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Original Article

# A comparison study on the effectiveness of pager and telephone systems during emergency department consultations and length of stay of consulted emergency department patients

## *Acil servis konsültasyonlarında çağrı ve telefon sistemlerinin etkinlikleri ile danışılan hastaların acilde kalış sürelerinin karşılaştırmalı çalışması*

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## ABSTRACT

**Aim:** Emergency department (ED) physicians use different tools and modalities to communicate with consulted clinical divisions in all over the world. Domestic phones, pagers, consultation stations, mobile phones and smart phone applications are commonly used examples. They have a changing trend over time and technology in practice. We evaluated the effectiveness of the consultations conducted by telephone and pager systems, compared the functionality of both systems and investigated their effects on length of stay (LOS) of the patients in the ED of a tertiary teaching hospital.

**Material and methods:** The study was planned as prospective and descriptive. The consulted patients in ED were assigned for the study group. The domestic telephones and pagers with central operating system were used as an ED consultation tool for a two-week period, respectively and separately. LOS and consultation response time (CRT) were evaluated.

**Results:** Three hundred eighteen consultations were requested for a total of 228 patients. The most frequently requested consultations were from Cardiology (17.6%), General Surgery (14.2%) and Orthopaedics (13.5%). When the telephone and pager systems were compared independently from the departments, CRT was found significantly longer via telephone compared to pager (52 min vs. 18 min; p=0.56, p=0.04). The LOS was 353 min for telephone, 314 min for pager but these results were not statistically significant (p>0.05).

**Conclusion:** The pager system for consultation request is a time and energy reducing option for ED physicians. In addition, it shortens CRT for the patients with high urgency levels. However there is no significant difference between both methods on LOS.

**Keywords:** emergency; consultation; communication; pager; length of stay

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## ÖZ

**Amaç:** Tüm dünyada Acil Servis Hekimleri konsültasyon istemlerini gerçekleştirmek için farklı araçlar ya da sistemler kullanmaktadır. Dahili telefonlar, çağrı cihazları, konsültasyon istasyonları, cep telefonları ve akıllı telefonlar sık kullanılan örneklerdir. Bu tercihleri pratikte zaman ve teknoloji ile değişen bir eğilim izlemektedir. Biz bu çalışmada konsültasyonlarda kullanılan dâhili telefonlar ile çağrı cihazlarının etkinliklerini değerlendirdik ve üçüncü basamak bir Eğitim ve Araştırma hastanesinde hastaların acil serviste bekleme süreleri (ABS) üzerine etkilerini araştırdık.

**Gereç ve Yöntemler:** Çalışma prospektif ve tanımlayıcı olarak planlanmıştır. AS'de konsültasyon istenen hastalar çalışma grubu olarak seçilmiştir. Dahili telefonlar ve merkezi işletim sistemli çağrı cihazları ayrı ayrı ve sırasıyla AS konsültasyon istemleri için 2 haftalık periyotlar halinde kullanılmıştır. ABS ve konsültasyon cevaplama süreleri (KCS) değerlendirilmiştir.

**Bulgular:** Toplam 228 hastadan 318 konsültasyon istenmiştir. En çok konsültasyon istenen bölümler Kardiyoloji (17.6%), Genel Cerrahi (14.2%) ve Ortopedi'dir (13.5%). Telefon ve çağrı cihazları bölümlerden bağımsız olarak karşılaştırıldıklarında, telefonla tespit edilen KCS değerleri çağrı cihazlarına göre belirgin uzun tespit edilmiştir (52 dk vs. 18 dk; p=0.56, p=0.04). ABS telefon için 353 dk iken çağrı cihazı için 314 dk olarak bulundu ancak bu sonuçlar istatistiksel olarak anlamlı değildi(p>0.05).

**Sonuç:** Çağrı cihazlar AS hekimleri için konsültasyon istemleri için zaman ve enerjiden tasarruf ettiren bir seçenektir. Ek olarak aciliyeti yüksek hastalar için KCS'yi kısaltmaktadır. Ancak AKS açısından iki yöntemle ilgili anlamlı bir fark tespit edilememiştir.


**Anahtar kelimeler:** acil; konsültasyon; iletişim; çağrı cihazı; yatış süresi

## Introduction

Emergency departments (ED) are the units of healthcare services which should offer uninterrupted and fast care, not compromise on quality at the same time. Overcrowding in EDs is a worldwide problem [1-6]. Patient triage, radiology-laboratory examinations, consultation and treatment processes affect the length of stay (LOS) in EDs, therefore these are the enhancing factors to overcrowding problem [7].

