

# EAJEM

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The journal aims to publish scientifically high quality articles which can contribute to the literature and written in the emergency medicine field and other related fields. Review articles, case reports, editorial comments, letters to the editor, scientific letters, education articles, original images and articles on history and publication ethics which can contribute to readers and medical education are also published.

The journal's target audience includes Emergency Medicine experts, School members who conduct scientific studies and work in the Emergency Medicine field, researchers, experts, assistants, practicing physicians and other health sector professionals.

Editorial and publication processes of the journal are shaped in accordance with the guidelines of the international organizations such as the International Council of Medical Journal Editors (ICMJE), the World Association of Medical Editors (WAME), the Council of Science Editors (CSE), the Committee on Publication Ethics (COPE), the European Association of Science Editors (EASE). The journal is in conformity with Principles of Transparency and Best Practice in Scholarly Publishing ([doaj.org/bestpractice](http://doaj.org/bestpractice)).

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Editorial and publication processes of the journal are shaped in accordance with the guidelines of the international organizations such as the International Council of Medical Journal Editors (ICMJE), the World Association of Medical Editors (WAME), the Council of Science Editors (CSE), the Committee on Publication Ethics (COPE), the European Association of Science Editors (EASE). The journal is in conformity with Principles of Transparency and Best Practice in Scholarly Publishing ([doaj.org/bestpractice](http://doaj.org/bestpractice)).

Originality, high scientific quality and citation potential are the most important criteria for a manuscript to be accepted for publication. Manuscripts submitted for evaluation should not be previously presented or published in an electronic or a printed medium. Editorial Board should be informed of manuscripts that have been submitted to another journal for evaluation and rejected for publication. Submission of previous reviewer reports will expedite the evaluation process. Manuscripts that have been presented in a meeting should be submitted with detailed information on the organization including the name, date and location of the organization.

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**Keywords:** Each submission must be accompanied by a minimum of three and a maximum of six keywords for subject indexing at the end of the abstract. The keywords should be listed in full without abbreviations.

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Type of manuscript	Word limit	Abstract word limit	Reference limit	Table limit	Figure limit
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Case Report	1500	200	10	No tables	10 or total of 20 images
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Clinical Imaging/ Visual Diagnosis	400	N/A	5	No tables	3 or total of 6 images
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# COVID-19: What Should We Do in Future Crises? The Leadership Role and Scope of Nurses in a Health Disaster: A Scoping Review

© Fariba Asgari<sup>1</sup>, © Latif Panahi<sup>2</sup>, © Somaye Pouy<sup>3</sup>

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## Abstract

**Aim:** The present study surveys the available evidence regarding the role and scope of nursing leadership in disaster and emergencies.

**Materials and Methods:** This scoping review was carried out between 2010 and 2020 through a series of databases including Embase, Scopus, CINHAL, Web of Science, Cochrane Library, PubMed, ProQuest, and Google Scholar with keywords of “leadership,” “nursing,” “competency,” “disaster,” and “emergency”.

**Results:** Seven articles met the inclusion criteria of the scoping review. Three main research questions were addressed, relating to the role of nursing leadership in times of disaster, the skills required of a nursing leader, and the strategies recommended for promoting nursing leadership during a disaster or pandemic.

**Conclusion:** This study shows that nurses are a vital part of the healthcare system in times of disaster and that nursing leaders provide valuable services for maintaining individual and community health. Given that there is no agreement in the existing research as to which competencies are required of nursing leaders in times of disaster, more researches must be developed to enhance the effectiveness of nursing leaders in future disasters and pandemics.

**Keywords:** Leadership, disaster, pandemic, health system, nurse

## Introduction

The coronavirus disease-2019 (COVID-19) pandemic began in December 2019 in Wuhan, China, and quickly spread around the world (1-3). According to the latest available statistics from August 1, 2020, 17,396,943 people in the world are currently infected with this disease (4). The COVID-19 infection can cause very mild to very critically infection in people and the most important intervention for treatment of critically ill patients seems to be the level of standard care and appropriate and early diagnosis and treatment (5).

The World Health Organization has described COVID-19 as both an emergency and a critical disaster for human health (6,7). Disasters demand special attention because they are sudden, disruptive, and involve considerable uncertainty. When a disaster occurs, the functioning of healthcare systems is often disrupted because there are so many victims in comparison to shortage of staff and resources (8). In these situations, nurses face new challenges and must set appropriate goals to ensure that the quality of their care is consistent. So new health leadership teams may be formed quickly to manage a disaster, even if team members lack the necessary leadership skills. Health team leaders often make



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quick decisions without having the required facilities available (9). In times of extreme stress, leaders must be able to identify the disaster, make effective decisions, develop appropriate communications, and balance existing resources—all despite a lack of time and information. Throughout history, leaders in healthcare systems have not performed well in response to complex and sudden disasters like the Anthrax epidemic in 2001 or H1N1 in 2009.

To some extent, this has resulted from a lack of standard protocols (10). In healthcare teams, nurses are at the front line of care, providing a wide range of services in critical situations and with limited resources; they are recognized as first responders, care providers, and service and information coordinators (9). The importance of nurses is evident in a disaster, as nurses make up the most substantial proportion of the healthcare community providing care (11). Therefore, effective leadership is especially crucial in preparing for disasters. Disaster leaders can only be successful if they have the necessary skills and abilities to manage the situation. The COVID-19 pandemic has forced nursing leaders to take a new approach because of changes in emergency care quality, workload, lack of staff availability, and special needs for coordination and management (12). Given that there have been several gaps in effective leadership in nursing during disasters such as COVID-19 pandemic, the present study is designed to provide evidence of nursing leaders' roles and scope and provide the necessary tips for improving effective leadership during a disaster.

## Materials and Methods

In the present study, the Scoping review approach was used to identify nursing leadership during disasters. Scoping review is a study that examines the domain and the extent of a particular topic in different literatures. Using this type of study, we will be able to examine newly available evidence about a specific topic (13). In this study, Joanna Briggs Institutes' protocol for scoping reviews was used to design and conduct this study (14).

## Determining Research Questions

The research questions in this study were based on Joanna Briggs Institute's guidelines, which is specifically designed for scoping review studies. PCC mnemonic means 'Population, Concept, and Context', which is specifically designed for scoping review studies and helps to adjust the research question according to the title of the research, purpose and inclusion criteria of the study (15). For this purpose, the main keywords used in this study based on PCC format were: nurse (person), the role of nursing leadership or the role of the nurse in disaster leadership or the main skills of nurses in the role of disaster leadership (concept) and disaster (context) (Table 1).

## Data Collection

In the present study, a comprehensive search was done in medical databases including Embase, Scopus, CINAHL, Web of Science, Cochrane library, PubMed, ProQuest, and Google Scholar with the keywords according to the MeSH and also through manual searching in library books, dissertations and related journals from 2010 to 2020.

In scoping review studies, the inclusion and exclusion criteria are usually selected based on the characteristics of PCC (person, concept, and context) and the type of published studies. Therefore, in this study, the inclusion criteria were any qualitative full-text articles related to the role of nursing leadership during disasters and pandemics that have been published in English language. Exclusion criteria were articles that focused on nursing leadership in non-crisis situations, as well as articles that have been published as a letter to the editor, correspondent, quantitative study or those that we did not have access to their full text.

In this study, Joanna Briggs Institute's (2017) guideline was used to gather available evidence. According to Joanna Briggs Institute's (2017) guideline, a three-step approach including initial search in at least two databases to identify keywords, a comprehensive search in databases, and additional searches in the list of

**Table 1. PCC, terms and keywords used in present study**

PCC	Terms	Keywords
Population	Nurses	Nurse Nurses Nursing
Concept	Nursing leadership	Leadership Management Competencies
	Nursing leadership role	
	Main competency of nurses in leadership	
Context	Emergency situation	Disaster Emergency
	Disaster condition	

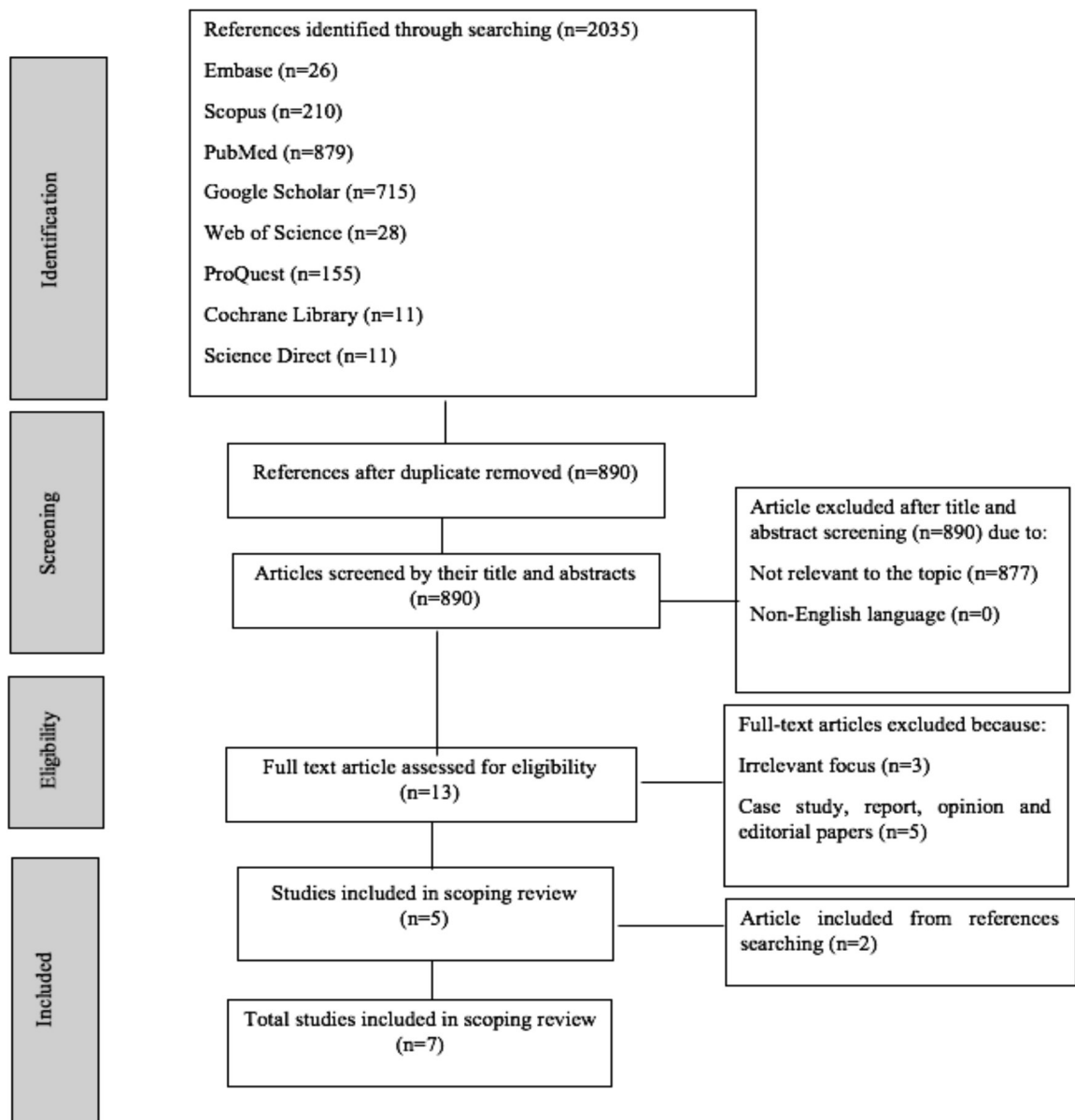
PCC: Population, concept, and context

article's references was performed (15). The search process in various databases is provided in the Preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow chart (Figure 1). The characteristics of included studies are presented in Table 2. In order to assess quality of evidence, we used GRADE evaluation as high (there is a lot of confidence that the true effect lies close to that of the estimated effect), moderate (there is moderate confidence in the estimated effect: The true effect is likely to be close to the estimated effect, but there is a possibility that it is substantially different), low (there is limited effect in the estimated effect: The true effect might be substantially different from the estimated effect), very low (there is very little confidence

in the estimated effect: The true effect is likely to be substantially different from the estimated effect) (16,17).The results of GRADE evaluation are presented in Table 2.

### Data Analysis

In this study, Bengtsson's approach to inductive content analysis was used to ensure the precise and objective interpretation of the texts. First, the articles were read carefully several times, and the answers to the research questions were extracted (18). From these answers, semantic units, codes and categories were identified.



**Figure 1.** Preferred reporting items for systematic reviews and meta-analyses (PRISMA)  
n: Number

**Table 2. Characteristic of included studies**

n	Author, year	Title	Country	Sample size	Study design	Key findings	GRADE evaluation
1	Veenema et al, 2016. (25)	Nurses as Leaders in Disaster Preparedness and Response-A Call to Action	UK	14 interviews, 70 workshop and participants	Qualitative study and systematic literature review	The role of nurses in times of crisis is very broad, and the role of nursing leaders needs to be enhanced.	Moderate
2	Thobaity et al, 2017. (24)	What are the most common domains of the core competencies of disaster nursing? A scoping review	Australia	200 questionnaires	Qualitative study and Scoping review	In this study, some tools have been designed to measure and examine the skills of nursing leaders and their barriers.	Moderate
3	Roberta, 2017. (21)	Society for the advancement of disaster nursing: Exploring the path to excellence	USA	None	Policy analysis of present condition of disaster leadership in nursing	It is essential that nursing care in crisis situations is precisely defined and explained.	Low
4	Pourvakhshoori et al, 2017. (23)	Nurse in limbo: A qualitative study of nursing in disasters in Iranian context	Iran	15 participants	Qualitative study	It is well mentioned about the main skills of nurses in crises.	Moderate
5	Loke et al, 2014. (35)	Nurses' competencies in disaster nursing: Implications for curriculum development and public health	USA	45 participants	Qualitative study	Leadership skills are one of the main skills for nurses in times of crisis.	Moderate
6	Beiranvand et al, 2014. (36)	Disaster nursing in Iran: Challenges and opportunities	Iran	32 articles	Qualitative study, systematic literature review	There are many tips for nursing leaders in disasters that need to be considered.	Moderate
7	Veenema et al, 2016. (24)	Exploration and development of standardized nursing leadership competencies in disasters	USA	22 articles	Qualitative study, systematic literature review	There are many tips for nursing leaders in disasters that need to be considered.	Moderate

n: Number

## Results

Seven articles were included in this scoping review. Based on the research questions, the results of the analysis were separated into three categories: reasons for choosing nurses to lead in times of disaster, the skills required of nursing leaders in times of disaster, and ways to improve the performance of nursing leaders in times of disaster.

### Reasons for Choosing Nurses to Lead in Times of Disaster

#### **A: Nurses make up a large part of the healthcare workforce and play a significant role in providing care**

According to a study by Edmonson et al. (19), nurses make up the largest workforce in any country's healthcare system. Numerous studies report that their presence and their leadership

are vitally important in times of health disaster. White et al. (20) note that providing leadership is among a nurse's primary roles, and that nursing leadership is central to the healthcare systems of countries facing health crises. The role of a nurse in leading a health disaster may include planning, preparing, managing problems, coordinating, and supervising care to ensure that it provide in highest quality. Evidently, a significant amount of knowledge is requisite under such circumstances. Effective nursing leadership also motivates other nurses to perform their tasks correctly and efficiently (21); in this regard, supporting, informing, and coordinating a nursing workforce are additional responsibilities borne by nursing leaders under disaster conditions (22). According to Ahmadi et al. (23), nursing leadership during disasters demands a strong knowledge of

care, communication skills, problem-solving, teamwork, and the ability to manage resources. Given that nurses account for the largest number of workers in our healthcare system, their role in times of disaster is critical (23). As stated by Veenema et al. (24), nurses are a pillar of care in healthcare systems, and they play a crucial role in leading the workforce in times of disasters.

**B: Nursing leadership in times of disaster benefits the population in numerous ways. Leadership is a central component of nursing.**

Nurses are highly knowledgeable and bring a wide range of leadership skills to disaster situations. In general, any nurse who is directly or indirectly involved in patient care develops some degree of nursing leadership. Basic nursing leadership skills include communication and coordination, the ability to lead, monitor, and manage; and the ability to provide holistic patient care (25).

**C: Unexpected events and disasters reveal the need for leadership in the healthcare system.**

Research suggests that disasters are occurring with increasing frequency each year. Such unpredictability has created a special need for nursing care. Today, we are facing crises of globalization and population growth (19). Roberta et al. (21), emphasize the special need for nursing leadership in such times. They note that the increasing number of crises at the international level increases the demand for nurses skilled in the preparation, supervision, and provision of care (21).

**E: Nurses are highly skilled in care and disaster leadership.**

Nurses offer excellent leadership in times of crisis, in part because of their managerial skills and their extensive knowledge in the field of care. They play an integral role in crisis management in the home, in the community, in their workplaces, and at the scene of a disaster. They also make up the largest proportion of workers in the healthcare system. Various researchers have acknowledged that employing nursing leaders is critical in communities experiencing crises (22). Given that crises can occur at any time, the presence of nurses with appropriate leadership skills is essential. Their role is to plan and prepare for major health crises and to provide quality care to victims. Nursing leaders contribute to crisis management by providing information, supporting other nurses, and coordinating care (20).

**Nursing Leaders' Competencies During Disasters**

In this section, the skills required of nursing leaders in disasters are presented according to the second research question, with support from relevant literature. Unfortunately, we find the lack of agreement among academics as to which competencies are central to nursing leadership.

**Lack of Agreement Regarding Nursing Competencies During Disasters**

A review of the literature reveals that competency-based leadership and training are relatively new concepts within the past ten years. However, this hardly justifies a failure to define the core skills required of nursing leaders in times of disaster (22). Numerous studies suggest that nursing students and even nurses are not adequately prepared to respond to disasters (16,21). Given the broad scope of disaster research, the focus on nurses and their role in disasters has been underestimated. More attention must be paid to this specific area (26).

Unfortunately, little research has been done to date on the basic skills required of nursing leaders (24,26). Veenema et al. (26), note that no study has yet identified nursing leaders' core competencies; though, they also acknowledge that nursing leadership in times of disaster is a new issue requiring special development and attention (18).

**The Skills Required of Nursing Leaders in Times of Disaster**

**A: Communication skills**

The primary role of nursing leaders is to maintain security and answer to the needs of nursing staff and patients in times of disaster. To do this effectively, nursing leaders must be skilled in maintaining patient safety, coordinating, communicating, and working with a team (19,20). The ability to communicate—both with patients and with colleagues—is imperative (25). The scoping review conducted by Thobaity et al. (26) supports this idea.

**B: Collaboration, coordination and teamwork skills**

Skills in collaboration, coordination, and teamwork are also central for nursing leaders in times of disaster. The ability to communicate with others and maintain effective and efficient relationships is particularly important. Nursing leaders must also provide guidance to staff who face multiple challenges in a disaster (19). The unpredictability and dynamicity of such circumstances demand special attention, response, and coordination among all policymakers and leaders (27), as timely communication can prevent the spread of rumors. Nurse leaders use coordination and cooperation skills through teamwork, hazard prevention, patient prioritization, and resource distribution (24).

**C: Personality traits (e.g., adaptability in unstable conditions)**

To lead in times of disaster requires certain personality traits. Studies suggest that the characteristics of nurses assigned as disaster leaders include a calm personality, professionalism, skillfulness, self-confidence, outward confidence, and courage; these traits promote appropriate performance in health-threatening situations (27). Veenema et al. (25), highlight

physical abilities, independence, a calm and decisive personality, emotional intelligence, and analytical abilities as core competencies.

#### **D: Decision-making ability**

Given the nature of crises and disasters, decisions made under these conditions have particular significance. Nursing leaders must be able to make quick decisions to save lives. According to Samuel et al., good decision-making skills are among the most essential characteristics of leaders in times of disaster (20).

#### **E: Critical thinking**

One of the most important skills for nursing leaders in times of disaster is critical thinking (19,28). Critical thinking is the ability to pay attention to, interpret, and analyze situations and relationships critically (19). Nursing leaders must be able to access information with ease and promptly make it available to policy makers (20).

#### **F: Emotional intelligence and humanity**

In life-threatening disasters, emotional intelligence and humanity are essential to leadership. Nursing leaders use these characteristics when assessing and managing critical situations. Effective disaster planning and evaluation rely on the emotional intelligence of leaders (24).

#### **G: Ethical principles, work commitment, and adherence to the goals and vision of the organization**

Nurses in leadership roles are expected to have clearly defined work perspectives (19). In addition, they must make ethical and values-based judgments in times of disasters. Nursing leaders must have moral convictions; they must be able to choose the best path in a moral dilemma (25) and perform humanitarian and ethical duties when dealing with the victims of a disaster (27).

#### **H: Planning**

Another core competency of a nursing leader is the ability to plan for disaster management and ensure preparedness. Communicating such plans to their organization, educating staff members and patients, assigning immediate-response groups, supporting nursing staff in their patient care, and managing costs are all important considerations. Nurse leaders must coordinate these efforts in order to prepare an effective disaster management strategy (29).

#### **Ways to Improve the Performance of Nursing Leaders in Times of Disasters**

In this section, we discuss ways to improve the performance of nursing leaders in times of disasters based on the selected literature.

#### **A: Lack of rigorous research**

Research on disaster leadership is being conducted in the health sciences and various other fields around the world (20); however, nursing leadership in disasters—a broad and valuable field—has not yet been the subject of extensive study (25). Further research is needed about the roles, abilities, and skills of nursing leaders in disasters (20).

#### **B: Evidence-based skills and education**

Given the increasingly valuable role of nurses in disasters worldwide, additional attention must be paid to the training and skills necessary for nursing leadership in disasters (30). Ever-changing educational curricula must shift to an evidence-based model and focus on nurse leaders in disasters (25,30).

#### **C: Inadequate recognition of nurses as leaders in disasters**

Little acknowledgment has been given to nurses for their effective disaster leadership; in fact, nurses themselves admit that they do not have sufficient preparation or knowledge to manage disasters. Their unpreparedness limits their ability to respond effectively and may impact patients' health outcomes. Therefore, the role of nursing leaders in disasters should not be overlooked.

#### **Discussion**

Nurses are the frontline workforce that provides a wide range of emergency care, rehabilitation, treatment, promotion, and preventive care for individuals, families, and communities. Nurses account for a significant proportion of the workforce managing crises and disasters, many stakeholders and policymakers fail to recognize the potential of nursing leadership in this area (23,30).

In a review of the literature, no consensus was found regarding the core competencies of nursing leaders in times of disaster; so far, no integrated standard has been designed for this purpose. The core competencies have thus been reported very differently in published articles. Even those articles that propose core competencies for nurses in times of disaster fail to consider nursing leaders.

Among a nursing leader's most important skills is the ability to plan in a disaster. Planning requires knowing the location, type, and nature of the disaster and determining effective solutions to control it. If nursing leaders are aware of the purpose and content of a disaster management plan, then they can manage a disaster effectively.

Another vital skill is the ability to cooperate and communicate with other team members. All nursing leaders require communication skills to effectively coordinate the members of their team, especially in times of disaster. Studies suggest



that most hospitals rank poorly in terms of communication, coordination, strength, common language, and disaster management training.

Another critical skill for nursing leaders is ethical commitment and work commitment. Nursing leaders must be able to identify and manage ethical challenges that arise in times of disaster and during regular care.

Critical thinking is also a core competency for nursing leaders (19,28). In times of disaster, they must be able to access information with ease and promptly make it available to policy makers (20). Nursing leaders must also interpret and synthesize information from different sources (19). Studies show that critical thinking in nurses improves with experience and age and that critical thinking related to disaster management is markedly better with experience (31,32).

Emotional intelligence is imperative to leadership in a disaster. Because nurses encounter different levels and types of emotions when dealing with the complex needs of each patient, they must be able to manage and understand emotions. Emotional intelligence allows nursing leaders to think clearly under challenging circumstances, avoid wasting time due to anger, anxiety, and fear, and calm the troubled minds of others easily (33).

Our study confirms that nurses play a critical role in disasters, especially in leadership roles. Despite their leadership skills and knowledge, however, nurses are often paid little attention by policy makers (19,20,25). However, the literature remains inconsistent in terms of what those skills are, and organizations have defined their own core competencies for nursing leaders based on their needs and contexts; as such, no universal skills have been defined (34) and there are lack of evidence-based standards contributes to this problem (24).

Based on our review of the literature, we are unable to determine the core competencies required of nursing leaders in disasters. One reason for the lack of consensus around nursing leadership skills is the general apathy toward the topic in both the scientific and professional communities (35,36).

The widespread unpreparedness of nursing leader's points to a need for appropriate education. The results of this study suggest that evidence-based research should be conducted to respond effectively to disasters and to determine the core competencies of nursing leaders. Also, it is suggested that preparedness in disasters included in the nursing curricula and support nurses' participation in disaster workshop and maneuvers.

As disasters continue to increase in frequency and present health risks worldwide, this research is of particular importance. Indeed, existing articles—even in the field of nursing—have failed to address the role of nursing leadership in disasters. While it may be a small consideration in the greater context of nursing, the scale, threat, and complexity of disasters—difficult though they may be to measure, assess, or predict (20)—are undeniable. Therefore, further research must be conducted to determine the essential skills that all disaster leaders need.

### Study Limitations

This study was designed as a scoping review. It is worth noting that most articles reviewed in this study were from the USA; few articles have been written about the leadership of nurses in disasters in different countries and contexts. Additionally, a limited number of articles focused specifically on nursing leadership in disasters; most referred more generally to the roles of nurses and leaders in crises. The content analysis used for extracting categories and selecting appropriate words was developed by non-native English speakers, which may also impact the reliability of the study.

### Conclusion

Nurses are central to the healthcare system in times of disaster, and they play a key role in patient care. Effective leadership is essential for nurses in times of disaster. Observing the gaps in nursing leadership in situations like the COVID-19 pandemic highlights the importance of effective planning. To ensure that nurses can provide the best care possible, we must take into account their physical and mental health. Additionally, we should incorporate more robust disaster management programs into their nursing school curricula.

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### Ethics

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Surgical and Medical Practices: F.A., L.P., S.P., Concept: F.A., L.P., S.P., Design: F.A., L.P., S.P., Data Collection and/or Processing: F.A., L.P., S.P., Analysis and/or Interpretation: F.A., L.P., S.P., Literature Search: F.A., L.P., S.P., Writing: F.A., L.P., S.P.

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# Effect of Ramadan on Emergency Department Attendances: A Retrospective Study

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## Abstract

**Aim:** Changes in diet and lifestyle are often observed during Ramadan. These changes may affect visits to the emergency department (ED). However, it remains unclear how exactly visits to the ED are affected. Thus, this study aimed to investigate the effect of Ramadan on visits to the ED.

**Materials and Methods:** Hospital records and files of patients aged >17 years who visited a university hospital ED just before, during and immediately after Ramadan from 2014 through 2016 were retrospectively reviewed.

**Results:** A total of 44146 ED visits were evaluated. It was found that ED visits were lower during Ramadan than during other months ( $p<0.001$ ). Further, during Ramadan, there was a significant increase in ED visits one hour after iftar and one hour before sahur ( $p<0.001$ ). The number of forensic cases significantly decreased during Ramadan ( $p<0.001$ ).

**Conclusion:** During Ramadan, the number of ED visits decreased and the timing of the ED visits was altered. There was a significant increase in visits one hour after iftar and one hour before sahur.

**Keywords:** Emergency department, iftar, ramadan

## Introduction

During Ramadan, Muslims perform fasting. Fasting requires abstaining from many activities such as eating, drinking, sexual activity, drug use and smoking from sunrise to sunset (1). This worship affects health by inducing changes in the life rhythm and physiological processes (2).

Due to limitations of many requirements during the day, excessive consumption after the sunset, and changes in sleep patterns, irritability and anxiety can develop in fasting individuals (3). However, the spiritual effect of Ramadan fasting may remove people from violence (4). On the other hand, Ramadan fasting

can cause changes in water electrolyte balance, serum total cholesterol, blood glucose level, systolic and diastolic blood pressure (5). Along with the psychological and physiological effects of fasting, changes in diet and lifestyle brought by the Ramadan month can affect emergency department (ED) attendances (6,7).

The analysis of the effect on the need for ED services in Ramadan is of great importance in terms of enabling emergency health service delivery in this month. The study aimed to investigate the effect of Ramadan on causes of ED attendances and time period of ED attendances.



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## Materials and Methods

The study was planned according to the descriptive research method. The Study conducted in a University Hospital Emergency Department. The Emergency Department have 38 bed capacity and average 250 attendances in 24 hours have been made to the department. In the study, in the three-years period covering the years 2014-2016, the ED attendances during the Ramadan months and as a control group just before and immediately after the Ramadan months were assessed and compared with each other. In the evaluation, between the dates of May 7 to August 4, 2016; May 18 to August 16, 2015; May 28 to August 27, 2014 hospital records of all attendances made by individuals 18 years of age and older were retrospectively reviewed. In the review, the data of the patients who underwent ethanol testing and the consultation notes of the patients who required toxicology consultation were evaluated separately. The research was carried out after the approval of the University Clinical Research Ethics Committee (date: 20/03/2017, decision no: 2017-30). In this study causes of ED attendances were divided into four groups. These groups are traffic accidents, work accidents, forensic cases (except from traffic and work accidents) and other emergency cases. Attendances which made for prescribed injections and dressing were not included in the study.

## Statistical Analysis

The data obtained in the study were analyzed in IBM Statistical Package for the Social Science (IBM SPSS; Armonk, NY, USA) for Windows v23.0 software. Qualitative data were assessed by chi-square test. Normality of distribution was determined using Kolmogorov-Smirnov test. Parametric tests were used for the analysis of normally distributed data, nonparametric tests were used for the analysis of the data that did not normally distribute. The effect of the Ramadan months on the attendance time was examined by using ANOVA tests with repetitive measurements. Qualitative data were presented by number and percentage (%), and quantitative data by arithmetic mean ± standard deviation formula. Statistically, p<0.05 was considered significant.

## Results

During the study period 44,146 ED attendances were made. In this period, the average age of the ED attendants was 42.1 years (min=18, max=104). 50.3% of patients were male and 49.7% of them were female. 27.5% (n=12,139) of the attendances were made in Ramadan month, of 38.3% (n=16,902) before the Ramadan and of 34.2% (n=15,105) after the Ramadan. The median number of daily attendances during Ramadan (median=137), was lower than the months just before the Ramadan (median=190) and immediately after the Ramadan (median=166) months. This difference between the months was statistically significant (p<0.001) (Table 1).

It was found that during the months of Ramadan, there was a decrease in the number of attendances for all hours of the day in general. It was seen that the decrease was more prominent especially about one hour before the iftar. However, about an hour after iftar (during the research period, iftar hours changed between 07.53 p.m.-08.07 p.m.), the attendances increased rapidly, and it was determined that the number of attendances exceeded the number of attendances made before and after Ramadan at the same time (Figure 1). It was also determined that the attendances to the ED increased significantly one hour before sahur and during the sahur hours compared to the attendances were made at the same time in the previous and next months (during the survey period, the hours of sahur changed from 02.39 a.m. to 03.16 a.m.). This change in the attendance hours during Ramadan was statistically significant (p<0.001).

It was determined that forensic cases accounted for 1.8% of all attendances during Ramadan. This rate was significantly lower than before and after Ramadan (p<0.001). In addition to traffic accidents constitute 1.3% of all attendances before Ramadan, 1.6% of during and after Ramadan (Table 2). Increase in the traffic accidents in Ramadan months was found to be statistically significant compared to the months just before Ramadan months (p=0.025).

**Table 1. Average daily emergency department attendances by period (n=44,146)**

Year	Before Ramadan (Mean ± SD)	Ramadan (Mean ± SD)	After Ramadan (Mean ± SD)		p-value
2014	160.9±16.49	115.5±13.21	148.0±14.66	F=74.30	<0.001
2015	195.8±19.70	141.8±19.74	180.2±19.64	F=58.45	
2016	206.6±16.42	157.2±22.02	175.2±23.60	F=42.44	
<b>Total*</b>	190.0 (39)	137 (36)	166.0 (39)	X <sup>2</sup> =106.99	

\*Data are shown as median (interquartile range)

In the study alcohol use related ED attendances were evaluated. During the study period, blood ethanol levels of 538 patients were examined. It was found that the attendances of individuals with high ethanol level were significantly lower in the month of Ramadan than the other months ( $p < 0.001$ ) (Table 3). Causes of attendance of patients with high blood ethanol level were examined. 34.2% ( $n=13$ ) of these patients admitted to the ED due to traffic accident and 52.6% ( $n=20$ ) of them were forensic cases.

