

ORIGINAL ARTICLE

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Patients' awareness and expectations regarding the reduction of waiting times for radiological examinations

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Abstract

This study aims to evaluate expectations regarding the reduction of prolonged appointment times for radiological examinations. This descriptive cross-sectional study was conducted in the radiology clinic of the University Hospital between March and April 2025. A total of 202 patients (82 males, 120 females; age range: 18–88 years; mean: 41.98±18.82 years) who had appointments for radiological examinations were interviewed face-to-face, and a 23-item questionnaire was completed. Regarding the reduction of appointment waiting times, 71.8% of patients stated that the number of radiological devices should be increased, while 5% believed that the number of radiologists should be increased. Among the responses to the question “How do you think the waiting time problem can be solved?”, patients with CT, MRI, and ultrasound appointments were significantly more likely to select “by increasing the number of devices” compared to other response options ($p=0.001$). Increasing the number of radiological devices and associated personnel may help reduce appointment times.

Keywords: Ultrasonography, magnetic resonance imaging, tomography, diagnostic imaging, radiology

Introduction

Requests for radiological examinations in hospitals are increasing due to technological advancements that enable rapid diagnosis and timely, appropriate treatment. Except in emergencies, appointment times for ultrasonography and cross-sectional imaging modalities (computed tomography (CT) and magnetic resonance imaging (MRI) are becoming longer. Many factors influence the appointment process, such as demographic characteristics, the growing number of admitted patients, ease of access to appointments, quality of medical devices, patients' previous experiences, and the diagnostic and therapeutic performance of the referring physician. Similarly, appointment systems are used in radiology clinics, where patients often face long waiting times.

A patient's knowledge about radiological procedures, compliance with examination requirements, communication with the

radiologist or technician, and the overall quality and diagnostic performance of the examination may all improve the process accordingly [1]. In many radiology departments, procedures are scheduled using an appointment system, and appointment times vary across different imaging modalities. Appointment duration increases in direct proportion to the length of the examination. X-ray examinations are often performed on the same day and typically do not require an appointment. CT scans usually have shorter appointment times, except in cases requiring metabolic function evaluation—such as with intravenous, oral, or rectal contrast—or in specific scenarios like nodule follow-up. Ultrasound examinations are performed by a sonographer or radiologist and generally take longer than X-ray-based procedures. Accordingly, appointment times in ultrasonography outpatient clinics, which can perform only a limited number of daily examinations, may be extended. MRI scans usually require longer appointment times. When appropriate technical

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parameters (e.g., TR, TE, NEX) are applied, MRI examinations tend to take longer than other radiological procedures. Each MRI exam may differ in duration depending on the protocol. In many countries, the standardization of radiological examinations such as CT and MRI is regulated by national or international associations [2,3].

Patients often undergo a waiting period before their scheduled appointment, and certain preparation steps—such as fasting or contrast administration—may be required prior to the examination. However, prolonged appointment times can negatively affect patients, leading to reduced expectations and dissatisfaction with the examination process.

The aim of this study was to assess patients' expectations regarding the reduction of extended appointment times for radiological examinations.

Material and Methods

Study Group & Ethical Statement

Prior to the study, approval was obtained from the Non-Interventional Clinical Research Ethics Committee of Pamukkale University Faculty of Medicine (E-60116787-020-664866). This study was designed as a descriptive cross-sectional study. A total of 202 patients (82 males, 120 females; age range: 18–88 years; mean age: 41.98 ± 18.82 years) were interviewed face-to-face, and a data collection form was completed. The study group consisted of adult patients who had previously scheduled appointments for ultrasonography, computed tomography (CT), or magnetic resonance imaging (MRI). Patients presenting from the emergency department or marked as urgent, those with medical priority, hospital staff or their relatives, forensic cases, patients from outside the city, and individuals under the age of 18 were excluded from the study. In the study, data were recorded on the data collection form by medical students in the waiting area of the radiology department, under the supervision of radiology specialists. Interviews for data collection were conducted during the busiest hours of the day. Efforts were made to ensure that these patients had not undergone similar imaging within the past six months.