Consultation processes are important and perpetual parts of emergency medicine practice (8). Therefore, for a holistic approach to cases, more than one field of medicine has become inevitable to work together. Consultation is the attaining procedure of patient's primary physician to a relevant speciality department via telephone or any other communication device on any matter relating to patient care [2,9,10]. Consultations requested by ED physicians may have different purposes. The most known are consultations for admission (most common), opinion only, special procedures, transfer of care and for outpatient referrals [11]. Consultations are important for requested department as much as requesting department. Because an unnecessary consultation means loss of energy, time and money for each department and for the patient. Most of the time, patients have to stay in ED until the consultation process is finished, even if the diagnosis and treatment procedures are completed [3]. Therefore, consultation difficulties and late responses by specialty departments enhance overloads in EDs in many countries by contributing to disposition delays in hospitals [3,11,12]. Inter-departmental communication-art deficiencies and the limitations of communication tools are most important consultation delay considerations. Domestic telephones, pagers, e-mail, MMS or other applications via mobile or smart phones and accessing patient information on hospital automation systems or internet are mostly used tools for consultation communication [13-16]. The aims of the study are to evaluate currently used domestic phones outcomes as consultation tool in our tertiary teaching hospital, to compare the functionality of phone and newly applied pager system and to investigate their effects on length of stay (LOS) of the patients in the ED.

## Material and Method

After the approval of hospital ethics committee, a total of 8849 patients admitted to Ankara Atatürk Teaching Hospital ED between 06/06/2011 and 04/07/2011 were included into study which was designed in a prospective and descriptive structure and 2549 of them consulted during ED stay. Uncompleted consultations, consultation requested via mobile phones, coincidental consultations (seen consultant who came to ED for another patient or just crossing over in the form of "early consultation"), out-patient clinic referrals in the purpose of consultation during work-hours and the patients with missing data in the follow-up forms were excluded. Finally, 228 patients admitted to the ED included into the study with 318 consultations requested for them. Each consultation was also analyzed separately in the patients who needed more than one consultation as well. The patients were studied in two main groups based on the consultation model as "telephone" and "pager" in defined time intervals. In the first two-week period,

all the ED consultations were held with domestic phones as usual. Meanwhile, the pager system was in the off position. In the second two-week period, by activating the pager system all consultations were carried out with this method. ED physicians were asked to fill the prepared patient follow-up forms. Diagnoses, age, gender, type of admission, time of admission, judicial status, urgency of the patient, consulted departments, LOS in ED, consultation response time (CRT) and final status of the patient were recorded in the forms. During the pager system period, the data that recorded on the main computer processor were compared with the noted durations in the forms at the same time. Mismatched forms were also excluded.

The portable part of newly integrated pager system is "pager devices" which are allocated to all consultant divisions (UDEA brand, UEL-924 model). The other part of the pager system is main control display which is located in ED, has a touch screen, and where every division has its own consultation column. When ED physician decides to consult, the physician just needs to touch the relevant section area for activating the consultation process. The relevant section area colour turns into yellow from blue by activation which means the consultation is detected by the system and the signal is transmitted to the related pager devise. If on-call physician of consulted section doesn't come to ED and receives a second demand in 20 minutes, the current yellow box turns into red this time. The system alerts relevant pager device in every 1.5 minutes after 20 minutes for every unreceived consultation until the consultation demand signal is received.

The duration from actualizing the consultation demand on pager screen until the arrival of the consultant to patient side in ED is defined as CRT. The duration between the admission of the patient to the ED and the final disposition (discharge, hospitalization, operation, outpatient/inpatient referral or transfer/exitus, etc.) defined as LOS in ED.

Data analysis was performed by SPSS for Windows 18.0 package program. The categorical variables were expressed with numbers and percentages, numeric variables were summarized in mean±standard deviation (SD), median and min-max. The differences between the two groups were compared with Mann-Whitney U test and the differences between more than two groups were analyzed with the Kruskal-Wallis test. The significance level was considered as $p<0.05$. Bonferroni correction is used for poly-comparisons. Local ethics committee approved the study and informed consent was obtained from participant(s)

## Results

In total, 8849 patients admitted to ED during the study interval and 2549 consultation requests were carried out (28.8%). Only 228 patients who met inclusion criteria included. Their distribution for gender (male vs. female) were [136 (59.6%) vs. 92 (40.4%)] with an average age 52.7 ± 22 (range: 01-94). A significant proportion of the study group were older than 65 years old (phone and pager for groups, respectively 40.3% vs. 42.9%), however the number of 0-19 age group was very low (9.6% vs. 4.3%). Again a large proportion of the consulted patients brought to the ED by ambulance (60.5% vs. 56.1%). There was no significant difference between phone and pager group in patients' gender, age, legal status and admission way to ED ($p>0.05$).

