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Can Nationwide Central Appointment Systems Reduce Waiting Times in Turkish Public Hospitals?

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ABSTRACT

Health service delivery is an important component of a well-functioning health system. To achieve a competitive healthcare system, healthcare should be provided on time to avoid delays that could harm the patient. In this respect, patient wait time is an important indicator of health services delivery performance. Countries develop national or regional booking systems to manage patient wait times and healthcare delivery resources more efficiently. In this study, the effect of a national booking system on outpatient waiting times in Turkish public healthcare settings was investigated. This study was conducted using anonymized national outpatient data sets for the year 2016 with permission from the Republic of Türkiye Ministry of Health. The data was analyzed after pre-processing and transformation. As a result of the study, patient wait times were calculated, analyzed and evaluated according to province and facility care levels (secondary or tertiary). Results showed that in 2016, only 30.69% of outpatient visits had appointments and that the average waiting time for patients with appointments was 11.18% shorter than for patients without ap-

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pointments. The results of this study fill a gap in the literature, as almost no studies have investigated this issue due to a lack of administrative and clinical data and will provide important evidence for the improvement of health service delivery systems.

Keywords: Appointment System, Healthcare Management, Health Systems, Health Informatics, Patient Wait Time

BACKGROUND

The World Health Organization states that health service delivery is an important component of a well-functioning health system (World Health Organization, 2010) and defines patient-centered care as "a tool to improve services related to access, quality, user satisfaction, and efficiency" (Gröne & Garcia-Barbero, 2001). Mature service delivery systems respect patients' values, preferences, and expressed needs and feature coordination and maintenance integration (Lewis, 2009). The evaluation of health service delivery is directly related to patient satisfaction of health services and this is reflected in service quality outcomes (Bleustein et al., 2014; Gunal & Pidd, 2008). An increase in patient waiting times in outpatient clinics is a driver of decreased patient satisfaction (Siciliani et al., 2014). The US Institute of Medicine states that there are six guiding principles for achieving a more competitive healthcare delivery system. One of these principles is the ability to provide timely health care and reduce delays that can result in patient harm (Corrigan, 2005). In this respect, patient waiting time is a key measurement of a healthcare system's ability to meet expectations. However, it is clear that accessing health services currently involves unacceptable wait times and that time wastage in service delivery is a global problem (Buckle & Stuart, 1996; Hong et al., 2013).

Access to health services is defined as the degree to which individuals are able to enter the health system and receive care (Canadian Institute for Health Information, 2012). Although there are many factors affecting service access, perhaps the most important factor from the patient's point of view is how long they must wait for the service they need (Statistics Canada, 2005). It is not surprising that access problems have negative consequences for patient health, such as prolonged wait times and delays in diagnosis, treatment, or follow-up. In conclusion, studies in the literature suggest that reducing patient wait times

is a priority for health systems (British Columbia Medical Association, 2006; Cook et al., 2006; Kielar et al., 2010; Schwartz et al., 2004; Speed et al., 2016)

Although prolonged wait times are an important problem affecting the quality of healthcare services, access to data in this area is very limited. As a result, there is a significant deficiency in evaluations of the prevalence and effects of this problem in terms of internationally accepted standards in research (Brandenburg et al., 2015; Leddy et al., 2003; Michael et al., 2013). Given the evidence that poorly designed systems lead to significant loss of time and resources, analyzing wait times is a good starting point for redesigning system accessibility (Kreindler, 2010).

Studies in the literature show that unnecessarily complicated appointment processes, unnecessary steps, probable system delays, in-hospital traffic jams, and insufficient use of human or physical resources contribute to long queues in healthcare services even in cases where capacity is sufficient to respond to demand (Kreindler, 2008). The complexity of the patient's route within the healthcare institution causes managerial difficulties, and this complexity means management needs evidence-based information to develop solutions. At this point, examining patient flow and monitoring waiting points can provide the evidence-based information that managers need to improve the situation. Some recent studies have shown that by analyzing patient flow routes, data can be used to better allocate resources and plan schedules, thus increasing productivity through informed decision making (Hong et al., 2013; Santibáñez et al., 2009; Sun et al., 2017; White et al., 2011). Thanks to this information, patient routes can be changed, staff distribution can be arranged, and management can be made more effective by developing a planning model for each process or by searching for alternative solutions (Hong et al., 2013).

Healthcare information systems are the most important data source for creating evidence-based information to improve the quality of healthcare services. This technology makes it possible to monitor patient care through the healthcare information system and to understand service expectations of patients, service supply capacities of healthcare facilities, and possible bottlenecks that may occur in the patient's route within facilities. In other words, real-time service delivery data is an extremely convenient material for evidence-based research (Devaraj et al., 2013; Institute of Medicine, 2015; Siciliani & Hurst, 2005).

