology (P=0038) and general surgery clinics (P<0.001) is higher in the false yellow group. In addition, in the false yellow group, more patients were treated intravenous medicine for symptoms in the ED (P<0.001) (Table 2).

When we examined the length of patients' stay (LOS) in the ED, it was seen that the LOS in the ED of the false yellow group were significantly longer (P<0.001). Similarly, the cost of the false yellow group were significantly higher compared to the green group (P<0.001) (Table 2).

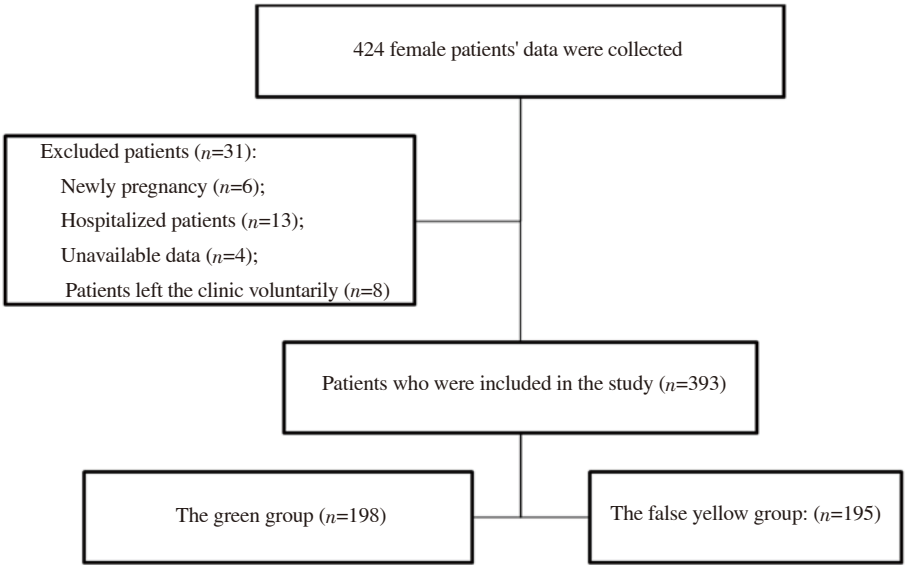

Figure 1. The study flowchart.

Table 1. Demographic and baseline information of the patients in different triage groups.

Variables	Overall, median (IQR)	Green group, median (IQR)	False yellow group, median (IQR)	*U*	*P*
Age, years	35.0 (24.0-46.5)	33.5 (24.0-45.0)	37.0 (24.0-47.0)	18113.5	0.272
Temperature, ℃	36.4 (36.2-36.5)	36.4 (36.2-36.5)	36.4 (36.2-36.4)	18541.0	0.482
SBP, mmHg	124.0 (119.0-133.0)	124.0 (119.0-132.0)	125.0 (119.0-134.0)	17663.0	0.144
DBP, mmHg	78.0 (73.0-83.0)	78.0 (72.0-83.0)	78.0 (74.0-84.0)	18048.5	0.264
HR, beats/min	81.0 (73.0-92.0)	80.0 (73.8-91.0)	83.0 (73.0-92.0)	17640.5	0.139
SpO_2, %	97.0 (96.0-98.0)	97.0 (96.0-98.0)	97.0 (96.0-98.0)	19277.0	0.980
VAS	2.0 (0.0-4.0)	2.0 (0.0-4.0)	2.0 (0.0-4.0)	18757.0	0.603

DBP: Diastolic blood pressure; SBP: Systolic blood pressure; HR: Heart rate; SpO_2; Oxygen saturation; VAS: Visual analogue scales.

Table 2. Comparions of tests, treatment, consultation, cost, and length of stay between the two groups.