Data Collection Form

Between March and April 2025, a data collection form consisting of 23 questionnaire items was completed through face-to-face interviews with patients who had appointments at the radiology clinic of Pamukkale University Faculty of Medicine (Figure 1). Before preparing the 23-question questionnaire, the opinions of the patients about the appointment times were obtained during the examinations in a period of approximately 2 weeks and the questionnaire form was prepared accordingly.

The first 13 questions focused on obtaining demographic information from the participants. The remaining nine questions assessed participants' knowledge about radiological examination appointments and their duration. The final question addressed participants' views on potential solutions to prolonged appointment times.

ANKETİN KONUSU: Radyolojik tetkik randevu süreleri hakkında hastaların farkındalık ve beklentileri

1) İsim-Soy İsim:

2) Yaşı:

3) Cinsiyet: ☐ Kadın ☐ Erkek

4) Meslek: ☐ Öğrenci ☐ Emekli ☐ Memur ☐ İşçi ☐ Diğer

5) Gelir Durumu: ☐ Geliri giderinden az ☐ Geliri giderine eşit ☐ Geliri giderinden fazla

6) Eğitim Düzeyi: ☐ İlköğretim ☐ Ortaöğretim ☐ Lise ☐ Üniversite ☐ Okuma- yazma bilmiyor

7) Medeni Durum: ☐ Evli ☐ Bekar

8) Uyruk: ☐ T.C. Vatandaşsınız ☐ Diğer

9) Yurt dışında sağlık hizmeti aldınız mı? ☐ Evet ☐ Hayır

10) Kronik bir rahatsızlığınız var mı? ☐ Evet ☐ Hayır

11) Kronik rahatsızlığınız nedir? (varsa)

12) Düzenli kullandığınız bir ilaç var mı? ☐ Evet ☐ Hayır

13) Düzenli olarak kullandığınız ilaç nedir? (varsa)

14) Radyoloji bölümüne hangi tetkik için geldiniz? ☐ Ultrason ☐ Bilgisayarlı Tomografi ☐ MR

15) Tetkiki tanı için mi yapıyorsunuz yoksa kontrol mü? ☐ Tanı ☐ Kontrol

16) Yapılacak tetkik hakkında bilginiz var mı? ☐ Evet ☐ Hayır

17) Randevu aldıktan ne kadar süre sonra işlem yaptınız?

18) Çekim yerini bulurken sorun yaşadınız mı? ☐ Evet ☐ Hayır

19) Size verilen saatte çekim yaptınız mı? ☐ Evet ☐ Hayır

20) Çekiminiz ilağı mı? ☐ Evet ☐ Hayır

21) Daha önce aynı tetkiki yaptırmış mıydınız? ☐ Yaptırdım. ☐ İlk defa yapıyorum.

22) Sizce bekleme sorunu nasıl çözülebilir?

A) Beklemeyi bir sorun olarak görmüyorum.
B) Cihaz sayısını artırarak.
C) Doktor sayısını artırarak.
D) Gereksiz tetkiklerin yapılmasını engelleyerek.
E) Sekreter sayısını artırarak.
F) Tetkiklerin ücretini artırarak.
G) Bekleme sorunu çözülemez.