As can be understood from the explanations above, in-hospital patient waiting time is an important factor affecting patient satisfaction, the performance of the healthcare system, and clinical outcomes. The main objective of this research paper was to understand the impact of the national appointment system (CPAS) used in Türkiye on outpatient wait times. This was obtained by looking at one-year data in the appointment system for public secondary and tertiary healthcare facilities in each of the 26 geographic regions identified as NUTS-2 regions. In this way, the impact of the national appointment system on patient wait time was analyzed and opportunities for improvement were identified.

A study analyzing wait times using appointment system data was conducted in Türkiye limited only to three hospitals (Küçük et al., 2021). The use of national appointment system (Central Physician Appointment System-CPAS) in Türkiye over the years and the problems conveyed to the ministry within the CPAS have been discussed in this study. However, since the data on waiting times are limited to only three hospitals, the relevant study findings cannot be generalized across Türkiye. No other study was found in the sample of Türkiye that revealed the general situation.

Confusion in the Literature

Different measures are seen in the literature to examine the concept of time in health service delivery. One of these measures is "flow time" which is the total time a patient spends in the hospital and includes both waiting and service durations (Cayirli & Veral, 2003). A second measure commonly found in the literature, "waiting time" is used, which is defined as the time between when the patient requests the service (i.e. makes the appointment) and when the service is actually received (Leddy et al., 2003). A third commonly used measure, and the measure used in this study, is "patient waiting time" which measures the time a patient waits in the clinic before being seen by the clinical staff.

Türkiye National Appointment System

The National Healthcare Information Systems (NHIS) is a functional database that is available to all citizens without any discrimination. Citizens can access their health records online through the NHIS, which collects and stores real-time healthcare utilization data from birth to death (TC Ministry of

Health, 2019). The NHIS was launched in Türkiye in 2002 as one of the main components of a comprehensive national healthcare transformation program.

With the nationwide implementation of the NHIS, standardized and accurate health information was made readily available to healthcare managers to support decision making.

The Turkish NHIS is integrated with a national Centralized Physician Appointment System (CPAS). Turkish citizens can obtain appointments for physicians of their choosing at any of the Ministry of Health hospitals, oral and dental health centers, or family physician offices. Citizens access the system by calling a national free hotline number for live operator assistance, by accessing the system's website, or by using the CPAS mobile applications (Yıldızbaşı et al., 2016) (Figure 1). All appointments are registered with CPAS. As a health-related services, CPAS can be counted as one of the 20 basic public services accepted by the European Union (Budinoski & Trajkovik, 2012). The CPAS gathered scattered appointment systems in public hospitals and health institutions into a single centralized system and claims to be the first and only system in the world to do so (TR Ministry of Health, 2020). According to the Ministry of Health 2016 data, the CPAS's accessibility rate by citizens through the call center, internet and mobile applications is 99.6% (TR Ministry of Health, 2020). Data collected from the CPAS appointment system is used to inform and develop new health policies (Bucak et al., 2018; Kurşun & Kaygısız, 2018).

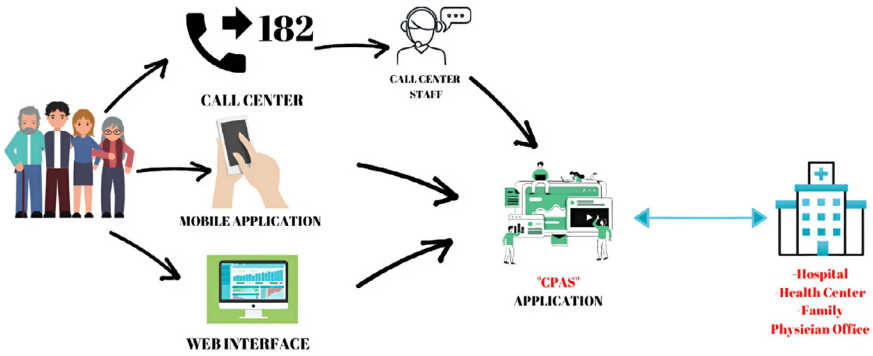

Figure 1. CPAS system overview

METHODS

Sample Selection

The scope of this study includes 2016 outpatient data sets from public secondary and tertiary level hospitals owned and managed by the Republic of Türkiye Ministry of Health. The sample selection was determined using the European Union's Nomenclature of Territorial Units for Statistics (NUTS). The NUTS 2 region provinces have been grouped together because they have common problems, are socioeconomically and culturally close to one other, and are geographically similar (Cheshire et al., 2011). The characteristics of populations in this group offer opportunities for comparison that can be used to explore practices and policies of the region (Eurostat, 2020). In this study, public secondary and tertiary level hospitals in the central province of the 26 geographical borders in the NUTS-2 region are discussed (Figure 2).

