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Diagnostic costs: a research in a family medicine outpatient clinic

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ABSTRACT. The aim of this study is to evaluate the direct diagnostic costs for disease groups and other variables (such as gender, age, seasons) that are related to the direct diagnostic costs based on a 3-year data. The population of the study consisted of 31,401 patients who applied to family medicine outpatient clinic in Turkey between January 1st, 2016 and December 31st, 2018. With this study, we determined in which disease groups of the family medicine outpatient clinic were most frequently admitted. Then, total and average diagnostic costs for these disease groups were calculated. Three-year data gave us the opportunity to examine the trend in diagnostic costs. Based on this, we demonstrated which diseases' total and average diagnostic costs increased or decreased during 3 years. Moreover, we examined how diagnostic costs showed a trend in both Turkish liras and USA dollars' rate for 3 years. Finally, we analysed whether the diagnostic costs differed according to variables such as age, gender and season. There has been relatively little analysis on the diagnostic costs in the previous literature. Therefore, we expect to contribute to both theorists and healthcare managers for diagnostic costs with this study.

Keywords: diagnosis groups; diagnostic cost; outpatient clinics; family medicine.

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Introduction

Diagnosis of diseases in health services is quite important for individuals, society and national economy (Miller, 1976). Especially, early diagnosis both affects the patient's quality of life and reduces treatment costs (e.g. Halperin et al., 2017; Howell et al., 2018; Ornoy, 2019). However, it is known that every procedure performed on behalf of diagnosis of the diseases increases the costs in health services and imposes a significant burden on the national economy (Beinfeld & Gazelle, 2005; Smith-Bindman, Miglioretti, & Larson, 2008; Ciarrapico et al., 2017). When deciding on examination procedures at the diagnostic stage, physicians remain in an important dilemma between loss of productivity or risking the patient's health (Bosco, Iorio, Barber, Barron, & Caplan, 2016).

In Turkey, access to healthcare services has become easier (Akinci, Mollahaliloglu, Gursoz, & Ogucu, 2012) due to the increased investment in health (Okem & Cakar, 2015). As a result, the number of outpatient clinic visits have increased. For example, in 2016 the number of outpatient clinic visits were 340.080.539. In 2017 and 2018, it was 353.703.814 and 380.623.055, respectively (Turkish Ministry of Health, 2018). We expect that increased number of outpatient clinic visits led to an increase in diagnostic costs. However, there has been a lack of statistical information on diagnostic cost of outpatient clinics.

Increasing hospital costs are one of the major causes of problems in the health sector (Minh et al., 2010). Therefore, it is particularly important to keep the costs under control and determine the cost information in order to provide an effective and efficient management in hospitals (Minh et al., 2010; Tarricone & Torbica, 2012; Labro, 2014). Many studies have investigated the cost analysis of health services in the world and Turkey (e.g. Asil et al., 2011; Ahn et al., 2016; Bozkurt et al., 2016; Karagoz et al., 2017; Kulkarni & Shepherd, 2019; Oyando et al., 2019; Van Baal et al., 2019). However, there has been relatively little analysis on the diagnostic costs in outpatient clinics. For example, Tahirbegolli, Cavdar, Sumer, Akdeniz, and Vehid (2016) examined only diagnostic costs of Syrian refugee patients in a Turkish outpatient clinic based on a six-month data in 2014. However, their study provides specific information about outpatient admissions and hospital costs of Syrian refugees (Tahirbegolli et al., 2016).

In our study, we aim to determine the direct diagnostic costs of the disease groups in the family medicine outpatient clinic by the year of 2016, 2017 and 2018. In addition to this, we aim to examine whether the diagnostic costs differ according to variables such as age, gender and season. Therefore, our study is expected to contribute to a better understanding of the direct diagnostic costs. Moreover, our study is expected to contribute to the policy makers and scholars by indicating the trends in direct diagnostic costs in both Turkish liras and US dollar.

Financing of health services in Turkey

Turkey is a middle-income developing country. In 2018, US$27,122 million were spent on health care in Turkey. Health expenditure per capita was US$PPP 1,181 in 2017, as a share of 4.2% of GDP in 2017, one of the lowest countries in OECD Health Data-2018 (Turkish Ministry of Health, 2018). Universal health insurance constitutes a major part of existing health care expenditures (78%), out-of-pocket expenses have a ratio of 18 percent and private health insurance expenditure has a ratio of 4 percent in Turkey (Turkish Ministry of Health, 2018).

The delivery and financing of health services are separated with the 'Health transformation program' (HTP), which was launched in 2003 (Yasar, 2011; Yardim, Cilingiroglu, & Yardim, 2014). Hospital care is delivered by both public and private hospitals. In 2018, there are 1,534 hospitals, of which 889 are owned by the Ministry of Health, 68 by universities, 577 by the private sector in Turkey (Turkish Ministry of Health, 2018). Hospitals provide both inpatient and outpatient care. Healthcare financing consists of Social Security Institution (SSI), central government budget, private health insurance institutions and out-of-pocket expenditures. Pricing of health services is determined by the Social Security Institution according to the Health Implementation Guide (HIG, SUT in Turkish) (Sahin, Ozcan, & Ozgen, 2011). HIG is updated annually by the Health Services Pricing Commission consisting of seven members, which of five representing Ministry of Labour and Social Security, Ministry of Finance, Ministry of Health, Ministry of Development, Undersecretariat of Treasury, and two members representing Social Security Institution (SSI) (Guvercin, Mil, & Tarim, 2016). SSI uses the diagnosis-related groups (DRGs) or the case-mix based payment systems (Sahin et al., 2011). Healthcare costs are paid by SSI within the scope of Universal Health Insurance (UHI), which was introduced in 2008 by Law No. 5510 (Karadeniz, 2012). UHI is mandatory and covers everyone. The critical threshold is to reside in Turkey. UHI's income consists of insurance premiums, government contributions and user contributions (Akinci et al., 2012; Yardim et al., 2014).