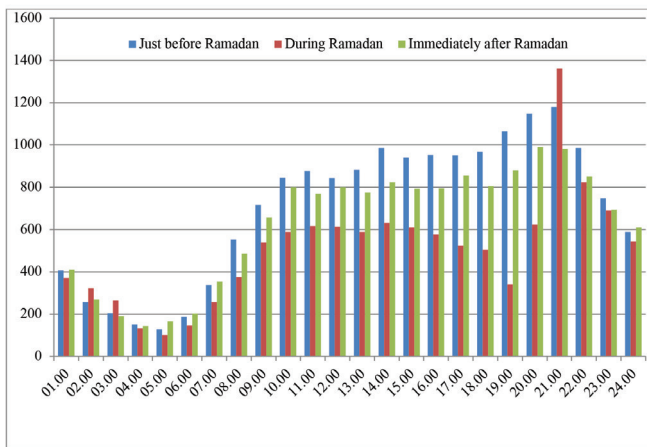
During the study period, toxicology evaluation of 157 patients was performed. When the attendance periods of these patients were examined, it was seen that the number of attendances related to substance use was lower in Ramadan (18.4%) compared to just before (36.7%) and immediately after (44.9%) the Ramadan months. The blood substance levels were examined according

to the attendance periods of the patients (Table 4). There was a significant difference between the months of Ramadan and the months after Ramadan in the blood Tetrahydrocannabinol level ( $p=0.016$ ). It was detected that the frequency of positive results was found to be lower in Ramadan compared to before and after Ramadan. However, this difference was not statistically significant ( $p=0.752$ ).

### Discussion

It was seen that in the month of Ramadan, ED attendances declined in general. While the ED attendances evidently decreased about an hour before iftar, there was sharply increase in the ED attendances approximately one hour after iftar. There was also significant increase in one hour before sahur in the ED attendances. In the study it was detected that there was a significant increase in traffic accidents compared to the month before Ramadan. On the other hand, there was a significant decrease in the number of forensic cases forensic cases in Ramadan. In addition, attendances of individuals with high blood ethanol level were significantly lower in the month of Ramadan.

Ramadan causes changes in nutrition, medication use and social life. Lifestyle and socio-cultural characteristics are known to influence the use of ED (8). However, a limited number of studies have been conducted on how the Ramadan month affects the use of ED. It was found that the daily attendances in the Ramadan are similar to the other months in terms of number and diagnosis (9,10). In the study of Pekdemir et al. (11), it was determined that the average number of attendances per day in



**Figure 1.** Emergency department attendance time; during, just before and immediately after Ramadan months

**Table 2. Causes of emergency department attendances by periods (n=44,146)**

Causes of attendances	Before Ramadan n* (%)	Ramadan n (%)	After Ramadan n (%)	X <sup>2</sup>	p-value
Forensic case	363 (2.1)	220 (1.8)	382 (2.5)	16.35	<0.001
Traffic accident	217 (1.3)	194 (1.6)	240 (1.6)	6.86	0.032
Work accident	110 (0.7)	94 (0.8)	95 (0.6)	2.40	0.301
Other emergency cases	16,212 (95.6)	11,631 (95.8)	14,388 (95.3)	9.43	0.009

\*Percentages give the proportion of selected cases in all cases, n: Number

**Table 3. Blood ethanol levels of patients by periods (n=538)**

Period	High n (%)	Normal n (%)	X <sup>2</sup>	p-value
Before Ramadan	15 (7.3)	190 (92.7)		
Ramadan	1 (0.7)	146 (99.3)	15.57	<0.001
After Ramadan	22 (11.8)	164 (88.2)		
<b>Total</b>	<b>38 (7.9)</b>	<b>500 (92.1)</b>		

n: Number

**Table 4. Laboratory test results for blood and urine substance levels by periods\* (n\*\*=1,857)**

	Before Ramadan		Ramadan		After Ramadan		X <sup>2</sup>	p
	Normal	High	Normal	High	Normal	High		
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)		
Benzodiazepine (U)	8 (72.7)	3 (27.3)	5 (50)	5 (50.0)	19 (70.4)	8 (29.6)	1.598	0.469
Tricyclic antidepressant (U)	7 (87.5)	1 (12.5)	9 (90.0)	1 (10.0)	16 (94.1)	1 (5.9)	0.340	1.000
Paracetamol (U)	7 (87.5)	1 (12.5)	9 (90.0)	1 (10.0)	16 (94.1)	1 (5.9)	0.340	1.000
Tetrahydrocannabinol (U)	5 (62.5)	3 (37.5)	8 (80.0)	2 (20.0)	16 (94.1)	1 (5.9)	3.909	0.151
Opiate (B)	51 (98.1)	1 (1.9)	19 (95.0)	1 (5.0)	56 (98.2)	1 (1.8)	0.749	1.000
Paracetamol (B)	51 (98.1)	1 (1.9)	18 (90)	2 (10)	51 (89.5)	6 (10.5)	3.435	0.145
Methamphetamine (B)	51 (98.1)	1 (1.9)	20 (100)	-	56 (98.2)	1 (1.8)	0.378	1.000
Tricyclic antidepressant (B)	49 (94.2)	3 (5.8)	19 (95.0)	1 (5.0)	57 (100)	-	3.296	0.214
Tetrahydrocannabinol (B)	45 (86.5)	7 (13.5)	20 (100)	-	43 (75.4)	14 (24.6)	7.061	0.029
Benzodiazepine (B)	38 (77.6)	11 (22.4)	16 (80.0)	4 (20.0)	32 (68.1)	15 (31.9)	1.554	0.460
Bonzai (B)	17 (94.4)	1 (5.6)	10 (100)	-	25 (100)	-	1.982	0.528

n\*\*\*: Number of tests applied, U: Urine test, B: Blood test  
\*: More than one test was administered to a patient

Ramadan was significantly higher than that of the next month. In our study, it was determined that the number of ED attendances decreased significantly in Ramadan compared to before and after Ramadan. The difference from other publications in the literature may be related to the fasting rate in the regions where the studies were conducted.

According to the results of the studies, there are some changes in the ED attendance times in Ramadan. Kayipmaz et al. (12) detected that ED admissions made during the fasting period in Ramadan was significantly higher than the other times of the day. In the study of Butt et al. (6) it was determined that during Ramadan, night-time attendances (07:00 p.m.-06:59 a.m.) were more compared to day-time attendances (07:00 a.m.-18:59 p.m.). In the study of Pekdemir et al. (11), it was found that the ED attendances in Ramadan concentrated during the first four hours (04:00 p.m.-08:00 p.m.) after iftar. In the study of Balhara et al. (9), The pattern of ED attendances in Ramadan changed significantly compared to the other months than Ramadan; it was determined that the number of ED attendances was lowest at the time of iftar and that the number of the attendances increased rapidly increased rapidly within one and a half-hour afterward. These results were in parallel with findings from our study.

In the study of Khammas et al. (13), it was determined that there is no difference in the number, seriousness and time of traffic accidents of fasting and non-fasting people in Ramadan. However, Kalafat et al. (14), and Tahir et al. (15), found that the traffic accidents in Ramadan were significantly higher than the

other months. Similarly, in the current study it was determined that traffic accidents increased in the month of Ramadan compared to the just before months of Ramadan. A survey showed that people felt more nervous in traffic during Ramadan (16). In addition, fasting individuals may develop insomnia, fatigue, inattention and such factors can lead to an increase in traffic accidents (17).

Mohseni et al. (18), reported that violence related ED attendances such as gunshot and knife injuries decreased significantly in Ramadan. Findings of this study support Mohseni et al.'s (18). We detected that forensic cases caused by violence significantly decreased in Ramadan compared to the other months. In Ramadan month, which is called as "patience month", cooperation and solidarity increase among people. Our findings are thought to be related to the spiritual effect of the month of Ramadan.

Literature about ED attendances related to substance use was not accessed. In this study, it was determined that the number of ED attendances related to substance use decreased during the month of Ramadan. This result is thought to be associated with Muslims trying to abandon the harmful habits in the month of Ramadan.

### Study Limitations

Patient files and hospital records were investigated retrospectively in the study. In the analyzed period, during Ramadan months, the fact that the rate of fasting and not fasting persons among patients is unknown is the limitation of this study.

## Conclusion

Findings obtained from this study showed that the number of ED attendances decreased during the month of Ramadan and the time period of the ED attendances changed. There was a noticeable increase in ED attendances an hour after iftar, and an hour before sahur. Significant decrease was seen in ED attendances due to forensic incidents.

## Ethics

**Ethics Committee Approval:** The research was carried out after the approval of the University Clinical Research Ethics Committee (date: 20/03/2017, decision no: 2017-30).

**Informed Consent:** Retrospective study.

**Peer-review:** Externally peer-reviewed.

## Authorship Contributions

Concept: P.Ş., M.Y., B.K., A.Ş., M.T., A.G., Design: P.Ş., M.Y., B.K., A.Ş., M.T., A.G., Data Collection and/or Processing: P.Ş., M.Y., Analysis and/or Interpretation: P.Ş., M.Y., B.K., A.G., Literature Search: P.Ş., M.Y., B.K., A.Ş., Writing: P.Ş., A.Ş., M.T., A.G.

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# Violence Towards Emergency Residents in Malaysia: The Unforeseen Perpetrators Among Us

© Rashidi Bin Ahmad<sup>1</sup>, © Amelia Binti Amir<sup>1</sup>, © Nur Fithriyaani Rashidi<sup>2</sup>

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## Abstract

**Aim:** Workplace violence in the emergency department (ED) is a common occurrence worldwide, affecting staff across all roles, compromising the safety, health, self-esteem, and job satisfaction of healthcare workers. Combating workplace violence in healthcare settings is a massive challenge as the problem's true scope is unknown due to insufficient documentation or underreporting. Thus, this study aims to explore and examine the magnitude and attitude of ED residents (ERs) towards workplace violence.

**Materials and Methods:** This study is a single centre, questionnaire-based, anonymous, and self-administered cross-sectional survey involving 63 ERs. A chi-square test examined the relationship between variables. Composite measures condensed the vast number of variables data into a single indicator.

**Results:** Workplace violence in ED was reported by 93.6% of respondents. Verbal assault (88.9%) was the predominant form of violence. Unforeseen perpetrators include physicians (17.5%), non-ED staff of the hospital (17.5%) and other ED staff (14.3%). The common site of violence occurrence was a non-critical area (81%). There was no significant relationship between attitude and gender ( $p=0.93$ ) or race ( $p=0.70$ ) or designation ( $p=0.45$ ). Composite measure of attitude scores revealed that 50.8% of respondents had a positive attitude towards workplace violence in ED.

**Conclusion:** Violence among ERs is an undeniable existence. Co-worker as the perpetrator is not acceptable at all. A continuous effort from ERs, ED staff and ED managers is required to mitigate the growing phenomenon of workplace violence in ED.

**Keywords:** ED residents, prevalence, attitude, workplace violence

## Introduction

Emergency departments (ED) has high stress environment that associated with violent acts (1-3). Violence in ED creates unhealthy environment such as reduce self-esteem, impaired staff perception and attention, dissatisfaction, and burnout to all level of ED workers including emergency residents (ERs) (4,5). As a result, it may affect the overall quality of emergency service (6).

Combating workplace violence in healthcare settings is a massive challenge as the true scope of the problem is not known due to scarcity of documentation and underreporting (7,8). The lack of a universally accepted definition of workplace violence and

measurement tools have also contributed to the difficulty in measuring the true percentage, magnitude, and scope of violence against healthcare providers (9,10).

Despite of workplace violence being a common occurrence among ERs, the prevalence of workplace violence among ERs and their attitude towards it have not been well explored that leaving significant knowledge gap in this psychosocial issue (11-13).

In this study we investigated the magnitude of workplace violence in ED and ERs attitude towards workplace violence. The findings from this study may change our perception towards the management of violence in ED and it may assist in apprising and



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updating the national healthcare policy on the management of violence at workplace.

## Materials and Methods

### Study Design

This 6-months period of a questionnaire-based, anonymous, and self-administered cross-sectional survey was conducted at Hospital Sungai Buloh (HSB) from June 2018 to November 2018. HSB is a tertiary hospital governed by Malaysian Ministry of Health. It is located at suburban area (Petaling District, Selangor) and its distance from Kuala Lumpur, Capital City of Malaysia is 20 km apart.

All ERs (house officers, medical officers, and specialists) were invited to participate in the study. Non-ERs and ERs who participated in the validation of KPA questionnaires were excluded.

### Study Instrument

All the relevant data was collected and documented into the paper-based self-administered questionnaire that was developed by the researcher after an extensive review of literature. Face validity was established by experts in the fields of emergency medicine and occupational violence, all of whom were independent of the study.

The questionnaire developed for this study is in English language as it is the universal language and it enables international comparisons. The questionnaire was not translated into other languages to prevent unintended deviations, to preserve the intended meaning and the measurement properties of the source questionnaire. The first section of the questionnaire seeking demographic characteristics of study population. The second section inquiring the prevalence of workplace violence and investigating respondents' knowledge, attitude, and practice towards workplace violence.

We instructed expert panels to rate level of representativeness, importance, clarity, and relevance of each item on the questionnaire. The design questionnaire was subsequently pilot tested on a sample of 10 participants. The reliability of the questionnaire was established by Cronbach's alpha and the values for each construct, namely knowledge, attitude and practice are 0.75, 0.75 and 0.79 respectively, suggesting accepted level of reliability.

### Enrolment Procedure

Participation in this study was voluntary and all data were treated as strictly confidential. The participants were provided with verbal and written information about the study. The

questionnaires were administered at various times and shifts to ensure confidentiality. The completed questionnaires were placed into a sealed and secured box, they were subsequently collected by the researcher.

### Statistical Analysis

Statistical analysis was performed using SPSS (Version 16.0). Variables were reported as mean [standard deviation (SD)] and percentage (%) for numerical and categorical data respectively.

A Chi-square test was performed to explore and analysis the relationship between independent variables and dependent variables (knowledge, attitude and practice). Point estimation from the general population mean with a lower and upper bound of 95% confidence interval was calculated using SPSS. A value of  $p < 0.05$  was statistically significant.

Composite measure was applied to condense the vast number of variables data into a single indicator, hence, it summarises a range of quality dimensions.

## Results

Seventy set of questionnaires were distributed among ERs and 63 (90.0%) of ERs completed and returned the questionnaires.

### Demographics of Participants

The sociodemographic of respondents were presented in Table 1. The mean age (SD) of participants was 31 (3.7) years. Female was the predominant gender (65.1%). Majority of the respondents were medical officers (69.8%).

	n (%)	Mean (SD)
<b>Age</b>	-	31 (3.7)
<b>Years of practice</b>	-	6 (3.7)
<b>Gender</b>		
Male	22 (34.9%)	-
Female	41 (65.1%)	-
<b>Race</b>		
Malay	38 (60.3%)	-
Chinese	9 (14.3%)	-
Indian	12 (19.0%)	-
Others	4 (6.3%)	-
<b>Designation</b>		
Specialist	12 (19.0%)	-
Medical officer	44 (69.8%)	-
House officer	7 (11.1%)	-
SD: Standard deviation, n: Number		

## Magnitude of Workplace Violence in ED

We presented the prevalence of workplace violence among ERs in Table 2. Majority of respondents (93.6%) reported that they have experienced workplace violence in ED.

The most shared form of violence experienced by respondents was verbal assault (88.9%). The distribution rate of emotional violence, physical violence and sexual assault were 69.8%, 30.2% and 1.6% respectively. Relatives of patient was the most common perpetrators of violence in ED (88.9%) followed by patient's himself (79.4%). Other perpetrators were clinical specialists (17.5%), non-ED staff of hospital (17.5%) and ED staff (14.3%). Violence took place recurrently at non-critical zone (81.0%).

## ERs Attitude Towards Workplace Violent

Personal safety at work are dreadful among most respondents (73.0%). This study revealed 41.2% of respondents felt threatened working in the non-critical area and waiting area. The distribution of violence frequency based on working area of triage zone, semi-critical zone, critical zone, and observation ward were 39.6%, 19.1%, 11.1% and 9.5% respectively. About 70.0% of respondents perceived that 'workplace violence is simply part of their job in the ED. However, more than three quarter of the respondents (79.3%) claimed of having upsetting feelings after experiencing the uneventful event.

	n (%)
<b>Experience of workplace violence in ED</b>	
Yes	59 (93.6%)
No	4 (6.3%)
<b>Form of violence</b>	
Verbal	56 (88.9%)
Emotional	44 (69.8%)
Physical	19 (30.2%)
Sexual	1 (1.6%)
<b>Perpetrators</b>	
Relatives of patients	56 (88.9%)
Patients	50 (79.4%)
Specialists	11 (17.5%)
Non-ED staff of hospital	11 (17.5%)
General public	9 (14.3%)
ED staff	9 (14.3%)
<b>Area</b>	
Non-critical zone	51 (81.0%)
Semi-critical zone	5 (7.9%)
Triage	4 (6.3%)
ED: Emergency department, n: Number	

Composite measure of attitude scores revealed 50.8% of respondents had positive attitude towards workplace violence in ED.

Chi-square analysis did not demonstrate a significant relationship between attitude and gender ( $p=0.93$ ) or race ( $p=0.70$ ) or designation ( $p=0.45$ ).

## Discussion

Workplace violence has emerged as an important safety and health issue in today's workplace (6). Workplace hazard is associated with physical and psychological harm risking high costs to employees, workplaces, and society (8). Being violated, beaten, or trampled is a distressing experience that may affect their tasks performance quality and psychosocial stability. Lack of focus on medical condition of patients, incorrect administration of medications and inappropriate communicate were reported among healthcare providers following experiences of workplace violence in ED (1,12). There were studies demonstrated work-related violence and threats are associated with psychological distress, depression, anxiety, fatigue, job dissatisfaction, employee absenteeism and job quitting (12-14). In this study, about 80% of respondents declared that violence at workplace affects their life.

Violence can potentially affect any occupation, any workplace, and any worker, typically occupation involving face-to-face interaction with clients such as healthcare, public administration, hotels, and restaurants (9,14,15). Healthcare staff experience more workplace violence than other industry workers because of high stress environment (1,16). Doctors, nurses, and social workers are all high on the list of occupations with serious stress levels while violence in the health sector constitutes almost a quarter of all violence at work (17). When stress and violence interact at the workplace, their negative effects cumulate in an exponential way, activating a vicious circle which is very difficult to break (18). Focusing on the interrelationship between stress and violence at the workplace, the study identifies negative stress as a cause of violence. The more negative stress is generated, the greater the likelihood of violence, up to the most extreme forms such as burnout, suicide, and homicide. Interestingly, many people under severe negative stress do not become perpetrators of violence (16-18). The combination of stress with several additional factors, such as alcohol or substance abuse may be the violence triggers at the workplace (18).

Health care is not only a high-risk sector as far as stress and violence are concerned, but it is also typically a sector with high levels of female employment. Exposure to the risks of stress and violence is therefore particularly high for women (19). It is even

higher for certain types of violence, such as sexual harassment, where the victims are predominantly women (19,20). In our study, 65% of respondents were female gender and they suffered most from verbal abuse instead of sexual abuse (1.6%).

Among high-risk hospital area of workplace violence were psychiatric ward, the emergency room, or the long-term care facilities (21). From previous studies (22,23), the prevalence of workplace violence in healthcare settings was reported higher than 50%. The prevalence of workplace violence among ERs in our study was extremely high (89.9%).

In this study, violence took place repeatedly at non-critical zone of ED (81.0%). Most of the time non-critical area was overwhelmed by patients and subsequently causing overcrowding. Hence, non-critical patients had the longest waiting times, highest levels of stress and dissatisfaction and complaints (23,24).

Attitudes are not directly observable. It represents an intermediate variable between a situation, and the response to the situation, and it could explain the reason for adopting certain practices although many studies have shown no association between attitude and practices (24). ED Staffs may be uncertain what constitutes violence and they perceive violent acts related to illness as unintentional thus may assume formal reporting is unnecessary and they perceive that taking action against patient's unintentional violent behaviour as immoral and will lead to punishment for the patient (11,25).

Majority of respondents accepting violence in ED as a norm or as it is part of the job because ED has unexpected, unpredictable, and chaotic environment. The ability to control stress and manage the unwanted and unexpected incidents including violence behaviour is a pride for ERs and for them it is a sign of competency (26,27). According to The Emergency Nurses Association national survey (1994), 3% of ED nurse managers would not report violent incidents because violence was considered part of the job and reporting the incident conflicts with their duty of care (28). Ironically, there was ED managers who take an action against healthcare professionals who report the incident (29). In our opinion, those ERs or ED staffs who view violence as a risk associated with their job were more likely to overlook violent incidents, contributing to underreporting and underestimating workplace violence in ED. We stipulated that this odd thinking or belief together with non-accountability culture may be the main reasons why healthcare staffs themselves are the perpetrator as demonstrated by our study.

There are four categories of workplace violence according the perpetrators by The National Institute for Occupational Safety and Health of U.S (30). Type I incidents are perpetrated by individuals with no legitimate business relationship to the worker

or workplace, usually with criminal intent such as robbery. Type II involves a patient or visitor as the perpetrator, Type III involves a co-worker as the perpetrator, and Type IV involves a perpetrator with no business relationship to the workplace but who has a personal relationship to the worker (30).

We noticed that type II was the custom type of workplace violence in our study and unexpectedly type III was the next common. According to ERs respondents, common perpetrators were visitors or family members (88.9%) and patients themselves (79.4%). Recent studies estimate that patient and visitor violence against healthcare workers has been increasing in both developed and developing countries (31,32). Personal and situational aspects may contribute to the violence acts (33). The experience of sickness and the processes they must go through as a result may cause fear and anxiety among patients and relatives. In these conditions, patients and visitors are dependent on healthcare staff. Hence, ineffective communication (insufficient, ill-mannered, miscommunication, misunderstandings, shortcomings in the way information is shared between practitioner and patient), lack of trust, unmet expectations, loss of respect for the doctor and the perception of a poor standard of care may contribute to patient and visitor violence include (32-34). Our recommendation to curb type II workplace violent include motivating hospital administrators to improve patient safety, monitoring educational quality of HCPs, violence prevention programs and interpersonal communication skill program for healthcare providers as a strategy for the reduction of workplace violence

In our study, the unforeseen type III perpetrators in ED were specialists/physicians (17.5%), ED staffs (14.3%) and non-ED staffs of hospital (17.5%). Providing care together with multidiscipline teams in overwhelming environment is the nature of emergency care. Power imbalances, interdependence management, greater points of contact between ED staffs with other workers and individual attributes, such as personality, may contribute to interpersonal conflicts among HCPs (34,35). Moreover, working in proximity in a high stress environment, work overload, lack of autonomy, and absence of organizational fairness may contribute to violence between co-workers (35,11). This volatile environment, characterized by insecurity, role conflict, and tension, allows few opportunities for socialization and even less time for conflict resolution may indirectly contribute to the emergence of aggressive behaviours and bullying (11). To curb workplace violence among HCPs, the design and implementation of a system-wide program likely makes more sense. We must take proactive steps to develop educational programs and to cultivate an atmosphere that eradicates the fear of reporting vulgarity. It is a major necessity for workplace violence policy or a code of conduct in place. It is our recommendation that employers give

serious thought to the establishment and enforcement of codes of conduct that make violence among HCPs a zero-tolerance matter. Type III violent should be stopped!

The principle behind health promotion model is that high knowledge leads to positive attitude and consequently good behaviour, albeit this transition is not always straightforward (36). As hospital staffs or ERs we should be accountable to any violent events in our premise. Therefore, educational approach on the stress and violence should be emphasized to communities and all level of hospital staffs including physicians and administrators. Workplace violence is preventable, and we start by educating ourselves.

### Study Limitations

The questionnaire that was developed for this study was administered in a single centre and sample size was small. Results obtained from this study may did not reflect or represent the whole ERs communities.

This survey can be repeated on a larger scale and at multiple sites to explore more in-depth on the current issue. Studies involving other healthcare personnel besides doctors as well as studies between public and private ED are also required to allow for comparison of results and reasons for differences should be explored.

### Conclusion

Violence among ERs is an undeniable existence and its management is challenging. Co-worker as the perpetrator is not acceptable at all. Regular education and competency training on the identification, notification, and management of workplace violence to hospital staffs indeed may promote the best practice. Hospital administrators including physicians and head department should provide a safe and secure working environment to all level of healthcare personnel. A continuous effort is essential to mitigate the growing phenomenon of workplace violence in ED.

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### Ethics

**Ethics Committee Approval:** The study was approved by Medical Review and Ethics Committee (MREC), Ministry of Health Malaysia (decision no: NMRR-17-2567-38385(IIR), date: 4th January 2018.

**Informed Consent:** Participation in this study was voluntary and all data were treated as strictly confidential. The participants were provided with verbal and written information about the study.

**Peer-review:** External peer-reviewed.

### Authorship Contributions

Surgical and Medical Practices: R.B.A., A.A., Concept: R.B.A., A.A., N.F.R., Design: R.B.A., A.A., Data Collection or Processing: A.A., Analysis or Interpretation: R.B.A., A.A., Literature Search: A.A., N.F.R., Writing: R.B.A., A.A., N.F.R.,

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# Comparison of the Modified Valsalva Maneuver and the Standard Valsalva Maneuver for Treatment of Supraventricular Tachycardia in Emergency Department

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## Abstract

**Aim:** The diagnosis and initial therapy of supraventricular tachycardia are always made in emergency departments. Vagal maneuvers are recommended as the first-line treatment for the termination of SVT. We aimed to compare the efficacy of standard and modified Valsalva maneuvers in treating patients with SVT.

**Materials and Methods:** This study was conducted between 16/03/2016 and 16/09/2016 at the Health Sciences University Ankara Training and Research Hospital Emergency Medicine Clinic. Our study was a randomized, prospective, case-control study. During the study, standard Valsalva maneuver (SVM) and modified Valsalva maneuver (MVM) were applied to two groups randomly allocated to patients with SVT. The maneuvering technique was determined by the envelope pulling method.

**Results:** This study was enrolled by 47 patients that included 23 patients who were treated by using SVM and 24 patients treated by using MVM. Four (%17,4) people from the patients undergoing SVM returned to sinus rhythm, nine (%37,5) people from the patients who underwent MVM returned to sinus rhythm. ( $p > 0.05$ ) Although the results from the MVM treated patients were more satisfying, no statistically significant difference was detected.

**Conclusion:** In this study, we found that MVM is numerically superior in terms of success compared to SVM, but we could not prove this statistically. Therefore, we concluded that there was no difference between the two maneuvers in terms of success. In studies with more cases, we conclude that the result will be statistically significant.

**Keywords:** Supraventricular tachycardia, Vagal maneuvers, Modified Valsalva maneuver

## Introduction

Supraventricular tachycardia (SVT); is a general term used for all tachycardias originating from the atrioventricular node. However, the term SVT is often used to describe sudden onset, regular, narrow complex tachycardias. Although the most common symptom is palpitation, it may present with chest pain, dizziness, and rarely fainting (1,2). Vagal maneuvers are recommended as the first-line treatment for termination of SVT. It is not invasive and does not require any medication. (3,4). Valsalva maneuver performed in the supine position is the most effective vagal maneuver to terminate of SVT (1,5,6). Although it is not a gold

standard technique for Valsalva maneuver, in general, the patient exhales against the closed glottis to produce intrathoracic pressure equivalent to at least 30-40 mmHg for 10-30 seconds (6). In the modified Valsalva maneuver, 45 degrees elevation is applied to the feet of the patient for 15 seconds immediately after the normal Valsalva maneuver. Thus, it is aimed to increase venous return and vagal stimulation during relaxation phase (7,8). In this study, we aimed to compare the efficacy of modified Valsalva maneuver and standard Valsalva maneuver on SVT patients and to evaluate the utility of modified Valsalva maneuver in the emergency department.



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## Materials and Methods

This study was conducted between 16/03/2016 and 16/09/2016 at Ankara Training and Research Hospital Emergency Medicine Clinic, which had 350,000 emergency department patient applications annually. Our aim was to compare the efficacy of standard and modified Valsalva maneuvers in the treatment of patients with SVT. Our study was a randomized, prospective, case-control study. Permission was obtained from the training, planning and coordination committee and ethics committee of the same hospital. The study was conducted in accordance with the latest version of the Declaration of Helsinki and the Good Clinical Practices Directive.

### Sample Size

When 81 cases were included in each group, 95% power was provided with 5% error margin. However, we received 23 patients in the SVM group and 24 patients in the MVM group and provided 50% power with 5% error margin.

### Patient Selection

Patients diagnosed as supraventricular tachycardia in the Emergency Medicine Clinic of Ankara Training and Research Hospital were included in the study. Written informed consent was obtained from the patients or their closest relatives. Patients under 18 years of age, hemodynamically unstable, GCS <15, chest pain at presentation, recent myocardial infarction, known aortic valve stenosis, and pregnant women were excluded. The number of cases included in the study was not limited. After completing the forms of the patients included in the study and completing their treatment, the data were checked. Patients with a lack of data or misdiagnosed patients were excluded from this study. After all these stages, 47 patients were analyzed statistically (Figure 1a).

### Electrocardiography Evaluation

In these patients, 12-lead ECG is the most necessary and valuable test in the diagnosis. SVT diagnosis; The ECG is based on regular, narrow QRS complex (<120 msec) pulses with a rate of 160-200/min, no p waves.

The Nihon Kohden ECG 1250 Cardiofax S (2009, Tokyo, Japan) device was used for recording ECGs. Records were obtained at 25 mm/s speed and with 10mm/mV amplitudes. Prolonged QRS duration was defined as  $\geq 120$  ms.

### Design of the Study

During the study, standard Valsalva maneuver (SVM) and modified Valsalva maneuver (MVM) were applied to two groups randomly allocated to patients with SVT. The maneuvering technique was determined by envelope pulling method. For the study, a

form was used to record demographic information, complaints, ECGs, vital signs, additional diseases and response to treatment options, and which maneuver would be performed. In the standard Valsalva maneuver; patients were asked to blow the 10 cc empty injector in a sitting position to push the plunger for 15 seconds and then return to normal respiration. In the modified Valsalva maneuver (MVM); The patients were asked to blow the 10 cc empty injector in a sitting position to push the plunger for 15 seconds. Immediately afterwards, the patient was passively taken to the supine position by the physician and the legs were elevated at an angle of 45 degrees for 15 seconds (Figure 1b). In unresponsive patients, both procedures were repeated 3 times at 1 minute intervals before switching to medical treatment according to the guidelines. (6,7)

### Statistical Analysis

Data were analyzed in SPSS Windows 18 version. The distribution of the variables was checked by Kolmogorov-Smirnov test. Mean and standard deviation (SD) in descriptive statistics of parametric data; median and interquartile range (IQR) were used for descriptive statistics of non parametric data. Student's t-test was used for the analysis of quantitative parametric data and Mann Whitney U test was used for the analysis of the nonparametric data. The qualitative data were analyzed by Pearson chi-square and Fisher's exact tests.  $p < 0.05$  was considered statistically significant.