A total of 318 consultations were practiced in 228 patients enrolled in the study. The most requested consultation divisions were Cardiology (17.6%), General Surgery (14.2%) and Orthopaedics (13.5%), respectively. The least consulted divisions were Nephrology (0.3%), Endocrinology (0.3%), and Haematology (0.3%).

CRT was found 36±47 min in total and significantly shorter via pager comparing to telephone (52 min vs. 18 min; p=0.56, p=0.04) with average (Table 1). Also the CRT of Cardiology, Neurology and Neurosurgery departments shortened statistically in pager group; (p=0.001, p=0.001 and p=0.019). Although the arrival of all sections in pager group were shortened, it was not statistically significant for each division. Time zone analyses of CRT showed that 00:00-05:59 time zone was statistically longer (p=0.02) and this result didn't change based on consultation systems (p=0.07). The fastest respondent divisions were Internal Medicine (28.2±19.2 min)

**Table 1.** The mean CRT of consulted ED patients by groups and time zones.

| | Telephone | | Pager | | Total | | P |
|---|---|---|---|---|---|---|---|
| Time Zone | Number of cons. | CRT* (minutes) | Number of cons. | CRT* (minutes) | Number of cons. | CRT* (minutes) | |
| 00:00 - 05:59 (Night) | 21 | 82.33±80.02 | 19 | 23.57±10.90 | 40 | 54.42±64.97 | 0.001 |
| 06:00 – 11:59 (Morning) | 34 | 55.44±46.35 | 37 | 15.40±7.45 | 71 | 34.57±38.04 | 0.000 |
| 12:00 – 17:59 (Afternoon) | 55 | 58.98±67.00 | 52 | 19.03±20.06 | 107 | 39.57±53.69 | 0.000 |
| 18:00 - 23:59 (Evening) | 59 | 33.50±45.17 | 41 | 19.14±15.23 | 100 | 27.62±36.60 | 0.157 |
| Total | 169 | 52.27±59.87 | 149 | 18.74±15.34 | 318 | 36.56±47.86 | |
| P | 0.000 | 0.36 | | | | | |

*CRT; Consultation Response Time

for phone group and Cardiology (13±9.4 min) for pager group.

It was detected that the consultation tool –whether phone or pager- didn't make significant difference on LOS of patients (353.18 vs. 314.47 min, p> 0.05, Table 2). One of the determining factors on LOS was the number of consultations required for the patient. LOS of the patients with one consultation was 273 min but it was extending to 539 min in those more than one consultation needed (p=0.000).

**Table 2.** The mean LOS of consulted ED patients by groups and consultation number.

| LOS* (minutes) | Telephone | Pager | Total | p |
|---|---|---|---|---|
| | 353.18±340.44 | 314.47±250.22 | 333.82±298.72 | >0.05 |
| Patients with one consultation | | | 273.17 ± 208.18 | 0.000 |
| Patients with more than one consultation | | | 539.13 ± 298.72 | |

*LOS; Length of Stay

After the observation, treatment and consultation protocols completed in ED, 55.3% of the patients were discharged, 38.2% were given admission decision, 6.5% were referred to another hospital for further or special treatment. Among the whole study group, 7.5% were hospitalized to intensive care unit (ICU) and 30.7% had a ward admission. There was not a significant difference between the groups in discharge and hospitalization (p>0.05, Table 3).

**Table 3.** The LOS of consulted ED patients according to their final dispositions.

| | Telephone | | | Pager | | | p |
|---|---|---|---|---|---|---|---|
| Final Disposition | Number | % | LOS* (min) | Number | % | LOS* (min) | |
| Discharge | 57 | 50.0 | 378.71±350.76 | 69 | 60.5 | 338.52±251.17 | 0.64 |
| Hospitalization(ward) | 44 | 38.5 | 314.13±276.05 | 26 | 22.8 | 255.38±171.18 | 0.41 |
| Hospitalization (ICU) | 6 | 5.2 | 249.50±362.55 | 11 | 9.6 | 228.18±363.07 | 0.96 |
| Exitus | 0 | 0.0 | | 1 | 0.8 | 330.00 | |
| Transfer to another hospital | 4 | 3.5 | 757.00±650.47 | 4 | 3.5 | 333.50±125.31 | 0.34 |
| Voluntarily abandonment | 3 | 2.6 | 109.66±47.12 | 3 | 2.6 | 559.33±382.673 | 0.10 |
| Total | 114 | 100 | 353.18±340.44 | 114 | 100 | 314.472±250.22 | |

*LOS; Length of Stay

When the delay causes were investigated for the patients who had a unexpected longer LOS, it was seen that the majority of delays occurred in telephone group and the main reason was inability to reach to the on-call physician by the domestic line (18 of 49 patients). In the general evaluation for both consultation systems; waiting for an empty bed, long duration of ordered treatments in ED, insufficient ED staff and waiting for the relatives of the patient were the major causes of delay.