Direct diagnostic costs at the family medicine outpatient clinic

Family physicians provide the treatment of diseases at appropriate steps, by following the services provided to the patients, ensuring coordination between the service units, and guiding the patients to reach specialist physicians (Mac & Ozturk, 2018). Family physicians enable the patients to go to the right specialty and the right centre which provide a more effective and economical use of secondary health services, the cost of which is higher than the primary health services (Mac & Ozturk, 2018).

Patients' applications to the family medicine clinic are made by Central Physician Appointment System (CPAS, MHRS in Turkish) since the year of 2012 (Pekgor et al., 2017; Bucak, Almis, Dogan, & Turgut, 2018). Appointments can be made to all public hospitals from CPAS's official website, official mobile applications, and 182 call centres. Access to healthcare services is facilitated with CPAS (Pekgor et al., 2017; Bucak et al., 2018). Although there are similar examples at the regional level in the world, CPAS is the first physician appointment system conducted from a single centre across the country (Ozmen & Gulec, 2018). As a result, outpatient clinic visits have increased (Turkish Ministry of Health, 2018).

In the family medicine outpatient clinic, invoicing procedures for examination and analysis are carried out through an electronic system called MEDULA within the framework of HIG (SUT in Turkish) provisions (Sahin et al., 2011). MEDULA is an integrated computer system that collects invoice information electronically without interfering with the internal processes of healthcare providers and ensures that transactions are performed in an integrated and simultaneous manner with SSI (Okem & Cakar, 2015). Thanks to the system that was put into practice in 2007, all procedures such as diagnosis tests, examination, treatment, hospitalization, and drug intake can be monitored when the patients applied to the family medicine outpatient clinic. As a result, cost control and process control became possible (Guvercin et al., 2016).

On one hand, there has been no significant increase in reimbursement prices made by SSI to hospitals in recent years. On the other hand, dollar exchange rate and the inflation rate in Turkey have been increasing annually. This

situation restricts the resources required by hospitals for healthcare provision (Yigit & Yigit, 2016). Yet, there is a lack of study which examines trends of the diagnostic costs by year. Therefore, in this study, diagnostic costs by years and ICD-10 diagnosis groups in the family medicine outpatient clinic were examined. In addition, it is aimed to examine whether the diagnostic costs differ according to gender, age groups, and seasons.

Material and methods

Design

This study is a single-centre, cross-sectional, retrospective, descriptive and analytical study.

Sample

The research population consists of 122,431 patients who applied to Family Medicine Outpatient Clinics of Sisli Hamidiye Etfal Training and Research Hospital between January 1st, 2016 and December 31st, 2018. In the data set, age, application date, diagnosed disease and diagnostic costs were used as variables. Incomplete, noisy and inconsistent data were excluded and a total of 31,401 patient data, which indicated the symptoms and diagnostic costs of patients, were included in our study. Necessary legal permissions have been acquired. This research was approved by the Clinical Research Ethics Committee of Sisli Hamidiye Etfal Education and Training Hospital (16 April 2019, Number: 1219). In order to protect patient's privacy, special information identifying patients have been removed from the data set. The age classification of the sample was grouped by dividing it into equal intervals.

Data analysis

The process of cost calculation in hospitals was not free of challenges (Mogyorosy & Smith, 2005; Riewpaiboon, Malaroje, & Kongsawatt, 2007). Therefore, in our study we only included the direct diagnostic costs. Diagnostic costs in Turkey are billed according to Health Implementation Guide (HIG, SUT in Turkish). The cost of service and material expenses of patients are calculated through Hospital Information Management Systems (Aslan & Top, 2016). In determining the direct diagnostic costs for the disease groups, only the examination costs requested by the physician were included, and direct labour and general administrative expenses were excluded.

Descriptive data for variables are shown in tables. First, while calculating the average diagnostic costs per person by year, the average dollar rate for each year was determined. Then, the diagnostic costs for each year were converted from Turkish lira into dollars. The total diagnostic cost for each year was calculated by dividing the number of patients for that year. Disease diagnosis and diagnostic costs are grouped according to the seasons, and the aggregated data in question were used for classification of diseases. Four seasons were formed as Winter (January, February, March), Spring (April, May, June), Summer (July, August, September), and Autumn (October, November, December). Diagnosed with the disease in Turkey, variables were coded appropriately aggregated in 12 groups in the International Classification of Diseases 10 (ICD-10). In addition, by calculating the costs related to the disease classes, the disease groups with the highest diagnostic cost were determined. Because the data were not normally distributed; we used non-parametric Kruskal-Wallis test to compare mean ranks of the groups. Our aim was to determine whether the average diagnostic costs for disease groups differ according to age group, gender and seasons. Following Elliott and Hynan (2011), we also used post-hoc analysis based on Kruskal-Wallis results for multiple comparison of each pair of groups. Statistical analysis was performed with SPSS 24.0 package program.

Results

Descriptive data of the sample were shown in Table 1. In the sample, the majority of the patients was consisted of females with a number of 19,210 (61.2%). The mean ± SD age of patients was 52.89 ± 22.10 years and the patients were not equally distributed between the age groups. Of the 31,401 patients, 9,659 (30.76%) were between 21-40 years, while 8,606 (27.41%) were between the ages of 41-60. A total of 13,579 (43.20%) patients visited family medicine outpatient clinic in 2016 and the number of patients was 8,826 (28.16%) with a decrease of 35% in 2017. There was a total of 8,996 (28.64%) patients who applied to the clinic in 2018. In general, the total number of patients who applied to outpatient clinic was found the highest (30.70%) in the Spring season and Summer season followed that with a total of 7,712 (24.60%) patients.