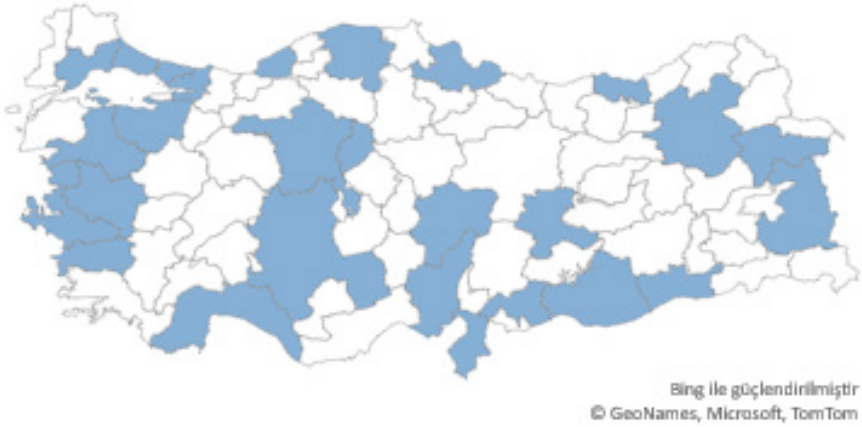

Figure 2. NUTS 2 regions in the central province of Türkiye
(Regions in blue indicate NUTS-2 regions.)

Data Collection and Pre-processing for Analysis

With permission from the Ministry of Health, access to anonymized data sets from the national appointment system (CPAS) for the year 2016 was obtained after submission of all required legal and ethical documentation. The study was conducted within the framework of the Ministry of Health's ethical guidelines. The study is a quantitative, retrospective, and cross-sectional study in which the waiting times of patients receiving outpatient treatment at public secondary and tertiary healthcare facilities in 2016 were analyzed. The data sets obtained are grouped as seen in Figure 3.

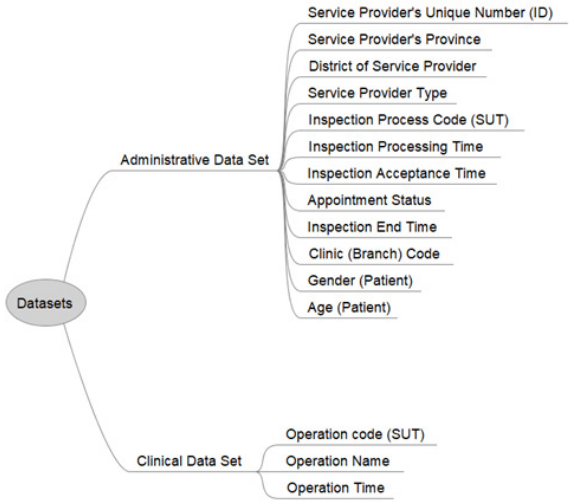

Figure 3. Data sets to be used in the analysis

In the data pre-processing phase, collected data were cleaned according to data types (nominal, sequential, continuous, range, etc.). During the cleaning phase, the status of missing, noisy, or inconsistent data was evaluated and assessed for data quality according to criteria such as validity, completeness, consistency, uniformity, density uniqueness, accuracy, integrity, etc. (Oğuzlar, 2003; Pyle, 1999). Records that were not suitable for analysis according to these criteria were excluded (Table 1).

To calculate the patient wait time (the time between patient registration and the beginning of the examination), records were selected by filtering for national medical service codes associated with "Normal Outpatient Examination". Next, any of the data elements in the data set that are essential in calculating the waiting time such as "Examination Process Time", "Examination Acceptance Time", "Examination End Time" were examined from the data set.

Data were pre-processed, analyzed and visualized with QlikView, a business intelligence tool (García & Harmsen, 2012), that was installed on a server allocated by the Ministry of Health. The data was not physically exported from that server, even after anonymization.

Data Exclusions and Cleaning Criteria

Public secondary and tertiary level hospitals with fewer than 4,000 outpatient admissions, fewer than 100 inpatient admissions per month, and hospitals that had opened for the first time in 2016 were excluded from the analysis. Emergency room examinations were also excluded from the analysis. Additionally, patient level records that indicate a patient wait time of less than or equal to zero minutes were excluded from the study due to data inconsistency. After the data exclusion processes described here, 65,893.517 anonymous data remained for analysis. Data cleaning operations continued using this anonymous data set.

In order to prepare the data for calculation, records with a "Processing Time and Appointment Time" between 09:00 and 16:00 on weekdays were included according to defined normal working hours for each facility, and any records that took place outside of these parameters were excluded from analysis. It was determined that some patient records had birth date information in the "age" field, so values for "age" that were outside the range of 0-116 years of age were excluded from the operations data set. In the transaction records in the data set, it was determined that two different Clinical Codes (147 and 197015) were used for the branch of General Surgery in the Clinical Code data field. These two types of records were merged into one category to prepare the data for analysis. The number of transactional data that remained for analysis after applying exclusions and cleaning the anonymous data made available by the Ministry of Health are presented in Table 1.

Table 1: The number of data remaining for analysis after data exclusion and cleaning operations

"Data Exclusion" and "Data Cleaning" process	Number of Remaining Data
Exclusion of records for transactions taking place outside of normal working days.	65,893.517
Exclusion of records for transactions taking place outside of normal working hours.	65,116.946
Exclusion of patients with ages outside the established range of 0 to 116 years.	50,404.785
Merging of two general surgery clinical codes	50,279.512

Calculation of Appointment Rate and Patient Wait Time

To calculate the appointment rate and the patient wait time, the following fields and time formats from the data set were used:

Appointment Time refers to the planned start time of the appointment that the patient was given on the CPAS. Some records indicate that no appointment was given on CPAS, but contained data in the "Appointment Time" field because the appointment was made by the hospital on the same day of the service.