## Discussion

The studies about ED consultations were initiated in the mid 90's [1,2,7,10,16,20-22]. In recent years there are precious studies showing the influences of consultation process on patient burden of EDs and patient care [23-24]. In this study, we aimed to compare the effectiveness of the mostly used consultation tools (domestic telephone and pager) for ED consultations in our country on LOS and CRT.

In our ED, 28.8% of the all patients presenting to ED require at least one consultation. The rate of consultations for ED patients ranges from 20% to 60% according to the characteristics of the studies [11]. In the literature, gender is not a variable [16] but age is an important determinative for consultation rate, for example the geriatric patient populations have a higher consultation rate [8].

The guidelines prepared by professional emergency organizations indicate that a reasonable consultation response duration is between 30-45 min for an ED based consultation demand but it's also emphasized that main determinant is the patient's clinical exigency[19]. The fastest mean CRT among all specialities was Internal Medicine (28.2 min) in telephone group and Cardiology (13 min) in pager group. CRT was significantly shortened in Cardiology, Neurology and Neurosurgery via pager. These three main divisions are the disciplines investigate the pathologies leading causes of adult death in the world, have "time=brain" and "time=heart" paradigms and practice urgent treatments and invasive procedures simultaneously with diagnoses.

The average LOS of an ED patient is 3.2 hour (192 min) according to 2007 CDC (Center for Disease Control) Survey in United States [17]. In a study conducted in California [18], LOS calculated 56 minutes, and Oktay et al [19] reported 3.3 hours (198 min). Average LOS was calculated 333 min in our study. But the main difference between our results and these studies probably may generate from focusing on just consulted ED patients only in the study also excluding out patient referrals and simultaneous early consultations. Cho et al [3] constructed a computerized

consultation management system to improve consultation process, compared it with previously used consultation system (mobile phone) and evaluated the results on LOS similarly with our study. They found significantly decreased ED LOS (311 min). But what we found is LOS was not altered by our newly implemented pager system. We detected some altering factors on LOS separately from consultation system (weekday admission, ambulance arrival and more than one consultation). Our results showed much longer LOS than expected compared with most of the studies. But it should be considered that only consulted patients were included. When the literature on ED consultations is perused, it can be notified there are a few studies including the number of consultations. Cho et all identified 77.6% of the patients needed at least one consultation and the number of consulted departments was associated with increased ED LOS. Single consultation need for a patient is calculated as 92% in a Canada based study [8]. And we calculated the single consultation rate as 77.6% similarly. Unexpected longer LOS was associated with insufficient bed capacity and uncompleted consultation processes mainly, as in the literature [3,5,6,10,20].

There are some advantages and disadvantages for both mentioned systems in our study. Among the delay reasons on domestic telephone system; broken telephones, hold position of the line accidently, multiple alternative number existence, not having a proper and up-to-date telephone number list on ED can be counted. In addition due to other responsibilities of the consultant, the physician's physical distance to the stationary phone is an important disadvantage. To be able to give the consultant detailed information about the patient is an incontrovertible advantage of the phone despite the difficulties in reaching and time spent. Pager system facilitates reaching the consultant with its portable structure and saves time for ED physicians, also the warning feature with frequent intervals provides the consultant's turn faster. However there are disadvantages like battery failure, forgotten on somewhere or failure on giving information about the patient.

Need for hospitalization, admission decision, physical challenges for admission preadmission processes increase the burden of EDs. According to the consultation purpose, almost all of the studies indicate the most common reason for consultation is for hospitalization of the patient [11]. The admission rate was reported 87% in the study Cortazzone et al. [25], 54% in the study of Woods et al [8]and 64-68% in the study Curry and Wang [26]. The admission rate in our study was 38.2%. According to our results, the admission rate is lower than expected compared to the examples in the literature. This difference can be due to the exclusion of a large group of patients with incomplete forms and simultaneous consultations.

## Conclusion

Every delaying step in emergency care should be investigated thoroughly for more functional emergency departments. We focused on consultation system tools for this purpose. The usage of pager system for consultation request is a time and energy reducing method for ED physicians. In addition, it shortens CRT for the patients with high urgency levels. However there is no significant difference between both methods on LOS. Also more further consultation system analyses and comparisons are needed.

## Declaration of conflict of interest

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