Table 1. Descriptive data of the sample.

Characteristics	
Mean age, years (SD)	52.89 (22.10)
0-20 years, n (%)	1,256 (4.00)
21-40 years, n (%)	9,659 (30.76)
41-60 years, n (%)	8,606 (27.41)
61-80 years, n (%)	7,222 (23.00)
81 and above, n (%)	4,658 (14.83)
Male, n (%)	12,191 (38.80)
Female, n (%)	19,210 (61.20)
Number of patients by years, n (%)	
2016	13,579 (43.20)
2017	8,826 (28.16)
2018	8,996 (28.64)
Number of patients by seasons n (%)	
Winter	6,983 (22.20)
Spring	9,625 (30.70)
Summer	7,712 (24.60)
Autumn	7,081 (22.50)

Table 2 provided the average diagnostic costs of patients by year and diseases per visit. During the study period, the total average diagnostic cost was $15.32 (73.16 TL) and it was the highest with $18.12 (54.78 TL) in 2016. The average diagnostic cost in total for endocrine and metabolic diseases (EMD) was $19 (72.80 TL) per visit, which was the highest among the diseases. The costs for EMD were $20.88 (63.13 TL), $16.88 (61.61 TL), and $16.9 (81.46 TL), in 2016, 2017 and 2018, respectively. It was followed by digestive system diseases with an average cost of $16.84 (64.50 TL). The lowest cost per diagnosis was $10.10 (38.68 TL) in reproductive system diseases and respiratory system diseases with $11.07 (42.41 TL) as the second lowest on average. Total number of patients differed greatly during the years. While there were 13,579 patients visited family medicine outpatient clinic in 2016, the numbers were down by one third in 2017 and 2018.

Table 2. Diagnostic costs according to years and diseases.

		2016			2017			2018			Average of 3-year			
No	Diseases	n	Total Cost $	Average Cost $/TL	n	Total Cost $	Average Cost $/TL	n	Total Cost $	Average Cost $/TL	N	%	Total Cost $	Average Cost $/TL
1	Endocrine and Metabolic Diseases	4,970	103,781.55	20.88/ 63.13	2,842	47,960.21	16.88/ 61.61	2,239	25,968.08	16.9/ 81.46	9,349	32.24	17,7709.85	19.00/ 72.80
2	General Examination	2,578	48,993.14	18.89/ 57.11	3,059	33,868.12	11.06/ 40.37	3,329	28,988.27	11.43/ 55.09	8,167	28.16	111,849.53	13.69/ 52.45
3	Circulatory System Diseases	1,458	24,912.47	17.09/ 51.67	795	10,743.86	13.51/ 49.31	1,048	10,308.39	11.93/ 57.5	3,117	10.75	45,964.72	14.74/ 56.47
4	Mental and Behavioral Diseases	1,207	19,779.27	16.39/ 49.55	849	11,047.34	13.01/ 47.49	868	6,121.20	9.7/ 46.75	2,687	9.27	36,947.81	13.75/ 52.66
5	Respiratory System Diseases	803	11,263.26	14.03/ 42.42	344	3240.29	9.42/ 34.38	435	2,062.74	6.21/ 29.93	1,479	5.1	16,566.28	11.20/ 42.89
6	Neoplasms and Immune Diseases	471	8,743.72	18.56/ 56.11	177	2,633.79	14.88/ 54.31	215	2,213.52	13.33/ 64.25	814	2.81	13,591.04	16.69/ 63.94
7	Musculoskeletal System Diseases	569	9,119.15	16.03/ 48.47	166	2,325.19	14.01/ 51.14	211	1,804.79	11.5/ 55.43	892	3.08	13,249.13	14.85/ 56.88
8	Neurological Diseases	601	7,001.01	11.65/ 35.22	254	2,310.26	9.1/ 33.22	206	1,353.31	12.53/ 60.39	963	3.32	10,664.58	11.07/ 42.41
9	Reproductive System Diseases	555	6,267.01	11.63/ 35.16	235	1,832.26	7.93/ 28.94	282	1,497.46	8.32/ 40.1	950	3.28	9,596.73	10.10/ 38.68
10	Digestive System Diseases	302	5,130.59	16.99/ 51.37	93	1,528.83	16.44/ 60.01	133	1,340.22	16.75/ 80.74	475	1.64	7,999.65	16.84/ 64.50
11	Infectious Diseases	65	1,109.98	17.08/ 51.64	12	177.05	14.75/ 53.84	30	255.63	9.13/ 44.01	105	0.36	1,542.65	14.69/ 56.26
	Total	13,579	24,6101.15	18.12/ 54.78	8,826	11,7667.20	13.33/ 48.65	8,996	81,913.63	12.37/ 59.62	28,998	100	4,45682	15.35/ 58.80

Note: The average exchange rates (USD/TRY) were 3.02 Turkish Liras (TL); 3.65 TL and 4.82 TL for the years 2016. 2017 and 2018, respectively. The exchange rates were derived from The Central Bank of the Republic of Turkey (http://www.tcmb.gov.tr). Total average cost per case was calculated as $15.35 (58.80TL).

The average diagnostic costs were summarized by season, age groups and gender in Table 3. Total costs of diagnoses were estimated to be $157,319 (750,412 TL) for the spring season and it was the lowest with $104,556 (498,732 TL) in the winter. Kruskal-Wallis test showed that there was a strong evidence of a difference in the average cost of diagnosis between the seasons ($p < 0.001$). To ascertain which pairs of the seasons, differ significantly, we performed a post-hoc analysis based on Kruskal-Wallis results. The average cost of diagnosis was significantly higher ($16.34) in Spring season than other seasons. There was no statistical difference between all pairs of other seasons. 30.65% of the patients were diagnosed in Spring season, while it was the lowest with 6,983 patients in Winter season, at 22.23% of all patients. In addition, the average cost per diagnosis was in a decline during the sample period. The differences in the costs may reflect economic-specific characteristics, as well as seasonal variation of diagnoses.