Registration Time refers to the actual time that the patient completes registration at the front desk upon arriving at the facility for their appointment. During registration, the type of service and department are recorded in the patient's record. For services other than physician visits (such as diagnostic imaging tests), the data in this field represents the time that the doctor requested/ scheduled the relevant transaction.

Physician Visit Start Time refers to the actual time that the patient is invited into the doctor's examination room, the actual time that the service begins, or the actual time that visit data is recorded on the Healthcare Information Management System.

The patient wait time is calculated as shown in the equation.

***Patient Waiting Time (min)*= Physician Visit Start Time-Registration Time**

Patient Waiting Time Equation

RESULTS

According to the analysis of the data for the 50,279.512 outpatient visits that remained after exclusion and cleaning procedures, 34,850.012 (69.31%) of the total visits were made without appointments. When the data set is looked at according to patient gender, 39% of visits were for male patients (19,389.902) and 61% were for female patients (30,889.610). Of the 30,69% of all patients that had appointments, 63.2% were female and 36.8% were male. Of all female patients in the data set, 32% made appointments. Of all male patients in the data set, 29% made appointments. Appointment rates by patient gender are shown in Table 2.

Table 2: Analysis of appointment rate by patient gender

Appointment Status	Number of Outpatient Physician Visits	% of Total	Patient Gender	Number of Visits by Patient Gender	% by Appointment Status and Patient Gender
With appointment	15,429.500	30.69%	Male	5,671.888	36.8%
			Female	9,757.612	63.2%
Without appointment	34,850.012	69.31%	Male	13,718.014	39.4%
			Female	21,131.998	60.6%
Total	50,279.512	100%	Male	19,389.902	38.6%
			Female	30,889.610	61.4%

Appointment Rates According to Facility Type

When the facility level of care is considered, 64.08% of all outpatient visits in the data set were performed at secondary care facilities and 35.92% were provided at tertiary care facilities. Appointment rates for outpatient visits were 29% at secondary care hospitals and 34% at tertiary care hospitals. Conversely, 71% of secondary and 66% of tertiary care hospital visits did not have appointments. As can be seen, the rate of visits without appointments is higher than those with appointments at both secondary and tertiary care facilities (Table 3).

Table 3: Appointment status according to facility care level

Facility Care Level	Appointment Status	Number of Visits	% by Facility Care Level and Appointment Status
Secondary	With appointment	9,341.697	29%
	Without appointment	22,877.015	71%
	Total	**32,218.712**	**64.08%**
Tertiary	With appointment	6,087.803	34%
	Without appointment	11,972.997	66%
	Total	**18,060.800**	**35.92%**
All Facilities		**50,279.512**	**100%**

Patient Wait Times According to Facility Care Level and Appointment Status

Patients with appointments waited for an average of 108.3 minutes in secondary care facilities, while patients without appointments waited an average of 128.1 minutes. In tertiary care facilities, patients with appointments waited an average of 61.4 minutes, while patients without appointments waited an average of 48.8 minutes. In secondary care facilities, patients with appointments on average waited 15.46% less than patients without appointments. In tertiary care hospitals, patients without appointments on average waited 25.82% less than patients with appointments (Table 4).

Table 4: Patient wait times according to appointment status and facility care level

Facility Care Level	Appointment Status	Average Wait Time (min)	Decrease Percentage in Waiting Time	% Rates
Secondary	With appointment	108.3	15.46%	29%
	Without appointment	128.1		71%
				64.08%
Tertiary	With appointment	61.4	(-) 25.82%	34%
	Without appointment	48.8		66%
				35.92%
All	**Average**	**98.3**		**100.0%**

When the average patient wait time for examinations at both secondary and tertiary level health institutions are analyzed, the average waiting time of all patients is 98.3 minutes (Table 4) of patients with appointments is 89.8 minutes, and of patients without appointments is 101.1 minutes.

Distribution of Outpatient Visits by Appointment Status, Facility Care Level, and Province

The number of outpatient visits in the data set with and without appointments according to province and facility care level is presented in Table 5. In terms of total number of visits, Istanbul, Ankara and Izmir were the top three largest provinces making up 47.1% of examinations in all provinces. These are also the three most populous regions in Türkiye. Istanbul, the largest province in terms of population and outpatient visit numbers, had an appointment rate of 32.0%. Ankara, the second largest province, had an appointment rate of 38.0%. İzmir, Türkiye's third largest province, had an appointment rate of 20.2%. Sanliurfa province showed the highest appointment rate at 62.4%, while Kastamonu had the lowest at 1.6%.

