

## COVID-19 costs: an example of province in Turkey

### COVID-19 maliyetleri; Türkiye’de bir il örneği

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#### ABSTRACT

**Objective:** The Coronavirus Disease (COVID-19) pandemic continues to negatively affect Turkey, as it does many other areas all over the world. One effect of COVID 19 has been the significant expenditure increases in health services in post-pandemic countries. Our aim for this study was the following: determining the frequency of outpatient, inpatient, and intensive care treatment in COVID-19 cases, the factors affecting the rates of inpatient and, intensive care treatments, and examining the changes in healthcare costs according to patient characteristics.

**Methods:** This research is a cross-sectional record review. The universe of this study is composed of outpatients and inpatients that have been treated after being diagnosed with COVID 19 as from March 11, the date the pandemic was first seen in Turkey, to November 30, 2020. Within the scope of the study, data relating to the COVID-19 diagnosis, comorbidity, age (<50 and ≥50), and gender were obtained from all primary, secondary, and tertiary healthcare institutions in the province.

**Results:** When the invoices of the inpatients who received no intensive care treatment were examined, it was found that the bills of the male patients aged 50 years

#### ÖZET

**Amaç:** Coronavirüs Hastalığı (COVID-19) pandemisinin tüm dünyada olduğu gibi Türkiye’de de olumsuz etkili olmuştur. COVID 19’un etkilerinden biri, pandemi sonrası ülkelerde sağlık hizmetlerinde yapılan önemli harcama artışları olmuştur. Bu çalışmadaki amacımız; COVID 19 vakalarında ayaktan, yatarak ve yoğun bakımda tedavi sıklığını, yatarak ve yoğun bakım tedavi oranlarını etkileyen faktörleri belirlemek ve hasta özelliklerine göre sağlık bakım maliyetlerindeki değişimleri incelemektir.

**Yöntem:** Bu araştırma, kesitsel bir kayıt incelemesidir. Bu çalışmanın evrenini, pandeminin Türkiye’de ilk görüldüğü 11 Mart 2020 tarihinden 30 Kasım 2020 tarihine kadar COVID-19 tanısı konularak tedavi gören, ayaktan ve yatarak tedavi gören hastalar oluşturmaktadır. Sakarya ilindeki tüm birinci, ikinci ve üçüncü basamak sağlık kuruluşlarından COVID-19 tanısı, komorbidite, yaş (<50 ve ≥50) ve cinsiyet bilgileri alınmıştır.

**Bulgular:** Yatarak tedavi alan hastalardan hiç yoğun bakım tedavisi almayanların hasta faturalarına bakıldığında 50 yaş ve üzeri erkek ve komorbiditesi olan hastaların faturalarının istatistiksel olarak anlamlı

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and older and those with comorbidities were statistically significantly higher. In the patient groups receiving both clinical and intensive care, the mean amount of invoices of female patients and those aged 50 and older were found to be higher ( $p < 0.05$ ). In addition to, In all other patient groups, it has been determined that the invoice amounts are below the patient costs, that is, the invoice amounts do not cover the patient cost.

**Conclusion:** The disease is more severe in those aged 50 and older, those with comorbidities, and it is more severe and more common in males. Consequently, bill amounts and costs of these patients were found to be higher than those of the opposing groups. As a result, the rate of men getting the COVID-19 disease is higher than women. The disease is more severe in males in hospitalized patients, in  $\geq 50$  age group, and in patients with comorbidities. In parallel with these, the invoice amounts and costs of these patients are higher than the opposite groups. In general, the treatment costs of the patients are higher than the invoice amounts and they carry great risks for the future in ensuring the sustainability of the service. Ensuring sustainability in healthcare services depends on the ability of healthcare institutions to obtain invoices to cover their costs. COVID-19 not only creates a big economic burden for reimbursement institutions but also brings a great economic burden for the institutions that provide the service.

**Key Words:** COVID-19, cost, Turkey

derecede yüksek olduğu bulunmuştur. Hem klinik hem de yoğun bakımda tedavi alan hasta gruplarında ise kadın hastaların, 50 yaş ve üzerindekiilerin fatura ortalamaları yüksek saptanmıştır ( $p < 0,05$ ). Ayrıca, diğer tüm hasta gruplarında fatura tutarlarının, hasta maliyetlerinin altında olduğu yani fatura tutarlarının hasta maliyetini karşılamadığı tespit edilmiştir.