Table 3. Diagnostic costs according to seasons, age, and gender.

Variables	Categories	2016	2017	2018	Total				p
		Average Cost $/TL	Average Cost $/TL	Average Cost $/TL	N	%	Total Cost $/TL	Average Cost $/TL	
Season	(a)Winter	16.56/ 50.01	13.32/ 48.62	13.79/ 66.47	6,983	22.23	104,556/ 498,732	14.97/ 57.33	<0.001
	(b)Spring	19.24/ 58.10	14.27/ 52.09	13.08/ 63.05	9,625	30.65	157,319/ 750,412	16.34/ 62.58 *(a, c, d)* *	
	(c)Summer	19.07/ 57.59	12.61/ 46.03	10.85/ 52.30	7,712	24.57	113,829/ 542,964	14.76/ 56.53	
	(d)Autumn	16.82/ 50.80	12.93/ 47.19	14.95/ 72.05	7,081	22.55	105,503/ 503,249	14.90/ 57.06	
	Total	18.12/ 54.72	13.33/ 48.65	13.05/ 62.90	31,401	100	481,207/ 2,295,357	15.24/ 58.37	
Age Group	(a) 0-20	15.85/ 47.87	11.61/ 42.38	12.05/ 58.08	1,256	4.00	16,645/ 79,398	13.25/ 50.74 *(b, c, d, e)*	<0.001
	(b)21-40	16.67/ 50.34	12.60/ 45.99	12.42/ 59.86	9,659	30.76	138,058/ 658,538	14.29/ 54.73 *(a, c, d, e)*	
	(c)41-60	19.69/ 59.46	15.71/ 57.34	13.98/ 67.38	8,606	27.40	146,819/ 700,327	17.06/ 65.33 *(a, b, d, e)*	
	(d)61-80	19.63/ 59.28	14.51/ 52.96	13.91/ 67.04	7,222	23.00	119,517/ 570,096	16.55/ 63.38 *(a, b, c, e)* *	
	(e)>81	16.05/ 48.47	10.16/ 37.08	11.56/ 55.71	4,658	14.84	60,168/ 286,998	12.92/ 49.48 *(a, b, c, d)* *	
	Total	18.12/ 54.72	13.33/ 48.65	13.05/ 62.90	31,401	100	481,207/ 2,295,357	15.32/ 56.73	
Gender	(a)Male	18.43/ 55.66	13.63/ 49.75	12.78/ 61.59	12,191	38.80	180,634/ 861,824	14.82/ 56.76 *(b)**	<0.001
	(b)Female	17.60/ 53.15	12.90/ 47.09	13.24/ 63.81	19,210	61.20	300,573/ 1,433,733	15.65/ 59.93 *(a)**	
	Total	18.12/ 54.72	13.33/ 48.65	13.05/ 62.90	31,401	100	481,207/ 2,295,357	15.32/ 58.67	

*denotes pairwise comparisons based on Dunn's test, The letters in the parenthesis show the groups which have statistically significant difference between each pair of the groups, Significance values have been adjusted by the Bonferonni correction for multiple tests, The significance level is 0.01, The average exchange rates (USD/TRY) were 3.02 Turkish Liras (TL); 3.65 TL and 4.82 TL for the years 2016, 2017 and 2018, respectively, The exchange rates were derived from The Central Bank of the Republic of Turkey (http://www.tcmb.gov.tr),

Among all patients, 30,76% was between the age of 21 and 40. Only 4% of the patients was 20 years and younger. The total costs significantly differed by age groups ($p < 0.001$). As a result of multiple comparison analysis, the differences between all pairs of the age groups were statistically significant. The average total cost per diagnosis was significantly higher in 41-60 age group while the oldest ($\geqslant$ 81 years) and youngest ($\leqslant$ 20 years) patients had lower diagnostic costs. Furthermore, the total costs of the diagnoses were $300,573 (1,433,733 TL) in the female group and the average costs in the female group were statistically and significantly higher ($15,65) than the male group ($p < 0.001$).

Discussion

The aim of this study is to examine the diagnostic costs by year and ICD-10 diagnosis groups in a family medicine outpatient clinic. To do this, direct diagnostic costs were analysed based on a three-year data of a family medicine outpatient clinic. Based on three-year data, we have reached notable results. First, it was determined in which disease groups of the family practice outpatient clinic was most frequently admitted. Second, total and average diagnostic costs for these disease groups were calculated. Third, 3-year data gave us the opportunity to examine the trend in diagnostic costs. Based on this, we determined which diseases' total and average diagnostic costs increased or decreased during 3 years. Moreover, we examined how diagnostic costs have shown a trend in both Turkish lira and USA dollar rate for 3 years. Finally, the differentiation of diagnostic costs according to variables such as age, gender and season was determined.