Variables	Overall, *n*=393	Green group, *n*=198	False yellow group, *n*=195	χ^2/U	*P*
Any test, *n* (%)	369 (93.9)	178 (89.9)	191 (97.9)	11.102	0.001
Blood test, *n* (%)	364 (92.6)	175 (88.4)	189 (96.9)	10.482	0.001
Hemogram, *n* (%)	361 (91.9)	172 (86.9)	189 (96.9)	13.278	<0.001
Biochemistry test, *n* (%)	357 (90.8)	171 (86.4)	186 (95.4)	9.608	0.002
Troponin, *n* (%)	151 (38.4)	58 (29.3)	93 (47.7)	14.057	<0.001
D-Dimer, *n* (%)	13 (3.3)	2 (1.0)	11 (5.6)	6.587	0.010
B-Hcg, *n* (%)	244 (62.1)	110 (55.6)	134 (68.7)	7.231	0.007
Urinalysis test, *n* (%)	312 (79.4)	147 (74.2)	165 (84.6)	3.217	0.051
X-Ray, *n* (%)	248 (63.1)	100 (50.5)	148 (75.9)	27.207	<0.001
Chest X ray, *n* (%)	226 (57.5)	87 (43.9)	139 (71.3)	30.057	<0.001
Abdominal X-Ray, *n* (%)	213 (54.2)	85 (42.9)	128 (65.6)	20.415	<0.001
Abdomen CT, *n* (%)	25 (6.4)	5 (2.5)	20 (10.3)	9.858	0.002
USG, *n* (%)	195 (49.6)	74 (37.4)	121 (62.1)	23.933	<0.001
Abdomen USG, *n* (%)	184 (46.8)	70 (35.4)	114 (58.5)	21.069	<0.001
Pelvic Doppler USG, *n* (%)	87 (22.1)	30 (15.2)	57 (29.2)	11.298	0.001
Intravenous treatment, *n* (%)	283 (72.0)	121(61.1)	162 (83.1)	23.518	<0.001
Consultation, *n* (%)	68 (17.3)	21 (10.6)	47 (24.1)	12.507	<0.001
General surgery, *n* (%)	36 (9.2)	4 (2.0)	32 (16.4)	24.448	<0.001
Obstetrics & gynecology, *n* (%)	47 (12.0)	17 (8.6)	30 (15.4)	4.313	0.038
Cost, median (IQR)	109.0 (77.0-140.0)	90.0 (67.0-122.0)	127.0 (100.0-160.0)	10684[a]	<0.001
LOS in ED, min, median (IQR)	130.0 (100.0-190.0)	110.0 (80.0-132.5)	180.0 (120.0-300.0)	8553[a]	<0.001

CT: computer tomography; ED: Emergency deparment; LOS: Length of stay; USG: Ultrasography (abdomen, pelvic doppler); [a]: Mann-Whitney *U*.

4. Discussion

Triage is an essential element of modern medical care and EDs, where we better understand its value, especially in cases of pandemics and disasters. The principal purpose of the ED triage is to ensure that the patient receives care at a level and quality appropriate to her clinical need (clinical justice), and the departmental resources are applied in the most useful way for this purpose[8]. On the other hand, recent disappointments in the ED as a result of increased demand and access barriers have brought to question on the continued benefits and value of triage systems[21,22]. Some have suggested that triage assessments can identify patients who need be referred to other departments, thereby reducing overcrowding in EDs. However, Schull *et al.* showed that low-complexity patients were associated with negligible increases in LOS in the ED and other performance indicators, thus it is not the cause of ED crowding[23].

In this study, our main purpose is to observe the impact of triage classification on the clinic decision of physicians in a presentation complaint (abdominal pain). For this purpose, the patients were evaluated based on the requested examinations and consultations, LOS in the ED and cost parameters.

Considering that the decision to order tests in patients was ultimately in the physician, it is not surprising that the factors affecting the test request were most physician-related factors. Studies suggest that doctors with more clinical experience, confidence in their clinical judgment[13,15,18], pride in their work[15], and who do not fear risk-taking or uncertainty[15,18,24] tend to request fewer tests than those who dislike uncertainty and have less experience. In addition, physician demographics appear to be affecting ordering tests. However, the results of two studies on this issue were inconsistent: one explained that younger doctors and male doctors tended to order fewer tests[13], while the other found that older doctors ordered fewer[12]. Furthermore, doctors in private or small offices tend to require more tests than group practices[12,17]. It has been shown that physicians who were given feedback about their colleague's ordering test rates reduce their test demand[17,24].