**Sonuç:** Hastalık 50 yaş ve üzerindekielerde, ek hastalığı olanlarda daha şiddetli; erkeklerde ise hem daha şiddetli ve hem de daha sık görülmektedir. Sonuç olarak bu hastaların fatura tutarları ve maliyetleri, kıyasladığımız gruplara göre daha yüksek bulunmuştur. Sonuç olarak, erkeklerin COVID-19 hastalığına yakalanma oranı kadınlardan daha yüksektir. Hastalık hastanede yatan,  $\geq 50$  yaş grubunda ve komorbiditesi olan erkek hastalarda daha şiddetli seyretmektedir. Bunlara paralel olarak bu hastaların fatura tutarları ve maliyetleri kıyaslanan gruplara göre daha yüksektir. Genel olarak hastaların tedavi maliyetleri fatura tutarlarından daha yüksek olup hizmetin sürdürülebilirliğini sağlamada gelecek için büyük riskler taşımaktadır. Sağlık hizmetlerinde sürdürülebilirliğin sağlanması, sağlık kurumlarının maliyetlerini karşılayacak ücret alabilmelerine bağlıdır. COVID-19, geri ödeme kurumları için büyük ekonomik yük oluşturması yanında hizmet veren kurumlara da büyük bir ekonomik yük getirmektedir.

**Anahtar Kelimeler:** COVID-19, maliyet, Türkiye

## INTRODUCTION

COVID-19, the biggest epidemic of the twenty-first century, had major negative effects on public health and its systems. As soon as COVID-19 threatening public health started, countries have experienced major disruptions in the management of COVID-19

cases, the provision of routine health services and health financing. With the onset and rapid spread of the pandemic, patient beds and intensive care beds, which were initially reserved for ordinary healthcare services, started to serve pandemic patients with special arrangements (Bhatt et al., 2020; Tandon et al., 2020). It is known that countries have increased

health expenditures in the post-pandemic era. With the emergence of the pandemic, it is thought that there is an increase in both public health expenditures and out-of-pocket health expenditures (Tandon et al., 2020).

COVID-19 is a disease with a high rate of acute respiratory distress and multiple organ failure and death in advanced stages (Chen et al., 2020). It is stated that COVID-19 is more severe and has worse outcomes, especially in people with diabetes, hypertension, chronic heart disease, respiratory diseases, and middle-aged to elderly patients (Bhatt et al., 2020; Garg et al., 2020; Liu et al., 2020; Muniyappa & Gubbi, 2020; Nurchis et al., 2020; Wang et al., 2020). In addition, there is information indicating the disease is more severe and has a higher mortality rate in patients with cancer (Robilotti et al., 2020). Therefore, it is thought that the rate and cost of inpatient treatment and the need for intensive care treatment are higher in patients who have underlying conditions. This is because hospitalization in the ICU generally costs 3-4 times more than the general ward on daily bases (Oostenbrink et al., 2003)

Covid-19 was first diagnosed on March 11th, 2020 and there isn't any official information relating to anyone who caught the disease before that date in Turkey (T.C. Sağlık Bakanlığı COVID-19 Bilgilendirme Platformu, 2020). COVID-19 cases in Turkey are treated according to the condition of the patient, not regarding whether they are an inpatient or an outpatient. The physician decides on the method of treatment according to the clinical condition of the patient, taking into account the existing chronic diseases and age. It is known that the medical characteristics and needs of outpatient patients, inpatients or in need of intensive care as well as their treatment costs are different from each other (Jin et al., 2021).

The COVID-19 pandemic has had major negative consequences on both health financing systems and healthcare institutions worldwide. The rapid spread of the disease, the lack of a well-defined treatment,

the necessity of intensive care treatment in patients, and the long hospitalization periods create an unexpected burden on the healthcare financing systems of countries. The treatment of COVID-19 is very costly for service providers, and for sustainable health services, healthcare providers are required to receive an invoice amount from healthcare financing institutions in a ratio that is adequate to cover the cost. Efficient use of resources is required in terms of effective delivery of health services (Tandon et al., 2020).