## Results

A total of 47 patients were included in the study. SVM was performed in 23 patients and MVM in 24 patients. The relationship between the type of maneuver and age was found to be statistically insignificant. The same conclusion applies to gender. There were no differences in age between the groups

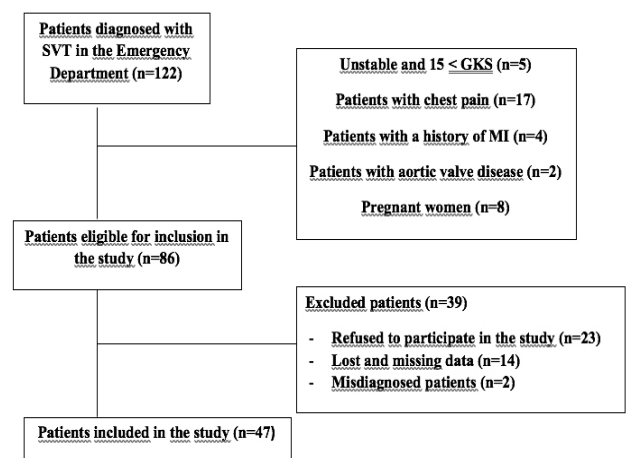
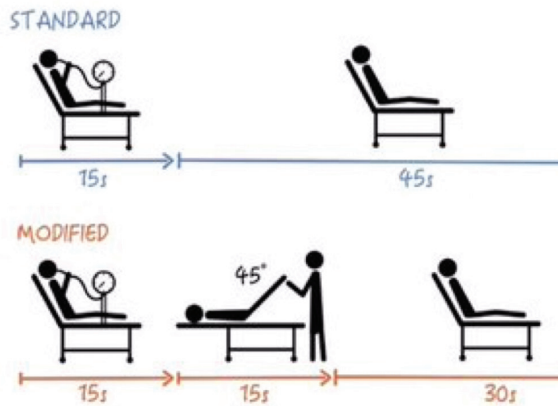


Figure 1a. Patient selection



**Figure 1b.** Standard and modified Valsalva maneuvers are described in detail with the aid of a picture. The picture retrieved from: medmastery.com/magazine/modified-valsalva-maneuver-video-review

( $p > 0.05$ ). There was no gender difference between the groups ( $p > 0.05$ ) (Table 1). There was no difference between the groups in terms of comorbidities. There was no difference between the groups in terms of vital parameters ( $p > 0.05$ ) (Table 2).

While 13 (27.7%) patients had a response to Valsalva maneuver, 34 (72.3%) had no response. While 4 (17.4%) of the patients with SVM returned to sinus rhythm, 19 (82.6%) remained in the SVT. While 9 (37.5%) of the patients undergoing MVM returned to sinus rhythm, 15 (62.5%) remained in SVT. Although the response of MVM patients was higher, there was no statistically significant difference ( $p > 0.05$ ) (Table 3). Of the four patients who responded to SVM, three (75%) responded in the first attempt and one (25%) responded in the second attempt; Eight (88.9%) out of nine patients who responded to MVM responded to the first attempt and one (11.1%) responded to the third attempt. There was no statistically significant relationship between maneuver responsiveness and number of maneuvers ( $p > 0.05$ ) (Table 3).

**Table 1. Relationship between age and sex type of maneuver**

		Total (n=47) Mean ± SD	SVM (n=23) Mean ± SD	MVM (n=24) Mean ± SD	p-value
Age		48±15	47.2±16.4	48.8±14.0	0.731
Gender	Male	19 (40.4%)	10 (43.5%)	9 (37.5%)	0.676
	Female	28 (59.6%)	13 (56.5%)	15 (62.5%)	

SD: Standard deviation, n: Number  
Student's t-test and Pearson chi-square tests were applied

**Table 2. Relationship between comorbidity and vital parameters type of maneuver**

	Total (n=47) Mean ± SD	SVM (n=23) Mean ± SD	MVM (n=24) Mean ± SD	p-value
SBP	125.1±22.5	129.2±25	121.2±19.4	0.224
DBP	73.4±18.0	73.1±22	73.8±13.3	0.901
Pulse	174.4±19.3	176.6±20.6	172.3±18.1	0.449
Fever	36.7±0.4	36.6±0.4	36.7±0.4	0.682
Respiratory rate	17.2±3.6	17.0±3.5	17.4±3.9	0.698
Saturation	96.4±2.5	95.9±2.8	97.0±2.0	0.164

Student t-test, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, SVM: Standard valsalva maneuver, MVM: Modified valsalva maneuver

	Total n (%)	SVM (n=23) n (%)	MVM (n=24) n (%)	p-value
HT	13 (27.7)	5 (21.7)	8 (33.3)	0.374*
CAD	11 (23.4)	3 (13.0)	8 (33.3)	0.101*
DM	7 (14.9)	2 (8.7)	5 (20.8)	0.416**
Asthma	2 (4.3)	1 (4.3)	1 (4.2)	>0.999**
COPD	1 (2.1)	0	1 (4.2)	>0.999**
CRF	1 (2.1)	1 (4.3)	0	>0.489**

\*Pearson chi square, \*\*Fisher's Exact Test, HT: Hypertension, CAD: Coronary artery disease, DM: Diabetes mellitus, CRF: Chronic renal failure, COPD: Chronic obstructive pulmonary disease, SVM: Standard Valsalva maneuver, MVM: Modified Valsalva maneuver



When the side effects developed in the study patients were evaluated, side effects (nausea) developed in one (7.7%) of 13 patients who responded to Valsalva maneuver, while no side effects occurred in 12 (92.3%). ( $p > 0.05$ ) In our study, none of the four patients responding to SVM developed side effects; one (11.1%) responding to MVM developed side effects (nausea) ( $p > 0.05$ ) (Table 4).

## Discussion

In different studies, the effectiveness of Valsalva maneuver was reported to be between 5%-20%. (9,10) Different methods for Valsalva maneuver have been described; It was stated that pressure duration, applied pressure and patient position may change Valsalva efficacy (9, 11-19). Since 1988, it is thought that by modifying the SVM by raising the legs, it will be easier to convert SVT to sinus rhythm. (20) In addition to SVM, epigastrium pressure or foot lifting may increase passive vagal stimulation by increasing venous return (11,19). Cochrane analysis evaluated the efficacy of the Valsalva maneuver and indicated that the success of the procedure ranged from 19.4% to 54.3% with modifications. However, the level of evidence for this study was reported to be low (21). Wong et al. (11) in their studies with the lifting of the feet R-R distance is the longest, increased when

the patient begins to erect and stated that the shortest sitting position. In this study, it was stated that posture on the back did not lead to changes in blood flow, leading to bradycardia (11). This hypothesis coincides with the results of Singer et al. (22) In their study by Walker and Cutting, patients were placed in the trelenderburg position and blown into a manometer to produce 40 mmHg pressure for 15 seconds. They stated that the success rate of Valsalva maneuver increased to 31% with this application (15). Wallentin and Sjol (23) reported that MVM was successfully applied without side effects in the case presented. n a case series published by Un et al. (24), MVM was applied to 5 patients who did not respond to standard vagal maneuvers. The patients were quickly taken from the sitting position to the supine position and were told to breathe deeply and slowly. The result was a return to sinus rhythm. This was attributed to increased venous return and increased baroreceptor activity triggering vagal stimulation. (24)

The first scientific randomized study was conducted by Appleboam et al. In 214 patients with SVM, 17% success was achieved and in 214 patients with MVM, 43% success was achieved. In the study, it was stated that MVM was superior (7). Michaud et al. (25) and Smith et al. (26) argued that Appleboam et al. (7) reported that MVM was superior to SVM. In our study, the response to SVM was 17.4% and the response to MVM was 37.5%, and this difference

**Table 3. Comparison of responses to SVM versus MVM. The relationship between the maneuver response and the number of maneuvering**

		Total	SVM (n=23)	MVM (n=24)	p-value
Response	Yes	13 (27.7%)	4 (17.4%)	9 (37.5%)	0.123
	No	34 (72.3%)	19 (82.6%)	15 (62.5%)	
		Number	SVM (n=4) (%)	MVM (n=9) (%)	p-value
Number of maneuvers	1		3 (75)	8 (88.9)	$s > 0.999$
	2		1 (25)	0	
	3		0	1 (11.1)	

SVM: Standard Valsalva maneuver, MVM: Modified Valsalva maneuver  
Pearson chi-square and Fisher's exact test were applied

**Table 4. Comparison of response to Valsalva maneuver and side effects**

Side effect	Response to Valsalva maneuver		p-value
	Yes (n=13) n (%)	No (n=34) n (%)	
Yes	1 (7.7)	9 (26.5)	0.244
No	12 (92.3)	25 (73.5)	
Side effect	SVM (n=4) n (%)	MVM (n=9) n (%)	p-value
Yes	0	1 (11.1)	$> 0.999$
No	4 (100)	8 (88.9)	

SVM: Standard Valsalva maneuver, MVM: Modified Valsalva maneuver  
Fisher's exact test was applied

was not statistically significant. Our treatment response rate was consistent with the study of Appleboam et al. However, it contradicts statistical significance. We believe that MVM is a more effective method. However, the reason for the lack of statistical significance is attributed to the small number of cases. We think that the elevation of the leg in MVM increases the venous return to the heart more and causes a better vagal response.

There was no relationship between the frequency of Valsalva maneuver application and response to maneuver in the literature. Appelboam et al. (7) stated that the results determined for SVM and MVM belong to the first minute, and that the response time was similar (7). In our study, 84.6% of the cases responded to Valsalva maneuver at the first application. The frequency of response of SVM and MVM in the first application was similar. Appelboam et al. (7) reported that none of the patients undergoing SVM and MVM had any serious side effects. Non-serious side effects such as hypotension, dizziness, nausea and musculoskeletal pain have been reported (7). Walker and Cutting reported that MVM is generally well tolerated, vomiting develops in only one patient and is superior to adenosine in terms of side effects (16). In our study, one of the patients who had MVM developed side effects and there was no difference between side effects and type of maneuver.

## Conclusion

In this study, we found that MVM is numerically superior in terms of success compared to SVM, but we could not prove this statistically. Therefore, we concluded that there was no difference between the two maneuvers in terms of success. We think that this is due to the small number of cases included in the study. In studies with more cases, we conclude that the result will be statistically significant. We anticipate that MVM can be used safely in emergency departments due to the absence of serious side effects in the treatment protocol applied, no difference in terms of serious side effects compared to SVM, and the ease of treatment.

## Study Limitations

When the literature is examined, studies on the subject are limited. In general, studies involving a small number of cases have been performed. Likewise, in our study, we reached a small number of cases in parallel with the literature. The reason for this is that our study is single-centered and performed within a certain period of time. Therefore, we think that the use of MVM in emergency services will become widespread with the increasing number of studies involving many patients. Thus, in the treatment of SVT, emergency physicians will be provided with a treatment alternative that is easier to do and with less side effects.

## Ethics

**Ethics Committee Approval:** This study was approved by Ankara Training and Research Hospital (decision no: 5319-633, date: 16/03/2016).

**Informed Consent:** Written informed consent was obtained from the patients or their closest relatives.

**Peer-review:** Externally peer-reviewed.

## Authorship Contributions

Surgical and Medical Practices: F.K.Ç., S.G., Y.K.G., Concept: F.K.Ç., S.G., Y.K.G., Design: F.K.Ç., S.G., Y.K.G., Data Collection or Processing: F.K.Ç., S.G., D.U.K., Analysis or Interpretation: Y.K.G., D.U.K., Literature Search: F.K.Ç., Y.K.G., D.U.K. Writing: F.K.Ç., Y.K.G.

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# Use of Bedside Ultrasonography for Diagnosis of Nasal Fractures in Emergency Service

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## Abstract

**Aim:** In our study, the reliability of bedside ultrasonography (USG) in fracture diagnosis was evaluated in the cases who applied to emergency service due to nasal traumas.

**Materials and Methods:** Forty cases presented to the emergency department with nasal trauma between 01.01.2016 and 31.12.2017 were evaluated prospectively. The patients' age, gender, physical examination findings, trauma type, causes of trauma, X-ray and USG results were recorded in the study. The physical examination was performed by an emergency medicine specialist, and physical examination and X-ray were accepted as the gold standard for diagnosis. In patients with suspected nasal fracture, physical examination and X-ray results were compared with USG in fracture diagnosis.

**Results:** The median age of the patients was 32.5 [interquartile range (IQR): 31], and 72.5% were male. There was no correlation between fracture presence with age or gender ( $p>0.05$ ). The most common findings were swelling (62.5%) and ecchymosis (47.5%). 77.5% of patients had isolated trauma, and the most common cause of injury was falls (52.5%). There was no correlation between the presence of fracture with the cause of trauma and the type of trauma ( $p>0.05$ ). The sensitivity, specificity, positive predictive value and negative predictive value of USG were identified as 88.5%, 78.6%, 88.5% and 78.6%, respectively

**Conclusion:** Bedside USG can be preferred as the first choice in diagnosing nasal fracture in patients applying to the emergency service due to nasal trauma.

**Keywords:** Nasal fractures, emergency service, bedside ultrasonography

## Introduction

Compared to other maxillofacial structures, the nose is an area that is prone to trauma due to its excessive protrusion (1,2). In maxillofacial traumas, nasal fracture is the most common with a rate of 40%-58% (3,4). Detection and correction of nasal fracture accordingly is cosmetically and clinically important for the future (1,5). Although physical examinations are considered gold standard for diagnosing nasal fractures, it is known that hematoma and edema of adjacent tissues make the diagnosis difficult (2). Imaging methods are often used in emergency service both for these cases and medico-legal reasons. Even though generally X-ray

is used for imaging, gold standard is computerized tomography (CT). However, use of CT imaging for isolated nasal fractures in emergency service settings is not common. Ultrasonography (USG) is an easy, inexpensive, mobile and radiation-free diagnostic method that is frequently used in many areas of trauma. Recently, USG has been reported to be useful in detection of the presence of fracture in maxillofacial injuries (6). In last two decades, use of bedside USG in emergency service steadily increased and there have been studies on the use of bedside USG in the diagnosis of various fractures (metacarpal, metatarsal, radius, phalanx) in emergency department (7-9). In these studies, USG has been



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shown to have high sensitivity and specificity.

The aim of this study was to report the value of bedside USG for identification of nasal fractures in patients who apply to emergency service due to nasal trauma by correlating clinical findings and X-ray.

## Materials and Methods

After the approval of the local ethics committee of Ankara Numune Training and Research Hospital (approval number: E-15-691, date: 23.12.2015), our study was conducted prospectively in 40 patients in accordance with Helsinki Declaration. The study was conducted according to the criteria set by the World Medical Association Declaration of Helsinki 'Ethical Principles for Medical Research Involving Human Subjects'.

Our study was performed in patients who presented to the emergency department with nasal trauma and received X-ray and USG imaging due to suspicion of nasal fracture after physical examination between dates of 01.01.2016 and 31.12.2017. Age, gender, physical examination findings, trauma type and causes of trauma were evaluated in the study. In our study, we created a "composite gold standard diagnosis" using the findings of physical examination (crepitation and/or dislocation) and X-ray for detection of nasal fractures diagnosis, then we compared the results of physical examination and X-ray with USG.

Specificity, sensitivity, positive predictive value (PPD) and negative predictive values (NPD) of USG were calculated. Nasal USG was performed by a radiologist (with 15-years of experience) in patients who gave consent. Ultrasonography and direct radiography were evaluated by radiologists separately. A linear probe (Toshiba Aplio500, Nasu, Japan) at 4-11 Mhz frequency was used for ultrasonography measurement. A water balloon was placed between the nose and the probe to get a better image (Figure 1).

The presence of cortical separation and staging in the nasal bone was considered significant for nasal fracture (Figure 2, Figure 3).

The reason why computed tomography was not preferred in this study even though it is gold standard was not to expose patients to radiation and for sole purpose of diagnosis of isolated nasal fractures it is not cost-effective.

Patients under 18 years of age, patients who refused to give consent, patients with open wound on the nasal dorsum and who had nasal fracture previously were excluded from the study.

## Statistical Analysis

The data obtained were analyzed using Statistical Package for Windows version 22 (SPSS version 22). The distribution of the

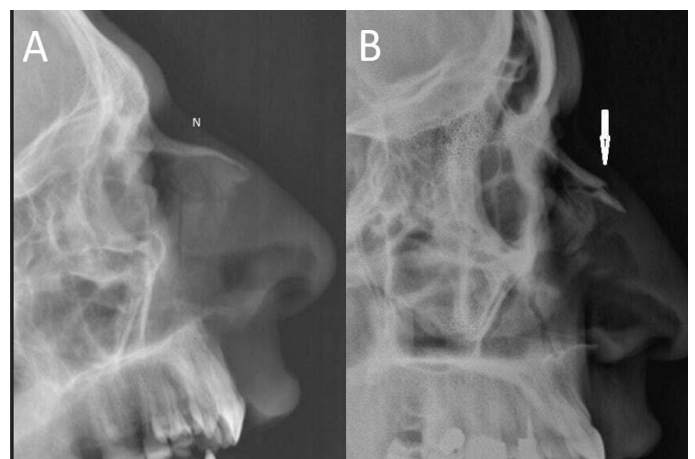
quantitative data was done by Kolmogrov-Smirnov test. In the representation of quantitative nonparametric data, median and inter-quantile range (IQR) were used, while the number of cases (n) and percentile (%) were used for the representation of qualitative data. The Mann-Whitney U test was used for the comparison of the quantitative data with the qualitative (categorical) data, the Pearson's square test and Fisher's exact test were used for the comparison of the qualitative data with each other.  $p < 0.05$  was considered significant.

## Results

The median age of the patients was 32.5 (IQR: 31); and 72.5% were male in our study. There was no correlation between fracture presence with age or gender ( $p > 0.05$ ). The most common findings were swelling (62.5%) and ecchymosis (47.5%). 77.5% of



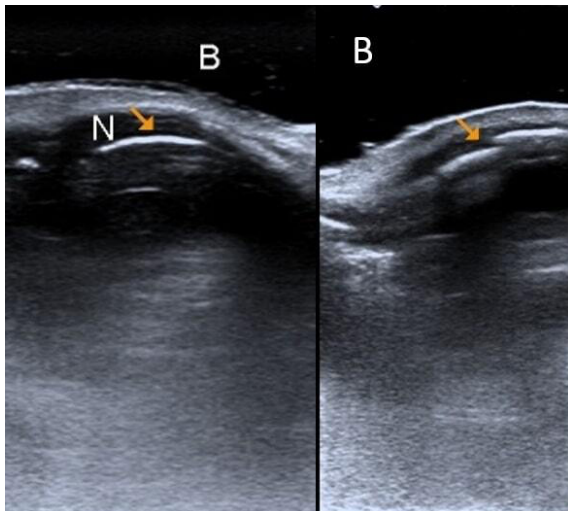
**Figure 1.** Nasal ultrasonography was performed using water balloon in supine position with 4-11 MHz linear probe



**Figure 2.** X-Ray Lateral Nasal view. Normal nasal bone formation is seen (A) and cortical separation and staging of the anterior nasal bone is observed (B)

the patients were injured due to isolated trauma and 22.5% due to multi-trauma. The most common injuries were due to falls (52.5%), followed by assaults (32.5%) (Table 1).

The frequency of crepitations was significantly low in patients who was diagnosed with a fracture ( $p < 0.05$ ). There was no correlation between the presence of fracture with the cause of trauma and the type of trauma ( $p > 0.05$ ) (Table 1).



**Figure 3.** Normal nasal bone sonographic examination is seen on the right image. On the left image, cortical separation and staging was detected secondary to nasal fracture (B: Baloon Water, N: Normal).

In patients whose fractures were identified with physical examination and X-ray, USG sensitivity, specificity, PPD and NPD were 88.5%, 78.6%, 88.5% and 78.6%, respectively (Table 2).

## Discussion

Ultrasonography is inexpensive, easy and non-invasive and allows high contrast imaging of even thin nasal bones at an appropriate frequency. In addition, high lateral resolution makes imaging of the smallest fractures and dislocations possible (10).

Studies have reported that patients presenting with nasal fracture are usually young males (4,6,11,12). Mozeika et al. (13) stated that maxillofacial injuries are frequently seen in young men. In our study, the incidence of nasal trauma and fracture was more frequent in young male patients in accordance with the literature. In our study, no significant relationship was found between the presence of fracture with age or gender.

Aksakal et al. (11) reported that swelling (70.2%) and hematoma (35.1%) were the most common findings (11). In the study of Doğan et al. (14) it is stated that the most common finding was swelling (51.1%) in children. In line with the literature, the most common symptom was swelling (62.5%), followed by ecchymosis (47.5%) and epistaxis (45%) in our study. We think that the edema occurs easily due to the protrusion of the nasal region and the absence of a structure to suppress the edema around this region.

**Table 1. Demographic and clinical characteristics of patients with nasal trauma**

		Whole population sample Yes (n=26)	Fracture		p-value
			No (n=14)	Yes (n=12)	
Age, Mean $\pm$ SD		32.5 (31)	34.5 (29)	32 (36)	0.546*
Gender	Male, n (%)	29 (72.5)	19 (73.1)	10 (71.4)	>0.999***
	Female, n (%)	11 (27.5)	7 (26.9)	4 (28.6)	
Symptom	Swelling, n (%)	25 (62.5)	18 (69.2)	7 (50)	0.231**
	Ecchymosis, n (%)	19 (47.5)	10 (38.5)	9 (64.3)	0.119**
	Epistaxis, n (%)	18 (45)	11 (42.3)	7 (50)	0.641**
	Crepitations, n (%)	11 (27.5)	11 (42.3)	0	0.004***
	Deviation, n (%)	6 (15)	6 (23.1)	0	0.074***
Type of trauma	Isolated, n (%)	31 (77.5)	22 (84.6)	9 (64.3)	0.234***
	Multi trauma, n (%)	9 (22.5)	4 (15.4)	5 (35.7)	
Cause of Trauma	Falls, n (%)	21 (52.5)	13 (50)	8 (57.1)	0.309***
	Assault, n (%)	13 (32.5)	10 (38.5)	3 (21.4)	
	Traffic accident, n (%)	4 (10)	3 (11.5)	1 (7.1)	
	Collision, n (%)	1 (2.5)	0	1 (7.1)	
	Animal Kick, n (%)	1 (2.5)	0	1 (7.1)	

\*Mann-Whitney U, \*\*Pearson's chi-square test, \*\*\*Fisher's exact test

**Table 2. Comparison of USG results to physical examination and X-ray**

		Physical examination + X-ray fracture						p-value
		Yes (n=26)			No (n=14)			<0.001
USG fracture	Yes (n=26)	21	88.5%	88.5%	5	35.7%	35.7%	
	No (n=14)	5	19.2%	19.2%	9	78.6%	78.6%	
		Sensitivity						
		Specificity						
		Positive predictive value						
		Negative predictive value						
USG: Ultrasonography, n: Number								

Aksakal et al. (11) reported that the most common cause of nasal injury was assault (40.5%) and falling (36.5%). Pham et al. (4) reported that nasal fractures usually develop as a result of blunt trauma (90.5%) and the most common causes were traffic accidents (27.5%) and falls (25.4%). It was reported that the most common cause of isolated fractures was falls in that study (4). Park et al. (1) reported that the most common cause of nasal fractures was fighting (40.6%). In our study, it was found that nasal injuries generally developed as a result of isolated injuries (77.5%), and the most common causes of injury were falls (52.5%) and assault (32.5). In our study, no significant relationship was found between the presence of fracture with the cause of trauma and the type of trauma.

Although tomography has been reported to be the best imaging tool for nasal fractures (5,6); many studies reported that USG and CT showed similar results in the detection of nasal fractures (1,2,5). Even though Lee et al. (5) reported that CT is much better than X-ray for detecting fractures; they also reported that USG has similar sensitivity to CT and better specificity for detecting nasal bone midline fractures, better PPV and NPV than CT. In the same study, it was reported that CT has more sensitivity than USG in detecting lateral nasal bone fractures (5). The fact that USG is better than CT in midline fractures has been attributed to thick-section CT images bypassing thin fracture lines (15).

In the study of Mohammadi et al. (16) sensitivity of nasal bone fracture detection rates for USG, CT and X-ray were 97%, 100% and 86% while specificity rates of USG, CT and X-ray were 87%, 72% and 73%, respectively. AL-Bahrany et al. (17) reported that the sensitivity of USG in nasal fractures was 76.6%. Lee et al. (5) found that sensitivity, specificity, PPV and NPV of USG according to localization of fracture were 70-80%, 75-90%, 50-72.7% and 86.4-93.3%, respectively. Caglar et al. (18) found that USG had a sensitivity of 84.8%, specificity of 93%, PPV of 90.7%, and NPV of 88.3% compared with radiography. Gürkov et al. (19) reported that compared to USG, the specificity of X-ray was higher for identification of lateral nasal bone fractures (75% and 94%).

However, the sensitivity of USG for identification of fractures of lateral nasal bone were significantly higher comparing to X-ray (98% and 28%). In our study; sensitivity, specificity, positive predictive value and negative predictive value of USG were 88.5%, 78.6%, 88.5% and 78.6%, respectively. According to our results, USG had high sensitivity for identifying fractures of nasal bone, in line with the literature.

We think that bedside USG can be used as the first choice especially in cases where radiation is avoided such as pregnancy in the emergency department for the detection of nasal fracture with suspicious physical examination because it is repeatable, documentable, cost-effective and due to its non-radiation, no required preparation, rapid and bedside application.

### Study Limitations

The most important limitation of our study was the small sample of cases. Another limitation which should mentioned was that we did not compare ultrasonography with CT which is the golden standard. This limitation stem from avoiding unnecessary radiation exposure and no requirement of additional imaging in existing traumas. Also, these results might not be confirmed in another center due to USG being operator-dependent.

### Conclusion

We think that bedside USG can be preferred as the first choice in the diagnosis of nasal fracture in patients presenting to the emergency service with a nasal trauma, because of its high sensitivity in the diagnosis of nasal fracture. Further studies are needed on this subject.

There is no conflict of interest between the authors.

### Ethics

**Ethics Committee Approval:** This study was approved by the Ethics Committee of Ankara Numune Training and Research Hospital (approval number: E-15-691, date: 23.12.2015).

**Informed Consent:** It was obtained.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Surgical and/or Medical Practices: S.E., Concept: S.E., T.T.T., M.A., Design: S.E., T.T.T, Y.D., Data Collection and/or Processing: S.E., Y.D., H.M.Ç., Analysis and/or Interpretation: S.E., Y.D., M.A., Literature Search: S.E., T.T.T., Writing: S.E.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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# Emergency Medicine Physicians' Approaches to Coping with Stress in COVID-19 Pandemic

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## Abstract

**Aim:** This study aimed to investigate the stress experienced by emergency medicine physicians working in emergency departments during the coronavirus disease-2019 (COVID-19) pandemic, the factors they stated to be effective against stress, and their coping approaches to stressful situations.

**Materials and Methods:** The study was designed in a general screening model, and 200 emergency medicine physicians participated via e-mail who work in emergency departments in Turkey. The sources of stress related to the pandemic, the factors that they find effective in combating stress, and their strategies to cope with stress were investigated with relation to their gender, marital status, after-shift accommodation, manner of working in a shift, smoking behavior, having a chronic disease, having children, and spouse's job as a healthcare professional.

**Results:** While the primary source of stress of emergency medicine physicians during the pandemic was the risk of transmitting the virus to their families, the most influential factor in combating stress was leisure activities. Emergency physicians' approaches to coping with stress were significantly predicted by the variables of using full personal protective equipment while working, having an adequate sleep and resting opportunities, obtaining additional economic income, and not knowing the pandemic's end date.

**Conclusion:** Emergency medicine physicians used active problem-oriented approaches, and among these, they used the social support seeking approach the most during the pandemic. It is necessary to provide social support, take precautions to care for healthcare workers' families and arrange emergency physicians' shifts to allocate their time to their leisure activities appropriately to reduce stress.

**Keywords:** COVID-19, coping with stress, emergency medicine physician, pandemic, stress

## Introduction

The coronavirus disease 2019 (COVID-19) epidemic, which started in November 2019 in China, caused an increase in the workload, working hours, and healthcare professionals' psychological stress (1). Work-related stress is associated with an overloaded work environment where demand exceeds capacity, and it affects healthcare professionals gravely (2). Emergency medicine physicians (EMPs) on the front line have become very sensitive to physical exhaustion, fear, emotional depression, and sleep problems especially; both due to increased workload and their close contact with infected patients (3). During the COVID-19 pandemic, healthcare professionals work knowing that this is

a fatal virus, human-to-human transmission is high, they lack personal protective equipment (PPE), and there is no definitive evidence-based treatment yet (4). Also, physicians' emotional trauma increases even more with the deaths they encounter, including their colleagues (5). In a study by Lai et al. (6); it has been reported that physicians who met the patient first experienced depression, insomnia, and intense anxiety.

Work-related stress has psychological consequences such as mood depression, anxiety, and feelings of helplessness (7). It also has physiological results such as hypertension, cardiovascular disease (8,9). The importance of stress management in the prevention of cardiovascular diseases is emphasized in the guideline (9). It leads



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to undesirable situations such as decreased job satisfaction, decreased productivity and production, and eventually losing experienced personnel (7). When it is evaluated in terms of healthcare professionals, it can be seen that job-related burnout directly affects the quality and safety of the health service provided (10). Determining the sources of stress and the approaches to combating the stress of EMPs, who are working at the forefront during the pandemic, are of great importance.

Although many studies on the stress and anxiety of healthcare professionals before the pandemic, the studies related to the additional load encountered due to the epidemic are limited. It is essential to know the sources of stress and EMPs' strategies to cope with the stress to successfully combat the pandemic that greatly impacted social life and has an unknown end date. Even though the entire community needs to give their best effort, successful public health outcomes are mainly dependent on the effective work of the health workforce (11).

Approaches to coping with stress are addressed in two ways in terms of their functions: the management or alteration of the person-environment relationship that is the source of stress (problem-oriented coping) and the regulation of stressful emotions (emotion-oriented coping) (12). In this study, EMPs' stress management approaches were examined in the context of problem-oriented and emotion-oriented coping. In addition to the individual, institutional and social benefits of the data to be obtained, it will also help define healthcare professionals' stress sources, the factors they stated to be effective in combating the stress efficiently, and their approaches to coping with stress. It is even thought that it will help prepare the content and method of preventive and supportive services offered to health professionals.

## Materials and Methods

### Study Design and Setting

This research was planned as a descriptive study in the general screening model to reveal the factors that affect the stress and coping strategies of EMPs working in the emergency departments (EDs) during the COVID-19 pandemic. This study was approved by Düzce University Non-Interventional Clinical Research Ethics Board with the registration number 2020/84.

### Selection of Participants

This research was conducted on EMPs who work in EDs in Turkey during the COVID-19 pandemic. The minimum sample size of the research was calculated as 185 (n) with the following formula (13):  $n = t^2pq/d^2$  [t: 1.96; p: 0.14, q: 0.86, d: 0.05]. The data collection tools used in the research were sent to the 276 EMPs'

via e-mail. However, 200 EMPs participated in the study (with a response rate of 72.5%).

### Measurements

Stress Coping Scale was developed by Folkman and Lazarus, is a 4-point Likert type scale with 66 items, which is frequently used in studies investigating the issue of dealing with stress (12). "Stress Coping Styles Scale", adapted by Sahin and Durak in Turkish, consists of 30 items (14). Sub-dimensions of the scale are self-confident, optimistic, social support seeking, helpless, and submissive approach. The first three of the subscales are called the active problem-oriented. The other two are called passive emotion-oriented. The increase in the scores obtained from the self-confident, optimistic, and social support seeking approach factors of the participants show that they use active styles more in coping with stress. The increase in the scores obtained from the helpless and submissive approach factors indicates that they use passive styles to cope with stress (14). The high scores obtained from the subscales indicate that the sub-scale approach is used more in dealing with stress. However, since the most elevated scores obtained from each subscale differ from each other, corrected scores were calculated in the analysis of the data.

Confirmatory factor analysis was performed to test the construct validity of the scale within the scope of this study and the obtained values were found to be at good and acceptable levels [2/SD = 1.523, RMSEA = 0.051, CFI = 0.903, TLI = 0.882] (15). Cronbach's alpha value was 0.84 for problem-oriented, 0.82 for emotion-oriented, 0.79 for self-confident, 0.76 for optimistic, 0.53 for social support seeking, 0.65 for submissive and 0.77 for helpless approach was calculated.

A personal information form was created to determine the participants' demographic information, consisting of questions of age, gender, marital status, having children, the spouse being a healthcare professional, smoking, having a chronic disease, after-shift accommodation, manner of working in a shift.

Pandemic Stress Factors Questionnaire was developed by the researchers to reveal the stress-related factors experienced by the participants during the COVID-19 pandemic. Open-ended questions were included to reveal the stressful situations of EMPs during the pandemic, and which factors they think are useful in coping with stress.

