Original Article

Effect of Emergency Department Crowding on the Number of Radiology Examinations

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Cite this article as: Karavas E, Tobcu E, Kazcı Ö, Eden AO. Effect of emergency department crowding on the number of radiology examinations. Arch Basic Clin Res., 2023;5(2):240-244.

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ABSTRACT

Objective: To reveal the relationship between the increase in the number of patient admission to the emergency department and the number of radiological examinations requested from emergency department.

Methods: In this study, we obtained the annual number of admissions to the emergency department between 2013 and 2017 in 2 different hospitals in Erzincan province. We obtained also the number of ultrasonography, computed tomography, and magnetic resonance imaging examinations requested in the emergency and non-emergency departments and performed the basic statistical analysis.

Results: While the annual number of patients admitted to emergency department was 209 814 in 2013, this number increased to 288 595 in 2017, which means an increase of approximately 38% in the number of emergency department patients between 2013 and 2017. There had always been an increase in the number of computed tomography and magnetic resonance imaging examinations in emergency department over the years between 2013 and 2017 without any decrease. The number of computed tomography utilization increased from 10 699 in 2013 to 22 510 in 2017, which means a proportional increase of 110%. The number of magnetic resonance imaging utilization increased from 113 in 2013 to 1478 in 2017, with a proportional increase of 1220%. The number of ultrasonography utilization in emergency department increased from 593 in 2013 to 867 in 2017, with a proportional increase of 46%. However, the number of ultrasonography examinations in emergency department had been decreasing regularly since 2014.

Conclusion: The rate of increase in radiology examinations performed in the emergency department is higher than the rate of increase in the number of admissions to the emergency department. In this sense, an increase in the number of physicians in emergency department and an improvement in examination times per patient can reduce and optimize the number of radiology examinations requested from emergency departments.

Keywords: Emergency department, radiology, ultrasonography, computed tomography, magnetic resonance imaging

INTRODUCTION

Since citizens in Turkey tend to go to the emergency departments (EDs) first when they get sick, the EDs are among the units with the highest number of patient admissions among the secondary and tertiary care hospitals.¹ With the population growth and migrations that have occurred in recent years, there is an excessive patient admission to the ED and this leads to some disruptions in health services.

After anamnesis and physical examination, diagnostic laboratory tests and radiological imaging modalities are frequently used in the evaluation of patients admitted to the ED.² Ultrasonography (US), computed tomography (CT), and magnetic resonance imaging (MRI) are the

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The study was presented as an oral presentation at the 2nd East Anatolia Emergency Medicine Days in Erzurum in 2018.

main imaging modalities that are frequently used in ED and contribute to the diagnosis.³ In recent years, the use of imaging modalities in ED has significantly expanded and become an essential component of patient evaluation.^{4,5} Nevertheless, the rate of growth of utilization has called into question the value of these studies, the risks of overutilization, and the number of incidental findings.^{2,6} This study aims to objectively reveal the relationship between the increase in the number of patient admission to the ED and the number of radiological examinations requested from the ED.

METHODS

In this study, we obtained the annual number of admissions to the ED between January 1, 2013, and December 31, 2017, in a secondary and tertiary care hospital in Erzincan province. We obtained also the number of US, CT, and MRI examinations requested in the ED and non-ED and performed the basic statistical analysis.

This research has been approved by the ethic committee of Erzincan Binali Yıldırım University (March 13, 2018 no.: 33216249-604.01.02-E.13620), and the study was conducted in accordance with the Declaration of Helsinki.

Statistical Analysis

The data were examined using the Statistical Package for Social Sciences for Windows 20 program (IBM SPSS Corp., Armonk, NY, USA). Data conformance to a normal distribution was determined using the Kolmogorov– Smirnov test. To evaluate the relationship between the variables, Spearman correlation analysis was used. A value of P < .050 was defined as statistical significance.