For secondary care facilities, Istanbul, Izmir, and Ankara had the highest number of outpatient visits in the data set. The secondary care facility appointment rate for Istanbul was 27.8%, for Izmir was 18.2%, and for Ankara was 44.2%. Sanliurfa had the highest appointment rate among secondary care facility visits in all provinces at 62.3%, while Kayseri had the lowest appointment rate at 5.7%.

For tertiary care facilities, Istanbul, Ankara, and Izmir had the highest numbers of outpatient visits respectively. The tertiary care facility appointment rate for Istanbul was 35.9%, for Ankara was 32.7%, and for Izmir was 23.6%. Malatya had the highest appointment rate (63.1%) among tertiary care facilities in all provinces. Erzurum had the lowest appointment rate at 8.5%. There are no tertiary care facilities in three of the provinces as shown in Table 5.

Table 5: Distribution of examinations by appointment status, facility care level, and province

Province	Secondary Care Facility		Tertiary Care Facility ** Province has no tertiary facility*		All Facilities	
	With appointments	Without appointments	With appointments	Without appointments	With appointments	Without appointments
ADANA	367,008	1,219.399	166,794	625,183	533,802	1,844.582
AGRI	34,455	216,102	*	*	34,455	216,102
ANKARA	1,059.553	1,338.086	920,762	1,891.180	1,980.315	3,229.266
ANTALYA	456,906	821,209	22,906	235,668	479,812	1,056.877
AYDIN	178,195	666,206	12,148	34,011	190,343	700,217
BALIKESIR	295,842	1,062.549	7,561	23,244	303,403	1,085.793
BURSA	888,794	846,217	303,890	217,483	1,192.684	1,063.700
ERZURUM	20,037	274,253	17,167	185,516	37,204	459,769
GAZIANTEP	152,280	987,785	52,814	519,862	205,094	1,507.647
HATAY	912,435	643,571	14,293	12,968	926,728	656,539
ISTANBUL	1,791.024	4,659.130	2,534.577	4,525.280	4,325.601	9,184.410
IZMIR	560,242	2,520.575	436,918	1,416.528	997,160	3,937.103
KASTAMONU	22,043	146,015	3,237	11,263	25,280	157,278
KAYSERI	15,571	259,866	175,919	480,307	191,490	740,173
KIRIKKALE	30,397	138,248	*	*	30,397	138,248
KOCAELI	346,237	1,193.835	138,206	286,203	484,443	1,480.038
KONYA	299,454	1,350.834	33,318	243,985	332,772	1,594.819
MALATYA	89,843	214,017	450,905	263,175	540,748	477,192
MANISA	161,281	1,209.198	12,400	37,843	173,681	1,247.041
MARDIN	39,703	157,904	7,804	7,230	47,507	165,134
SAMSUN	405,907	538,713	334,388	221,074	740,295	759,787
SANLIURFA	737,280	445,852	306,690	182,199	1,043.970	628,051
TEKIRDAG	225,003	713,590	*	*	225,003	713,590
TRABZON	80,005	330,733	28,149	196,879	108,154	527,612
VAN	46,483	273,702	93,735	307,065	140,218	580,767
ZONGULDAK	125,719	649,426	13,222	48,851	138,941	698,277

Patient Wait Times by Appointment Status, Facility Care Level, and Province

The average patient wait times and standard deviations for outpatient visits by province are shown in Table 6.

Table 6: Average patient wait times in minutes by appointment status, facility care level, and region