### Statistical Analysis

The data was analyzed using SPSS 17 statistics program, with a 95% confidence level. Frequency, percentage, mean, median, and standard deviation were used to describe the demographic characteristics of EMPs, the factors that they considered as a source of stress during the COVID-19 pandemic, the factors

that they stated to be effective in dealing with stress, and their coping approaches. Mann-Whitney U, chi-square, and stepwise (forward) multiple regression analyses were conducted for further investigations.

## Results

The average age and shift time of participants was  $36.21 \pm 6.16$  years and  $18.89 \pm 6.17$  hours, respectively. Detailed demographic characteristics of 200 EMPs who participated in the study were presented in Table 1.

Results towards the approaches of EMPs show that they used the problem-oriented rather than emotion-oriented approach [ $\bar{X}_p = 61.8 \pm 14.5$ ;  $\bar{X}_e = 33.10 \pm 16.15$ ]. Besides, it was found that they resorted to seeking social support mostly [ $\bar{X}_{p1} = 64.6 \pm 17.5$ ]. Other approaches were self-confident [ $\bar{X}_{p2} = 62.6 \pm 17.5$ ], optimistic [ $\bar{X}_{p3} = 58.4 \pm 19.5$ ], helpless [ $\bar{X}_{e1} = 33.5 \pm 18.2$ ] and submissive [ $\bar{X}_{e2} = 32.5 \pm 17.9$ ].

It has been determined that EMPs' problem-oriented ( $p=0.020$ ) and optimistic ( $p=0.015$ ) approaches differ significantly in favor of men according to gender (Table 2). Married EMPs had a passive stress approach with a higher average than singles ( $p=0.041$ ). The submissive stress approach of EMPs remained with their family after their shift was higher than those who remained alone ( $p=0.047$ ). It was found that the helpless stress approach of the married EMPs is higher than the average of the singles ( $p=0.022$ ).

Also, the helpless stress approach average of smoker EMPs was higher than that of non-smokers ( $p=0.039$ ).

The factors that the EMPs stated that they caused stress during the COVID-19 pandemic were transmitting the virus to the family (f:150, 75%), unknown end date of the pandemic (f:148, 74%), the risk of self-contamination (f:134, 67%), discomfort from PPE (f:132, 66%), lack of definitive treatment or vaccine (f:119, 59.5%), the necessity of frequent cleaning and equipment change (f:109, 54.5%), lack of full PPE (f:72, 36%), long shifts (f:60, 30%), lack of medical equipment (f:58, 29%), having fewer colleagues during shifts (f:55, 27.5%), and comorbidity (f:22, 11%).

The research data examining the relationship between stress sources that EMPs experience during the COVID-19 pandemic and demographic variables are presented in Table 3. Accordingly, the risk of transmitting the virus to the family was found to be related to the marital status ( $p=0.004$ ) and after-shift accommodation ( $p=0.009$ ). The risk of self-contamination was associated with the manner of working in a shift ( $p=0.021$ ). It was observed that the comorbidity as a stressor was related to the chronic disease status ( $p=0.000$ ), the lack of medical equipment was related to gender ( $p=0.019$ ), marital status ( $p=0.035$ ), and chronic disease ( $p=0.021$ ). The necessity of frequent cleaning and equipment change was associated with gender ( $p=0.004$ ) and smoking ( $p=0.027$ ). Besides, the lack of PPE was related to marital status ( $p=0.025$ ) and the manner of working in a shift ( $p=0.034$ ).

**Table 1. Demographic Characteristics of EMPs Participated to the Study**

Variables	n		f	%
Gender	200	Female	88	44
		Male	112	56
Marital status	200	Married	126	63
		Single	74	37
After-shift accommodation	200	Alone	77	38.5
		With family	123	61.5
Smoking behavior	200	Smoker	69	34.5
		Non-smoker	131	65.5
Having chronic disease	200	Yes	28	14.0
		No	172	86.0
Manner of working in a shift	200	Alone	105	52.5
		With another EMP <sub>(s)</sub>	95	47.5
Having children	143*	Yes	107	74.8
		No	36	25.2
Spouse's job as a healthcare professional	126	Yes	73	57.9
		No	53	42.1

EMPs: Emergency Medicine Physicians; \*Married or divorced EMPs answered this item (f:143)

**Table 2. Investigating Coping With Stress Approaches of EMPs According to the Demographic Variables**

Variable	Problem-oriented		Self-confident		Optimistic		Social support		Emotion-oriented		Submissive		Helpless		
	N	MR	SR	MR	SR	MR	SR	MR	SR	MR	SR	MR	SR		
<b>Gender</b>															
Female	88	89.81	7,903	94.97	8,357	89.30	7,858	94.59	8,323.5	101.44	8,926.5	101.82	8,960	101.98	8,974.5
Male	112	108.90	12,197	104.85	11,743	109.30	12,242	105.15	11,776.5	99.76	11,173.5	99.46	11,140	99.33	11,125.5
	200	U=3,987 p=0.020* d=0.332		U=4441 p=0.229		U=3,942 p=0.15* d=0.348		U=4,407.5 p=0.195		U=4,845.5 p=0.839		U=4,812 p=0.774		U=4,797.5 p=0.748	
<b>Marital status</b>															
Married	126	101.12	12,740.5	101.87	12,835	103.61	13,055	95.63	12,049	106.89	13,468	103.81	13,080	107.67	13,566.5
Single	74	99.45	7,359.5	98.18	7,265	95.20	7,045	108.8	8,051	89.62	6632	94.86	7,020	88.29	6,533.5
	200	U=4,584.5 p=0.844		U=4,490 p=0.662		U=4,270 p=0.318		U=4,048 p=0.116		U=3,857 p=0.041* d=0.291		U=4,245 p=0.289		U=3,758.5 p=0.022* d=0.328	
<b>After-shift accommodation</b>															
Alone	77	100.71	7,755	97.19	7,483.5	99.3	7,646	109.39	8,423	90.58	6,974.5	90.25	6,949.5	92.44	7,117.5
With family	123	100.37	12,345	102.57	12,616.5	101.25	12,454	94.93	11,677	106.71	13,125.5	106.91	13,150.5	105.55	12,982.5
	200	U=471.9 p=0.967		U=4,480.5 p=0.520		U=4,643 p=0.815		U=4,051 p=0.082		U=3,971.5 p=0.055		U=3,946.5 p=0.047* d=0.283		U=4,114.5 p=0.118	
<b>Smoking behavior</b>															
Smoker	69	94.21	6,500.5	99.72	6,880.5	91.08	6,284.5	95.22	6,570.5	108.51	7,487.5	100.96	6,966	112.12	7,736
Non-smoker	131	103.81	13,599.5	100.91	13,219.5	105.46	13,815.5	103.28	13,529.5	96.28	12,612.5	100.26	13,134	94.38	12,364
	200	U=4,085.5 p=0.264		U=4,465.5 p=0.889		U=3,869.5 p=0.093		U=4,155.5 p=0.344		U=3,966.5 p=0.155		U=4,488 p=0.935		U=3,718 p=0.039* d=0.294	
<b>Having chronic disease</b>															
Yes	28	108.25	3,031	108.84	3,047.5	104.89	2,937	104.48	2,925.5	93.29	2,612	88.2	2,469.5	98	2,744
No	172	99.24	17,069	99.14	17,052.5	99.78	17,163	99.85	17,174.5	101.67	17,488	102.5	17,630.5	100.91	17,356
	200	U=2,191 p=0.444		U=2,174.5 p=0.409		U=2,285 p=0.663		U=2,296.5 p=0.691		U=2,206 p=0.476		U=2,063.5 p=0.223		U=2,338 p=0.805	
<b>Manner of working in a shift</b>															
Alone	105	100.78	10,582	98.58	10,350.5	104.43	10,965.5	102.2	10,731.5	96.83	10,167.5	98.25	10,316	95.62	10,040.5
With another EMP(s)	95	100.19	9,518	102.63	9,749.5	96.15	9,134.5	98.62	9,368.5	104.55	9,932.5	102.99	9,784	105.89	10,059.5
	200	U=4,958 p=0.942		U=4,785.5 p=0.620		U=4,574.5 p=0.309		U=4,808.5 p=0.658		U=4,602.5 p=0.346		U=4,751 p=0.561		U=4,475.5 p=0.209	

Table 2 continued

Variable	Problem-oriented		Self-confident		Optimistic		Social support		Emotion-oriented		Submissive		Helpless		
	N	MR	SR	MR	SR	MR	SR	MR	SR	MR	SR	MR	SR		
<b>Having children</b>															
Yes	107	73.25	7,837.5	73.09	7,820.5	74	7,917.5	72.13	7,717.5	71.98	7,702	71.4	7,640	72.69	7,778
No	36	68.29	2,458.5	68.76	2,475.5	66.07	2,378.5	71.63	2,578.5	72.06	2,594	73.78	2,656	69.94	2,518
	143	U=1,792.5 p=0.534		U=1,809.5 p=0.586		U=1,712.5 p=0.317		U=1,912.5 p=0.949		U=1,924 p=0.993		U=1,862 p=0.765		U=1,852 p=0.730	
<b>Spouse's job as a healthcare professional</b>															
Yes		67.92	4,958.5	68.32	4,987.5	63.94	4,667.5	68.71	5,015.5	59.10	4,314	58.84	4,295.5	60.26	4,399
No		57.41	3,042.5	56.86	3,013.5	62.90	3,333.5	56.33	2,985.5	69.57	3,687	69.92	3,705.5	67.96	3,602
		U=1,611.5 p=0.110		U=1,582.5 p=0.081		U=1,902.5 p=0.873		U=1,554.5 p=0.057		U=1,613 p=0.112		U=1,594.5 p=0.091		U=1,698 p=0.241	

MR: Mean rank, SR: Sum of ranks, \*p<.05, d: Cohen's d, EMPs: Emergency medicine physicians

There was a significant relation between long shifts and marital status (p=0.030), after-shift accommodation (p=0.029), manner of working in a shift (p=0.009), having children (p=0.004), and spouse's health professional status (p=0.038). Lack of co-worker was found related to after-shift accommodation (p=0.026), manner of working in a shift (p=0.010) and having children (p=0.007). Besides, the unknown end date of the pandemic was found related to gender (p=0.010). A significant correlation was found between the lack of definitive treatment or vaccine and gender (p=0.002).

The factors that EMPs stated that they were effective in dealing with the stress they experienced during the COVID-19 pandemic were mostly leisure activities (f:124, 62%), having full PPE while working (f:106, 53%), additional income (f:96, 48%), public appreciation (f:83, 41.5%), having adequate sleep and rest (f:74, 37%), religion (f:22, 11%) and psychological support (f:18, 9%). Also, as seen in Table 4, the appreciation was found to be associated with having children (p=0.012) and spouse's being a healthcare professional (p=.009). Getting psychological support was linked to having a chronic disease (p=0.025).

The regression analysis result showed that having full PPE while working and having adequate sleep/rest were significant predictors and explained 5.6% of the total variance in the active coping approaches of EMPs for stress (p=0.003) (Table 5). It was concluded that having full PPE while working was a significant predictor and explained 6% of the total variance in EMPs' self-confidant coping approach to stress (p=0.000). It was determined that having adequate sleep/rest was a significant predictor and explained 2.6% of the total variance in EMPs' optimistic approach to coping with stress (p=0.022). Besides, the additional income was a significant predictor and explained 2.2% of the level of EMPs resorting to social support seeking approach to deal with stress (p=0.037).

According to the multiple regression analysis results, it was concluded that the unknown end date of the pandemic, additional income, and having full PPE variables were significant predictors and explained 7.5% of the total variance in the EMPs' passive coping approach to stress (p=0.002). Additionally, it was decided that the pandemic's unknown end date, additional income, and having full PPE while working were significant predictors and explained 8.7% of the total variance in EMPs' helpless coping approach to stress (p=0.000). However, as a result of forward stepwise regression analysis that revealed the variables predicting EMPs' submissive coping approach to stress, a significant model and independent variable could not be calculated.

**Table 3. Relationship between demographic variables and the factors that cause stress on the EMPs during the COVID-19 pandemic**

Variables	Transmitting virus		Self-contamination		Comorbidity		Medical equipment		Equipment change		PPE		Discomfort		Long shifts		Lack of co-worker		End date		Treatment/vaccine	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
<b>Gender</b>																						
Female	65	23	63	25	8	80	33	55	58	30	34	54	62	26	30	58	21	67	73	15	63	25
Male	85	27	71	41	14	98	25	87	51	61	38	74	70	42	30	82	34	78	75	37	56	56
Chi-square tests of independence	$\chi^2(1)=0.108$ $p=0.742$ $\phi=0.023$ $n=200$		$\chi^2(1)=1.498$ $p=0.221$ $\phi=0.087$ $n=200$		$\chi^2(1)=0.585$ $p=0.444$ $\phi=0.054$ $n=200$		$\chi^2(1)=5.514$ $p=0.019^*$ $\phi=0.166$ $n=200$		$\chi^2(1)=8.249$ $p=0.004^*$ $\phi=0.203$ $n=200$		$\chi^2(1)=0.474$ $p=0.491$ $\phi=0.049$ $n=200$		$\chi^2(1)=1.390$ $p=0.238$ $\phi=0.083$ $n=200$		$\chi^2(1)=1.252$ $p=0.263$ $\phi=0.079$ $n=200$		$\chi^2(1)=1.042$ $p=0.307$ $\phi=0.072$ $n=200$		$\chi^2(1)=6.549$ $p=0.010^*$ $\phi=0.181$ $n=200$		$\chi^2(1)=90.533$ $p=0.002^*$ $\phi=0.218$ $n=200$	
<b>Marital status</b>																						
Married	103	23	79	47	15	111	30	96	66	60	38	88	82	44	31	95	31	95	91	35	72	54
Single	47	27	55	19	7	67	28	46	43	31	34	40	50	24	29	45	24	50	57	17	47	27
Chi-square tests of independence	$\chi^2(1)=8.265$ $p=0.004^*$ $\phi=0.203$ $n=200$		$\chi^2(1)=2.850$ $p=0.091$ $\phi=0.119$ $n=200$		$\chi^2(1)=0.285$ $p=0.594$ $\phi=0.038$ $n=200$		$\chi^2(1)=4.456$ $p=0.035^*$ $\phi=0.149$ $n=200$		$\chi^2(1)=0.617$ $p=0.432$ $\phi=0.056$ $n=200$		$\chi^2(1)=5.043$ $p=0.025^*$ $\phi=0.159$ $n=200$		$\chi^2(1)=0.129$ $p=0.720$ $\phi=0.025$ $n=200$		$\chi^2(1)=4.723$ $p=0.030^*$ $\phi=0.154$ $n=200$		$\chi^2(1)=1.433$ $p=0.231$ $\phi=0.085$ $n=200$		$\chi^2(1)=0.559$ $p=0.455$ $\phi=0.053$ $n=200$		$\chi^2(1)=0.785$ $p=0.376$ $\phi=0.063$ $n=200$	
<b>After-shift accommodation</b>																						
Alone	50	27	54	23	10	67	25	52	43	34	33	44	53	24	30	47	28	49	59	18	51	26
With family	100	23	80	43	12	111	33	90	66	57	39	84	79	44	30	93	27	96	89	34	68	55
Chi square tests of independence	$\chi^2(1)=6.765$ $p=0.009^*$ $\phi=0.184$ $n=200$		$\chi^2(1)=0.555$ $p=0.456$ $\phi=0.053$ $n=200$		$\chi^2(1)=0.505$ $p=0.477$ $\phi=0.050$ $n=200$		$\chi^2(1)=0.731$ $p=0.393$ $\phi=0.060$ $n=200$		$\chi^2(1)=0.091$ $p=0.763$ $\phi=0.021$ $n=200$		$\chi^2(1)=2.555$ $p=0.110$ $\phi=0.113$ $n=200$		$\chi^2(1)=0.447$ $p=0.504$ $\phi=0.047$ $n=200$		$\chi^2(1)=4.788$ $p=0.029^*$ $\phi=0.155$ $n=200$		$\chi^2(1)=4.934$ $p=0.026^*$ $\phi=0.157$ $n=200$		$\chi^2(1)=0.448$ $p=0.503$ $\phi=0.047$ $n=200$		$\chi^2(1)=2.356$ $p=0.125$ $\phi=0.109$ $n=200$	
<b>Smoking behavior</b>																						
Smoker	48	21	51	18	11	58	19	50	45	24	29	40	50	19	24	45	17	52	54	15	40	29
Non-smoker	102	29	83	48	11	120	39	92	64	67	43	88	82	49	36	95	38	93	94	37	79	52
Chi square tests of independence	$\chi^2(1)=1.569$ $p=0.198$ $\phi=0.091$ $n=200$		$\chi^2(1)=2.277$ $p=0.131$ $\phi=0.107$ $n=200$		$\chi^2(1)=2.628$ $p=0.105$ $\phi=0.115$ $n=200$		$\chi^2(1)=0.110$ $p=0.741$ $\phi=0.023$ $n=200$		$\chi^2(1)=4.880$ $p=0.027^*$ $\phi=0.156$ $n=200$		$\chi^2(1)=1.662$ $p=0.197$ $\phi=0.091$ $n=200$		$\chi^2(1)=1.961$ $p=0.161$ $\phi=0.099$ $n=200$		$\chi^2(1)=1.147$ $p=0.284$ $\phi=0.076$ $n=200$		$\chi^2(1)=0.433$ $p=0.511$ $\phi=0.047$ $n=200$		$\chi^2(1)=0.994$ $p=0.319$ $\phi=0.070$ $n=200$		$\chi^2(1)=0.102$ $p=0.749$ $\phi=0.023$ $n=200$	
<b>Having chronic disease</b>																						
Yes	18	10	20	8	17	11	3	25	12	16	9	18	10	10	10	18	9	19	19	9	17	11
No	132	40	114	58	5	167	55	117	97	75	63	109	114	58	50	122	46	126	129	43	102	70

Table 3. continued

Variables	Transmitting virus		Self-contamination		Comorbidity		Medical equipment		Equipment change		PPE		Discomfort		Long shifts		Lack of co-worker		End date		Treatment/vaccine		
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Chi square tests of independence	$\chi^2(1)=1.993$ $p=0.158$ $\phi=0.100$ $n=200$		$\chi^2(1)=0.289$ $p=0.591$ $\phi=0.038$ $n=200$		$p=0.000^*$ $\phi=0.641$ $n=200$		$\chi^2(1)=5.287$ $p=0.021^*$ $\phi=0.163$ $n=200$		$\chi^2(1)=1.780$ $p=0.182$ $\phi=0.094$ $n=200$		$\chi^2(1)=0.210$ $p=0.647$ $\phi=0.032$ $n=200$		$\chi^2(1)=0.043$ $p=0.836$ $\phi=0.015$ $n=200$		$\chi^2(1)=0.506$ $p=0.477$ $\phi=0.050$ $n=200$		$\chi^2(1)=0.352$ $p=0.553$ $\phi=0.042$ $n=200$		$\chi^2(1)=0.639$ $p=0.424$ $\phi=0.057$ $n=200$		$\chi^2(1)=0.020$ $p=0.888$ $\phi=0.010$ $n=200$		
Manner of working in a shift																							
Alone	77	28	78	27	12	93	36	69	61	44	45	60	72	33	40	65	37	68	78	27	67	38	
with EMP(s)	73	22	56	39	10	85	22	73	48	47	27	68	60	35	20	75	18	77	70	25	52	43	
Chi square tests of independence	$\chi^2(1)=0.327$ $p=0.567$ $\phi=0.040$ $n=200$		$\chi^2(1)=5.307$ $p=0.021^*$ $\phi=0.163$ $n=200$		$\chi^2(1)=0.041$ $p=0.839$ $\phi=0.014$ $n=200$		$\chi^2(1)=2.999$ $p=0.083$ $\phi=0.122$ $n=200$		$\chi^2(1)=1.152$ $p=0.283$ $\phi=0.076$ $n=200$		$\chi^2(1)=4.511$ $p=0.034^*$ $\phi=0.150$ $n=200$		$\chi^2(1)=0.651$ $p=0.420$ $\phi=0.057$ $n=200$		$\chi^2(1)=6.898$ $p=0.009^*$ $\phi=0.186$ $n=200$		$\chi^2(1)=6.639$ $p=0.010^*$ $\phi=0.182$ $n=200$		$\chi^2(1)=0.009$ $p=0.923$ $\phi=0.007$ $n=200$		$\chi^2(1)=1.704$ $p=0.192$ $\phi=0.092$ $n=200$		
Having children																							
Yes	91	16	68	39	17	90	25	82	53	54	31	76	66	41	24	83	25	82	76	31	63	44	
No	26	10	23	13	3	33	14	22	22	14	14	22	25	11	17	19	17	19	28	8	21	15	
Chi square tests of independence	$\chi^2(1)=2.978$ $p=0.084$ $\phi=0.144$ $n=143$		$\chi^2(1)=0.001$ $p=0.971$ $\phi=0.003$ $n=143$		$\chi^2(1)=1.278$ $p=0.258$ $\phi=0.095$ $n=143$		$\chi^2(1)=3.273$ $p=0.070$ $\phi=0.151$ $n=143$		$\chi^2(1)=1.448$ $p=0.229$ $\phi=0.101$ $n=143$		$\chi^2(1)=1.228$ $p=0.268$ $\phi=0.093$ $n=143$		$\chi^2(1)=0.701$ $p=0.402$ $\phi=0.070$ $n=143$		$\chi^2(1)=8.096$ $p=0.004^*$ $\phi=0.238$ $n=143$		$\chi^2(1)=7.391$ $p=0.007^*$ $\phi=0.227$ $n=143$		$\chi^2(1)=0.619$ $p=0.432$ $\phi=0.066$ $n=143$		$\chi^2(1)=0.003$ $p=0.954$ $\phi=0.005$ $n=143$		
Spouse's job as a healthcare professional																							
Yes	59	14	41	32	7	66	22	51	39	34	20	53	49	24	13	60	21	52	57	16	44	29	
No	44	9	38	15	8	45	8	45	27	26	18	35	33	20	18	35	10	43	34	19	28	25	
Chi square tests of independence	$\chi^2(1)=0.099$ $p=0.753$ $\phi=0.028$ $n=126$		$\chi^2(1)=3.168$ $p=0.075$ $\phi=0.159$ $n=126$		$\chi^2(1)=0.887$ $p=0.346$ $\phi=0.084$ $n=126$		$\chi^2(1)=3.830$ $p=0.050$ $\phi=0.174$ $n=126$		$\chi^2(1)=0.076$ $p=0.783$ $\phi=0.025$ $n=126$		$\chi^2(1)=0.628$ $p=0.428$ $\phi=0.071$ $n=126$		$\chi^2(1)=0.319$ $p=0.572$ $\phi=0.050$ $n=126$		$\chi^2(1)=4.320$ $p=0.038^*$ $\phi=0.185$ $n=126$		$\chi^2(1)=1.622$ $p=0.203$ $\phi=0.113$ $n=126$		$\chi^2(1)=2.971$ $p=0.085$ $\phi=0.154$ $n=126$		$\chi^2(1)=0.695$ $p=0.405$ $\phi=0.074$ $n=126$		

\*Fisher Exact,  $p < 0.05$ ,  $\phi$ : Effect size for Phi, transmitting virus: Transmitting the virus to the family, Self Contamination: The risk of self-contamination, Medical equipment: lack of medical equipment, Equipment change: necessity of frequent cleaning and equipment change, PPE: Lack of full PPE, Discomfort: discomfort from PPE, Lack of co-worker: Having fewer colleagues during shifts, End date: unknown end date of the pandemic, Treatment/Vaccine: Lack of definitive treatment or vaccine. EMPs: Emergency medicine physicians, PPE: Personal protective equipment, COVID-19: Coronavirus disease-2019, n: Number

**Table 4. Relationship between demographic variables and factors stated by EMPs as effective on coping with stress during COVID-19 pandemic**

Variables	Religion		Additional income		Full PPE		Appreciation		Psychological support		Adequate rest		Leisure activities	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
<b>Gender</b>														
Female	12	76	44	44	40	48	35	53	8	80	29	59	51	37
Male	10	102	52	60	66	46	48	64	10	102	45	67	73	39
Chi-square tests of independence	$\chi^2(1)=1.116$ $p=0.291$ $\phi=0.075$ $n=200$		$\chi^2(1)=0.252$ $p=0.616$ $\phi=0.035$ $n=200$		$\chi^2(1)=3.592$ $p=0.058$ $\phi=0.134$ $n=200$		$\chi^2(1)=0.193$ $p=0.660$ $\phi=0.031$ $n=200$		$\chi^2(1)=0.002$ $p=0.968$ $\phi=0.003$ $n=200$		$\chi^2(1)=1.103$ $p=0.294$ $\phi=0.074$ $n=200$		$\chi^2(1)=1.092$ $p=0.296$ $\phi=0.074$ $n=200$	
<b>Marital status</b>														
Married	12	114	63	63	69	57	50	76	11	115	47	79	79	47
Single	10	64	33	41	37	37	33	41	7	67	27	47	45	29
Chi-square tests of independence	$\chi^2(1)=0.758$ $p=0.384$ $\phi=0.062$ $n=200$		$\chi^2(1)=0.546$ $p=0.460$ $\phi=0.052$ $n=200$		$\chi^2(1)=0.424$ $p=0.515$ $\phi=0.046$ $n=200$		$\chi^2(1)=0.463$ $p=0.496$ $\phi=0.048$ $n=200$		$\chi^2(1)=0.030$ $p=0.862$ $\phi=0.012$ $n=200$		$\chi^2(1)=0.013$ $p=0.908$ $\phi=0.008$ $n=200$		$\chi^2(1)=0.071$ $p=0.791$ $\phi=0.019$ $n=200$	
<b>After-shift accommodation</b>														
Alone	9	68	37	40	43	34	36	41	10	67	32	45	48	29
With family	13	110	59	64	63	60	47	76	8	115	42	81	76	47
Chi-square tests of independence	$\chi^2(1)=0.061$ $p=0.806$ $\phi=0.017$ $n=200$		$\chi^2(1)=0.000$ $p=0.991$ $\phi=0.001$ $n=200$		$\chi^2(1)=0.407$ $p=0.524$ $\phi=0.045$ $n=200$		$\chi^2(1)=1.423$ $p=0.233$ $\phi=0.084$ $n=200$		$\chi^2(1)=2.430$ $p=0.119$ $\phi=0.110$ $n=200$		$\chi^2(1)=1.116$ $p=0.291$ $\phi=0.075$ $n=200$		$\chi^2(1)=0.006$ $p=0.938$ $\phi=0.006$ $n=200$	
<b>Smoking behavior</b>														
Yes	6	63	38	31	38	31	31	38	8	61	30	39	44	25
No	16	115	58	73	68	63	52	79	10	121	44	87	80	51
Chi-square tests of independence	$\chi^2(1)=0.571$ $p=0.450$ $\phi=0.053$ $n=200$		$\chi^2(1)=2.111$ $p=0.146$ $\phi=0.103$ $n=200$		$\chi^2(1)=0.182$ $p=0.670$ $\phi=0.030$ $n=200$		$\chi^2(1)=0.510$ $p=0.475$ $\phi=0.050$ $n=200$		$\chi^2(1)=0.866$ $p=0.352$ $\phi=0.066$ $n=200$		$\chi^2(1)=1.897$ $p=0.168$ $\phi=0.097$ $n=200$		$\chi^2(1)=0.140$ $p=0.708$ $\phi=0.026$ $n=200$	
<b>Having chronic disease</b>														
Yes	6	22	17	11	14	14	15	13	6	22	7	21	17	11
No	16	156	79	93	92	80	68	104	12	160	67	105	107	65
Chi-square tests of independence	$p^a=0.094$ $\phi=0.134$ $n=200$		$\chi^2(1)=2.109$ $p=0.146$ $\phi=0.103$ $n=200$		$\chi^2(1)=0.118$ $p=0.732$ $\phi=0.024$ $n=200$		$\chi^2(1)=1.954$ $p=0.162$ $\phi=0.099$ $n=200$		$p^a=0.025^*$ $\phi=0.175$ $n=200$		$\chi^2(1)=2.011$ $p=0.156$ $\phi=0.100$ $n=200$		$\chi^2(1)=0.023$ $p=0.880$ $\phi=0.011$ $n=200$	
<b>Manner of working in a shift</b>														
Alone	9	96	46	59	57	48	39	66	7	98	39	66	64	41
with EMP(s)	13	82	50	45	49	46	44	51	11	84	35	60	60	35
Chi-square tests of independence	$\chi^2(1)=1.332$ $p=0.248$ $\phi=0.082$ $n=200$		$\chi^2(1)=1.555$ $p=0.212$ $\phi=0.088$ $n=200$		$\chi^2(1)=0.147$ $p=0.702$ $\phi=0.027$ $n=200$		$\chi^2(1)=1.729$ $p=0.189$ $\phi=0.093$ $n=200$		$\chi^2(1)=1.469$ $p=0.225$ $\phi=0.086$ $n=200$		$\chi^2(1)=0.002$ $p=0.965$ $\phi=0.003$ $n=200$		$\chi^2(1)=0.103$ $p=0.748$ $\phi=0.023$ $n=200$	
<b>Having children</b>														
Yes	14	93	52	55	58	49	49	58	9	98	42	65	70	37
No	1	35	17	19	17	19	8	28	2	34	12	24	21	15



Table 4. continued

Variables	Religion		Additional income		Full PPE		Appreciation		Psychological support		Adequate rest		Leisure activities	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Chi-square tests of independence	p <sup>a</sup> =0.116 φ=0.146 n=143		χ <sup>2</sup> (1)=0.020 p=0.886 φ=0.012 n=143		χ <sup>2</sup> (1)=0.527 p=0.468 φ=0.061 n=143		χ <sup>2</sup> (1)=6.244 p=0.012* φ=0.209 n=143		p <sup>a</sup> =0.730 φ=0.047 n=143		χ <sup>2</sup> (1)=0.402 p=0.526 φ=0.053 n=143		χ <sup>2</sup> (1)=0.585 p=0.444 φ=0.064 n=143	
<b>Spouse's job as a healthcare professional</b>														
Yes	5	68	36	37	38	35	36	37	5	68	29	44	45	28
No	7	46	27	26	31	22	14	39	6	47	18	35	34	18
	χ <sup>2</sup> (1)=1.441 p=0.230 φ=0.107 n=126		χ <sup>2</sup> (1)=0.033 p=0.857 φ=0.016 n=126		χ <sup>2</sup> (1)=0.513 p=0.474 φ=0.064 n=126		χ <sup>2</sup> (1)=6.728 p=0.009* φ=0.231 n=126		p <sup>a</sup> =0.525 φ=0.078 n=126		χ <sup>2</sup> (1)=0.436 p=0.509 φ=0.059 n=126		χ <sup>2</sup> (1)=0.083 p=0.774 φ=0.026 n=126	
<sup>a</sup> Fisher's Exact, *p<.05, φ: Effect size for Phi, religion: Religious believes, Full PPE: Having full personal protective equipment while working, Appreciation: Getting public appreciation, psychological support: Getting psychological support, adequate rest: Having adequate sleep/rest, Additional income: Having additional income, EMPs: Emergency medicine physicians, PPE: personal protective equipment, COVID-19: Coronavirus disease-2019, n: Number														

## Discussion

Research findings revealed that EMPs use mostly problem-oriented approach in combating the stress and mainly used social support, self-confident, optimistic, helpless, and submissive approaches, respectively. Other studies indicate that healthcare professionals use a self-confident approach more to deal with stress (16,17). In this research, it was found that EMPs used the most social support seeking approach. This may be due to the general stress caused by working in the field of health, as well as the stress factors brought by the COVID-19 pandemic. Sagar et al. (18) state that individuals can tend to combat stress through social support when there is not much to interfere with the source of stress. Besides, the increasing social support of society may have reinforced this trend. In many countries such as the United States of America and Turkey, expressing their feelings of gratitude to healthcare professionals and providing social support well-attended events, such as certain times of applause on the balconies, were organized through social media (19,20). As a matter of fact, research findings in the literature emphasize the relationship between perceived social support seeking and active coping approach to stress (21-23). It is stated that the approach to seeking social support triggers the feeling of sympathy, increases social resources, and reduces the sense of loneliness (24). Also, the influential social support offered during and after stressful situations increases the psychological resilience and work performance (25). In a study conducted during the COVID-19 pandemic, it was concluded that there was a negative relationship between the social support level perceived by healthcare professionals and their stress levels (26). There are also studies that examine healthcare professionals' approach to cope with stress supporting the research findings (27,28).