RESULTS

All patient visits between January 1, 2013, and December 31, 2017, were included in our study, and a total of 1 298

MAIN POINTS

- The number of hospital admissions has been increasing in Turkey over the years, which causes an increase in admission to the emergency department (ED).
- Compared to Organisation for Economic Co-operation and Development (OECD) countries, Turkey has to serve more patients with fewer physicians.
- The increase in the number of admissions to ED causes a higher increase in the number of radiology examinations performed in ED.
- Improvements such as an increase in the number of physicians in ED or optimization in examination times per patient can reduce and optimize the number of radiology examinations requested from EDs.

828 ED patient visits were reviewed for analysis. While the annual number of patients admitted to ED was 209 814 in 2013, this number increased to 288 595 in 2017, which means an increase of approximately 38% in the number of ED patients between 2013 and 2017. In consecutive years, the number of ED patients has always increased compared to the previous year, and the highest proportional increase was between the years 2013 and 2014 (Figure 1).

There had always been an increase in the number of CT and MRI examinations in ED over the years between 2013 and 2017 without any decrease. The number of CT utilization increased from 10 699 in 2013 to 22 510 in 2017, which means a proportional increase of 110%. The rates of CT utilization increased from 5.1% in 2013 to 7.8% in 2017 (Figure 2). The number of MRI examinations in the ED was 1478 in 2017, while the number of total MRI examinations was only 113 in 2013. That points to a significant increase with a rate of 1220% in the number of MRI examinations between 2013 and



Figure 1. Annual admission to ED between 2013 and 2017. ED, emergency department.



Figure 2. Number of US examinations requested from ED between 2013 and 2017.

US, ultrasonography; ED, emergency department.



Figure 3. Number of CT examinations requested from ED between 2013 and 2017.

CT, computed tomography; ED, emergency department.

2017. The rates of MRI utilization increased from 0.05% in 2013 to 0.51% in 2017 (Figure 3). In the province of Erzincan, the total number of CT devices increased in 2015 and MRI devices in 2017, and the rate of examinations increased more significantly in these years compared to the previous years (24% and 132%, respectively).

The number of US utilization in ED increased from 593 in 2013 to 867 in 2017, with a proportional increase of 46%. The rate of US examination of the patients who were admitted to the ED in 2013 and 2017 was 0.28% and 0.30%, respectively. However, in terms of US utilization, the number of US examinations in ED had been decreasing regularly since 2014 (Figure 4).

When the number of radiology examinations performed in non-emergency inpatients and outpatients between 2013 and 2017 is evaluated, the proportional increase in the number of US and CT examinations is 96% and 118%, respectively, which is higher than the increase in the rate of radiology examinations performed in patients admitted to ED. Nevertheless, the rate of increase in the



Figure 4. Number of MRI examinations requested from ED between 2013 and 2017.

MRI, magnetic resonance imaging; ED, emergency department.





number of non-emergency MRI scans is 492%, which is lower than that of the ED (Figure 5).

When the data were subjected to the correlation test, a very strong correlation was found between ED admissions and ultrasound requests (r=0.905), a strong correlation between ED admissions and CT requests (r=0.847), and a very weak correlation between ED admissions and MRI requests (r=0.131).

DISCUSSION

Emergency departments constitute the frontline defense for a healthcare system, and with increased activity witnessed throughout Turkey departments, delivering safe and effective care to patients can be problematic. The number of hospital admissions has been increasing in Turkey over the years, which causes an increase in admission to ED.7 Compared to OECD countries, Turkey has to serve more patients with fewer physicians.⁸ For this reason, there is an increase in the number of patients per physician, which reduces the time that the physician spares for the patient in the ED, and causes to abandon the algorithms required by the clinical examination. This causes the physician to try to make a diagnosis by using laboratory and imaging modalities by devoting little time to patient examination. In their study, Aydın et al⁹ found that several radiology examinations are performed in 12.6% of 3000 ED patients. In addition, the demand for imaging services like CT and MRI has expanded dramatically over the last decades as a result of the radiology departments' fast technical advancements.^{10,11}