Diagnostic costs according to years

We have expected that the increased number of outpatient clinic visits led to an increase in total diagnostic costs. However, the number of outpatient clinic visits did not increase by years in our study. While there were 13,579 patients visited family medicine outpatient clinic in 2016, patient visits of 2017 and 2018 were 8,826 and 8,996, respectively. Since the number of consulting rooms in the family medicine outpatient clinic has been reduced and moved to another service building, the number of patients in 2017 and 2018 has decreased compared to 2016. In addition, the average diagnostic costs were $18.12 (54.78 TL) in 2016, $13.33 (48.65 TL) in 2017, and $12.37 (59.62 TL) in 2018. Although, there has been no significant increase in diagnostic tests' prices made by Social Security Institution, considering the Turkish Lira (TL), a decrease was observed in the diagnostic costs in 2017, while an increase was observed in 2018. Considering the US dollar ($), on the contrary, it was seen that there was a decrease in diagnostic cost by year. The decrease of the diagnostic cost in US dollar ($) was due to the increase in the dollar's exchange rate. According to Turkish Statistical Institute (TSI) (2018), health expenditure per capita was 1,751 TL in 2017 and it reached to 2,030 TL with an increase of 15.9% in 2018. When health expenditure per capita based on US Dollar ($) was evaluated, it was $480 in 2017 and $430 in 2018 (Turkish Statistical Institute, 2018). Results of our study were in line with Turkish Statistical Institute (Turkish Statistical Institute, 2018).

Diagnostic costs according to diseases

Family Physicians were defined as "[...] personal doctors, primarily responsible for the provision of comprehensive and continuing care to every individual seeking medical care irrespective of age, sex and illness" (Wonca Europe, 2011, p. 6). Therefore, in our study, disease and age variables were wide ranged.

In our study, diseases with the highest diagnostic costs in the total of 3-year were endocrine and metabolic diseases (1), general examination (2), circulatory system diseases (3), mental and behavioural diseases (4), respiratory system diseases (5), respectively. At the same time, these diseases were the top five disease groups having the most patient visits in outpatient clinic. For instance, most of the visits to our outpatient clinic was EMD with 32%. In a review in USA, percentage of EMD was %5 and most of them was obesity and diabetes (Prasad, Sung, & Aggarwal, 2012). According to World Health Organization [WHO] (2016), obesity rate in Turkey was 29.4% and diabetes was 13.2%. Therefore, our result about EMD was compatible with existing literature. The second one was the general examination, which was a code that entered when participant requested a report for marriage, starting work or driver licence, etc. Our results were also in line with the results of Dunn, Rittmueller, and Whitmire (2016) and Wieser and his colleagues (2018). Dunn et al. (2016) reported that the disease categories of circulatory conditions, routine care, musculoskeletal conditions, respiratory conditions, and endocrine system conditions were the five most expensive per capita in USA in 2010. In Wieser and his colleagues' study, cardiovascular diseases, musculoskeletal disorders, mental and substance use disorders, injuries, and urogenital, blood and endocrine diseases were the five highest health expenditure in Switzerland in 2011 (Wieser et al., 2018). In line with our study, Wieser et al. (2018) reported that neoplasms were ranked only sixth among the diseases with the highest total cost.

When the 3-year average diagnostic costs were examined, the diseases with increasing average diagnostic costs were EMD (1), digestive system diseases (2), neoplasms and immune diseases (3), neurological diseases (4), and circulatory system diseases (5). However, in their study with a 10-year data, Dunn et al. (2016) stated that per capita spending growth for endocrine system conditions and circulatory

conditions had the slowdown in USA in the second half of the years of 2000-2010. In our study, the reason for the increase in the diagnostic cost of these diseases may be the increase in facility of diagnostic imaging tests. For example, gastroscopy, which is used to diagnose digestive system diseases, has started to be used after 2017 in our outpatient clinic.

In our study, despite the increase in diagnostic costs of various diseases over the years, there was also a decrease in costs of some diseases which were respiratory system diseases, infectious diseases, general examination, mental and behavioural diseases. The reason for the decrease in the cost of these diseases may be the vaccination, which has been implemented by our polyclinic since 2017. Our outpatient clinic has cooperated with the adult vaccination outpatient clinic since 2017. Patients who applied to our outpatient clinic and were in the risk group were started to be vaccinated. Attack of allergic respiratory diseases and infection may be reduced with vaccination. As a result, the average diagnostic cost of respiratory and infectious diseases may have decreased. It is known that the vaccine is a cost-effective primary protection method (Rémy, Largeron, Quilici, & Carroll, 2015).

Age

It has been acknowledged that medical costs increase with age (Merrill & Fowers, 2019). In our study, average diagnostic costs increased by age, except the age group of over 81 years. The patients who applied on our clinic was mostly over 40 with the ratio of 65. This was associated with an increased in prevalence of chronic diseases worldwide (Lee, Park, & Lee, 2020). Chronic diseases start at middle ages and increase with age and most of the patients are over the age of 65 years. In the United States, about 80% of these older adults have one chronic condition, and about 50% have at least two (Prasad et al., 2012). However, most over the age of 65 have disabilities. Therefore, they cannot be admitted to outpatient clinics. Thus, a decrease in number of visits was observed in our outpatient clinic for patients over 65 years old. Moreover, our finding was consistent with the results of Kucukerdem, Arslan, Koc, and Can (2017). According to their study, the most frequent visits to family medicine outpatient clinic in Izmir was in the 46-64 years of age group with 319 patients (Kucukerdem et al., 2017).

Gender

Medical costs are influenced by several factors including gender (Owens, 2008; Zhang, Crowe, & Meltzer, 2017). Sex differences between women and men include differences in sex hormones and their effects on system organs (Gambineri & Pelusi, 2019). According to Turdep-II study, most of diabetes were mostly in female (Satman et al., 2013). Obesity was prevalent in females, too (Kim, Chun, & Kwon, 2011). Therefore, women significantly tend to apply more on services and spend more health care dollars than men (Owens, 2008). An analysis of Express Scripts' integrated database of medical and pharmacy claims revealed that women contribute to 60% of medical spending and consume 59% of the prescription volume (McNamara, 2001). Our results about the relationship between diagnostic cost and gender were in line with previous studies (Erturk, Sut, & Sipahioglu, 2004; National ambulatory medical care survey [NCHS], 2018).