The factors that EMPs stated in this research to cause stress in the COVID-19 pandemic were similar to the study results investigating stress factors felt by the healthcare professionals during the MERS-CoV epidemic (29). Also, similar outcomes were found in another study examining healthcare professionals' stress factors and managers' expectations in the COVID-19 pandemic (30). Furthermore, in a study conducted with healthcare professionals during the COVID-19 pandemic in China, it was found that they perceived transmitting the virus to their families and lack of PPE as a stress factor (31).

Research findings show a significant difference between men and women in favor of men in terms of their approach to dealing with stress by problem-oriented and optimistic approaches. Sinha and Latha suggest that this difference in women and men's approach to coping with stress may be due to the interaction of sex hormones with adrenaline, noradrenaline, and cortisol, which are the three major stress hormones (32). There are studies in the literature revealing that men are more optimistic than women (33). Besides, it is stated that optimists tend to use more problem-oriented coping strategies than pessimists (34). This research finding is compatible with the results of the active approach (32,35), and the optimistic approach findings among men and women healthcare professionals in favor of the problem (36).

Additionally, stress factors, lack of medical equipment, the necessity of frequent cleaning and equipment change, and the lack of definitive treatment and vaccine, the unknown end date of the pandemic perceived by EMPs were found related to gender. Folkman and Lazarus state that the coping approaches of women and men towards emotion do not differ in similar contexts of life, but they differ when it comes to the context in which stress occurs (12).

Table 5. Predicting variables EMP's coping with stress approaches during COVID-19 pandemic

Coping with stress approaches	Model		Unstandardized coefficients		Standardized coefficients	t	p-value	95.0% CI	
			B	Std. Error	Beta			Lower bound	Upper bound
Problem-oriented approach	1	Constant	64.605	1,479		43.693	0.000	61.690	67.521
		Full PPE (yes)	-5.250	2,031	-0.181	-2.585	0.010*	-9.255	-1.245
	2	Constant	66.073	1,609		41.059	0.000	62.900	69.247
		Full PPE (yes)	-4.809	2,022	-0.165	-2.379	0.018*	-8.796	-0.822
		Adequate rest (yes)	-4.599	2,090	-0.153	-2.201	0.029*	-8.720	-0.478
R=0.236, R <sup>2</sup> =0.056, F(2,197)=5.827, p=0.003, Durbin Watson=2.160, VIF=1.010									
Self-confident approach	1	Constant	67.173	1.758		38.206	0.000	63.706	70.640
		Full PPE	-8.593	2.415	-0.245	-3.558	0.000*	-13.355	-3.830
	R=0.245, R <sup>2</sup> =0.060, F(1,198)=12.659, p=0.000, Durbin Watson=2.1, VIF=1								
Optimistic approach		Constant	60.847	1.720		35.369	0.000	57.454	64.239
		Adequate rest (yes)	-6.522	2.828	-0.162	-2.306	0.022	-12.100	-0.945
	R=0.162, R <sup>2</sup> =0.026, F(1,198)=5.318, p=0.022. Durbin Watson=2, VIF=1								
Social support seeking approach		Constant	67.147	1.702		39.445	0.000	63.790	70.504
		Additional income (yes)	-5.168	2.457	-0.148	-2.103	0.037*	-10.014	-0.323
	R=0.148, R <sup>2</sup> =0.022, F(1,198)=4.424, p=0.037, Durbin Watson=1.9, VIF=1								
Emotion-oriented approach	1	Constant	28.526	2.213		12.888	0.000	24.161	32.890
		End date (yes)	6.191	2.573	0.169	2.406	0.017*	1.117	11.265
	2	Constant	25.934	2.481		10.454	0.000	21.042	30.826
		End date (yes)	6.456	2.550	0.176	2.531	0.012*	1.427	11.485
		Additional income (yes)	4.991	2.239	0.155	2.229	0.027*	0.576	9.407
	3	Constant	23.755	2.652		8.958	0.000	18.525	28.984
		End date (yes)	5.999	2.535	0.163	2.367	0.019*	1.000	10.998
		Additional income (yes)	4.864	2.219	0.151	2.192	0.030*	0.488	9.239
		Full PPE (yes)	4.866	2.226	0.151	2.186	0.030*	0.476	9.255
R=0.274, R <sup>2</sup> =0.075, F(3,196)=5.288, p=0.002, Durbin Watson=1.9, VIF=1-1.009									
Helpless approach	1	Constant	27.644	2.487		11.115	0.000	22.739	32.549
		End date (yes)	7.970	2.891	0.192	2.756	0.006*	2.268	13.671
	2	Constant	24.600	2.784		8.835	0.000	19.108	30.091
		End date (yes)	8.280	2.863	0.200	2.893	0.004*	2.635	13.925
		Additional income (yes)	5.864	2.513	0.161	2.333	0.021*	0.908	10.820
	3	Constant	22.069	2.974		7.421	0.000	16.204	27.934
		End date (yes)	7.750	2.843	0.187	2.726	0.007*	2.144	13.356
		Additional income (yes)	5.715	2.488	0.157	2.297	0.023*	0.808	10.623
		Full PPE (yes)	5.649	2.496	0.155	2.263	0.025*	0.726	10.572
R=0.294, R <sup>2</sup> =0.087, F(3,196)= 6.203, p=0.000, Durbin Watson=1.8, VIF=1-1.009									
*p<0.05, Full PPE: Having full personal protective equipment while working, Adequate rest: Having adequate sleep/rest, Additional income: Having additional income, End date: Unknown end date of the pandemic. EMPs: Emergency Medicine Physicians, PPE: personel protective equipment, Std: Standard									

Research results show a significant difference between married and single EMPs in favor of married people in terms of passive and helpless coping approaches to stress. The risk of transmitting the virus to their families, long shifts, lack of full PPE, and lack of medical equipment was related to marital status. There is evidence that satisfaction with the workplace's physical conditions decreases, the helpless approach to coping with stress increases in individuals (14). It is stated that individuals tend towards passive and helpless coping strategies when they feel that the situation is unchangeable and that control is not in their hands (14,37). Also, the loss of beliefs that they can manage the process in this stressful situation, seeing themselves as the cause of the negativities, may cause them to fail to produce a solution to the problem and take a helpless approach (14). It is suggested assuring care of healthcare professionals' family members would enhance workforce confidence and availability (38). However, no significant difference was found between married and single EMPs in terms of problem-oriented stress coping approaches, partially overlaps with other research findings in the literature (17).

It was seen that the helpless stress approaches of smoker EMPs were higher than non-smokers. Besides, the necessity of frequent cleaning and equipment change as a stress factor was related to smoking behavior. This may be because smoking has a short-term and temporary function that relieves stress. Mansouri et al. (39) found significant positive relationships between the number of cigarettes smoked per day and escape/avoidance, distancing behaviors, which are passive stress approaches to emotions. Additionally, the comorbidity factor and lack of medical equipment were related to having a chronic disease. At this point, EMPs may be trying to suppress the feeling of helplessness they experience in the face of stress factors brought about by the COVID-19 pandemic, which is not yet fully controlled. Also, the fact that smoking is a preventive factor in the treatment of COVID-19 may lead those who are currently smoking to feel themselves at higher risk and lead to an inevitable acceptance in the face of current stress. Indeed, there is evidence in the literature that reveals the link between smoking and negative outcomes of the COVID-19 treatment (40).

Research results suggest that the submissive stress approach of EMPs that remain with their family after their shift is significantly higher than those who stay alone. Besides, after-shift accommodation was related with the risk of transmitting the virus to their families, long shifts and having fewer colleagues in shifts. In the COVID-19 pandemic, public guesthouses and hotels are put into service for the after-shift stays of healthcare professionals to reduce the possibility of transmitting the virus to their families (41). However, despite this opportunity, those who have children

or parents looking after may have to stay in their homes after their shifts. Besides, having children was found related to long shifts and having fewer colleagues in shifts. Also, having a spouse work as a healthcare professional was related long shifts. This can be explained by the fact that EMPs cannot find time and energy to share with their children due to increased workload and decreased rest periods. Prolonged shifts can prevent the individual from fulfilling his responsibilities regarding child care, household chores, and shopping (42). In this case, the individual may adopt a fatalistic attitude and accept to experience stress-related negativities and take a submissive approach (14).

It was found that working alone in a shift was associated with perceiving the risk of self-contamination, long shifts, lack of full PPE, and lack of co-workers. This may be related to the more fatigue of working alone, increased virus load and relaxation in the measures taken, or the lack of time to take the necessary precautions and the necessary professional support. It is stated that working alone increases mental and physical workload and psychosocial risks (43). At this point, it can be noted that dealing with irrefutable personal needs of healthcare professionals such as adequate rest and care of elderly family members in the COVID-19 pandemic will help maintain their individual and team performance in this marathon (38).

Results of this research partially coincide with the findings of the study conducted during the MERS-CoV epidemic period regarding the factors that were stated to be effective in coping with stress in healthcare professionals (29). It is observed that one of the sources of healthcare professionals' work-related stress before COVID-19 pandemic is not being appreciated. In the COVID-19 pandemic period, appreciation of the EMPs was found to be among the factors they stated to cope with stress effectively. This highlights a critical point in showing the change in society's approach to healthcare professionals. The appreciation was found significantly related to the situation of having children and spouse being a healthcare professional. This may be related to the appreciation of healthcare professionals' devoted efforts in the pandemic by society, being a role model for their children, and the satisfying aspect of winning the community's praise in their children's eyes. Likewise, since the spouse is also a healthcare professional, sharing the same difficulty, struggle and appreciation process can be effective in the EMP's coping with stress as a social support factor. In another study, it was found that having a spouse working in the same area and knowing the content of the spouse's work, is beneficial to both to share information and to understand the negativities of the job and to find solutions (44).

Getting psychological support was found related with having a chronic disease. This finding may be related to those with

chronic disease taking a more pessimistic, fatalistic and passive approach to cope with the COVID-19 pandemic. Studies show that when healthcare professionals experience physiological or psychological health problems, they prefer self-treatment rather than consulting a physician (45). Those who do not have a chronic disease may be more willing and diligent to get psychological support from their social circles or professionals in coping with stress with a more optimistic approach.

The research findings showed that the variables of having full PPE while working and having sufficient sleep and rest were significant predictors of active approach attitudes towards the problem used by EMPs to deal with stress. When analyzed in terms of sub-dimensions, it was determined that having full PPE while working predicted the self-confident approach and having sufficient sleep and rest predicted the optimistic approach. Indeed, other research results reveal that sleep quality is an essential predictor of the stress experienced by healthcare workers in the COVID-19 pandemic (26).

According to this, having full PPE while trying to reduce the risk of virus transmission can reinforce EMPs' desire to fight this stressful situation. It can help them to take stronger steps in the fight against COVID-19 with the sense of trust given by taking precautions. Also, having the opportunity to sleep and rest can positively affect the psychological processes by providing the soul and the body to relax and contributing to the individual's attitude towards stress to be more constructive and optimistic. It was concluded that getting additional income significantly predicted the level of EMPs using the social support seeking approach to deal with stress. In the literature, social support's dimension to support needs for concrete needs such as time, money, and labor is called instrumental support (46,47). At this point, it can be said that getting additional income constitutes the instrumental support dimension of EMPs' social support seeking approaches to cope with stress.

Research findings show that the factors of the unknown end date of the pandemic, getting additional income, and having full PPE while working significantly predict the tendencies of EMPs to choose a passive coping approach to stress and emotions. When analyzed in terms of sub-dimensions, none of the variables discussed in the study can predict the submissive approach statistically. It was determined that the factors of the unknown end date of the pandemic, getting additional income, and having full PPE while working are significant predictors of the helpless approach. In this context, the current uncertainty of how long the COVID-19 pandemic will last and when it will end can create a sense of desperation and a lack of control in EMPs participating in the research. Besides, while getting additional income due

to the pandemic makes EMPs feel safe, it may also cause them to perceive that getting extra income is not as meaningful and valuable as before the pandemic. Having full PPE while working can make EMPs feel safe against the virus; on the other hand, they may feel helpless in fighting against the virus and have anxiety about the protection without having full PPE.

### Study Limitations

The research was carried out with 200 EMPs working in EDs during the COVID-19 pandemic. The study can be conducted in a larger sample of other healthcare professionals. Also, research data is limited to data collected through a scale to identify survey and stress coping approaches. At this point, semi-constructed interviews can be held with a smaller group selected from the research participants for a more detailed evaluation. The research was conducted with limited demographic features belong to participants. In subsequent studies, the variables such as age, work experience, duration of shifts, number of children, and number of patients in a shift can be examined to cope with stress.

### Conclusion

It has been determined that EMPs use problem-based active approaches the most and the social support seeking approach significantly among them in the fight against stress brought by the COVID-19 pandemic. It is crucial to provide healthcare professionals with the support they need and analyze stress factors. It is recommended to increase the social support provided to healthcare professionals and to offer them more effective resources in response to the social support seeking approach. Based on our finding that the risk of transmitting the virus to EMPs' families as the most stressful factor during the COVID-19 pandemic, practices aimed at protecting the families of healthcare professionals can be introduced. Within the research scope, it was observed that leisure activities were the most effective in the fight against stress brought about by the COVID-19 pandemic. In this context, the duration of shifts should be arranged so that healthcare professionals can allocate time for themselves, and psychological support should also be provided.

### Ethics

**Ethics Committee Approval:** This study was approved by Düzce University Non-Interventional Clinical Research Ethics Board with the registration number 2020/84.

**Informed Consent:** Informed consent was obtained from those who volunteered to participate in the study.

**Peer-review:** Externally peer-reviewed.

## Authorship Contributions

Concept: M.C.D, A.K.A., Design:M.C.D, A.K.A., Data Collection and/or Processing: M.C.D, A.K.A., Analysis and/or Interpretation: M.C.D, A.K.A., Literature Search: M.C.D, A.K.A.,

Writing: M.C.D, A.K.A.

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# Assessment of Patients Transferred from the Emergency Department to Home by Ambulance

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## Abstract

**Aim:** Our research aimed to examine patients' sociodemographic characteristics transferred from the emergency department to home by ambulance and the factors that cause ambulance transport. To our knowledge, there is no study presenting a perspective on patients who were discharged from the emergency department but were transferred home by ambulance. Although the literature on patients using pre-hospital ambulance services is full, it lacks patients in need of post-hospital ambulance services. Since it is the first study on this subject, it aims to guide future studies.

**Materials and Methods:** This retrospective study was conducted at an academic tertiary care emergency department in Turkey between March 2019 and March 2020.

**Results:** Of the 1059 patients included in the study, 56.1% were women, 43.9% were male, and their average age was 74.21 years. The most influential factors in transporting patients from the emergency department to home by ambulance were bedridden (%47,4), social reasons(%37,7) and oxygen need (%14,9).

**Conclusion:** The high average age of patients transferred from the emergency department to the home and the reasons for their transportation demands show that the increasing elderly population creates new requirements in health. Providing ambulance service to special groups for home transport after emergency room discharge should be seen as an emergency treatment. Standardization should be developed by carrying out studies on this subject.

**Keywords:** Ambulance, transfer, emergency department

## Introduction

Emergency services are easily accessible units that provide uninterrupted health care. In addition to medical necessity, special conditions related to the patient and his/her social situation may also play a role in emergency service admissions. In the developing health system, leaving the hospital should be scrutinized as well as the patients' arrival process. Every patient admitted to the emergency department should be carefully evaluated (1). Pre-hospital emergency health services have been established to provide both rapid treatment and critically ill patients' transport to emergency departments (2). Inter-hospital transfer rules regulated and supervised by various circulars issued by the Turkish Republic Ministry of Health maintain

their importance (3,4). Also, the American College of Emergency Physicians states that institutions should obey certain rules regarding "appropriate interhospital patient transfer" (5). Demand for emergency ambulance services has been increasing in recent years. The rate of demand for ambulance services for hospital admission has grown over the years. Remarkably, the need for ambulance services for transfer from the hospital to home has also recently increased. Although there are studies on transfer from the field to the hospital, there are no regulations or research regarding transferring from the hospital to home.

Our study aimed to reveal the sociodemographic characteristics of the patients who transferred home from the emergency department by ambulance and the factors that impact the



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ambulance request. This first study was also intended to provide a basis for further studies.

## Materials and Methods

This retrospective, cross-sectional study was conducted at an academic tertiary care hospital emergency department in Turkey between March 2019 and March 2020. The study protocol was approved by the Düzce University Ethics Committee (decision number: 2020/41, date: 02/03/2020).

Patient information was obtained from the hospital data processing system, emergency department triage records, and forms that were prepared and required to be filled in by the hospital administration to transfer by ambulance. By examining the patients' symptoms and the International Classification of Diseases (ICD) codes at the time of admission that was accessed from the medical records, mean age, gender distribution, the way of arrival to the hospital, disease-based patient distribution, the reason for requesting an ambulance on discharge from the emergency department, transport, transfer time, and the distance (kilometers) the hospital and home were evaluated. When the reasons for the transfer from the emergency department to home by ambulance were analyzed, it was noted that they were categorized into three groups of patients: immobile or bedridden patients who need someone's care; patients who need oxygen support before applying to the emergency department; patients who had transportation problems due to social reasons such as financial impossibility, not having a private car, and not having a public bus at the time of discharge were examined in three groups.

All patients were included in the study because the file records were not missing. Patients transferred from other clinics by ambulance were not included in the study.

## Statistical Analysis

The data were analyzed with IBM SPSS V23. Analysis results were presented as mean and standard deviation for quantitative data. The results were evaluated and interpreted at the 95% confidence interval and at the significance level of  $p < 0.05$ .

## Results

A total of 2,554 patients was transferred to home by ambulance from a tertiary care university hospital in Turkey in one-year period. One thousand and fifty-nine patients (41.5%) were transferred home from the emergency department, and 1,495 (58.5%) from other clinics. Patients transferred from another clinic other than the emergency service were excluded. Of the 1,059 patients included in the study, 56.1% ( $n=594$ ) were female and 43.9% ( $n=465$ ) were male; their mean age was  $74.21 \pm 13.08$

years (Table 1). Eighty-nine percent ( $n=948$ ) of the patients were transported to the hospital by ambulance, and 11% ( $n=111$ ) presented without an ambulance. An analysis of the reasons for admission to the emergency department of the patients showed that 26.3% ( $n=278$ ) of the patients had dyspnea; 14% ( $n=148$ ) had abdominal pain; 7.2% ( $n=72$ ) had poor overall status; and 7.1% ( $n=71$ ) had seizure (Table 2). The underlying diseases of the patients who were transferred home were as follows;

**Table 1. Distribution of transferred patients according to gender and emergency department visiting**

Variables		n (%)
Gender	Male	465 (43.9)
	Female	594 (56.1)
Emergency department visit	By ambulance	948 (89)
	By their own means	111 (11)
Total, n		1,059 (100)

n: Number of the cases

**Table 2. Complaints of patients at the emergency department**

Complaints	n	%
Chills	7	0.7
Dyspnea	278	26.3
Abdominal pain	148	14.0
PEG problem	66	6.2
Epileptic seizures	71	6.7
Trauma	25	2.4
Dysuria	7	0.7
Cough	21	2.0
Fever	40	3.8
Hematuria	21	2.0
Headache	33	3.1
Poor overall status	72	6.8
Nausea/vomiting	47	4.4
Clouding of consciousness	45	4.2
GIS bleeding	32	3.0
General pain	50	4.7
Incontinence	25	2.4
Tachycardia	14	1.3
Chest pain	20	1.9
Lumbago	7	0.7
Agitation	18	1.7
Syncope	12	1.1
<b>Total</b>	<b>1,059</b>	<b>100,0</b>

n: Number of the cases, PEG: Percutaneous endoscopic gastrostomy, GIS: Gastrointestinal system



cerebrovascular accident (CVA) in 37.4% (n=396), malignancy in 14.2% (n=152), Chronic Obstructive Pulmonary Disease (COPD) in 11% (n=116), and Alzheimer's disease in 5.4% (n=57) (Table 3). The reason for home transport from the emergency department by ambulance was being bedridden in 47.4% (n=502) patients, social reasons in 37.7% (n=399), and the need for oxygen support in 14.9% (n=158) (Table 4). Of the patients who were admitted to the emergency department, 96.8% (n=1025) were transported in company with an attendant while 3.2% (n=34) of the patients were transported alone. Forty-two percent (n=4,449) of the patients were transferred between 08:00 and 16:00; 39.9% (n=423) between 04:00 p.m. and 12:00 a.m.; and 17.7% (n=187) between 12:00 a.m. and 08:00 a.m. The mean transport distance was 15.9±10.1 kilometers (km) (min-max: 5.3-49.9 km), and the mean transfer time was 51.6±29.7 minutes (min) (min-max: 10-150 min).

**Table 3. Chronic diseases of patients**

Disease	n	%
CVA	396	37.4
COPD	116	11.0
Lung Ca	60	5.7
Alzheimer	57	5.4
CAD	49	4.6
Hip fracture	42	4.0
Pancreatic Ca	33	3.1
Diabetes mellitus	32	3.0
Stomach Ca	20	1.9
Epilepsy	20	1.9
HT	20	1.9
CHF	19	1.8
Other	125	13.4
Healthy	52	4.9

CVA: Cerebrovascular accident, COPD: Chronic obstructive pulmonary disease, Ca: Cancer, CAD: Coronary artery disease, HT: Hypertension, CHF: Congestive heart failure

**Table 4. Factors causing the transfer of patients from the emergency department to home by ambulance**

Transfer request reason factors	n	%
Bedridden	502	47.4
Social reasons	399	37.7
Need for oxygen support	158	14.9
Total	1,059	100.0

n: Number of the cases

## Discussion

The providing ambulance services in developed or developing countries and the ambulance usage rates of communities vary depending on local, socioeconomic, and cultural conditions. Emergency ambulance services worldwide are provided uninterruptedly for 24 hours under command-and-control centers at the provincial or regional scale (6).

As a result of an expansion in the elderly population, there has been an increase in the admissions of elderly patients to the emergency department (7). A study examining the age-based distribution of patients transported from the field by ambulance found that 13%-47.9% of patients were over 60 years of age (8). In another study examining geriatric patients admitted to the emergency department, patients who were taken under observation for follow-up and treatment purposes had a mean age of 77.8 years (9). In the literature, the male patients have a higher proportion in the gender- and age-based patient distribution, while the number of female patients exceeded the number of male patients only in the patient group over the age of 65 (10). Like the literature, our study found the mean age of 74.2 years and the female portion of 56.1% among the transferred patients.

A study showed that patients frequently present to the emergency department with respiratory system-related complaints (9). In line with previous reports, our study found that the most common admission complaint was dyspnea. In our research, the most common emergency department admission complaints in descending order after dyspnea were abdominal pain, poor overall status, and seizure. In the literature, patients who were transported to the emergency department by ambulance mostly had a provisional diagnosis of trauma, while elderly patients were most commonly transported with cardiovascular system diseases (8,10-12). In our study, the patients transferred home had CVA (37.4%), malignancy (14.2%), and COPD (11%). As most patients who request home transport by ambulance are bedridden due to a history of CVA, our CVA rate was high.

When we examine the reasons for transferring patients from the emergency department to home by ambulance, 47.4% was due to being bedridden, 37.7% to social causes, and 14.9% to oxygen need. There are no studies in the literature on patients transferred home from the emergency department by ambulance to the best of our knowledge.

In a study on ambulance services in Ireland, 81% of the patients were transported from the scene to the hospital in under 15 minutes (13), while the average time was found to be 8.2 minutes in the United States of America (14). In our study, the meantime

of home transport from the hospital was 51.6 minutes, and the mean transport distance was 15.9 km. No comparison could be made due to the lack of similar studies in the literature on home transport from the hospital; however, the transport time and distance may have been increased by an unknown destination and insufficient supporting personnel in transport ambulances.

In the literature studies, 53.6% of patients were admitted to the emergency department between 04:00 p.m. and 08:00 a.m. (12), and a decrease in the number of patients presenting both by ambulance and as an outpatient between 12:00 a.m. and 07:59 a.m. was reported (15). In our study, 42% of the patients admitted to the emergency department between 08:00 a.m. and 04:00 p.m.; 39.9% between 04:00 p.m. and 12:00 a.m.; and 17.7% between 12:00 a.m. and 08:00 a.m.. These findings are consistent with the results reported by researches on hospital admission by ambulance.

## Conclusion

With the prolongation of human life, the number of elderly patients admitted to the emergency department is also increasing. However, patients demanding an ambulance for home transfer from the hospital increased. Providing ambulance service to special groups to reach home after discharge in the emergency department should be seen as a part of emergency treatment. To standardize patient transfers from hospital to home by ambulance, proper indications should be determined by regulations, and studies involving interdisciplinary cooperation should be carried out.

## Ethics

**Ethics Committee Approval:** This retrospective clinical study was approved by the Local Ethics Committee of Düzce University Faculty of Medicine (decision number: 2020/41, date: 02/03/2020).

**Informed Consent:** Retrospective study.

**Peer-review:** Externally peer-reviewed.

## Authorship Contributions

Surgical and/or Medical Practices: H.S., Concept: M.B., M.C.D., Design: H.S., G.A., Data Collection and/or Processing: H.S., M.B., G.A., M.C.D., Analysis and/or Interpretation: H.S., G.A., M.C.D., Literature Search: H.S., M.B., Writing: H.S.

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# Prognostic Performance of qSOFA in Pulmonary Embolism

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## Abstract

**Aim:** This study aimed to investigate the role of the quick sequential organ failure assessment (qSOFA) score in determining the prognosis of patients with acute pulmonary embolism (PE).

**Materials and Methods:** This study included patients aged >18 years who were admitted to the emergency department for complaints of shortness of breath and/or chest pain for 3 years and who were found to have acute PE on computed tomography pulmonary angiography. The qSOFA, pulmonary embolism severity index (PESI), and simplified PESI scores were calculated in patients with acute PE. During follow-up, the in-hospital mortality and requirement of intensive care continuation were determined.

**Results:** In total, 166 patients with acute PE, of which 88 (53%) were female, were included. The mean age of the patients was 67.4±17.3 years, and 26 (15.7%) patients were admitted to the intensive care unit (ICU). The mortality rate was 9% (n=15). The predictive value of qSOFA in predicting in-hospital mortality [area under the curve (AUC) 0.907, 95% confidence interval (CI) 0.852-0.946] was similar to that of PESI (AUC: 0.846, 95% CI: 0.782-0.897) and sPESI (AUC: 0.796, 95% CI: 0.726-0.854) (p=0.23 and p=0.16, respectively). While it was superior to PESI (AUC: 0.794, 95% CI: 0.724-0.852) and sPESI (AUC: 0.721, 95% CI: 0.646-0.787) in determining the admission of patients in the ICU (AUC: 0.882, 95% CI: 0.823-0.927) (p=0.04 and p=0.01, respectively). A positive correlation was found between qSOFA and PESI (r=0.49, p=0.001) and sPESI (r=0.36, p=0.001).

**Conclusion:** In this study, we found that the qSOFA score performed well in predicting in-hospital mortality and ICU admission in patients with acute PE admitted to the emergency department.

**Keywords:** qSOFA, pulmonary embolism, prognosis

## Introduction

Pulmonary embolism (PE) is a relatively common emergency condition and associated with severe mortality and morbidity rates (1,2). The risk of mortality can be assessed by considering many factors such as the patient's age, comorbid status, hemodynamic status, presence of right ventricular dysfunction, myocardial injury status, and other clinical and laboratory tests (3,4). Current guidelines recommend the use of the pulmonary embolism severity index (PESI) and its simplified version (sPESI) to both predict prognosis and determine treatment strategy (5,6). Recently, it has been suggested that the sepsis-related quick sequential organ failure assessment (qSOFA) score can be used successfully to support the diagnosis of sepsis and predict

mortality in patients with suspected infection outside the intensive care unit (ICU). qSOFA score is formed by evaluating three criteria: respiratory rate  $\geq 22$ /min, systolic blood pressure  $\leq 100$  mmHg and altered mental state (Glasgow Coma Scale  $< 15$ ). Each criterion gets a single score, and the highest possible score is three while the lowest score is zero (7). It has been suggested that a qSOFA score of  $\geq 2$  strongly predicts the patient's primary outcome. In the group other than ICU, in-hospital mortality was shown to be 3-14 times higher in patients with qSOFA  $\geq 2$  than in patients with qSOFA  $< 2$  (8). Since the qSOFA score does not require any laboratory analysis or a special test and can be calculated rapidly (9), it has been investigated in many disease groups in order to evaluate the adverse outcome possibility of patients who were admitted to the emergency department (ED). In this



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study, we aimed to evaluate the role of qSOFA in determining the prognosis, in-hospital mortality and the need for intensive care follow-up of patients diagnosed with acute PE in the ED.

## Materials and Methods

The study was initiated after the ethics committee's approval (Firat University Noninvasive Researches Ethics Committee; no: 415001, date: 30.09.2020). Patients older than 18 years old who were admitted to the ED with complaints of shortness of breath and/or chest pain for 3 years and found to have acute PE on computed tomography pulmonary angiography were included in the study. The files of the patients were analyzed retrospectively. The qSOFA, PESI and sPESI values were calculated for all patients diagnosed with acute PE. Those with a qSOFA score of  $\geq 2$  were considered positive qSOFA. During the follow-up, in-hospital mortality and the requirement of intensive care continuation were determined. Patients with missing data and those who were transferred to another hospital during their follow-up were excluded from the study.

## Statistical Analysis

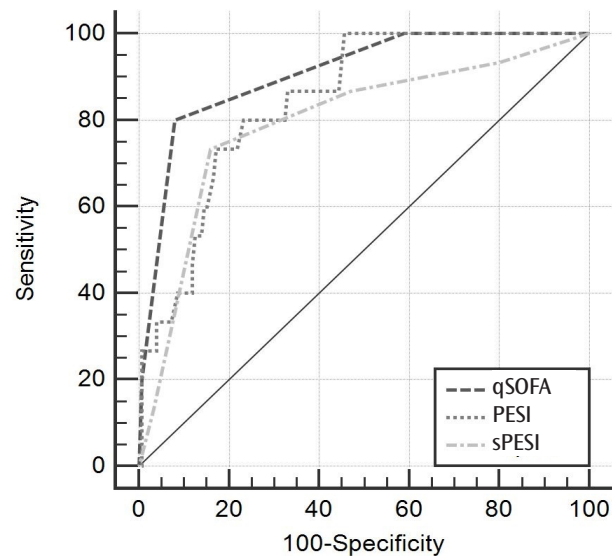
Statistical Package for the Social Sciences (SPSS v.22, Chicago, IL, USA) and MedCalc (Version 10.1.6.0) package software were used for statistical analysis. Results were presented as mean  $\pm$  standard deviation if they were within normal distribution, and as median (interquartile range) if they were not within a normal distribution. Categorical variables are given as numbers (percentages). Chi-square test was used for non-measurable parameters, Student's t-test was used to compare parameters between groups, Mann-Whitney U test was used to compare non-parametric groups, and Pearson correlation test was used to examine the relationship between parameters in groups.  $p < 0.05$  values were accepted as the lowest significance level.

## Results

One hundred and sixty-six PE patients were included in the study. The mean age of the patients was  $67.4 \pm 17.3$  and 88 (53%) of them were women. During the follow-up, 26 patients (15.7%) were admitted to the ICU. Mortality rate was 9% ( $n=15$ ). The clinical and laboratory values of the patients are summarized in Table 1.