A previous single-center retrospective study published in 2014 reported that the yearly number of ED patients rose from 63 770 in 2001 to 94 609 in 2010. The CT utilization climbed from 105.5 per 1000 patient visits in 2001 to 289.2 per 1000 patient visits in 2010, whereas MRI utilization increased from 8.1 per 1000 patient visits in 2001 to

74.6 per 1000 patient visits in 2010. Overall CT and MRI use rose across all patient age categories.¹¹ In our study, we found that of approximately 38% in the number of ED patients between 2013 and 2017, also the number of ED patients has always increased compared to the previous year. In addition, there was an increase of 46% in the number of US examinations, 110% in the number of CT examinations, and 1220% in the number of MRI examinations in ED between 2013 and 2017. A higher rate of increase is observed in the number of radiology examinations compared to the increase in the number of patients admitted to the ED. We think that the reason for this is primarily the decrease in the time that the physicians working in the ED spare for the patient due to the increase in the number of patients per physician, thus less time is devoted to processes such as anamnesis and physical examination, and radiology examinations are requested more easily by physicians. Also, we believe that the increase in the number of malpractice cases in our country in recent years has caused physicians to keep the list of possible differential diagnoses wider than normal and to apply more diagnostic methods under all circumstances. Wong et al¹² concluded in their study, published in 2011, that increased fears due to malpractice cases increased the rate of radiological examination requests.

In our study, we observed a decrease in the number of US examinations in ED since 2014. Multiple causes can contribute to the decline of US scanning in EDs. This decline can be explained by the widespread use of picture archiving and communication systems in hospitals that leads reporting CT and MRI examinations easily and quickly. In addition, the increase in the number of CT and MRI devices has also increased the accessibility of the examination. In the survey study conducted by Durmus and Güneysu¹³ in 2020 with 178 physicians working in the EDs; 60.7% of the physicians stated that they did not have the opportunity to have an ultrasound performed 7/24 in the department where they work, and in the same study, 76.8% of the physicians stated that this situation leads to an increase in the number of CT examinations requested. In a previous study in 2000, Aydın et al⁹ found that the most frequently requested radiology examination in a tertiary care hospital is CT.

Our research has a number of limitations. First, because the data obtained for this study did not represent all EDs in Turkey, our findings may not be applicable to other practice contexts, such as university medical clinics. Second, we did not ascertain why there was radiology utilization for individual patients. There may be critical issues considering the purpose of a certain investigation since the necessity and validity of workups in sick versus trauma patients differ. Third, as an important limitation, the data we collected ended up at the end of 2017; therefore, the results of this study may not reflect today's conditions totally.

In conclusion, the rate of increase in radiology examinations performed in the ED is higher than the rate of increase in the number of admissions to the ED. The increase in the number of patients increases the rate of radiological examination requests by the physicians working in the ED. In this sense, an increase in the number of physicians in ED and an improvement in examination times per patient can reduce and optimize the number of radiology examinations requested from EDs. In addition, the accessibility of CT and MRI examinations decreases the utilization of US. Improvements in accessibility to US examinations can reduce unnecessary CT and MRI examinations performed in EDs.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Erzincan Binali Yıldırım University (Date: March 13, 2018, Number: 33216249-604.01.02-E.13620).

Informed Consent: Patients were not required to give informed consent to the study because the analysis used anonymous clinical data that were obtained after each patient agreed to treatment by written consent and permission was obtained from the hospital management for data analysis.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – E.K.; Design – E.K., A.O.E.; Supervision – E.K., E.T., Ö.K.; Resources – E.K.; Materials – E.K.; Data Collection and/or Processing – E.K., A.O.E.; Analysis and/or Interpretation – E.K., Ö.K.; Literature Search – E.K., E.T.; Writing Manuscript – E.K., E.T.; Critical Review – E.K., E.T., Ö.K., A.O.E.

Declaration of Interests: The authors have no conflicts of interest to declare.

Funding: The authors declared that this study has received no financial support.

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