Figure 1. Data collection form

Clinical Setting and Imaging Capacity

The study was conducted in the radiology clinic of the university hospital, specifically in the waiting areas of the imaging units where patients were scheduled for examinations. The radiological modalities where the patients' appointments were scheduled are located on the ground floor of the hospital, approximately 50 to 100 meters from the hospital entrance doors. The radiology department includes four ultrasonography outpatient clinics, where a total of 150–180 ultrasound examinations are performed daily. Ultrasonography appointment waiting times range from 14 to 60 days, depending on the type of examination (e.g., fasting requirements, follow-up scans, control studies). Computed tomography appointments are scheduled using one multidetector CT scanner. Waiting times range from 1 to 14 days, depending on the nature of the examination (e.g., dynamic studies, contrast use, coronary CT). A total of 60–80 CT scans are performed daily. In addition, there is one CT scanner dedicated to imaging for the emergency department and inpatients. Patients scanned using this device were not included in the study. Magnetic resonance imaging (MRI) is performed using two MRI scanners. A total of 80–90 patients are examined daily, including routine diagnostic protocols and specialized MRI sequences. Appointment times range from 30 to 120 days, depending on the type of examination (e.g., dynamic studies).

Statistical Analysis

Data analysis was performed using SPSS version 27.0 for Windows (IBM Corp., Armonk, NY, USA) on a personal

computer. Descriptive statistics were presented as mean±standard deviation for continuous variables and as percentages for categorical variables. Chi-square test was used for categorical variables. P<0.05 was considered statistically significant.

Result

Data on Radiological Examination Appointments

The education level of 64.4% of the patients in the study group

was high school or university graduate. A total of 60.4% of the patients stated that their income was equal to their expenses. Of the 202 patients included in the study, 69 (34.2%) had appointments for ultrasound, 74 (36.6%) for CT, and 59 (29.2%) for MRI. In addition, 46.5% of the patients reported having a chronic disease, and 68.8% stated that they had previously undergone the same examination. The demographic characteristics of the patients and their responses to the data collection form are presented in Table 1.

Table 1. Data on radiological examination appointments

Study group characteristics	Answers	Number (n)	Percentage (%)
Gender	Female	120	59.4
	Male	82	40.6
Occupation	Student	45	22.3
	Retired	29	14.4
	Public servant	26	12.9
	Worker	22	10.9
	Other	80	36.6
Income Status	Income < expenses	56	27.7
	Income = expenses	122	60.4
	Income > expenses	24	11.9
Educational Level	Primary school	42	20.8
	Secondary school	21	10.4
	High school	42	20.8
	University	88	43.6
	Illiterate	9	4.5
Marital Status	Married	129	63.9
	Single	73	36.1
Nationality	Turkish citizen	193	95.5
	Other	9	4.5
Have you ever received healthcare abroad?	Yes	16	7.9
	No	186	92.1
Do you have a chronic disease?	Yes	94	46.5
	No	108	53.5
Do you regularly use any medication?	Yes	97	48.0
	No	105	52.0
Which examination are you here for?	Ultrasonography	69	34.2
	CT	74	36.6
	MRI	59	29.2
Is the examination for diagnosis or follow-up?	Diagnosis	106	52.5
	Follow-up	96	47.5
Do you have information about the examination?	Yes	131	64.9
	No	71	35.1
Did you experience difficulty finding the imaging location?	Yes	30	14.9
	No	172	85.1
Was the imaging performed at the scheduled time?	Yes	143	70.8
	No	59	29.2
Have you had the same examination before?	Yes	139	68.8
	This is my first time	63	31.2
	Total	202	100.0

CT: Computed tomography, MRI: Magnetic resonance imaging

Data on Radiological Examination Accessibility

A total of 64.9% of the patients reported having prior knowledge about the examination to be performed. Thirty patients (14.9%) reported difficulties in locating the examination site, while 59 patients (29.2%) experienced delays in their examination on the day of the appointment (Table 2).

Suggestions for Reducing Radiological Appointment Waiting Times

A statistically significant difference was found between education level and recommendations to reduce appointment times (p=0.030). A weak positive correlation was observed between age and recommendations for reducing appointment times (r=0.40). There was no statistically significant difference between patients younger than 40 years (n=98) and those older than 40 years (n=104) regarding the recommendations for reducing appointment times (p=0.053). On the other hand,

no statistically significant differences were observed between income level, responses to questions such as 'Do you have a chronic disease?', 'Is the examination for diagnosis or follow-up?', 'Did you experience difficulty finding the imaging location?', 'Do you have information about the examination?', and 'Have you had the same examination before?' and the recommendations for reducing appointment times.