There was a positive correlation between qSOFA and PESI ( $r=0.49$ ,  $p=0.001$ ) and sPESI ( $r=0.36$ ,  $p=0.001$ ). A high qSOFA score was associated with mortality and ICU admission. The receiver operating characteristics curve in determining in-hospital mortality and admission to ICU are shown in Figures 1 and 2. The predictive value of qSOFA in determining in-hospital mortality [area under the curve (AUC): 0.907, 95% confidence interval (CI):

0.852-0.946] was similar to PESI (AUC: 0.846, 95% CI: 0.782-0.897) and sPESI (AUC: 0.796, 95% CI: 0.726-0.854) ( $p=0.23$  and  $p=0.16$  respectively). While it was superior to PESI (AUC: 0.794, 95%



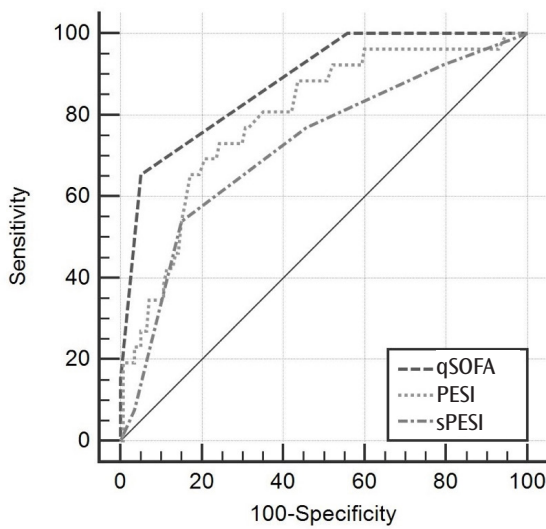
**Figure 1.** Areas Under the Receiver Operating Characteristics (ROC) Curve for in-mortality

qSOFA: Quick sequential organ failure assessment, PESI: Pulmonary embolism severity Index, sPESI: Simplified pulmonary embolism severity Index

**Table 1. Clinical and laboratory values of acute pulmonary embolism patients**

Data of patients	
Age (years) (mean $\pm$ SD)	67.4 $\pm$ 17.3
Gender (female/male)	88/78
SBP (mmHg) (mean $\pm$ SD)	124.6 $\pm$ 23.5
DBP (mmHg) (mean $\pm$ SD)	74.7 $\pm$ 12.9
Heart rate (bpm) (mean $\pm$ SD)	100 $\pm$ 22.4
Respiratory rate (mean $\pm$ SD)	21.7 $\pm$ 4.3
sO <sub>2</sub> (%) (mean $\pm$ SD)	88.3 $\pm$ 8.2
Glasgow Coma Score (mean $\pm$ SD)	14.8 $\pm$ 0.6
Wells Score (mean $\pm$ SD)	3.8 $\pm$ 2.1
Revised Geneva Score (mean $\pm$ SD)	6.3 $\pm$ 2.8
qSOFA (median) (IQR)	1 (0-1)
PESI (median) (IQR)	104 (79.7-123.2)
sPESI (median) (IQR)	2 (1-2)
D-dimer ( $\mu$ g/L) (median) (IQR)	3,208 (1,680-4,977)
Troponin (ng/mL) (median) (IQR)	0.1 (0-0.05)
Lactate (mg/dL) (median) (IQR)	1.3 (1-2)

SBP: Systolic blood pressure, DBP: Diastolic blood pressure, qSOFA: Quick sequential organ failure assessment, PESI: Pulmonary embolism severity Index, sPESI: Simplified pulmonary embolism severity Index, IQR: Interquartile range, SD: Standard deviation



**Figure 2.** Areas Under the Receiver Operating Characteristics (ROC) Curve for ICU admission. ICU: Intensive care unit, qSOFA: Quick sequential organ failure assessment, PESI: Pulmonary embolism severity Index, sPESI: Simplified pulmonary embolism severity Index

CI: 0.724-0.852) and sPESI (AUC: 0.721, 95% CI: 0.646-0.787) in determining the inclusion of patients in ICU (AUC: 0.882, 95% CI: 0.823-0.927) ( $p=0.04$  and  $p=0.01$  respectively).

The sensitivity and specificity of a qSOFA score  $\geq 2$  for predicting in-hospital mortality were 80% and 92%, respectively. The sensitivity and specificity of patients in ICU admission were 65.4% and 95%, respectively. While the sensitivity of qSOFA in determining in-hospital mortality and admission to ICU was lower than PESI and sPESI, its specificity was higher. The sensitivity and specificity of qSOFA, PESI and sPESI for in-hospital mortality and admission to the ICU are presented in Tables 2 and 3.

The qSOFA score was positive in 14.5% ( $n=24$ ) of the patients at admission to the ED. Median PESI [137 (interquartile range (IQR): 73-206) and sPESI (2 (IQR): 1-3)] values of patients with a positive qSOFA score had a higher median than those with qSOFA  $< 2$  [PESI: 98.5 (IQR: 27-208), sPESI: 1 (IQR: 1-2)] ( $p$ -value 0.001 and 0.005, respectively). Similarly, mortality (50%) and ICU admission rate (70.8%) were higher in patients with positive qSOFA than those with qSOFA  $< 2$  (6.3% ICU admission rate, 2.1% mortality rate) ( $p=0.001$ ) (Table 4).

**Table 2. Performance of qSOFA, PESI and sPESI in determining in-hospital mortality in patients with acute pulmonary embolism**

Score	AUC	%95 CI	Cut-off	Sensitivity (%)	Specificity (%)
qSOFA	0.907	0.852-0.946	$\geq 2$	80	95
PESI	0.846	0.782-0.897	$\geq 86$	100	35
sPESI	0.796	0.726-0.854	$\geq 1$	93.3	20.7

qSOFA: Quick sequential organ failure assessment, PESI: Pulmonary embolism severity Index, sPESI: Simplified pulmonary embolism severity Index, AUC: Area under the curve, CI: Confidence interval

**Table 3. Performance of qSOFA, PESI and sPESI in determining ICU admission in patients with acute pulmonary embolism**

Score	AUC	%95 CI	Cut-off	Sensitivity (%)	Specificity (%)
qSOFA	0.882	0.823-0.927	$\geq 2$	65.4	95
PESI	0.794	0.724-0.852	$\geq 86$	96.2	35
sPESI	0.721	0.646 -0.787	$\geq 1$	92.3	20.7

qSOFA: Quick sequential organ failure assessment, PESI: Pulmonary embolism severity Index, sPESI: Simplified pulmonary embolism severity Index, AUC: Area under the curve, CI: Confidence interval

**Table 4. Patients' qSOFA scores and in-hospital mortality and intensive care unit admission rates**

qSOFA scores (n)	Mortality rate (%)	ICU admission rate (%)
0 (62)	0	0
1 (80)	3.8	11.3
2 (20)	45	65
3 (4)	75	100
qSOFA $\geq 2$ (24)	50	70.8
qSOFA $< 2$ (142)	2.1	6.3

qSOFA: Quick sequential organ failure assessment

## Discussion

In our study, we found that qSOFA score was strongly associated with in-hospital mortality and ICU acceptance in patients with acute PE who were admitted to the ED. In-hospital mortality and ICU admission rates were 0% in patients with a qSOFA score of 0, while those with a qSOFA score of 3 were 75% and 100%, respectively. In-hospital mortality and ICU admission rate for those with positive qSOFA scores were 50% and 70.8%, respectively. In addition, the qSOFA score was positively correlated with PESI and sPESI, which are used to determine both the prognosis and treatment strategy of PE patients.

qSOFA has been proposed as a simple reference guide to identify septic patients and predict patient prognosis (9). Since the day it was defined, the benefit of the qSOFA score in different patient groups admitted to the ED was evaluated. PE is a relatively common condition with high mortality in EDs (10). In PE patients, the qSOFA score can be calculated easily and quickly with the vital signs of the patients at the bedside, without the need for any laboratory test. The Sepsis 3 study group recommended the use of the qSOFA score to determine the in-hospital mortality of patients with suspected infection, except for ICU (7). It has been suggested that the qSOFA score can be used as a potential tool to predict clinically significant outcomes in ED patients, regardless of whether an infection is suspected or not (9). In a study of 11,205 patients with suspected infection in ED, it was shown that positive qSOFA patients had a 2-fold increase in ICU stay and a 5-fold increase in-hospital mortality compared to negative qSOFA patients, and the sensitivity of positive qSOFA in determining in-hospital mortality was 61% and its specificity was 80% (11). In another study, 22,530 patients admitted to the ED with and without suspected infection were examined and it was reported that qSOFA scores were associated with inpatient mortality, hospitalization, admission to ICU, and length of stay, and it was suggested that it may be useful in forecasting the outcomes. In this study, they found AUC: 0.76 (%95 CI: 0.73-0.78) in determining mortality and AUC: 0.61 (%95 CI: 0.59-0.63) at admission to ICU. When the qSOFA score is  $\geq 2$ , they found the sensitivity and specificity at admission to ICU as 10% and 97%, respectively, and the sensitivity as 29% and specificity as 97% in determining mortality (9). Shu et al. (12) found the sensitivity of the qSOFA score of 2,292 patients transported by ambulance as 40.6% and specificity as 91.9% in determining in-hospital mortality and reported that higher qSOFA score was associated with higher hospitalization and ICU admission. In another study in which 42,722 trauma patients were examined, it was shown that the pre-hospital qSOFA score was strongly associated with in-hospital mortality in trauma patients (13). In a study in which

1,849 patients transported by helicopter were examined, it was shown that the in-hospital mortality rate increased significantly as the qSOFA scores of the patients increased (14).

However, some studies have reported that qSOFA does not perform well enough in determining the patient's mortality and admission to ICU. In a review of 27 studies examining 380,920 patients, Lo et al. (15) found that qSOFA was not a clinically useful prognostic tool for one-month mortality or ICU admission. Garbero et al. (16) investigated 184 patients who admitted to ER with suspected infection and reported that the qSOFA score did not perform well as a screening tool to predict poor prognosis in sepsis and emergency services but showed reasonable sensitivity to predict negative outcomes and that qSOFA  $\geq 2$  scores were associated with poor prognosis.

In our study, we found the AUC value of qSOFA score to be 0.907 (95% CI: 0.852-0.946) in determining in-hospital mortality in patients with PE. The sensitivity and specificity of positive qSOFA were 80% and 92%, respectively. In determining the admission of patients to ICU, we found AUC: 0.882 (95% CI: 0.823-0.927), and the sensitivity and specificity of positive qSOFA as 65.4% and 95%, respectively.

In a study in which 1,318 patients with acute PE were examined, the role of qSOFA and ECG parameters in determining the risk of cardiovascular collapse was investigated (17). In this study, it was shown that all patients who died met the qSOFA  $\geq 2$  criterion. It has been shown that the qSOFA score, when used in combination with the diagnosis of tachycardia in ECG, S1Q3T3, right bundle branch block and T wave inversion of leads V1-V3, effectively contributes to the identification of patients with acute PE who need possible reperfusion therapy and have a hemodynamic collapse. In our study, we found that the qSOFA score of the patients revealed a positive correlation between PESI and sPESI score, which reliably establishes the 30-day mortality risk of the patients. It also performed well in admitting patients to ICU and determining in-hospital mortality.

## Study Limitations

Since our study is a retrospective study, there may be errors in inputting the data.

## Conclusion

As a result, we found that the qSOFA score performed well in determining in-hospital mortality and ICU admission in acute PE patients admitted to the ED. In our study, the increase in qSOFA score was strongly associated with ICU admission and in-hospital mortality.

## Ethics

**Ethics Committee Approval:** Firat University Noninvasive Researches Ethics Committee was approved this study (no: 415001, date: 30.09.2020).

**Informed Consent:** Retrospective study.

**Peer-review:** Externally peer-reviewed.

## Authorship Contributions

Surgical and Medical Practices: M.G., F.A.A., M.Y., Concept: M.G., F.A.A., M.Y., M.A., Design: M.G., M.Y., M.A., Data Collection or Processing: M.G., F.A.A., Analysis or Interpretation: M.G., M.Y., Literature Search: M.G., M.A., Writing: M.G.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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# The Effect of Blood Lactate Level on Mortality in COVID-19 Positive Patients

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## Abstract

**Aim:** We aimed to investigate the relationship between increased lactate values and mortality in COVID-19 patients.

**Materials and Methods:** This study was conducted in a tertiary training and research hospital. According to the order of application, a total of 316 patients over the age of 18 who were admitted to the emergency department (ED) with symptoms of COVID-19 during the two months and whose data could be completely accessed were included in the study retrospectively. Plasma lactate values and mortality within 28 days were determined.

**Results:** The median age of the patients was 69 years. Of the patients, 53.5% were male, 72.2% had comorbidities, and the most common comorbidity was COPD (13.0%). Of the patients, 83.5% were hospitalized. The mean lactate value of the patients was  $2.05 \pm 1.45$  mmol / L. Mortality developed in 14.2% of the patients during the first 28 days. The 28-day mortality was significantly higher in patients with a positive Polymerase Chain Reaction (PCR) (23.8%) than that of negative PCR (8.2%) ( $p < 0.001$ ). The lactate level was found to be significantly different in both PCR positive and negative groups in which mortality developed within 28 days ( $p < 0.001$ ;  $p < 0.001$ ). If the cut-off value of lactate in terms of mortality was 2.45, the sensitivity and specificity were determined as 80.0% and 81.2%, respectively.

**Conclusion:** In patients with COVID-19 infection, the blood lactate level examined at the first admission to ED can be used as a practical screening test to predict mortality.

**Keywords:** COVID-19, pneumonia, lactate, mortality, pandemic

## Introduction

A group of unknown pneumonia cases emerged in Wuhan, China in December 2019. Most of the patients lived or worked in the local Huanan seafood wholesale market, where live wild animals were also on sale. In some patients, a clinical condition similar to acute respiratory distress syndrome (ARDS) rapidly appeared in the early stages of pneumonia. The new type of coronavirus infection with the zoonotic transition, called 2019-nCoV, has spread rapidly in China and then worldwide, causing a pandemic.

After emerging in Wuhan, Hubei province of China, the coronavirus disease-2019 (COVID-19) infection, which has rapidly spread to other countries in Asia, Pacific, Europe, and Africa, has caused a pandemic that threatens the preparation and biosafety conditions of countries worldwide (1). The world was unprepared for such a pandemic. Capacities of health facilities were insufficient.

This infection, later called COVID-19 by the World Health Organization (WHO), has caused 132,485,386 million confirmed cases and approximately 2,875,672 deaths with current data. (April 8, 2021) (2).



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The outbreak is still not fully under control. COVID-19 infection, which has clinical symptoms such as fever, cough, shortness of breath, myalgia, and fatigue, causes serious lower respiratory tract infections and mortality (3-6).

Due to the rapid spread of COVID-19 infection, the health infrastructure and resources of most countries have become insufficient. As a result of excessive admissions, the number of patients has dramatically increased especially in the emergency departments (ED), which has created a need to identify markers that can help us differentiate patients with serious life-threatening clinical findings and needing urgent treatment.

The usefulness of plasma lactate level measurement in EDs as an estimation for early detection of patients with tissue hypoperfusion that can cause severe sepsis and death has been reported (5). In this study, we aimed to investigate the relationship between increased lactate values and mortality in COVID-19 patients.

## Materials and Methods

This retrospective cohort study started after the local ethical approval of Clinical Research Ethics Committee (2011-KAEK-25 2020/05-05) was obtained.

The standard data entry form including information regarding the patient's age, gender, presence of comorbid disease, plasma lactate, d-dimer, ferritin, C-reactive protein (CRP) values, Polymerase Chain Reaction (PCR) testing results of oropharyngeal and nasopharyngeal swab samples, presence of pneumonic infiltration in thorax computerized tomography (CT), outcome (hospitalization, exitus, discharge) and whether there was mortality within 28 days were used. Patients over 18 years old who were admitted to ED with symptoms of COVID-19 (fever, cough, shortness of breath, diarrhea, fatigue, muscle or joint pain) between 16.03.2020 and 16.05.2020, and recorded in the hospital automation system with COVID-19 ICD-10 codes (U07. 1 and U07. 2) were screened. A total of 348 patients were detected. Patients whose study data were not fully available (32 patients) were excluded. Totally 316 patients were included to the study.

## Statistical Analysis

The data were analyzed using SPSS 22.0 for Windows (SPSS Inc., Chicago, IL, USA) computer program. Descriptive statistics were expressed as median (IQR: 25<sup>th</sup>-75<sup>th</sup> percentiles) for continuous numerical variables while numbers and (%) for categorical variables. Kolmogorov-Smirnov test was used for the normality of data. The significance of the difference in terms of continuous numerical variables in which parametric test statistic assumptions were not provided was evaluated with Mann-Whitney U test. Chi-

square and Fisher's exact tests were used to analyze whether there was a relationship between categorical variables. The ROC curve was plotted to investigate the diagnostic value of lactate. In the study,  $p < 0.05$  value was considered statistically significant.

## Results

A total of 316 patients were included in the study and the median (IQR: 25<sup>th</sup>-75<sup>th</sup> percentiles) age of the patients was 69 (60-78) years and 53.5% (n=169) of the patients were male. Pneumonia was detected in thorax CT in 87.0% (n=275) of the patients. Comorbidities were found in 72.2% (n=228) of the patients. The most common comorbidity was chronic obstructive pulmonary disease (COPD) with 13.0% (n=41). While 83.5% (n=264) of the patients were hospitalized, 15.8% (n=50) were followed-up at home. Two patients (0.6%) died in ED. Mortality developed in 14.2% of the patients (n=45) within 28 days. Distribution of patients' features are shown in Table 1. There was an increase in the mean lactate ( $2.05 \pm 1.45$  mmol/L), CRP ( $52.22 \pm 65.90$ ), D-dimer ( $2.65 \pm 6.96$ ) and ferritin ( $344.28 \pm 524.82$ ) values of the patients (Table 2). In the chi-square test, a statistically significant relationship was found between PCR positivity and 28-day mortality ( $p < 0.001$ ) (Table 3). In the Kolmogorov-Smirnov test conducted to analyze the normality distribution, it was seen that the data were not normally distributed. Within this scope, Mann-Whitney U test was conducted to investigate whether there was a difference between the lactate level and the 28-day mortality as well as PCR positivity/negativity. As a result of this test, lactate level was found to be significantly different in patients in both PCR positive and PCR negative groups who developed mortality within 28 days ( $p < 0.001$ ;  $p < 0.001$ ) (Table 3).

When the cut-off value of lactate in terms of mortality was 2.45, the sensitivity was found as 80.0%, the specificity was detected as 81.2%, and the area under the curve (AUC) was determined as 0.915 [95% confidence interval (CI): 0.876-0.955] in the ROC analysis ( $p < 0.001$ ). If the the cut-off value of lactate in terms of mortality was 3.22, the sensitivity decreased to 57.8%, the specificity increased to 98.2% (Table 4).

## Discussion

Excessive intense referral to healthcare facilities has led to the need to identify markers that can help us differentiate patients with serious life-threatening clinical findings needing urgent treatment.

Clinical, laboratory, and image findings, and factors related to the evolution of the disease and its consequences constitute critical information that must be carefully examined when a new infectious disease occurs. It is important to distinguish

which COVID-19 patients are at risk. Some patients can be safely managed as an outpatient. Reliable prognostic markers should be used to identify patients who will need more aggressive treatment. Advancing age, male gender, pre-existing coronary artery diseases (CAD), diabetes mellitus (DM), hypertension (HT), asthma, COPD, malignancies, and immunosuppressive diseases have been reported to adversely affect clinical prognosis in patients with COVID-19 (7,8). Similarly, in our study, 53.5% (n=169) of patients with COVID-19 were male, the mean age was

69 (min-max: 19-99) years, and the most common comorbidities were COPD, HT, DM, and CAD.

In a meta-analysis, clinical symptoms and findings such as fever (88.7%, 95% CI: 84.5-92.9), cough (57.6%, 95% CI: 40.8-74.4), dyspnea (45.6%, 95% CI: 10.9-80.4), myalgia or fatigue (29.4%, 95% CI: 19.8-39.0), sputum (28.5%, 95% CI: 10.8-46.3) and sore throat (11%, 95% CI: 2.8-19.2) were reported in patients with COVID-19, which was statistically significant (p<0.001). In laboratory tests,

**Table 1. Distribution of patients' features**

Variables	Frequency	Percentage	
<b>Gender</b>	Female	147	46.5
	Male	169	53.5
<b>Comorbidities</b>	None	88	27.8
	COPD	41	13.0
	Multiple diseases	39	12.3
	HT	37	11.7
	HT + DM	27	8.5
	DM	18	5.7
	CAD	17	5.4
	HT + CAD	12	3.8
	CRF	8	2.5
	Other	29	9.2
<b>Total</b>	228	72.2	
<b>Pneumonia findings on CT</b>	No	41	13.0
	Yes	275	87.0
<b>PCR</b>	Positive	122	38.6
	Negative	194	61.4
<b>Outcome</b>	Hospitalization	264	83.5
	Follow up at home	50	15.8
	Exitus in the emergency service	2	0.6
<b>28-day mortality</b>	Yes	45	14.2
	No	271	85.8
	Total	316	100

CT: Computed tomography, PCR: Polymerase chain reaction, HT: Hypertension, DM: Diabetes mellitus, CAD: Coronary artery disease, COPD: Chronic obstructive pulmonary disease, CRF: Chronic renal failure

**Table 2. Distribution of laboratory variables**

Variables	n	Mean	Standard deviation
Lactate	316	2.05	1.45
CRP	316	52.22	65.90
D-Dimer	316	2.66	6.96
Ferritin	316	344.29	524.82

CRP: C-reactive protein; n: number

**Table 3. Chi-square and Mann-Whitney U analysis of variables**

Chi-square analysis						Total	Chi-square analysis
Variables			28-day mortality				
			Yes	No			
PCR	Positive	n (%)	29 (23.8)	93 (76.2)	122 (100)	X <sup>2</sup> = 14.778 (p<0.001)	
	Negative	n (%)	16 (8.2)	178 (91.8)	194 (100)		
Total		n (%)	45 (14.2)	271 (85.8)	316 (100)		

Mann Whitney U Analysis					
PCR	Mortality in 28 days	n	median (IQR: 25th-75th percentiles)	p-value	
Positive	Lactate	Yes	29	2.1 (1.3-2.88)	<0.001
		No	93		
		Total	122		
Negative	Lactate	Yes	16	1.7 (1.2-2.3)	<0.001
		No	178		
		Total	194		

PCR: Polymerase chain reaction,; n: Number,; IQR: Interquartile range

**Table 4. Sensitivity and specificity analysis of lactate level**

AUC (95% CI)	p-value	Risk fact	Cut-off	Sensitivity (%)	Specificity (%)
0.915 (0.876-0.955)	<0.001	Lactate	1.75	97.8	55.4
			2.08	95.6	67.2
			2.45	80.0	81.2
			2.75	71.1	90.0
			2.95	62.2	93.7
			3.22	57.8	98.2
			3.85	33.3	98.9

AUC: Area under the curve, CI: Confidence interval

the decrease in albumin (75.8%, 95% CI: 30.5-100.0), increase in CRP (58.3%, 95% CI: 21.8-94.7), increase in lactate dehydrogenase (LDH) (95% CI: 38.0-76.0), increase in lymphopenia (43.1%, 95% CI: 18.9-67.3) and erythrocyte sedimentation rate (ESR) (41.8%, 95% CI: 0.0-92.8) were reported to be statistically significant (p<0.001) (9). In our study, CRP, D-dimer, ferritin, and lactate were studied and it was seen that CRP (52.22± 65.9), D-dimer (2.66 ± 6.96), ferritin (344.29 ± 524.82) and lactate (2.05±1.45 mmol/L) levels increased. In addition, lactate value over 4 mmol/L in patients with sepsis was reported to be associated with high mortality (10). As a biomarker in critical diseases and even as a therapeutic target, lactate attracts attention (11).

In patients with sepsis, widespread tissue hypoxia is found when the plasma lactate value is above 4 mmol/L, even if patients are normotensive (12). Lactate is a by-product of anaerobic cellular

metabolism. In the case of hypoperfusion, blood lactate level increases due to insufficient oxygen. Since anaerobic metabolism is predominant in global hypoperfusion states or shock, lactate metabolism increases in the liver and kidneys, and as a result, the lactate level in the blood increases. In some studies, increased lactate concentration has been associated with high mortality, irrespective of the presence of lactic acidosis (13). In our study, it was found that there was a relationship between high lactate values and mortality in patients with COVID-19. Lactate level was found to be statistically significantly different in both PCR positive and PCR negative groups in which mortality developed within 28 days (p<0.001), p=0.004). When the cut-off value of lactate in terms of mortality was 2.45, the sensitivity was found as 80.0%, the specificity was detected as 81.2%, and the area under the curve (AUC) was determined as 0.915 (95% CI: 0.876-0.955) in the ROC analysis (p<0.001).

When the first COVID-19 patients were detected in our hospital, we started to perform PCR testing to the oropharyngeal and nasopharyngeal swab samples of the patients. However, Thorax CT was performed in all patients with COVID-19 suspicion, since PCR was not concluded immediately and the accuracy rate was reported as low (30%-60%) in the literature (5). In our study, 38.6% of the patients had positive PCR testing, and pneumonia was detected via thorax CT in 87% of patients admitted to ED with COVID-19 symptoms. Thorax CT is a conventional, noninvasive, fast, and highly accurate imaging method. In accordance with the literature, there were characteristic CT findings (ground-glass opacification, bilateral multilobar involvement, posterior and peripheral distribution, consolidation) in our patients with COVID-19 (14). Thorax CT is considered as a routine imaging method for the monitoring and diagnosis of patients with COVID-19 pneumonia. Thorax CT may help to screen patients with suspected disease, particularly symptomatic patients with the first negative PCR scan result, and early detection of lung abnormalities (15).

### Study Limitations

The main limitations of our study were the relatively low number of patients, being retrospective, not considering lactate clearance, and not investigating the treatment methods that may affect mortality.

### Conclusion

In conclusion, the blood lactate level examined at the first admission to ED in patients with COVID-19 can be used as a beneficial screening test to predict mortality.

### Ethics

**Ethics Committee Approval:** This study was approved by Bursa Yüksek İhtisas Training and Research Hospital Clinical Researches Ethics Committee (decision no: 2011-KAEK-25 2020/05-05, date: 13.05.2020).

**Informed Consent:** Retrospective study.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Surgical and/or Medical Practices: M.Y., Ş.İ., Concept: Y.İ., H.K., M.O.A., M.B., Design: H.K., M.Y., M.B., Data Collection and/or Analysis: H.K., M.O.A., Ş.İ., M.B., Literature Search: Y.İ., M.Y., Ş.İ., M.B., Writing: H.K., M.O.A., Ş.İ.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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# The Burden of Chronic Obstructive Lung Disease Disease on the Health System

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## Abstract

**Aim:** To analyze the cost of patients hospitalized in secondary and tertiary hospitals due to the diagnosis of Chronic Obstructive Lung Disease (COPD) and to draw attention to the cost of COPD and the reasons that increase the cost in our country.

**Materials and Methods:** This research was carried out in a chest diseases clinic in second and third-level hospitals affiliated with the ministry of health, between 1 January 2018-31 December 2018. Demographic features, smoking, duration of hospitalization, length of hospitalization in intensive care, antibiotics used, number of outpatients applied, total hospitalization cost, total costs and duration of antibiotics used were recorded. Costs were stated in Turkish Lira and converted into dollars. Cost data of patients with more than one hospitalization were entered separately.

**Results:** The numbers of men and women were equal in both 2nd level and 3rd level patients. Looking at patients with COPD in both the secondary and tertiary, total hospital cost in patients was significantly higher than those who did not. When the length and number of hospitalization increased, the total cost of the hospital increased significantly. Significant differences were not found between age groups, gender, smoking status, comorbidities, antibiotic use, number of outpatient clinic admissions, and the number of hospitalizations in the last two years in terms of total hospital cost.

**Conclusion:** The elimination and prevention of both internal and external factors that cause the disease, especially without the need for medication, is of great importance in terms of financial and labor loss prevention and reduction.

**Keywords:** Chronic obstructive lung disease, COPD, the burden of COPD, hospital cost, hospital cost in the health system

## Introduction

The Chronic Obstructive Lung Disease (COPD) is defined as a general preventable disease characterized with frequent respiratory symptoms and airflow limitation by The Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2017 (1).

The COPD leads an important challenge for the health care provider and it is the third leading cause of death in the United States in 2014 (2). Also the COPD is the fourth leading cause of death all around the World (3). Risk factors for the development of COPD include occupational exposures (chemical agents, fumes

and dust, indoor air pollution (Wood burning stove, biomass fuel), asthma and airway hyperresponsiveness (4,5).

Countries use a significant portion of their Gross Domestic Product, and individuals' income, for health expenditures. As a result of this, the cost of healthcare services is one of the important issues that are constantly on the agenda (6). It was announced that the COPD has created a significant financial burden of approximately \$ 50 billion in the spending of the US government in 2010 (7).

COPD is a common health problem that causes both labor loss and financial loss. In particular, the increase in the frequency of hospital admissions, the increase in hospitalization and the



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increase in the drugs used create great burdens on the health system of governments. For this reason, it is great importance to take measures for reduction of hospital admissions and management of the disease including non-pharmacological treatment options whenever possible.

In the current study, we aim to analyze the cost of patients hospitalized in 2nd and 3rd hospitals due to the COPD and to draw attention to the cost of COPD that increase the cost in our country.

## Materials and Methods

This research was carried out the chest diseases clinic in second and third level hospitals affiliated to the ministry of health in Konya province, between 1 January 2018 - 31 December 2018. The data of 100 patients (fifty men and fifty women) who were hospitalized and followed up with COPD diagnoses over the years were analyzed.

The study was conducted with the permission and approval of Konya Provincial Health Directorate commission with the following date and numbered (Date: 05/07/2018/ Number:16-03). The patients admitted to the hospital for other reasons than COPD were not included in the current study. For this purpose, approximately ...patients were excluded in the current study. The study was done retrospectively. As the limitations of the study, it can be given that it is conducted only in one center and it covers the last two years.

Demographic data such as age and gender of the patients, smoking, duration of hospitalization, length of hospitalization in intensive care, diseases in addition to COPD, antibiotics used, number of outpatient apply in the last two years, total number of hospitalizations in the last two years, total hospitalization cost, total hospitalization cost of intensive care, daily costs of antibiotics used, total costs of antibiotics used, duration of antibiotics were recorded. Costs were stated in Turkish Lira (TL). It was converted into dollars as a currency using the exchange rate from which the data was taken. Cost data of patients with more than one hospitalization were entered separately.

This study was approved by University of Health Sciences, Konya Training and Research Hospital (decision no and date: 16-03, 05/07/2018).

## Statistical Analysis

The research data were uploaded and analyzed via "SPSS (Statistical Package for Social Sciences) for Windows 22.0 (SPSS Inc, Chicago, IL)". Descriptive statistics were presented as median (interquartile range), frequency distribution and percentage.

Pearson Chi-Square Test and Fisher's Exact Test were used to evaluate categorical variables. The suitability of variables to normal distribution was examined using visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov / Shapiro-Wilk Test). The Mann-Whitney U Test was used as a statistical method for statistical significance between two independent groups, and the Kruskal Wallis Test between three independent groups, for variables that were found to be inconsistent with the normal distribution. When a significant difference was detected between three independent groups, Bonferroni correction was applied in post-hoc paired comparisons to determine the source of the difference. Statistical significance level was accepted as  $p < 0.05$ .

## Results

Within the scope of the research, a total of 200 patients with a diagnosis of COPD, 100 of whom were from the 2nd hospital and 100 from the 3rd hospital patients, were examined.

The median age of the second level patients was 69 (IQR: 67-78), and the numbers of men and women were equal. 9.0% of the patients were still smoking, 7.0% cessation of smoking and the remaining 84.0% had never smoked. 78.0% of the second level patients diagnosed with COPD had at least one additional disease. In these diseases; hypertension took the first place with 41.0%, followed by diabetes mellitus with 32.0% and heart failure and asthma with 14.0%. The least common additional diseases were hyperlipidemia (20%), chronic renal failure (4.0%) and bronchitis (7.0%) (Table 1).

When looking at the 3rd level patients examined within the scope of the research; while the median age was 56 (IQR: 53-58), the numbers of men and women were equal. 66.0% of the patients were smoking, while the remaining 34.0% were not. 47.0% of the patients with COPD had additional disease. Among the existing additional diseases, hypertension took the first place with 18.0%, diabetes mellitus with 14.0% and heart failure with 10.0%. The least common additional diseases were bronchitis (1.0%), chronic renal failure (3.0%) and hyperlipidemia (4.0%) (Table 1).