Province	Secondary Care Facility				Tertiary Care Facility ** Province has no tertiary facility*				All Facilities			
	With appointments		Without appointments		With appointments		Without appointments		With appointments		Without appointments	
	Avg. Pt. Wait Time	Standard Deviation	Avg. Pt. Wait Time	Standard Deviation	Avg. Pt. Wait Time	Standard Deviation	Avg. Pt. Wait Time	Standard Deviation	Avg. Pt. Wait Time	Standard Deviation	Avg. Pt. Wait Time	Standard Deviation
ADANA	22.8	449.3	5.1	223.2	0.9	5.7	2	122.7	16.2	375.4	4.1	195.2
AGRI	7.1	29.5	1.8	71.8	*	*	*	*	7.1	29.5	1.8	71.8
ANKARA	211.3	2063.9	99.7	1550.5	29.5	55.1	55.1	1356.7	127	1514.5	72.9	1437.4
ANTALYA	50.9	1286.5	34.4	635.9	108.5	139.5	44.4	145.2	53.6	1257	36.9	557.1
AYDIN	20.2	208.4	41.9	521.2	14.9	10.7	15.9	11.7	19.9	201.7	40.5	506.8
BALIKESIR	57.1	1752.6	43.9	721.4	34.8	33.1	38.7	103.6	56.6	1730.6	43.8	714
BURSA	213.7	7052.3	77.6	2718.3	72.9	1725.8	112	2469.8	178	6155.6	84.1	2672.9
ERZURUM	27	138.5	32	872.9	7.3	19.4	8	121.4	17.4	100.7	21.4	656.5
GAZIANTEP	14.8	652	73.7	2689.3	2.7	92	2.3	85.9	11.7	563.8	48.7	2170.2
HATAY	27.4	40.5	26.8	40.5	46.4	67.6	50.5	69.4	27.7	41.1	27.3	41.3
ISTANBUL	247.8	4303.7	531.2	10827.8	109	5538.5	60.2	1829.8	166.7	5062.8	297.2	7791.4
IZMIR	17.1	168.7	13.1	246.9	15.2	11.3	30.8	951.2	16.2	126.6	19.7	612.4
KASTAMONU	58.2	81.2	48.5	840.4	36.7	79.9	36.8	47.8	55.4	81.4	47.7	813.3
KAYSERI	30.9	53.2	26.7	650.4	7.5	230.3	177.2	1853.9	9.4	221.4	122.6	1532.4
KIRIKKALE	30	60.5	36.6	107.5	*	*	*	*	30	60.5	36.6	107.5
KOCAELI	7.2	124.5	5.5	156.1	2.8	9.1	2.9	17.5	6	105.4	5	141.4
KONYA	34.3	666.6	28.9	882.1	18.4	105.7	55.8	845.9	32.7	633.7	33	876.8
MALATYA	30.6	51.4	45.5	1117.5	30.1	40.5	31.1	35.6	30.2	42.5	38.8	814.8
MANISA	9.2	204.5	29.9	477	0.9	0.6	0.4	1	8.6	197.1	28.9	468.7
MARDIN	38.7	128.6	195.6	1785.6	87.8	1150.9	90.7	1310.3	46.8	481.4	191.7	1770.3
SAMSUN	24.8	217.8	45.9	752.9	25	46.6	29.3	50.6	24.9	164.4	41.7	652.7
SANLIURFA	29.8	46.8	51.3	612.6	*	*	*	*	31.6	45.8	46.8	512.1
TEKIRDAG	32.8	251	57.6	954.7	35.7	43.4	36.4	44.5	32.8	251	57.6	954.7
TRABZON	13.9	323.9	13.5	202	85.2	2491.5	104.5	3940.1	32.5	1303.5	47.4	2410.9
VAN	4	10.6	3.2	137.7	0.6	5.1	4.8	251.7	1.8	7.7	4	203.8
ZONGULDAK	2.6	143.2	3.2	90.2	5.5	7	5.1	8.6	2.8	136.3	3.3	87

As shown in Table 6, average patient wait times for patients with appointments in secondary care facilities reveals that the five provinces with the longest patient wait times are in Istanbul, Bursa, Ankara, Kastamonu, and Balikesir (247.8, 213.7, 211.3, 58.2, and 57.1 minutes, respectively). For those without appointments in secondary care facilities, the longest average patient wait times are in Istanbul, Mardin, Ankara, Bursa, and Gaziantep (531.2, 195.6, 99.7, 77.6, and 73.7 minutes, respectively). Istanbul has the longest wait time for outpatient visits with and without appointments at secondary care facilities.

For tertiary care facilities, the five provinces with the longest average wait times for patients with appointments are Istanbul, Antalya, Mardin, Trabzon, and Bursa (109, 108.5, 87.8, 85.2, and 72.9 minutes, respectively). For those without appointments, the longest average patient wait times are in Kayseri, Bursa, Trabzon, Mardin, and Istanbul (177.2, 112, 104.5, 90.7, and 60.2 minutes, respectively). Istanbul has the longest average wait times in tertiary care hospitals for patients with appointments, while Kayseri has the longest average wait times for those without appointments.

An analysis of all facilities shows that the five provinces with the longest average wait times for patients with appointments are Bursa, Istanbul, Ankara, Balıkesir, and Kastamonu, (178, 166.7, 127, 56.6, and 55.4 minutes, respectively). The longest average wait times for patients without appointments are in Istanbul, Mardin, Kayseri, Bursa, and Ankara (297.2, 191.7, 122.6, 84.1, and 72.9 minutes, respectively). This analysis reveals that the province of Istanbul is the province with the highest waiting time for patients with and without appointments for outpatient visits.

DISCUSSION

Healthcare information systems are a key tool for evidence-based efforts to increase healthcare service. Many studies in the literature are based on questionnaires, direct observations, or retrospective calculations of patient wait times (Johnson & Rosenfeld, 1968; Kreindler, 2010; Mardiah & Basri, 2013; Pierce et al., 1990; Schoen & Doty, 2004; Siciliani et al., 2014). According to a study published in 2017, studies on patient wait times that are based on administrative records of health service delivered in a hospital setting are rare (Sun et al., 2017). Many studies in the literature have demonstrated that es-

tablishing a process improvement team to evaluate and redesign patient care processes in any healthcare facility can be a successful approach to reducing patient wait times (Adamu & Oche, 2014; Pierce et al., 1990). Similarly, methods developed in the fields of operations research and systems engineering have provided significant improvements in hospitals and clinics in terms of cost, efficiency, and patient satisfaction (Litvak & Fineberg, 2013; Rohleder et al., 2013). However, these efforts are still in development and are relatively few in number (Watts et al., 2013).