Seasons

Some diseases are influenced by the season (Chew, Doraisingham, Ling, Kumarasinghe, & Lee, 1998; Paynter, Ware, Sly, Weinstein, & Williams, 2015). Respiratory diseases are the most common human diseases worldwide (Ferkol & Schraufnagel, 2014) and these diseases were mostly common in spring (Yeh, Chou, Huang, Pu, & Chou, 2016). Consistent with literature, the highest total diagnostic cost belonged to spring in our study. Spring was also the season with the most applications to our outpatient clinic.

Theoretical implications

There is a lack of study which examines the trends in the diagnostic costs by year in previous literature. For instance, Dunn et al. (2016) investigated the trends in the cost of illness by years from 2000 to 2010 in United States. However, to our best knowledge, there is a scarcity of studies on diagnostic cost based on longitudinal data. Therefore, our knowledge about diagnostic cost of illness is very limited. From this point, the current study enables us investigate the factors related to the direct diagnostic costs based on a three-year data, which contribute the literature on health costs by indicating the trends in direct diagnostic costs in both Turkish liras and US dollar.

Limitations

Besides its strengths, this study has some limitations. First, the study was carried out in a single centre. This may affect the generalizability of the data. It also includes data over a 3-year period. However, variables affecting patient admission and total diagnostic costs could not be controlled in a 3-year period. For example, reducing the number of rooms for the family medicine polyclinic or moving the polyclinic to another building. In addition, in determining the direct diagnostic cost, only costs which were determined by SSI were calculated and other costs could not be included.

Conclusion

The most important way to control health expenditures is to determine the costs. One of the elements that make up the health expenditure is the diagnostic costs. As a result of this study, it was observed that there was an increase in the diagnostic cost of EMD and digestive system diseases while there was a decrease in the diagnostic cost of respiratory diseases and infectious diseases. In addition, it was found that the average diagnostic cost increased with age, the highest average diagnostic cost belonged to spring, and the average diagnostic cost of female group was higher than male group.

References

Ahn, Y-J, Shin, J-S, Lee, J, Lee, Y. J., Kim, M-R., Park, K. B., … Ha, I-H. (2016). Evaluation of use and cost of medical care of common lumbar disorders in Korea: cross-sectional study of Korean health insurance review and assessment service national patient sample data. *BMJ Open*, *6*(9), 1-12. DOI: https://doi.org/10.1136/bmjopen-2016-012432

Akinci, F., Mollahaliloglu, S., Gursoz, H., & Ogucu, F. (2012). Assessment of the Turkish health care system reforms: a stakeholder analysis. *Health Policy*, *107*(1), 21-30. DOI: https://doi.org/10.1016/j.healthpol.2012.05.002

Asil, T., Celik, Y., Sut, N., Celik, A. D., Balci, K., Yilmaz, A., & Karaduman, F. (2011). Cost of acute ischemic and haemorrhagic stroke in Turkey. *Clinical Neurology and Neurosurgery, 113*(2), 111-114.

Aslan, H., & Top, M. (2016). Cost analysis of treatment transaction in hospitals: cost analysis for lumber discectomy based on transaction costs, billing charges & diagnostic related groups. *SGD- Journal of Social Security*, *6*(2), 167-199.

Beinfeld, M. T., & Gazelle, G. S. (2005). Diagnostic imaging costs: are they driving up the costs of hospital care? *Radiology, 235*(3), 934-939. DOI: https://doi.org/10.1148/radiol.2353040473

Bosco, J., Iorio, R., Barber, T., Barron, C., & Caplan, A. (2016). Ethics of the physician's role in health-care cost control: AOA critical issues. *Journal of Bone & Joint Surgery, 98*(14), e58.

Bozkurt, I., Sunbul, M., Yilmaz, H., Esen, S., Leblebicioglu, H., & Beeching, N. J. (2016). Direct healthcare costs for patients hospitalized with Crimean-Congo haemorrhagic fever can be predicted by a clinical illness severity scoring system. *Pathogens and Global Health, 110*(1), 9-13. DOI: https://doi.org/10.1080/20477724.2015.1136130

Bucak, I. H., Almis, H., Dogan, F., & Turgut, M. (2018). A retrospective analysis of central physician appointment system data in a tertiary health center in Turkey. *Telemedicine and e-Health, 24*(3), 216-221. DOI: https://doi.org/10.1089/tmj.2017.0109

Chew, F. T., Doraisingham, S., Ling, A. E., Kumarasinghe, G., & Lee, B. W. (1998). Seasonal trends of viral respiratory tract infections in the tropics. *Epidemiology & Infection*, *121*(1), 121-128.

Ciarrapico, A. M., Ugenti, R., Di Minco, L., Santori, E., Altobelli, S., Coco, I., … Simonetti, G. (2017). Diagnostic imaging and spending review: extreme problems call for extreme measures. *Medical Radiology*, *122*(4), 288-293. DOI: https://doi.org/10.1007/s11547-016-0721-7

Dunn, A., Rittmueller, L., & Whitmire, B. (2016). Health care spending slowdown from 2000 to 2010 was driven by lower growth in cost per case, according to a new data source. *Health Affairs, 35*(1), 132-140. DOI: https://doi.org/10.1377/hlthaff.2015.1109

Elliott, A. C., & Hynan, L. S. (2011). A SAS® macro implementation of a multiple comparison post hoc test for a Kruskal–Wallis analysis. *Computer Methods and Programs in Biomedicine, 102*(1), 75-80.

Erturk, N. T., Sut, N., & Sipahioglu, F. (2004). A three years' profile of patients referring to family medicine outpatient clinics. *Cerrahpasa Journal of Medicine, 35*(3), 115-121.