Previous studies have shown that many factors affect the physician's approach to the patient. In particular, cognitive biases affect the diagnostic process as a whole and therefore inevitably have an effect on ordering tests[25,26]. Both time pressure[15,16,27] and fear of litigation[15,27] have been shown to lead to more tests orders. Lawsuits place a greater financial burden on doctors; in addition, doctors spend time and effort defending themselves and can seriously damage a doctor's reputation[28]. Many doctors can

be overly conservative in deciding for their patients because they fear they will be sued by patients and see their patients as potential plaintiffs[14]. In a study conducted in Pennsylvania, a significant portion of the physicians participating in the study (93%) reported that they practiced defense medicine[29]. An additional influence may be the physician's perception of test accuracy. For example, a survey of Canadian neurologists found that 92% routinely order magnetic resonance imaging (MRI) scans in patients with suspected multiple sclerosis, and 93% felt that MRI was "very useful" for the workup of these patients[30]. It appears that the decisions made by physicians, who are highly trained professionals, in terms of collecting evidence and treatment are also sensitive to bias[11,14,25]. Prejudices can occur at every stage of doctors' interactions with patients[31]. There is no surefire method to eliminate bias in medical decision making, but there are some positive signs that adopting an evidence-based medicine approach can improve the quality of doctors' reasoning. Evidence-based medicine can be very helpful at reducing bias in the stages of gathering evidence and choosing treatments because it provides valid and current information on disease characteristics, coordinates efforts of an interdisciplinary team, reduces deviations from optimal practice and identifies gaps in current knowledge[32]. A number of studies have shown that the use of clinical guidelines and policy recommendations[33,34] or a structured test order form decreases the physicians' test request[12,18,33]. One of a related factor affecting test demand is the ease of access to tests. Three qualitative studies reviewing primary care physicians reported that the differences in ordering tests were caused by local and national policymakers or the organization of the institution[15,16,18], and this is beyond the direct control of the individual physician.

In our study with physicians who work under the same conditions with similar age and clinical experience showed no significant difference in terms of application complaints, vital parameters, and outcome between patients with similar clinical conditions. Only, there was a difference in the color given to the patients in the triage. In our study, it was observed that doctors were affected by the categorization performed in triage, and more examinations and consultations were requested in patients whose urgency level was labelled as high in triage than in other patients. It has been observed that this leads to higher cost and longer stays in the ED of patients. Therefore, it must be kept in mind that triage assessment may affect the clinical approach of the physician, may create a vulnerability to show the patients the care they deserve or may cause excessive attention, examination and emergency service intensity. However, all doctors should be aware of the potential pitfalls in making medical decisions and take steps to avoid biases.

There are some limitations to our study. Firstly, this was a single-center study executed on a relatively small population, so the results needs to be confirmed in a larger, multi-center cohort. Second, we conducted our study only through patients who were cared about by four physicians. Other physicians could not be included in the study because they had a wide range of ages and clinical experience, or because they were people who served in different units during the study. In addition, no matter how much we want to standardize patients and doctors, the clinical decision can be influenced by many factors.

As a result, the decision to order a test belongs to the doctor in consultation with the patient. In addition to previous studies, we have shown that labelling in triage, like many other factors, will affect the physician's decision. Ignoring these factors and focusing solely on test accuracy risks will miss out on the diagnostic facts in clinical practice. It is clear that further study will be worth the effort to reduce potential bias and improve the quality of medical decision-making when physicians are making diagnostic and treatment decisions.

Conflict of interest statement

The authors report no conflict of interest.

Authors' contributions

H.A: Concept and design of study, acquisition of data, drafting the article; H.D.: Acquisition of data, critically revised the work.

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