Overall, 71.8% of patients stated that the number of radiological devices should be increased, 5% suggested increasing the number of radiologists, and 16 patients (7.9%) believed that the problem could not be solved. There were no significant differences in responses to the question 'How do you think the waiting time problem can be solved?' when stratified by gender, occupation, income, education level, or marital status. However, patients with CT, MRI, or ultrasound appointments were significantly more likely to suggest increasing the number of devices as a solution compared with other options (Table 3, p=0.001).

Table 2. Data on appointment characteristics

Questions about examination appointments	Answers	Ultrasound	CT	MRI	Total
Do you have information about the examination?	Yes	49 (24.3%)	39 (19.3%)	43 (21.3%)	131 (64.9%)
	No	20 (9.9%)	35 (17.3%)	16 (7.9%)	71 (35.1%)
Did you experience difficulty finding the imaging location?	Yes	9 (4.5%)	9 (4.5%)	12 (5.9%)	30 (14.9%)
	No	60 (29.7%)	65 (32.2%)	47 (23.3%)	172 (85.1%)
Was the imaging performed at the scheduled time?	Yes	42 (20.8%)	55 (27.2%)	46 (22.8%)	143 (70.8%)
	No	27 (13.4%)	19 (9.4%)	13 (6.4%)	59 (29.2%)
		69 (34.2%)	74 (36.6%)	59 (29.2%)	202 (100%)

CT: Computed tomography, MRI: Magnetic resonance imaging

Table 3. Suggestions for solving appointment delays

Modality	I don't see waiting as a problem	By increasing the number of devices	By increasing the number of doctors	By preventing unnecessary examinations	By increasing the number of secretaries	By increasing examination fees
US	5 (7.2%)	45 (65.0%)	6 (8.7%)	3 (4.3%)	3 (4.3%)	0
CT	8 (10.8%)	57 (77.0%)	2 (2.7%)	2 (2.7%)	1 (1.4%)	1 (1.4%)
MRI	3 (5.0%)	43 (72.9%)	2 (3.4%)	4 (6.8%)	1 (1.7%)	0
Total	16 (7.9%)	145 (71.8%)	10 (5.0%)	9 (4.5%)	5 (2.5%)	1 (0.5%)

US: Ultrasonography, CT: Computed tomography, MRI: Magnetic resonance imaging

Discussion

The use of radiological examinations is steadily increasing due to clinicians' desire to achieve accurate diagnoses in a shorter time [4]. The growing number of radiological examination requests has increased the workload in radiology departments. This situation has led to a heavier appointment burden in radiology clinics, which rely heavily on advanced technology and specialized equipment. The increased volume of examinations extends appointment waiting times, which are critical to the overall quality of service provided by radiology departments [5]. A study conducted at a foundation university reported that delays in radiological examination appointments and the appointment process accounted for 43% of complaints related to radiology services [6]. Another study investigating complaints within healthcare institutions found that imaging services had a complaint rate of 2.2% [7]. Appointments for radiological examinations are arranged automatically in the hospital information management systems (HIMS) or by the relevant clinic or radiology secretariat. The preparation requirements and technical characteristics of each imaging modality vary and may contribute to longer appointment times under certain conditions, independent of examination volume. The preparation requirements and technical characteristics of each imaging modality vary and may contribute to longer appointment times under certain conditions, independent of examination volume. Appointment times may vary depending on the imaging modality used. For example, MRI examinations typically take longer than other imaging modalities, such as CT or ultrasound, and each MRI exam consists of multiple sequences with distinct technical parameters used to evaluate different tissues. Modifying technical parameters to shorten examination time may compromise MRI image quality, potentially reducing the diagnostic accuracy of the examination.