The median number of outpatient clinic apply in the last two years was 11 (IQR: 5.2-17.0), while the median number of hospitalizations in the last two years was 2 (IQR: 1-3) in the 2nd level patients with COPD. The patients were hospitalized for a median of 6 (IQR: 4-9) days. 25.0% of the 2nd patients diagnosed with COPD had stayed in the intensive care unit (ICU). The median length of stay in the ICU was 3 (IQR: 1.0-10.5) days. The median length of hospital stay in all patients with COPD was 7 (IQR: 5-11) days.

	<b>2<sup>nd</sup> level (n=100)</b>	<b>3<sup>rd</sup> level (n=100)</b>
<b>Age (year), median (IQR)</b>	69 (61-78)	56 (53-58)
<b>Sex, n (%)</b>		
Male	50 (50.0%)	50 (50.0%)
Female	50 (50.0%)	50 (50.0%)
<b>Smoking status, n (%)</b>		
Still using	9 (9.0%)	66 (66.0%)
Stopped smoking	7 (7.0%)	0 (0%)
Never used	84 (84.0%)	34 (34.0%)
<b>Presence of additional diseases, n (%)</b>	78 (78.0%)	47 (47.0%)
<b>Existing diseases, n (%)</b>		
HT	41 (41.0%)	18 (18.0%)
DM	32 (32.0%)	14 (14.0%)
HF	14 (14.0%)	10 (10.0%)
Asthma	14 (14.0%)	8 (8.0%)
Bronchitist	7 (7.0%)	1 (1.0%)
CHR	4 (4.0%)	3 (3.0%)
HL	2 (2.0%)	4 (4.0%)
Other	16 (16.0%)	29 (29.0%)

COPD: Chronic obstructive lung disease, n: Number of the patients, IQR: Interquartile range (25%-75%), <sup>a</sup>Mann-Whitney U-test, <sup>b</sup>Chi-square test, <sup>c</sup>Fisher's exact test, HT: Hypertension, DM: Diabetes Mellitus, HF: Heart failure, CHR: Chronic Renal Failure, HL: Hyperlipidemia

The median number of outpatient clinic apply of patients with 3rd level COPD in the last two years was 5 (IQR: 2-9), while the median number of hospitalizations in the last two years was 1 (IQR: 0-2). The median length of stay in the service was 7 (IQR: 5-10) days. 29.0% of the patients with a diagnosis of 3rd level COPD that were remained in the ICU. The average length of stay in the ICU was 3 (IQR: 2-7) days. The median length of hospital stay in all patients with level 3 COPD was 8 (IQR: 5.0-11.8) days.

Hospital costs of the patients examined within the scope of the study were calculated as USD. According to this; the median cost of the ICU of 25 of the patients with 2rd level COPD who stayed in the ICU was 448.6 (IQR: 181.5-1416.7) USD. While the median hospital cost of the 2rd level patients hospitalized in the ICU was USD 701.7 (IQR: 306.9-1526.2), the median hospital cost of the patients not hospitalized in the ICU was USD 274.7 (IQR: 196.1-490.2). The median total cost of the hospital for the 2rd level patients was 305.0 (IQR: 216.2-593.5) USD (Figure 1a,b,c and d).

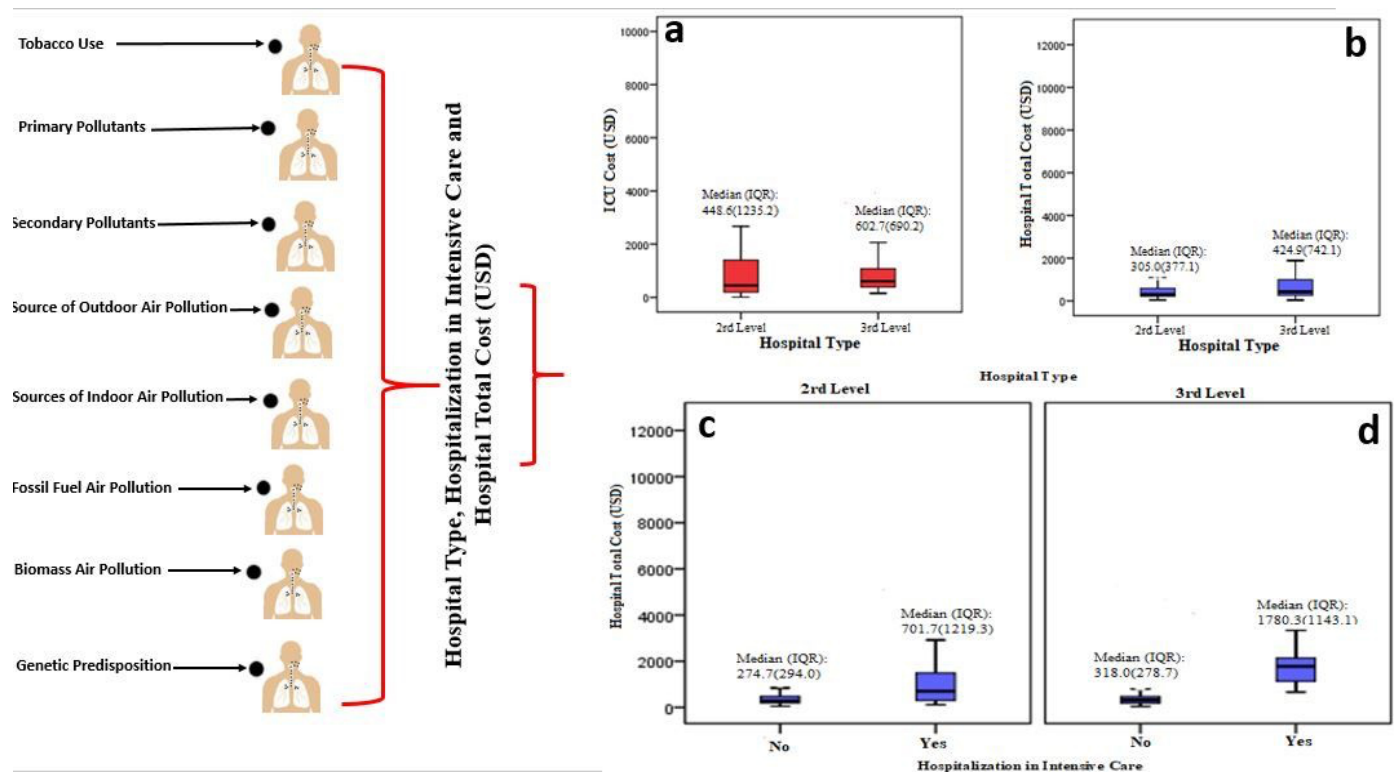
The median ICU cost of 29 of the patients with a diagnosis of 3rd level COPD who stayed in the ICU was 602.7 (IQR: 383.2-1073.4) USD. The median hospital cost of the 3rd level patients staying in the ICU was 1780.3 (IQR: 1057-9-2201.0) USD, while the median hospital cost of the 3rd level patients not staying in the ICU was 318.0 (IQR: 191.1-469.7) USD. The median total cost of the

hospital for 3rd level patients was 424.9 (IQR: 257.8-1000.0) USD (Figure 1a,b,c and d).

While antibiotic treatment was applied to 50.0% of the 2rd level patients examined within the scope of the study, it was applied to 71.0% of the 3rd level patients. The median duration of antibiotic use was 6.5 (IQR: 4-10) days for 2rd level patients, while it was 6.0 (IQR: 4-10) days for 3rd level patients. Looking at the antibiotics used; while cefuroxime was applied to 36.0% of the 2rd level patients and ceftriaxone was applied to 14.0% of the 2rd patients, the ceftriaxone was applied in the first place with 40.0% of 3rd patient, followed by moxifloxacin with 23.0% of 3rd patient and cefuroxime with 16.0% of 3rd patient (Table 2).

The median total antibiotic cost of 50 patients who received antibiotic treatment among the 2rd level patients was 17.9 (IQR: 11.5-25.8) USD, while the median total antibiotic cost of 71 patients who received antibiotic treatment among the 3rd level patients was 65.4 (IQR: 34.5-155.5) USD ( Table 3).

Among patients who applied to 2rd level health care institutions and hospitalized in ICU, total hospital cost was significantly higher than those who did not ( $p < 0.001$ ). In addition, as the length of hospitalization increased, the total cost of the hospital increased significantly ( $p < 0.001$ ) (Table 4). On the other hand, no statistically significant differences were found between the



**Figure 1.** Risk factors for COPD (Tobacco use, source of outdoor air pollution, primary and secondary pollutants, fossil fuel air pollution, sources of indoor air pollution, biomass air pollution, genetic predisposition). Patients are divided into three groups as follows. Distribution of total hospital cost and ICU cost according to the health institution level applied by COPD patients (a, b) and distribution of the total cost of the hospital according to the hospitalization status in the ICU at the health institution levels applied by the patients with COPD (c, d)

COPD: Chronic obstructive lung disease, ICU: Intensive care unit

age groups, gender, smoking status, comorbidities, antibiotic use, number of outpatient clinic admissions, and the number of hospitalizations in the last two years in terms of total hospital cost ( $p > 0.05$ ) ( $p > 0.05$ ) (Table 4). Looking at patients with tertiary COPD diagnosis; hospital total cost was significantly higher among men than women, those who were hospitalized in the ICU than non-hospitalized in the ICU, those who did use antibiotics than who did not use antibiotics, and those with more than 10 outpatient apply from less than 5, and those between 5-10 ( $p = 0.025$ ;  $p < 0.001$ ;  $p < 0.001$ ;  $p < 0.001$ ). Also when the number of admissions and length of hospital stay increased in the last two years, the total cost of the hospital increased significantly ( $p < 0.001$  for both) (Table 4).

On the other hand, no statistically significant difference was found between the age groups, smoking status and comorbidities of the patients with COPD who applied to the 3rd level hospital in terms of the total cost of the hospital ( $p > 0.05$ ) (Table 4).

Distribution of age, comorbidity, smoking status, antibiotic use, and length of stay at the healthcare institution level of patients

with COPD according to sex and smoking status were given in the table 5 and 6.

## Discussion

According to the GOLD 2017 report; COPD is a common, preventable and treatable disease characterized by persistent airflow restriction and respiratory symptoms due to airway and / or alveolar abnormalities, usually caused by severe exposure to harmful particles or gas. COPD is one of the most important causes of illness, death and disability worldwide (1).

COPD is a very common and heterogeneous disease with increasing morbidity and mortality worldwide, placing a significant burden on healthcare providers. Although pharmacological and non-pharmacological treatment options are abundant, smoking cessation continues to be the most effective therapeutic and preventive intervention in the care of these patients (4).

Since patients with COPD are mostly smokers or have used smokers, additional diseases such as cardiovascular system, circulatory system and central system diseases may be developed



	2 <sup>nd</sup> level (n=100)	3 <sup>rd</sup> level (n=100)
<b>Antibiotic use status, n (%)</b>		
No	50 (50.0%)	29 (29.0%)
Yes	50 (50.0%)	71 (71.0%)
<b>Antibiotic use time (day), median (IQR)</b>	6.5 (4-10)	6.0 (4-10)
<b>Antibiotics used, n (%)</b>		
Ceftriaxone	14 (14.0%)	40 (40.0%)
Cefuroxime	36 (36.0%)	16 (16.0%)
Moxifloxacin	0 (0%)	23 (23.0%)
Piperacillin	0 (0%)	8 (8.0%)
Ampicillin	0 (0%)	6 (6.0%)
Ciprofloxacin	0 (0%)	6 (6.0%)
Meropenem	0 (0%)	6 (6.0%)
Clarithromycin	0 (0%)	6 (6.0%)
Cefazolin	0 (0%)	4 (4.0%)
Imipenem	0 (0%)	4 (4.0%)
Levofloxacin	0 (0%)	3 (3.0%)
Teicoplanin	0 (0%)	3 (3.0%)
Vancomycin	0 (0%)	3 (3.0%)
Tigecycline	0 (0%)	2 (2.0%)
Fusidic acid	0 (0%)	2 (2.0%)
Amoxicillin	0 (0%)	1 (1.0%)
Colistin	0 (0%)	1 (1.0%)
Linezolid	0 (0%)	1 (1.0%)
Caspofungin	0 (0%)	1 (1.0%)
Rifamycin	0 (0%)	1 (1.0%)
Metronidazole	0 (0%)	1 (1.0%)

COPD: Chronic obstructive lung disease, IQR: Interquartile range (%25-%75), n: Number of the patients

	2 <sup>nd</sup> level (n=50)	3 <sup>rd</sup> level (n=71)
	<b>Median (IQR)</b>	<b>Median (IQR)</b>
<b>Total antibiotic cost (USD)</b>	17.9 (11.5-25.8)	65.4 (34.5-155.5)

COPD: Chronic obstructive lung disease, n: Number of patients, <sup>a</sup>Mann-Whitney U test, <sup>b</sup>Chi-square test, Interquartile range (25%-75%), USD: United States dollar

because of smoking. In addition to the primary effects of COPD on the lung in these patients, these systemic effects and accompanying diseases also require treatment and increase the cost of the disease (8).

In our study, when the additional diseases to be considered in both 2<sup>nd</sup> and 3<sup>rd</sup> level patients, hypertension took the first place, followed by diabetes mellitus, heart failure and asthma. The least common additional diseases were hyperlipidemia, chronic renal failure and bronchitis.

It was reported that women with COPD were younger and their number of pack years was considerably lower than it was among men. Also in COPD patients, men had increased risk for comorbidities or tended to be and greatly higher among mortality men than women (9). Interestingly, it was reported that COPD is still mainly a “men’s disease” (10). Also, while COPD mortality is especially decreasing among men, similar pronounced change has not been observed among women, and it may be said that COPD mortality in women will surpass or is surpassing that in men (11, 12).

**Table 4. Distribution of total hospital costs according to some descriptive and clinical characteristics at the health institution levels where COPD patients apply**

	Hospital total cost (USD)			
	2 <sup>nd</sup> level		3 <sup>rd</sup> level	
	n	Median (IQR)	n	Median (IQR)
<b>Age group</b>				
<55 yaş	11	271.8 (181.8-514.3)	33	499.5 (253.3-893.4)
55-65 yaş	33	376.2 (212.5-627.7)	67	366.6 (257.3-1141.2)
>65 yaş	56	291.5 (227.8-593.5)	0	-----
p-value		0.572 <sup>a</sup>		0.608 <sup>b</sup>
<b>Sex</b>				
Male	50	292.8 (205.9-526.0)	50	718.9 (291.5-1780.3)
Female	50	343.7 (222.0-701.7)	50	347.4 (233.0-643.8)
p-value		0.176 <sup>b</sup>		<b>0.025<sup>b</sup></b>
<b>Smoking</b>				
Yes	16	365.3 (232.2-790.0)	66	450.1 (233.0-1175.4)
No	84	305.0 (209.0-582.8)	34	359.4 (279.1-835.9)
p-value		0.625 <sup>b</sup>		0.558 <sup>b</sup>
<b>Additional diseases</b>				
Yes	78	302.1 (207.0-596.9)	47	366.6 (259.4-1278.0)
No	22	333.7 (228.5-482.4)	53	457.4 (245.8-991.5)
p-value		0.897 <sup>b</sup>		0.814 <sup>b</sup>
<b>ICU admission</b>				
Yes	25	701.7 (306.9-1526.2)	29	1780.3 (1057.9-2201.0)
No	75	274.7 (196.1-490.2)	71	318.0 (191.1-469.7)
p-value		<b>&lt;0.001<sup>b</sup></b>		<b>&lt;0.001<sup>b</sup></b>
<b>Antibiotic use</b>				
Yes	50	319.1 (210.6-600.0)	71	638.3 (341.6-1499.5)
No	50	291.5 (216.5-584.8)	29	235.0 (147.4-347.4)
p-value		0.615 <sup>b</sup>		<b>&lt;0.001<sup>b</sup></b>
<b>Outpatient clinic applications number</b>				
<5	18	418.9 (233.4-843.9)	41	280.8 (173.6-616.1)
Between 5-10	31	294.0 (216.2-452.9)	38	463.6 (300.7-852.8)
>10	51	291.5 (204.9-600.2)	21	1789.5 (772.6-2426.0) <sup>xy</sup>
p-value		0.154 <sup>a</sup>		<b>&lt;0.001<sup>a</sup></b>
<b>Hospitalizations number in the last 2 years</b>				
Never	7	600.2 (312.6-1935.2)	49	280.8 (185.7-388.9) <sup>yz</sup>
1-2	56	295.0 (198.3-641.8)	27	538.8 (304.0-974.5) <sup>z</sup>
≥3	37	285.2 (211.9-548.1)	24	1707.5 (875.9-2080.7)
p-value		0.163 <sup>a</sup>		<b>&lt;0.001<sup>a</sup></b>
<b>Length of stay in the hospital</b>				
≤5 day	29	183.7 (131.6-271.7) <sup>yz</sup>	27	180.6 (119.7-235.0) <sup>yz</sup>
6-10 day	44	291.5 (247.1-417.2) <sup>z</sup>	44	388.9 (307.5-768.5) <sup>z</sup>
≥11 day	27	627.7 (549.2-1593.3)	29	1780.3 (718.9-2201.0)
p-value		<b>&lt;0.001<sup>a</sup></b>		<b>&lt;0.001<sup>a</sup></b>
COPD: Chronic obstructive lung disease, Interquartile range (25%-75%), ICU: Intensive care unit, <sup>a</sup> Kruskal Wallis Test; <sup>b</sup> Mann-Whitney U Test, USD: United States dollar Significant p-values shown in bold and italic.				

**Table 5. Distribution of age, comorbidity, smoking status, antibiotic use, and length of stay at the healthcare institution level where COPD patients apply according to sex**

	2 <sup>nd</sup> level			3 <sup>rd</sup> level		
	Sex		p-value	Sex		p-value
	Male (n=50)	Female (n=50)		Male (n=50)	Female (n=50)	
Age (year), median (IQR)	70.5 (61-78)	69 (59.8-80.0)	0.975	56 (53.8-58.0)	56 (53-58)	0.972
Additional diseases, n (%)	36 (72.0)	42 (84.0)	0.148	17 (34.0)	30 (60.0)	0.009
Smoking, n (%)	15 (30.0)	1 (2.0)	<0.001	37 (74.0)	29 (58.0)	0.091
Hospitalization (days), median (IQR)	7.5 (4.8-10.2)	7 (5-13)	0.570	8 (6.0-16.2)	7 (5-10)	0.064
Use of Antibiotics, n (%)	21 (42.0)	29 (58.0)	0.110	40 (80.0)	31 (62.0)	0.047

COPD: Chronic obstructive lung disease, n: Number of patients, IQR: Interquartile range (25%-75%); <sup>a</sup>Mann-Whitney U test; <sup>b</sup>Chi-square test  
Significant p-values shown in bold.

**Table 6. Distribution of age, presence of comorbidities, antibiotic use and length of stay at the healthcare institution level where COPD patients apply according to smoking status**

	2 <sup>nd</sup> level			3 <sup>rd</sup> level		
	Smoking		p-value	Smoking		p-value
	Yes (n=16)	No (n=84)		Yes (n=66)	No (n=34)	
Age (year), median (IQR)	63.5 (55.5-75.0)	70.5 (61.0-79.8)	0.165	56 (53-58)	57 (53-58)	0.615
Additional Diseases, n (%)	9 (56.3)	69 (82.1)	0.043 <sup>c</sup>	31 (47.0)	16 (52.9)	0.993
Smoking, n (%)	7.5 (5.2-9.0)	7 (5-11)	0.883	8 (5.0-12.2)	7 (4.8-11.2)	0.574
Hospitalization (days), median (IQR)	5 (31.3)	45 (53.6)	0.102	51 (77.3)	20 (58.8)	0.054

COPD: Chronic obstructive lung disease, n: Number of patients, IQR: Interquartile range (25%-75%), <sup>a</sup>Mann-Whitney U Test, <sup>b</sup>Chi-Square test; <sup>c</sup>Fisher's exact test  
Significant p-values shown in bold.

According to our results, the man had higher smoking status than women. In the 3rd level patients with COPD; hospital total cost was significantly higher among men than women, those who were hospitalized in the ICU than non-hospitalized in the ICU, those who did use antibiotics than who did not use antibiotics, and those with more than 10 outpatient apply from less than 5, and those between 5-10, respectively. In addition, as the number of admissions and length of hospital stay increased in the last two years, the total cost of the hospital increased significantly, too.

COPD is a major public health problem and will remain a challenge for clinicians within the 21st century. COPD puts enormous pressure on healthcare systems due to its high prevalence, morbidity and mortality. The prevalence of COPD in the population has significant effects in daily life compared to other chronic conditions, and serious resources are required. Therefore it is important to allocate minimum resources and reduce the relative impact of COPD (13).

According to our results, the median total antibiotic cost of 50 patients who received antibiotic treatment among the 2nd level patients studied was 17.9 USD, while the median total antibiotic

cost of 71 patients who received antibiotic treatment among the 3rd level patients was 65.4 USD. Accordingly, the cost of the 3rd level patients using antibiotics was higher than the 2nd level patients. We think that this is due to the fact that the prognosis of patients admitted to 3rd hospitals is more severe compared to 2nd hospitals.

According to hospital costs of the patients, the median cost of the ICU of the patients with 2nd level COPD who stayed in the ICU was 448.6 USD. While the median hospital cost of the 2nd level patients hospitalized in the ICU was 701.7 USD, the median hospital cost of the patients not hospitalized in the ICU was 274.7 USD. The median total cost of the hospital for the 2nd level patients was 305.0 USD. Also, the median ICU cost of 29 of the patients with COPD who stayed in the ICU of 3rd level hospital was 602.7 USD. The median hospital cost of the 3rd level patients staying in the ICU was 1780.3 USD, while the median hospital cost of the 3rd level patients not staying in the ICU was 318.0 (IQR: 191.1-469.7) USD. The median total cost of the hospital for 3rd level patients was 424.9 USD. Among patients who hospitalized in ICU, total hospital cost was significantly higher than those who did not. In addition, as the length of hospitalization increased,

the total cost of the hospital increased significantly. It can be said that when the number and duration of patients hospitalized in the ICU increased, the total cost of the hospital increased, too.

## Conclusion

COPD is an extremely common heterogeneous disease all over the world. This disease affects people at different levels, causing serious costs over the state from hospitals and also loss of workforce. The frequency of hospital admissions, the length of stay in the intensive care unit, the bad prognosis of the disease and the drugs used cause serious financial burdens and loss of healthcare personnel time. There are pharmacological and non-pharmacological treatment options for the disease. For this reason, the elimination and prevention of the both of internal and external factors that cause the disease, especially without the need for medication, is of great importance in terms of both financial and labor loss prevention and reduction.

## Ethics

**Ethics Committee Approval:** This study was approved by University of Health Sciences, Konya Training and Research Hospital (decision no and date: 16-03, 05/07/2018).

**Informed Consent:** Retrospective study.

**Peer-review:** Externally peer-reviewed.

## Authorship Contributions

Surgical and/or Medical Practices: K.Y., Ö.A., Concept: K.Y., Ö.A., Design: K.Y., Ö.A., Data Collection and/or Processing: K.Y., Ö.A., Analysis and/or Interpretation: Ö.A., Literature Search: K.Y., Writing: K.Y.

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# Thorax Computed Tomography Involvement Can Be Predicted by Evaluating the Laboratory Parameters of Patients Admitted to the Emergency Department During the COVID-19 Pandemic Period

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## Abstract

**Aim:** In this study, we evaluated the predictability of lung parenchymal involvement on computed tomography (CT) with laboratory parameters in patients with confirmed coronavirus disease-2019 (COVID-19) with and without lung parenchymal involvement at the first admission to the emergency department.

**Materials and Methods:** The study included one hundred and nine patients diagnosed with COVID-19 in the emergency COVID-19 department between April and September 2020. Laboratory parameters and thorax CT images were evaluated to evaluate the severity of the disease in all patients. The relationship between laboratory parameters was analysed in the patient groups with and without CT involvement.

**Results:** CT involvement was detected in 58 of 109 patients included in the study. There was a significant difference in lymphocyte, monocyte, eosinophil, ferritin, fibrinogen, C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), platelet (PLT) and urea values in the group with CT involvement. Receiver operator characteristics analysis was performed to evaluate the diagnostic performance of laboratory parameters in CT involvement. Significant diagnostic predictability values were determined for age, lymphocyte, monocyte, eosinophil, ferritin, fibrinogen, CRP, ESR, PLT and urea. The highest area under the curve values was obtained in CRP, ESR and eosinophil parameters.

**Discussion:** Lymphocyte, monocyte, eosinophil, ferritin, fibrinogen, CRP, ESR, PLT and urea parameters can be used to predict lung involvement in the emergency department in patients with COVID-19 disease. According to these values, thorax CT can be decided for the patients. CRP, ESR and eosinophil parameters provided the highest specificity and sensitivity values in predicting lung involvement.

**Keywords:** COVID-19, lung, tomography, laboratory parameters

## Introduction

Due to the pandemic caused by coronavirus disease-2019 (COVID-19), worldwide cases are increasing day by day and the disease is becoming a global outbreak. As the number of patients increases, it poses great challenges for the health system (1,2). Early diagnosis and treatment continue to be key elements of COVID-19 management. Laboratory and radiological findings of patients diagnosed with COVID-19 are critical in the diagnosis and treatment of the disease (3). A significant correlation has been shown between pulmonary inflammation and lymphocyte,

monocyte, CRP, procalcitonin (PCT) values. Thorax computed tomography (CT) is often performed to rule out pneumonia in patients who were diagnosed with COVID-19 at emergency service admission. It was found that there was a significant correlation between pulmonary involvement and laboratory results and computed tomography played an important role in the diagnosis, and evaluation of the disease (4). CT scan increases the cost and poses a risk of exposure to medical radiation. In addition to these disadvantages, in hospital emergency services where trauma, and stroke admissions are intense, a large number of patients have to undergo a CT scan in



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a limited time. In patients diagnosed or suspected of COVID-19, 30 minutes or more is required for post-CT cleaning. This long period may cause disruptions in CT scans in routine emergency practice. This cleaning time delays access to CT for other patients in the emergency department. Depending on the prolongation of this period, other patient groups will be more likely to be exposed to COVID-19 (5,6).

In this study, it was planned to determine the predictability of COVID-19 lung involvement with routine laboratory evaluations in the emergency department. Thus, by looking at the laboratory tests, it can be estimated which patients may have a higher risk of COVID-19 lung involvement. With this estimation, computed tomography can be performed only in patients who are thought to have lung involvement. Patients who do not require thorax CT will be excluded.

## Materials and Methods

A total of 109 patients with PCR positivity who applied to the emergency department of Balıkesir University Medical Faculty Hospital between April and September 2020 were included in the study. Patients with chronic disease (cirrhosis, cardiac failure, chronic renal failure) that may affect clinical and laboratory parameters and patients using drugs (such as steroids) that may affect laboratory values were excluded from the study. Children and pregnant women were excluded from the study. Laboratory data were obtained from detailed medical records. Complete blood count, kidney and liver function tests, inflammation parameters such as CRP, ESR, PCT, ferritin, D-dimer and fibrinogen were recorded at the first admission to the emergency department. NLR value was calculated. CT examinations were performed with a 16-line multi-detector CT scanner (Siemens Somatom Sensation; Siemens, Erlangen, Germany). CT images of all patients included in the study were evaluated and cases with bacterial pneumonia or pulmonary oedema were excluded from the study. This retrospective chart review study involving human participants was in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards, and the local ethics committee approved this study (decision number: 2020/182, date: 14.10.2020).

## Statistical Analysis

Shapiro-Wilk test was used to test the normality of variables. Continuous variables were presented as median (1<sup>st</sup> quartile - 3<sup>rd</sup> quartile) values since the data were not normally distributed. Mann-Whitney's U-test was used for comparison of two independent groups. Categorical variables were expressed with numbers and percentages. Comparisons between the groups

were performed with Pearson chi-square test for categorical variables. Risk factors were also evaluated with binary logistic regression analysis. Receiver operating characteristics (ROC) curve analysis was performed to evaluate and compare the performances of diagnostic markers. Significance level was taken as  $\alpha=0.05$ . Statistical analyses were performed with IBM SPSS Statistics version 22.0 (IBM Corp., Armonk, NY, USA) and MedCalc version 12.3.0.0.

## Results

The study included 109 patients, 58 (53.21%) of whom had positive chest CT findings and 51 (46.79%) of whom had negative chest CT findings. Among 109 patients, 45 (41.28%) were male, 64 (58.72%) were female, and the median age was 56 (1<sup>st</sup> quartile - 3<sup>rd</sup> quartile: 38-68) years.

There was a significant difference between chest CT positive and negative groups in terms of age, lymphocytes, monocytes, eosinophils, ferritin, fibrinogen, CRP, ESR, PLT and urea. There was no significant difference between the two groups in terms of NLR and the other variables (Table 1).

We conducted backward conditional logistic regression analysis by including the variables into the model which were found statistically significant in univariate analysis. In the last model remaining variables were eosinophils, monocytes, ferritin, ESR and urea. The last model was statistically significant ( $p<0.001$  for Omnibus test;  $p=0.917$  for Hosmer & Lemeshow test). Eosinophils was not statistically significant in the model. One unit decrease in the monocytes increased the risk of chest CT positivity 1.006 times ( $p=0.001$ ), one unit increase in the ferritin increased the risk of chest CT positivity 1.014 times ( $p=0.021$ ), one unit increase in the ESR increased the risk of chest CT positivity 1.069 times ( $p=0.001$ ), and one unit increase in the urea increased the risk of chest CT positivity 1.090 times ( $p=0.013$ ), compared to chest CT negative patients (Table 2).

We performed ROC curve analyses to evaluate the diagnostic performances of age, WBC, neutrophil count, lymphocyte count, NLR, monocyte count, eosinophil count, ferritin, PCT, fibrinogen, D-dimer, CRP, ESR, PLT, RDW, urea, creatinine, AST and ALT in discriminating patients with positive and negative CT imaging findings. Optimal cut-off values were obtained according to Youden J index, corresponding sensitivity and specificity values are given. Significant diagnostic performances were obtained for age, lymphocyte count, monocyte count, eosinophil count, ferritin, fibrinogen, CRP, ESR, PLT and urea. Three largest area under the curves (AUCs) were obtained for CRP, ESR and eosinophil count. (Table 3, Figure 1).