Ferkol, T., & Schraufnagel, D. (2014). The global burden of respiratory disease. *Annals of the American Thoracic Society, 11*(3), 404-406. DOI: https://doi.org/10.1513/AnnalsATS.201311-405PS

Gambineri, A., & Pelusi, C. (2019). Sex hormones, obesity and type 2 diabetes: is there a link? *Endocrine Connections*, *8*(1), 1-9. DOI: https://doi.org/10.1530/ec-18-0450

Guvercin, A., Mil, H. İ., & Tarim, B. (2016). Health reforms and the evaluation of health expenditures in Turkey. *SGD – Journal of Social Security, 7*(13), 80-94.

Halperin, J., Katz, M., Pathmanathan, I, Myers, L., Van Sickels, N., Seal, P. S., & Richey, L. E. (2017). Early HIV diagnosis leads to significantly decreased costs in the first 2 years of HIV care in an urban charity hospital in New Orleans. *Journal of the International Association Providers of AIDS Care, 16*(6), 527-530. DOI: https://doi.org/10.1177/2325957417737381

Howell, K. B., Eggers, S., Dalziel, K., Riseley, J., Mandelstam, S., Myers, C. T, ... Harvey, A. S. (2018). Victorian severe epilepsy of infancy study group a population-based cost-effectiveness study of early genetic testing in severe epilepsies of infancy. *Epilepsia, 59*(6)*,* 1177-1187. DOI: https://doi.org/10.1111/epi.14087

Karadeniz, O. (2012). Extension of health services coverage for needy in Turkey: From social assistance to general health insurance. *SGD – Journal of Social Security*, *2*(2), 103-123.

Karagoz, G., Kadanali, A., Ozturk, S., Cakar, S. E., Comoglu, S., & Dogan, F. (2017). The analysis of the cost and amputation rates of hospitalized diabetic foot infection patients. *International Journal of Diabetes in Developing Countries, 37*(2), 201-205. DOI: https://doi.org/10.1007/s13410-016-0524-3

Kim, I-H., Chun, H., & Kwon, J-W. (2011). Gender differences in the effect of obesity on chronic diseases among the elderly Koreans. *Journal of Korean Medical Science*, *26*(2), 250-257. DOI: https://doi.org/10.3346/jkms.2011.26.2.250

Kulkarni, K., & Shepherd, S. (2019). Do we know the cost of orthopaedic care? *International Journal of Health Planning and Management*, *34*(1), 71-86. DOI: https://doi.org/10.1002/hpm.2571

Kucukerdem, H. S., Arslan, M., Koc, E. M., & Can, H. (2017). Retrospective evaluation of family medicine outpatient clinic profile at a tertiary hospital in İzmir. *Journal of Academic Research in Medicine, 7*(3), 112-116.

Labro, E. (2014). Health care costs: discussion of 'the impact of changes in regulation on cost behavior'. *CAR, 32*(2), 567-574. DOI: https://doi.org/10.1111/1911-3846.12114

Lee, M., Park, S., & Lee, K-S. (2020). Relationship between morbidity and health behavior in chronic diseases. *Journal of Clinical Medicine*, *9*(1), 1-11. DOI: https://doi.org/10.3390/jcm9010121

Mac, C. E., & Ozturk, G. Z. (2018). The comparison of patient records admitted to the family medicine polyclinics of an education and research hospital and an educational family medicine center. *Ankara Medical Journal, 18*(1), 14-21. DOI: https://doi.org/10.17098/amj.408959

McNamara, A. (2001). Women's health: issues and opportunities for managed care pharmacy. *Journal of Managed Care & Specialty Pharmacy*, *7*(4), 263-267. DOI: https://doi.org/10.18553/jmcp.2001.7.4.263

Merrill, R. M., & Fowers, R. (2019). To what extent does sex, age and BMI impact medical and pharmacy costs? A retrospective cohort study involving employees in a large school district in the USA. *BMJ Open*, *9*(5), 1-14.

Miller, D. G. (1976). What is early diagnosis doing? *Cancer*, *37*(S1), 426-432.

Minh, H. V., Giang, K. B., Huong, D. L., Huong, L. T., Huong, N. T., Ngan, P., ... Wright, P. (2010). Costing of clinical services in rural district hospitals in northern Vietnam. *International Journal of Health Planning & Management*, *25*(1), 63-73. DOI: https://doi.org/10.1002/hpm.970

Mogyorosy, Z., & Smith, P. C. (2005). *The main methodological issues in costing health care services - a literature review* (CHE Research Paper 242). York, UK: CHE. Retrieved from: http://www.york.ac.uk/inst/che/publications/rp.htm

National ambulatory medical care survey [NCHS]. (2018). *National ambulatory medical care survey: 2014 state and national summary tables*.

Ornoy, A. (2019). Early ADHD treatment provides large economic benefits in Israel. *Pharmaco Economics & Outcomes News, 833*(1)*,* 18-27. DOI: https://doi.org/10.1007/s40274-019-6082-4

Owens, G. (2008). Gender differences in health care expenditures, resource utilization, and quality of care. *Journal of Managed Care & Specialty Pharmacy*, *14*(3), 2-6. DOI: https://doi.org/10.18553/jmcp.2008.14.s3-a.2

Oyando, R., Njoroge, M., Nguhiu, P., Kiruri, F., Mbui, J., Sigilai, A., ... Barasa, E. (2019). Patient costs of hypertension care in public health care facilities in Kenya. *International Journal of Health Planning and Management*, *34*(2), e1166-e1178. DOI: https://doi.org/10.1002/hpm.2752

Okem, Z. G., & Cakar, M. (2015). What have health care reforms achieved in Turkey? An appraisal of the 'Health transformation programme'. *Health Policy, 119*(9), 1153-1163. DOI: https://doi.org/10.1016/j.healthpol.2015.06.003

Ozmen, A., & Gulec, K. (2018). Content analysis of news reflected to the media related to the operation of the central physician appointment system. *Journal of Awareness, 3*(5), 581-590.