Published studies on the Turkish national appointment system have covered such topics as the attitudes and awareness of patients and physicians towards the CPAS application; the effectiveness of the application; the effects of the application on patient and physician satisfaction; the effect of wait times on patients, and problems encountered in practice (Şahin, 2013). With increasing popularity since the 2000s, studies have also utilized lean hospital methods and lean transformation activities to increase efficiency in hospitals (Özdemir, 2013) and have shown that lean hospital studies have contributed positively to shortening patient wait times. However, these studies were also focused on a single hospital and several processes within that hospital. No comprehensive study was found in the literature that analyzed in-hospital patient wait times for multiple hospitals and provinces based on administrative and clinical data.

According to the findings of our study, of the 50,279.512 normal outpatient visits in the study data set, 30.69% had appointments and 69.31% did not (walk in patients). Although, the CPAS system was launched in 2010, the 2016 data set implies that desired utilization rates have not yet been achieved (Table 2).

When the distribution of all outpatient visits according to patient gender is evaluated (Table 2), it is seen that 38.6% of the patients are male and 61.4% are female. Looking at the distribution of these visits by appointment status (Table 2), 36.8% of visits with appointments are for male patients and 63.2% are for female patients. For visits without appointments, 39.4% are for male and 60.6% are for female patients. As seen in Table 2, 29% of male patients have appointments and 32% of women have appointments. Female patients are seen to have higher appointment rates than male patients.

According to analysis of the appointment status of outpatient visits according to the care level of the facility (Table 3), 64.08% of total visits were carried

out in secondary and 35.92% in tertiary care facilities. According to the results shown in Table 3 data, out of a total of 32,218.712 visits that took place at secondary care facilities, 28.99% were made with appointments and 71.05% were made without appointments. For tertiary care facilities, 33.70% of a total of 18,060.800 visits were made with appointments and 66.29% were made without appointments. According to these results, most patients come to the hospital without appointments at both secondary and tertiary care facilities. Also, while patients with appointments in secondary care facilities wait, on average, 15.46% less than patients without appointments, patients with appointments in tertiary care facilities actually experience 25.82% longer wait times than patients without appointments. It is an unexpected finding that patients with appointments in tertiary care facilities have longer wait times than patients without appointments. Explanation of this finding requires additional research to identify variables that may affect patient wait times, such as clinical department, patient case-mix, patient demographics, or appointment distribution.

According to the average patient wait times for outpatients shown in Table 4, the average wait time for patients with appointments is 89.8 minutes. The average wait time for patients without appointments is 101.1 minutes. Overall, the CPAS has an 11.18% positive effect on average patient wait times. In general, patients with appointments spend less time waiting for normal outpatient visits to begin than those who walk in without appointments in Türkiye. Increasing utilization of the CPAS is expected to have a positive impact on the health care delivery of outpatient services in public hospitals.

When appointment rates are broken down by provinces, as shown in Table 5, outpatient visits without appointments were more common in all provinces except for Bursa, Hatay, Malatya, and Sanliurfa which had appointment rates of over 50%. When secondary and tertiary care facilities are considered separately, appointment rates over 50% for secondary care facilities were seen in Bursa, Hatay, and Sanliurfa and for tertiary care facilities in Bursa, Hatay, Malatya, Mardin, Samsun, and Sanliurfa provinces. These findings indicate that appointment rates are driven more by local dynamics than by general policy. The difficulty of managing such a large number of walk-in patients without appointments and planning in-hospital processes is obvious. Local and centralized efforts to increase appointment rates needed.

As shown in Table 6, average patient wait times for outpatient visits in hospitals in Istanbul, Ankara, Bursa, Balikesir, Kastamonu, Antalya, and Mardin provinces range from 2-3 hours. Conversely, the average patient wait times ranging from 1 to 7 minutes are seen in Adana, Agri, Kocaeli, Van and Zonguldak provinces do not seem reasonable (does not seem to be logical). This may be explained by local practices where appointments are recorded on the CPAS at the time of patient registration in hospitals, which would mean that true pre-examination wait times are not recorded. In general, the high standard deviations of average patient wait times indicate that wait times across hospitals in the province are highly variable. To understand this further, additional studies are needed to identify variables that may affect results of hospitals within the same province.

As shown in Table 6, Bursa province has the longest average patient wait time for patients with appointments (178 ± 6155 minutes) and for patients without appointments (average 297 ± 791 minutes). It is particularly striking that Istanbul has the highest average patient wait time for examinations with and without appointments. This finding could be explained by the number of doctors per capita in Istanbul, however, there are relatively fewer public hospitals in Istanbul in comparison to other provinces and there are more private hospitals in Istanbul which are not included in this study. Additionally, the large population in Istanbul means that a larger number of patients come to hospitals without appointments demanding health services (Turkish Statistical Institute, 2018a; Turkish Statistical Institute, 2018b). All these factors may contribute to the long waiting times in this province.