Appointment waiting times in hospitals also have an economic impact. A study conducted in Canada reported that, in 2016, the average waiting time to access treatment was 10 weeks, resulting in an estimated financial loss of \$1.759 to \$5.360 per person [8]. Ultrasound and MRI, which are more operator-dependent and have longer examination durations, tend to have longer waiting times compared to CT appointments. In Canada, it has been reported that on average, waiting times are 3.7 weeks for CT and 11.1 weeks for MRI [9]. A study conducted in Norway reported ultrasound appointment waiting times ranging from 7.9 to 11.4 weeks and MRI appointments from 8.7 to 12 weeks. Waiting times were found to be longer in private healthcare institutions compared to public ones. However, it has been observed that waiting times decrease with an increase in personnel, particularly with the addition of devices such as MRI scanners, which typically have the longest waiting times [10]. A study investigating the wait times of 58 CT and 26 MRI scanners in Croatia reported an average waiting time of 77.6 days for CT and 288.5 days for MRI. In these studies, longer waiting time was reported in larger hospitals [11]. Another survey study

reported that adding MRI scanners and related personnel in regions with long MRI appointment times, as well as simplifying the appointment process, can reduce waiting times and alleviate difficulties experienced by patients [12]. In our study setting, the maximum waiting time for ultrasonography appointments is 60 days, 14 days for CT, and 120 days for MRI. Although long appointment times were observed in our study, increasing the number of imaging devices—as suggested by 71.8% of participants—may be a viable solution, consistent with previous studies. It has been reported that online appointment scheduling can reduce waiting times and no-show rates while increasing patient satisfaction [13,14]. In our study setting, appointments are scheduled by radiology secretaries. However, 5% of respondents stated that increasing the number of secretarial staff could help reduce appointment waiting times. Although an online appointment system is not currently used in our study area, it has been suggested that its implementation could reduce waiting times and improve efficiency.

In the study by Lambert et al., although 64.4% of participants had completed high school or university education, 14.9% had difficulty locating the examination site, and 29.2% arrived late for their scheduled examination time [15]. Similarly, In our study, 14.9% of participants had difficulty locating the examination site, and two-thirds of the study group had completed high school or university education. This suggests that the guidance systems in healthcare institutions may be insufficient even for individuals with higher levels of education. Additionally, 29.2% of participants experienced delays in their examination times. Facilitating access to the examination site and ensuring the timely performance of examinations may enhance patient satisfaction. Despite inadequate guidance services, artificial intelligence in radiology is already being used for triage, patient positioning, and image quality control, in addition to improving workflow efficiency. Accelerated radiological processes and reduced appointment times through artificial intelligence are expected to positively influence patient satisfaction [16,17]. It has also been reported that non-compliance among patients lacking accurate information about the examination may reduce the quality of the procedure [1]. In our study, 64.9% of the patients reported having prior knowledge about the examination.

Our study had several limitations. First, it had a cross-sectional design and was conducted with a limited number of patients in the radiology clinic of a university hospital. Multi-center studies with larger sample sizes, carried out across the province or region, would contribute to addressing the problem of prolonged appointment times. Second, patients were evaluated before their appointments; however, reporting times and post-appointment satisfaction were not assessed. Third, the study did not investigate patients' clinical needs, insurance status, or underlying conditions that might influence their appointment process. Additionally, interviews were conducted with patients who received their radiological examinations free of charge, and they were not asked about their clinical diagnoses or conditions.

Fourth, radiological devices are electronic and subject to malfunction, which can affect appointment times. Although a short-term malfunction occurred in the MRI scanner during our study, it did not affect the scheduled appointments.

Conclusion

In conclusion, increasing the number of radiological devices and associated personnel in centers with long appointment waiting times may help reduce delays.

Conflict of Interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

The authors declare that they have received no financial support for the study.

Ethical Approval

This study was approved by the Non-Interventional Clinical Research Ethics Committee of Pamukkale University Faculty of Medicine (E-60116787-020-664866).

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