Paynter, S., Ware, R. S., Sly, P. D., Weinstein, P., & Williams, G. (2015). Respiratory syncytial virus seasonality in tropical Australia. *Australian and New Zealand Journal of Public Health, 39*(1), 8-10. DOI: https://doi.org/10.1111/1753-6405.12347

Pekgor, S., Eryilmaz, M. A., Solak, I., Pekgor, A., Yaka, H., Kayihan Kaya, I. F., ... Koc, M. (2017). Evaluation of factors affecting the use of the central physician appointment system. *Southern Clinics of Istanbul Eurasasia, 28*(3), 204-211. DOI: https://doi.org/10.14744/scie.2017.36855

Prasad, S., Sung, B., & Aggarwal, B. B. (2012). Age-associated chronic diseases require age-old medicine: role of chronic inflammation. *Preventive Medicine, 54*(Suppl.), S29-S37. DOI: https://doi.org/10.1016/j.ypmed.2011.11.011

Rémy, V., Largeron, N., Quilici, S., & Carroll, S. (2015). The economic value of vaccination: why prevention is wealth. *Journal of Market Access & Health Policy, 3*(1), 1-4. DOI: https://doi.org/10.3402/jmahp.v3.29284

Riewpaiboon, A., Malaroje, S., & Kongsawatt, S. (2007). Effect of costing methods on unit cost of hospital medical services. *Tropical Medicine & International Health, 12*(4), 554-563.

Sahin, I., Ozcan, Y. A., & Ozgen, H. (2011). Assessment of hospital efficiency under health transformation program in Turkey. *Central European Journal of Operations Research, 19*(1), 19-37.

Satman, I., Omer, B., Tutuncu, Y., Kalaca, S., Gedik, S., Dinccag, N., ... Tuomilehto, J. (2013). Twelve-year trends in the prevalence and risk factors of diabetes and prediabetes in Turkish adults. *European Journal of Epidemiology*, *28*(2), 169-180. DOI: https://doi.org/10.1007/s10654-013-9771-5

Smith-Bindman, R., Miglioretti, D. L., & Larson, E. B. (2008). Rising use of diagnostic medical imaging in a large integrated health system. *Health Affairs*, *27*(6), 1491-1502. DOI: https://doi.org/10.1377/hlthaff.27.6.1491

Tarricone, R., & Torbica, A. (2012). Costing and performance in healthcare management. In F. W. Faltin, R. S. Kenett, & F. Ruggeri (Eds.), *Statistical methods in healthcare* (p. 386-406). Wiley Online Library. DOI: https://doi.org/10.1002/9781119940012.ch19

Tahirbegolli, B., Cavdar, S., Sumer, E. C., Akdeniz, S. I., & Vehid, S. (2016). Outpatient admissions and hospital costs of Syrian refugees in a Turkish university hospital. *Saudi Medical Journal, 37*(7), 809.

Turkish Ministry of Health. (2018). *Health statistics yearbook 2017*. Retrieved from https://dosyasb.saglik.gov.tr/Eklenti/30148,ingilizcesiydijiv1pdf.pdf?0

Turkish Statistical Institute. (2018). *Statistics for health expenditure*. Retrieved from: http://www.tuik.gov.tr/PreHaberBultenleri.do?id=30624

Van Baal, P., Perry-Duxbury, M., Bakx, P., Versteegh, M., Van Doorslaer, E., & Brouwer, W. (2019). A cost-effectiveness threshold based on the marginal returns of cardiovascular hospital spending. *Health Economics*, *28*(1), 87-100. DOI: https://doi.org/10.1002/hec.3831

Wieser, S., Riguzzi, M., Pletscher, M., Huber, C. A., Telser, H., & Schwenkglenks, M. (2018). How much does the treatment of each major disease cost? A decomposition of Swiss National Health Accounts. *The European Journal of Health Economics, 19*(8),1149-1161. DOI: https://doi.org/10.1007/s10198-018-0963-5

Wonca Europe. (2011). *The european definition of general practice/family medicine*. Barcelona, ES. Retrieved from https://www.woncaeurope.org/page/definition-of-general-practice-family-medicine

World Health Organization [WHO]. (2016). *Prevalence of diabetes and related risk factors*. Retrieved from: https://www.who.int/diabetes/country-profiles/tur_en.pdf?ua=1

Yardim, M. S., Cilingiroglu, N., & Yardim, N. (2014). Financial protection in health in Turkey: the effects of the health transformation programme. *Health Policy and Planning*, *29*(2), 177-192.

Yasar, G. Y. (2011). 'Health transformation programme' in Turkey: an assessment. *International Journal of Health Planning and Management*, *26*(2), 110-133. DOI: https://doi.org/10.1002/hpm.1065

Yeh, Y-H., Chou, Y-J., Huang, N., Pu, C., & Chou, P. (2016). Seasonal variations of prescriptions for the major syndrome types and manifestations of upper respiratory tract infection in tradition Chinese medicine. *Complementary Therapies in Medicine, 29*(1), 213-218. DOI: https://doi.org/10.1016/j.ctim.2016.10.008

Yigit, V., & Yigit, A. (2016). Financial sustainability of university hospitals. *Mehmet Akif University Journal of Social Science Institute, 8*(16), 253-273. DOI: 10.20875/sb.84868

Zhang, J. X., Crowe, J. M., & Meltzer, D. O. (2017). The differential rates in cost-related non-adherence to medical care by gender in the US adult population. *Journal of Medical Economics*, *20*(7), 752-759. DOI: https://doi.org/10.1080/13696998.2017.1326383