Average patient wait times in secondary care facilities reflect the results for Türkiye in general. Patients with appointments in secondary care facilities wait for shorter average durations than those without appointments. However, results for 14 provinces were exceptions (Adana, Agri, Ankara, Antalya, Balikesir, Bursa, Hatay, Izmir, Kastamonu, Kayseri, Kocaeli, Konya, Trabzon, and Van) as shown in Table 6. Patients with appointments had longer wait times than patients without appointments in secondary care hospitals in these 14 provinces. Patients without appointments in secondary care facilities waited the longest durations in Istanbul, Mardin, Ankara, Bursa, and Tekirdag, ranging from 1-9 hours. Patients with appointments in secondary care facilities waited

the longest durations in Istanbul, Ankara, and Bursa with average durations of approximately 4 hours.

Similarly, patients without appointments in tertiary care facilities had longer average wait times than patients with appointments as seen in Table 6. Conversely, in Antalya, Gaziantep, Istanbul, Manisa, and Zonguldak provinces, patients with appointments had longer wait times than patients without appointments in tertiary care facilities.

As can be seen in the tables, it is noteworthy that the standard deviations are much higher than the provincial mean values. This indicates that province-based results are not healthy and makes it difficult to conclude that the available data is acceptable for evaluating the performance of the health care delivery system. Just as there is large variation among hospitals within a province, there is also variance among provinces that cannot be attributed to any specific factor. It is reasonable to assume that there are data entry errors in the system, challenges in user-based data classifications in the database, and non-standard data management customs and cultures among hospitals and provinces. To demonstrate the effectiveness of the appointment system in hospitals and to carry out effective improvement studies of patient management processes, further efforts are needed to review standard data definitions and improve data entry reliability.

CONCLUSIONS

In this study, one year of data from the national "Centralized Physician Appointment System" used in Türkiye was analyzed to understand the impact of the CPAS on normal outpatient public hospital patient wait times by facility care level and province. As other studies have found, monitoring and analyzing data in the healthcare information system is valuable to manage patient wait times and improve healthcare delivery systems using evidence-based data. This study was comprehensive from both administrative and clinical perspectives and included all public secondary and tertiary healthcare facilities in Türkiye. As such, the data retrieved from the national information technology database offers original analyses that are generalizable to Türkiye. The study has three main findings: First, patients with appointments wait on average, 11.18% less than patients without appointments for outpatient visits. The av-

erage wait time for patients with appointments is 89.8 minutes, while the average wait time for patients without appointments is 101.1 minutes. This finding suggests that the CPAS has a positive effect on patient wait times. Further study of patient wait times according to clinical department may offer further insight. Second, only 30.69% of patients made appointments for normal outpatient visits at public secondary and tertiary healthcare facilities. This finding suggests that more work is needed to increase CPAS utilization. Third, patients with appointments in tertiary care facilities wait, on average, 25.82% longer than patients without appointments. This unexpected finding reveals the need for further research into the variables that may affect tertiary level outpatient patient wait times.

Appointment status by gender was also included in the analyses, and it was observed that women had more visits than men (both with and without appointments). This is consistent with multiple studies that demonstrate gender differences in health service utilization (Shafeek Amin & Driver, 2020; Borboudaki et al., 2021; Mondal & Dubey, 2020). Also, a more detailed examination revealed that walk-in visits without appointments were more common for both men and women than visits with appointments. When appointment status at secondary and tertiary care hospitals were investigated separately, the rate of walk-in visits without appointments was higher at both levels of care. As the analysis deepens, however, it is noteworthy that appointment status rates did not vary according to facility care level or province. This finding supports our recommendation of further efforts to increase utilization of the CPAS.

An unexpected finding was revealed in the average patient wait times at secondary and tertiary care facilities. While patients with appointments at secondary care facilities have, on average, 15.46% shorter wait times than patients without appointments, patients with appointments in tertiary care facilities have, on average, 25.82% longer wait times than patients without appointments. Further investigation is required to identify variables driving this outcome. For example, patient wait times may vary according to specific clinical department structures. Further investigation into patient wait times by clinical department is planned.

Abbreviations

CPAS: Centralized Physician Appointment System

NUTS: Nomenclature of Territorial Units for Statistics

Ethical Approval and Consent to Participate: The authors are solely responsible for the comments in the study. Since our study was a retrospective and record/registry-based study, any personal information of patients was not used in this study (Contains non-personal information such as waiting time. Human Participants / clinical data are not included in the study.). Thus, patient approval was not required. Since our study was a record-based and retrospective study, it was approved by the non-interventional ethics committee **(Istanbul Medipol University Non-Interventional Clinical Research Ethics Committee [2017/520])** that the study was conducted without obtaining an informed consent form and that informed consent was not required. Necessary access permissions to this registry have been obtained from the Ministry of Health. Additionally, the use of this data was also approved by the Istanbul Medipol University Non-Interventional Clinical Research Ethics Committee (2017/520). All protocols in the study were carried out in accordance with the relevant guidelines and regulations.

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