**Table 1. Comparison of demographic and laboratory characteristics between patients with positive and negative thorax CT findings**

Variable	CT positive	CT negative	p-value
<b>Gender</b>			
Male	24 (41.38)	21 (41.18)	1.000
Female	34 (58.63)	30 (58.82)	
Age (years)	60 (48-69)	44 (31-67)	0.016
WBC (µL)	5,350 (4,500-6,600)	6,100 (4,800-7,600)	0.125
Neutrophils (µL)	3,366 (2,711-4,541)	3,692 (2,462-4,680)	0.762
Lymphocytes (µL)	1,244 (694-1,611)	1,624 (1,044-1,996)	0.006
NLR	2.87 (1.89-4.49)	2.26 (1.53-3.95)	0.109
Monocytes (µL)	413 (337-555)	490 (411-755)	0.004
Eosinophils (µL)	12 (4-36)	61.00 (25-112)	<0.001
Ferritin (ng/mL)	77 (39-179)	38 (18-73)	0.001
PCT (ng/mL)	0.09 (0.04-0.13)	0.07 (0.04-0.10)	0.430
Fibrinogen (mg/dL)	399 (288-516)	300 (260-336)	<0.001
D-dimer (ng/mL)	213 (142-270)	153 (130-234)	0.051
CRP (mg/L)	22 (6-48)	3 (2-6)	<0.001
ESR (mm/h)	44 (24-67)	22 (13-33)	<0.001
PLT (10 <sup>3</sup> /mm <sup>3</sup> )	203 (166-246)	227 (197-273)	0.013
RDW (%)	14.2 (13.4-15.2)	14.0 (13.2-15.2)	0.447
Urea (mg/dL)	31 (26-40)	24 (19-34)	0.004
Creatinine (mg/dL)	0.94 (0.81-1.07)	0.89 (0.78-1.02)	0.214
AST (IU/L)	26 (22-33)	24 (21-37)	0.309
ALT (IU/L)	22 (15-28)	21 (14-38)	0.995

Data given as median (1<sup>st</sup> Q - 3<sup>rd</sup> Q) or n (%)

CT: Computed tomography, WBC: White blood cell distribution width, NLR: neutrophil lymphocyte ratio, PCT: Procalcitonin, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate, PLT: Platelet, RDW: Red cell distribution width, AST: Aspartat aminotransferaz, ALT: Alanin aminotransferaz, Q: Quartile, n: Number

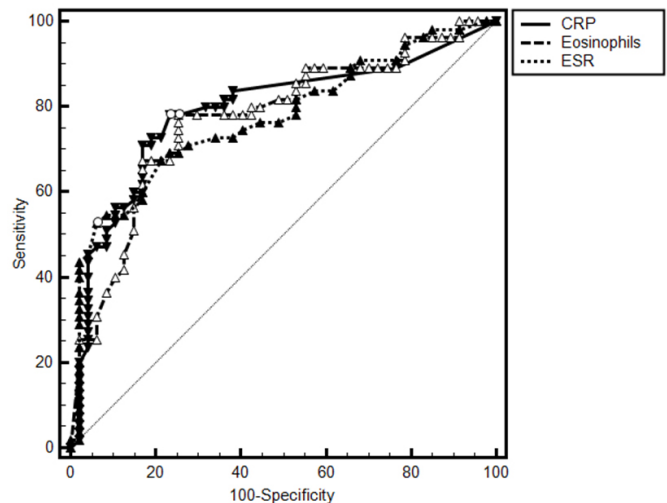
**Table 2. Results of logistic regression analysis**

Independent variables	p-value	OR	95% CI for OR	
			Lower	Upper
Eosinophils	0.071	1.008	0.999	1.016
Monocytes	0.001	1.006	1.002	1.009
Ferritin	0.021	1.014	1.002	1.025
ESR	0.001	1.069	1.027	1.113
Urea	0.013	1.090	1.018	1.168

OR: Odds ratio, CI: Confidence interval, ESR: Erythrocyte sedimentation rate

## Discussion

In our study, there was a significant difference in age, lymphocyte count, monocyte count, eosinophil count, platelet count, ferritin, fibrinogen, CRP, ESR, and urea parameters between patients with and without lung involvement in thoracic CT. Sensitivity of COVID-19 pneumonia in CT was found to be 75% or more in patients with lymphocyte count ≤1610 (µL), age >44, eosinophil



**Figure 1. ROC curve for CRP, ESR and eosinophils**

ROC: Receiver operating characteristics, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate

**Table 3. ROC curve analysis results for thorax CT results**

	AUC	p-value	Cut-off value	Youden J index	Sensitivity (95% CI)	Specificity (95% CI)
Age (years)	0.634	0.015	>44	0.305	77.59 (64.7-87.5)	52.94 (38.5-67.1)
Lymphocytes (µL)	0.654	0.004	≤1610	0.274	75.44 (62.2-85.9)	52.00 (37.4-66.3)
Monocytes (µL)	0.664	0.002	≤466	0.289	64.91 (51.1-77.1)	64.00 (49.2-77.1)
Eosinophils (µL)	0.750	<0.001	≤37	0.472	77.19 (64.2-87.3)	70.00 (55.4-82.1)
Ferritin (ng/mL)	0.683	<0.001	>65	0.364	61.40 (47.6-74.0)	75.00 (60.4-86.4)
Fibrinogen (mg/dL)	0.711	<0.001	>383	0.452	53.57 (39.7-67.0)	91.67 (80.0-97.7)
CRP (mg/L)	0.783	<0.001	>6.26	0.523	75.86 (62.8-86.1)	76.47 (62.5-87.2)
ESR (mm/h)	0.762	<0.001	>43	0.452	53.57 (39.7-67.0)	91.67 (80.0-97.7)
PLT (10 <sup>3</sup> /mm <sup>3</sup> )	0.638	<0.001	≤170	0.254	29.31 (18.1-42.7)	96.08 (86.5-99.5)
Urea (mg/dL)	0.660	0.003	>26	0.349	74.14 (61.0-84.7)	60.78 (46.1-74.2)

CT: Computed tomography, AUC: Area under the curve, ROC: Receiver operating characteristics, CI: Confidence interval, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate, PLT: Platelet

count ≤37 (µL), CRP >6.26 (mg/L), and urea >26 (mg/dL). In CT, the specificity of COVID-19 pneumonia was found to be 90% or more in patients with fibrinogen >383 (mg/dL), sedim >43 (mm/h) and platelet ≤170 (10<sup>3</sup>/mm<sup>3</sup>). In the retrospective conditional logistic regression analysis, eosinophil count, monocyte count, ferritin, ESR and urea parameters were determined in the last model by including the variables found to be statistically significant in the univariate analysis. Although eosinophil count was not statistically significant in the model, a one-unit decrease in monocyte count value significantly increased the risk of thoracic CT positivity by 1.006 times, a one-unit increase in ferritin increased the risk of thoracic CT positivity by 1.014 times, a one-unit increase in ESH increased the risk of thoracic CT positivity by 1.069 times and a one-unit increase in the urea value increased the risk of thoracic CT positivity by 1.090 times.

Lymphopenia is a laboratory finding of COVID-19 infection and was detected in 63% of cases (7). It has been suggested that the degree of lymphopenia may predict the severity, progression and prognosis of COVID-19 (8,9). In our study, a significant difference was found between lymphocyte count between patients with and without involvement in thoracic CT. In patients with lymphocyte count ≤1610 (µL), the sensitivity and specificity was found 75.44%, and 52%, respectively in predicting involvement in thoracic CT.

Previous studies have shown that two-thirds of patients infected with COVID-19 have elevated CRP. In the early stage of the disease, CRP was correlated with lung lesions, severity of pneumonia, and overall disease severity (9-13). In our study, a significant difference was found between CRP values between patients with and without involvement in thoracic CT. Predicting of involvement of thoracic CT in patients with CRP >6.26 (mg/L)

sensitivity and specificity were 75.86%, and 76.47%, respectively.

A meta-analysis evaluating severe and non-severe confirmed COVID-19 cases showed significant reductions in monocyte, eosinophil and platelet levels in patients with severe disease (13). In our study, a significant difference was found between monocyte, eosinophil and platelet values between patients with and without involvement in thoracic CT. The sensitivity and specificity in predicting thoracic CT involvement were 64.91% and 64%, respectively, in patients with monocytes ≤466 (µL), and a one-unit decrease in monocytes increased the risk of thoracic CT positivity 1.006 times. The sensitivity and specificity in predicting thoracic CT involvement were 77.19% and 70%, respectively, in patients with eosinophils ≤37 (µL). The sensitivity and specificity in predicting thoracic CT involvement were 29.31% and 96.08%, respectively, in patients with platelets ≤ 170 (10<sup>3</sup>/mm<sup>3</sup>).

Ferritin levels have been shown to increase significantly compared to those without severe COVID-19 disease and patients with mortality have higher ferritin levels (9,12,14). In our study, a significant difference was found between ferritin values between patients with and without involvement in thoracic CT. The sensitivity and specificity in predicting thoracic CT involvement were 61.40% and 75%, respectively, in patients with ferritin >65 (ng/mL), and a one-unit increase in ferritin value showed that it increased the risk of thoracic CT positivity 1.014 times.

Fibrinogen levels have been shown to be higher in COVID-19 patients compared to healthy controls, as well as higher in critical COVID-19 patients compared to mild or moderate cases (12,13,15). However, fibrinogen level may not have a predictive value for mortality in COVID-19 patients (16). It is recommended that fibrinogen be evaluated together with D-dimer levels to



have more appropriate prognostic assumptions (17). A significant correlation has been reported between the severity of COVID-19 disease and D-dimer serum level (9,12,13,18,19). However, in a cohort, it was shown that there was no difference between the severity of the disease and D-dimer level in COVID-19 patients (20). D-dimer has been emphasized to have a promising value for guiding anticoagulation strategies in the treatment of COVID-19 (17). In our study, a significant difference was found in fibrinogen values between patients with and without involvement in thoracic CT. In patients with a fibrinogen value  $>383$  mg/dL, sensitivity and specificity was 53.57% and 91.67%, respectively, in predicting thorax CT involvement. In our study, D-Dimer levels were found to be similar between patients with and without involvement in thoracic CT. This may be due to the small number of severe patients in our study.

Among the laboratory tests used for the evaluation of the acute phase reaction reflecting the inflammatory condition, ESR is considered the least specific. It is known to be affected by a large number of other physiological and pathophysiological conditions and its use is limited to a few specific clinical conditions (21). Nevertheless, ESR is still persistently used in routine laboratory patient examinations regardless of the clinical problem (22). It has been shown that there is a significant difference in ESR values between severe and non-severe COVID-19 cases (9,13,23). In our study, a significant difference was found between ESR value among patients with and without involvement in thoracic CT. The sensitivity and specificity in predicting thoracic CT involvement were 53.57% and 91.67%, respectively, in patients with ESR  $>43$  mm/h, and a one-unit increase in ESR increased the risk of thoracic CT positivity by 1.069 times.

When severe COVID-19 cases and mild cases were compared, statistically significantly higher AST, ALT, creatinine, and urea levels were found (9,13). In our study, a significant difference was found between blood urea values among patients with and without involvement in thoracic CT, and the sensitivity and specificity in predicting thoracic CT involvement were 74.14% and 60.78%, respectively, in patients with urea values  $>26$  mg/dL. A one-unit increase in urea value increased the risk of thoracic CT positivity 1.090 times. In our study, creatinine, AST and ALT levels were found to be similar between patients with and without involvement in thoracic CT.

RDW has been shown to be a prognostic predictor for severe COVID-19 patients (24). When severe COVID-19 cases and mild cases were compared, it was reported that PCT value was higher and was a poor prognostic marker (9,12,13). The meta-analysis evaluating severe and non-severe confirmed COVID-19 cases showed increased neutrophil and NLR rates and no difference was

found between leukocyte values (13). In our study, no significant relationship was found between leukocyte, neutrophil, NLR and RDW values between patients with and without pulmonary involvement in thoracic CT.

### Study Limitations

Our study has its limitations; firstly, the number of patients included in the study was small. Secondly, this study was a single center study, and it is not capable of evaluating various ethnic differences, thus preventing the generalized use of the study results.

### Conclusion

As a conclusion, in the first evaluation in the emergency department, a significant difference was found in lymphocytes, monocytes, eosinophil, ferritin, fibrinogen, CRP, ESR, PLT and urea values between patients with and without pulmonary involvement in thoracic CT, and eosinophil count, ESR and CRP values provided the highest AUC values in predicting thoracic CT involvement. It can be predicted that patients with ESR  $>43$  mm/h and CRP  $>6.26$  mg/L and eosinophil count  $\leq 37$   $\mu$ L will have a high probability of lung involvement. The need for thoracic CT during the pandemic can be planned according to these criteria.

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### Ethics

**Ethics Committee Approval:** Balıkesir University Clinical Studies Ethics Committee approved this study (decision number: 2020/182, date: 14.10.2020).

**Informed Consent:** Not applicable since the study is a retrospective chart review study.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Surgical and Medical Practices: H.B.Ç., H.Ç., Concept: H.B.Ç., H.Ç., Design: H.B.Ç., H.Ç., Data Collection and/or Processing: H.B.Ç., H.Ç., Analysis and/or Interpretation: H.B.Ç., H.Ç., Literature Search: H.B.Ç., H.Ç., Writing: H.B.Ç., H.Ç.

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# Cornual Pregnancy with Uterine Rupture: A Case Report

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## Abstract

Cornual pregnancy is a rare and hazardous form of ectopic pregnancy that causes massive hemorrhage and death. Presented herein is a 38-year-old female patient who was brought to our Emergency Department at 30 + 6 weeks of gestation for abdominal pain and hypotension due to uterine rupture, as a result of left cornual pregnancy. Here, the confusion of cornual pregnancy with normal intrauterine pregnancy and its associated catastrophic complications of uterine rupture and fetal demise are highlighted. This case report demonstrates the importance for an emergency physician to maintain the suspicion of ectopic pregnancy even at advanced gestational age.

**Keywords:** ectopic pregnancy, emergency, uterine rupture

## Introduction

Ectopic pregnancy occurs in 1% to 2% of pregnancies when the embryo is implanted outside the endometrial cavity, with the most common site being the fallopian tube (1-3). Identified risk factors for ectopic pregnancy include tubal damage due to infection or prior surgery, in-vitro fertilization and smoking (1). Ectopic pregnancy is an important cause of maternal mortality in the first trimester, making it an important diagnosis to exclude. A confidential inquiry into maternal and child health from 2003 to 2005 has identified that 10 out of 295 maternal deaths were attributable to ectopic pregnancies (4).

Cornual pregnancy, a rare sub-type making up 2% to 4% of ectopic pregnancies, occurs in the interstitial portion of the fallopian tube and invades through the uterine wall (5,6). This is the most hazardous form of ectopic pregnancies due to the diagnostic dilemmas associated with it (7). Uterine rupture may occur in up to 20% of the cases that progress beyond 12 weeks of gestational age, resulting in massive hemorrhage and high mortality rates (8). In this case report, we present a third trimester cornual pregnancy, which is a rare phenomenon, that resulted in a uterine rupture.

## Case Report

A 38-year old Chinese female, with gestational diabetes and hypertension, was brought to the Emergency Department (ED) by Emergency Medical Services (EMS) for abdominal pain and hypotension. She was 30+6 weeks pregnant (Gravida 3, Parity 1). Her past obstetric history included a live birth delivered via lower segment Caesarean section due to non-reassuring fetal status 18 years ago, and a first trimester miscarriage 8 years ago. For her current pregnancy, she was receiving routine prenatal care. She had an episode of threatened miscarriage during the second trimester at 15+1 weeks for which she was treated with intramuscular hydroxyprogesterone and oral progesterone. She recovered well and subsequent antenatal blood and ultrasound investigations were assessed to be normal with no suspicion of ectopic pregnancy or fetal and placental abnormality.

The patient developed generalized abdominal pain prior to the ED presentation. There was no vaginal bleeding or discharge. She also complained of non-vertiginous giddiness worse with postural changes and shortness of breath. The patient denied fever, nausea, vomiting, constipation, diarrhea, urinary symptoms, chest pain and neurological deficits. In the ED, her vitals were: temperature of 36.5 °C, heart rate of 135 beats per minute,



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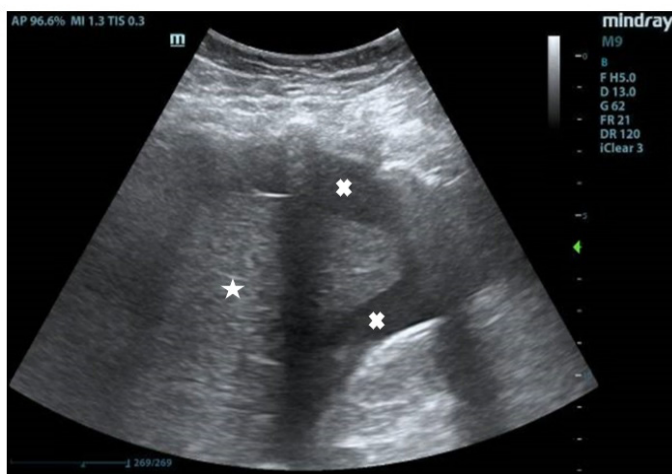
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respiratory rate of 26 breaths per minute, blood pressure of 110/89 mmHg, and oxygen saturation of 99% with supplemental oxygen at 2 liters per minute. She was pale, diaphoretic and lethargic. Her pulses were weak and thready. She had generalized tenderness with guarding and rebound over her abdomen. No blood or fluid was noted on vaginal examination and the cervix was closed. The rest of the examination was unremarkable. Point of care ultrasound was performed and showed large amount of intra-abdominal free fluid (Figure 1) and the fetal heart rate was 170 beats per minute. The point of care hemoglobin was 7.1 g/dL and lactate was 6.8 mmol/L. The patient's blood pressure dropped precipitously to 50/36 mmHg and her heart rate went up to 141 beats per minute.

The clinical impression was profound shock secondary to uterine rupture. She was started on massive transfusion protocol and tranexamic acid was administered. Dexamethasone was also given. Urgent surgical and obstetric consults were obtained and she was brought to the emergency operating theatre for exploratory laparotomy.

During the operation, there was extensive hemoperitoneum and the fetus was seen in the abdominal cavity. The fetus was delivered immediately and handed to the neonatal team. On exploration of the uterus, the point of rupture was at the left cornual region where the placenta was attached to. Left salpingectomy was performed and the uterus was repaired with hemostasis achieved. Oxytocin was administered and the patient was subsequently admitted to the Intensive Care Unit.

After delivery, the neonate was pale, cyanotic, listless and not crying with an APGAR score of 0. The birth weight was 1,810 grams. He had no respiratory effort or pulse. He was



**Figure 1.** Point of Care Ultrasound Image. Ultrasound image of the hepatorenal space showing the presence of free fluid (hypoechoic areas indicated by white crosses) surrounding the liver (white star)

warmed, intubated and chest compressions were initiated with administration of adrenaline and sodium bicarbonate, as well as boluses of normal saline and blood. The initial point of care pH was less than 6.5 with an unrecordable base excess, hemoglobin was 13.7 g/dL and hypocount was 7.4 mmol/L. After 93 minutes, the neonate experienced return of spontaneous circulation with the following vital signs: temperature of 31.2 °C, heart rate of 101 beats per minute, blood pressure of 48/16 mmHg, mean arterial pressure of 25 mmHg, oxygen saturation of 85% on ventilator (patient triggered ventilation mode, PIP 28, PEEP 5 and FiO<sub>2</sub> 100%). He was started on dopamine infusion and brought to the neonatal intensive care unit. However, his condition continued to deteriorate and further resuscitation efforts were terminated due to poor prognosis and medical futility after discussion with the family. The cause of death was birth asphyxia. Bereavement support was provided to the family.

For the patient, her recovery was uneventful and she was discharged 5 days later. She was reviewed in the outpatient clinic one month later and remained well. She was advised against future pregnancy due to her increased risk of uterine rupture.

Consent was obtained from the patient for this case report.

## Discussion

Uterine rupture can result in hemorrhagic shock, making it a true obstetric emergency with significant morbidity and mortality for the patient and the fetus. Therefore, an early diagnosis in the ED is crucial (9). However, as it is a rare condition with a reported incidence of 0.5% in all pregnancies, it is a diagnosis that is often missed (10). Uterine rupture can be divided into two main types (11). The first is a complete rupture involving the full thickness of the uterine wall and the second is an incomplete rupture when the visceral peritoneum remains intact. One key consideration in the evaluation of uterine rupture is to know whether or not the uterus is scarred. Uterine rupture more commonly occurs in a scarred uterus due to a previous lower segment Caesarean section, with a reported incidence between 0.22% to 0.5% (12,13). As maternal age advances, there is decreasing strength of the myometrium and defective healing of the uterine scar, along with increasing dysfunctional labor, the risk of uterine rupture is further increased (14). In the unscarred uterus, uterine rupture has been associated with trauma from obstetric maneuvers such as external cephalic version of breech to vertex presentation and assisted fundal pressure during delivery (11).

In this case report, the patient had advanced maternal age and previous lower segment Caesarean section, making the scar from previous lower segment Caesarean section the likely site of uterine rupture. However, at the time of operation, it was

discovered that the point of rupture was at the left cornual region, away from the site of scar from previous lower segment Caesarean section. To date, there was only one case report of third trimester uterine rupture secondary to a cornual pregnancy (15). However, the patient described, sought prenatal care late in her pregnancy at 28 weeks. She was asymptomatic and a silent uterine rupture was picked up on initial ultrasound evaluation. This was in stark contrast to the patient in this case report as she had been followed up by an obstetrician closely throughout her pregnancy, and presented to the ED with abdominal pain and profound shock.

Cornual pregnancy poses a higher risk of rupture and hemorrhage compared to other types of ectopic pregnancies (16). However, it is difficult to diagnose with low ultrasonographic sensitivity and hence is commonly confused with normal intrauterine pregnancy (16,17). Therefore, cornual pregnancy tends to present at 7 to 12 weeks of gestation, because of myometrial distensibility (5). A cornual pregnancy that continues beyond the second trimester, as in this case, is a rare phenomenon (15). A careful inspection of second trimester ultrasonogram can potentially prevent the rupture of a cornual pregnancy and its associated morbidity and mortality (18).

The use of point of care ultrasound greatly facilitated the diagnosis and management of this patient. Ultrasound is a safe imaging modality during pregnancy and its availability at the bedside in the ED made it a useful tool for emergency physicians in their assessment of patients who present with symptoms to determine the possibility of uterine rupture. Other than frank rupture as in this case, the applicability of point of care ultrasound can also be extended to patients who are not in need of immediate delivery and who present with very subtle symptoms (19). The diagnosis of uterine rupture is strongly suggested with the recognition of free fluid on point of care ultrasound as a result of blood in the peritoneal cavity (12). However, it may be difficult or impossible to visualize the actual site of rupture.

## Conclusion

Cornual pregnancy is associated with fatal complications for the mother and fetus, necessitating the prompt diagnosis and management in the ED.

## Ethics

**Informed Consent:** Consent was obtained from the patient for this case report.

**Peer-review:** Externally peer-reviewed.

## Authorship Contributions

Surgical and Medical Practice: V.E., J.H.P., Concept: V.E., J.H.P., Design: V.E., J.H.P., Data Collection and/or Processing: V.E., J.H.P., Analysis and/or Interpretation: V.E., J.H.P., Literature Search: V.E., J.H.P., Writing: V.E., J.H.P.

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# Craniofacial Trauma and Intraocular Surgical Implants

© Sunny Chi Lik Au, © Simon Tak Chuen Ko

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**Keywords:** Eye, glaucoma, glaucoma drainage implant, eye injuries, eye foreign bodies

## Introduction

Surgical implants are evolving and trending towards a smaller size to facilitate minimally invasive surgery. However, without adequate knowledge, they could be misinterpreted as harmful foreign bodies from trauma.

## Case Report

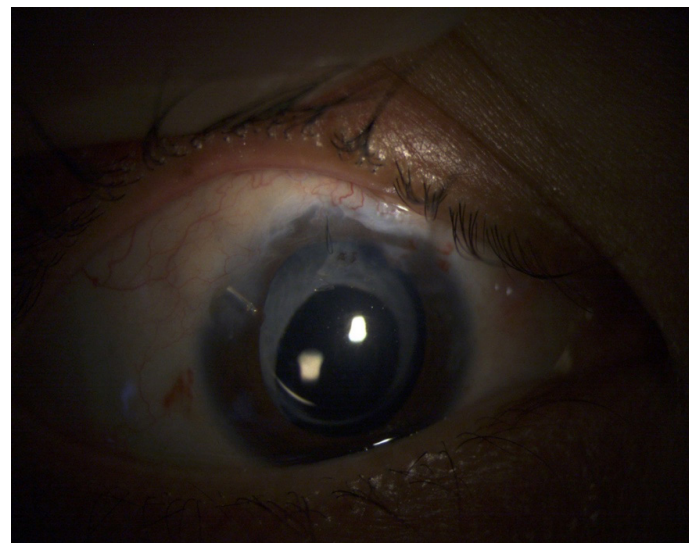
A 34-year-old male construction site worker suffered from right eye blunt injury while hammering metals, and hit by a metal bar over his right head. He remained conscious without any nausea or dizziness, but attended the emergency department hours later for right eye pain. Applying latanoprost eye drop daily, he volunteered history of right eye uveitic glaucoma with glaucoma implant surgery. The ophthalmologist's record mentioned an Ex-PRESS (excessive pressure regulating shunt system) shunt (Alcon Laboratories, Fort Worth, Texas, USA) was implanted and was compatible to magnetic resonance imaging (MRI) (1).

Visual acuities were Snellen decimal 0.1 and 0.8, whereas intraocular pressures (IOP) were 11 and 17 mmHg over right and left eye respectively. Right pupil was irregular with relative afferent pupillary defect. Slit lamp examination found a shiny metal over the superotemporal quadrant of the right eye (Figure 1), plugged by the iris adhering to cornea. There was conjunctival scarring, but no penetrating wounds, subconjunctival haemorrhage or hyphaema. Dilated fundus examination revealed glaucomatous changes without any retinal haemorrhage, commotio retinae, detachment nor rupture. Left eye was unremarkable. Computed tomography scanned for head

injury highlighted the hyperdense implant inside the right eye (Figure 2), but no other intraocular foreign bodies nor fracture and intracranial haemorrhage.

## Discussion

Head computed tomography is often scanned for head injury cases, but clinical correlation is essential in case of intraocular surgical implants, particularly their radiological imaging

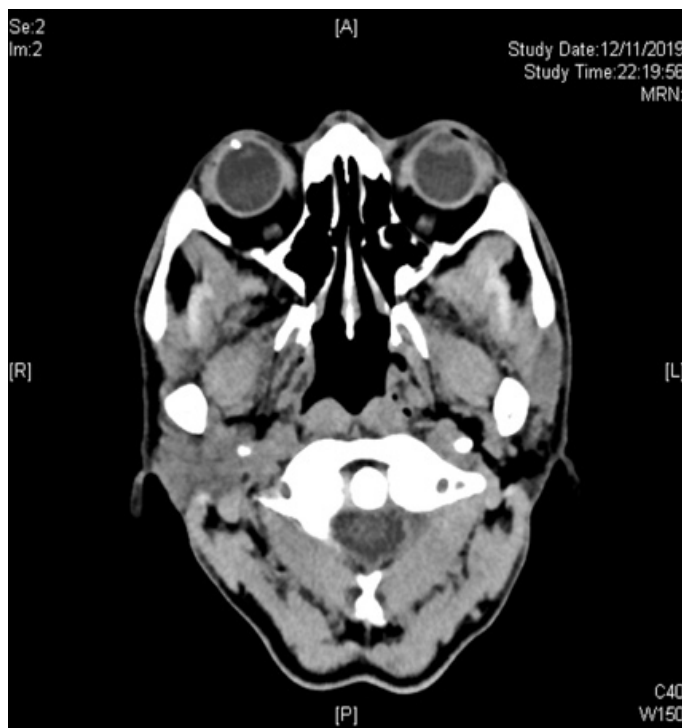


**Figure 1.** Slit lamp photo of the right eye. The Ex-PRESS shunt, appearing as a tubular metal, was over the superotemporal quadrant of the right eye plugged by the iris adhering to the cornea. No penetrating wound, but scarring over the adjacent conjunctiva suggested previous surgical manipulation. Superior corneal stitch and posterior capsule intraocular lens were also evidenced.



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**Figure 2.** Computed tomography of the head. Transverse cut over the right eye intraocular implant showed its radiologically hyperdense appearance and its location at the anterior chamber in front of the intraocular lens, sticking to the cornea, mimicking a penetrating injury by metallic foreign body

compatibility. Uveitic glaucoma arises from chronic uveitis with persistent elevated IOP (2). In refractory cases that failed pharmacological and traditional trabeculectomy surgery, glaucoma drainage device is the ultimate choice (3). Newer and smaller implants are evolving including the non-valved Baerveldt, valved Ahmed implant and Ex-PRESS. Among them, Ex-PRESS is the smallest (<3 mm), and the only metallic implant, made of stainless steel, giving its shiny appearance (4). Implanted patient is safe to undergo MRI without disturbing the implant (5).

Normally, we only see the tubular tip end of Ex-PRESS, whereas in our case, it has inferiorly subluxed, but held by the iris sticking it to the cornea. Ophthalmologists were consulted for assessment

of the intraocular implant after the trauma, and they offered watch-and-wait conservative treatment with close monitoring of any subsequent rise in IOP. Repair surgery was not indicated unless uncontrollable IOP.

## Conclusion

Intraocular implants are advancing, and smaller in size. This case helps emergency physicians to understand more on differentiating a surgical implant from an exogenous foreign body injury.

## Ethics

**Informed Consent:** Informed consent was obtained from the patient.

**Peer-review:** Externally peer-reviewed.

## Authorship Contributions

Surgical and Medical Practices: S.C.L.A., S.T.C.K., Concept: S.C.L.A., Design: S.C.L.A., Data Collection and/or Processing: S.C.L.A., Analysis and/or Interpretation: S.C.L.A., Literature Search: S.C.L.A., Writing: S.C.L.A., S.T.C.K.

**Conflict of Interest:** No conflict of interest was declared by the authors.

**Financial Disclosure:** The authors declared that this study received no financial support.

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# An Acidic Esophagus!

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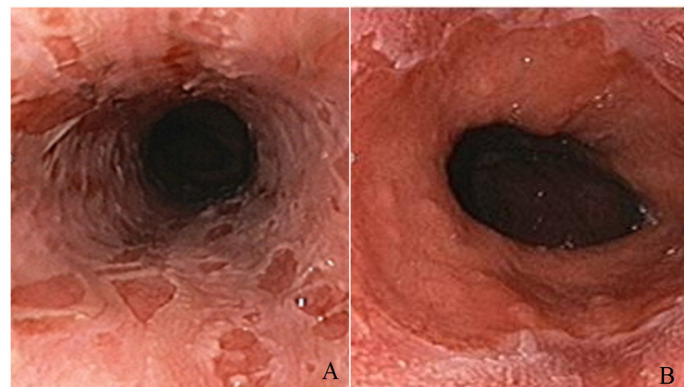
**Keywords:** Corrosive acid, Endoscopy, Dysphagia

## Case Description

A 19-year-old female presented with odynophagia and a burning sensation in the mouth for 2 hours. She had deliberately taken a mild amount of dilute hydrochloric acid due to suicidal intention. On examination, she had diffuse erosions and edema on her oropharynx; upper gastrointestinal endoscopy was done after 24 hours revealed multiple erosions and slough throughout her esophagus (Figure 1a and 1b). She was started on proton pump inhibitors, steroids and broad-spectrum antibiotics; in addition, a nasogastric tube was inserted under endoscopic guidance. Her hospital stay was uneventful, and a repeat endoscopy in 2 months follow-up revealed only minimal strictures.

Ingestion of corrosive substances (alkalis or acids) is mostly accidental in children compared to adults, where it is usually suicidal (1). In western countries, alkaline material is common, whereas injuries from acid are more common in developing countries, likely due to easy accessibility to acids like sulfuric acid (2). Acids cause coagulation necrosis, leading to eschar formation, limiting penetration and injury depth (1). The type of the substance, amount, physical form and time of presentation determine the clinical picture. Dysphagia and odynophagia are seen due to oropharyngeal or esophageal involvement; hoarseness and stridor occur due to laryngeal or epiglottic damage, presence of epigastric pain and hematemesis are more common in stomach involvement (3). Worsening of abdominal pain or development of chest pain implies a perforation. Laboratory tests that predict poor prognosis are a high white

blood cell count, elevated serum C-reactive protein and arterial pH less than 7.22 (1-3). Upper gastrointestinal endoscopy to determine the extent of damage is recommended in the first 12-48 h after caustic ingestion. Contraindications to endoscopy are suspicion of perforation or supraglottic or epiglottic burns with edema (3). A CT scan is valuable in these patients and offers a more detailed evaluation of the transmural damage of esophageal and gastric walls (2). The initial priority in management is airway and hemodynamic stability. Gastric lavage and induced emesis are contraindicated as it causes re-exposure to the corrosive agent (3). Nasogastric tubes under guidance can be inserted as a stent in severe circumferential burns. Proton pump inhibitors and steroids are started in order to prevent stricture formation. In addition, broad-spectrum antibiotics are started when steroids are initiated or when pulmonary involvement is seen.



**Figure 1.** a-b. Endoscopic view of the esophagus showing diffuse erosions and edema throughout the esophagus



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## Conclusion

Patients with evidence of perforation require urgent surgical intervention such as laparotomy, esophagectomy, gastrectomy or jejunostomy feeding (2, 3). The most common delayed sequel is stricture formation others are intractable pain, gastric outlet obstruction, late achlorhydria, protein-losing gastroenteropathy, mucosal metaplasia and development of carcinoma (4).

## Ethics

**Informed Consent:** Informed consent was obtained from the patient.

**Peer-review:** Externally peer-reviewed.

**Financial Disclosure:** The authors declared that this study received no financial support.

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