In this study, our aim is to determine the frequency of outpatient, inpatient, and intensive care treatment of COVID-19 cases, and to determine the factors affecting the rates of inpatient and intensive care treatments, along with examining the changes in healthcare costs according to the patient characteristics.

## MATERIAL and METHOD

This research is a cross-sectional record review. The universe of this study is composed of outpatients and inpatients that have been treated after being diagnosed with COVID-19 from March 11, the date the pandemic was first seen in Turkey, to November 30, 2020. The permission required for the research was obtained from the Ministry of Health of Turkey (MoH), Sakarya University Non-Invasive Ethics Committee of Medicine Faculty (Date: 04.09.2020 and Number: 715522473/050.01.04/467)

The data for this research was obtained from the Information Processing Unit of the Sakarya Provincial Health Directorate. Within the scope of the study, data relating to COVID-19 diagnosis, comorbidity, age (<50 and ≥50), and gender were obtained from all primary, secondary, and tertiary healthcare institutions in Sakarya Province between a specified date ranges. Patients' diagnoses; Obtained according to ICD10 as Hypertensive diseases (I10-I15), ischemic heart diseases (I20-I25), Malignant neoplasms (C00-C96), Diabetes disease (E09-E14), and Chronic

renal failure (N18) and included in the analysis. In addition, invoice and cost data of inpatients were also obtained. The Social Security Institution (SGK) determines the pricing of health services in Turkey. The prices of drugs, medical equipment/devices, laboratory services, radiology services, and all medical services used for patient treatments are determined according to the Health Implementation Communiqué (SUT) issued by the SGK. Health institutions invoice all the services they provide, all medicines and medical supplies they use at these SUT prices. However, according to the invoicing rules of the SGK, there are some billing restrictions to prevent the health expenditures from showing too much. Institutions providing health services record their health services with SUT prices, but they cannot reflect all of them on the invoice due to invoicing limitations.

In this study, patient costs were calculated over the total amount of all medications, medical supplies, laboratory services, radiology services, and all other medical services used according to the SUT prices. The invoice amounts were obtained from the invoices issued by the health service institutions to the SGK. Then the calculations were converted to dollar-denominated, based on the Central Bank of the Republic of Turkey's (TCMB) buying rate of exchange of USDs in 2020, which was 7.01 Turkish Liras.

### Statistical Analysis

In the first stage of the study, the descriptive characteristics of all patients who received outpatient and inpatient treatments were examined, categorical data were expressed as numbers and percentages, and continuous variables were expressed as mean  $\pm$  SD. The  $2 \times 2$   $\chi^2$  test was used to compare the hospitalization rates of the patient groups and to determine whether the status of receiving intensive care treatment differs according to patient characteristics. The Mann-Whitney U test was used to determine whether patients' invoices and costs varied with patient characteristics. The confidence interval in the study was determined as

95%, significance value was determined as  $p < 0.05$  (Alpar, 2020).

## RESULTS

In Table 1, descriptive information about gender, age, malignant neoplasm and chronic disease groups for all outpatients and inpatients and the  $\chi^2$  test analysis results regarding the comparison of hospitalization rates of these patient groups are given. According to the results of the study; it can be said that the hospitalization rate of female patients (5.1%) is higher than that of male patients (4.8%), and this is statistically significant ( $\chi^2=2.806$ ;  $p<0.05$ ).

Male patients (55.1%) were found to have higher rates of inpatient treatment than females, and patients aged 50 years and older (67.5%) than patients under the age of 50. Of the inpatients, 7.6% consist of hypertensive disease, 3.3% ischemic heart disease, 1.6% malignant neoplasm, 6.4% diabetes, and 2.6% chronic renal failure. According to these results, hospitalization rates were found to be higher in male patients,  $\geq 50$  age group, along with patient groups with hypertension, neoplasm, diabetes and chronic kidney diseases, compared to the opposite groups.

Descriptive statistics and  $\chi^2$  test analysis results of patient groups pertaining to all patients receiving treatment in clinical and intensive care are given in Table 2. According to the findings shown in Table 2, the rate of receiving intensive care treatment in male patients aged over 50 years with hypertension, heart disease, diabetes, and chronic kidney disease was found to be higher than the patients in the opposite group. Fig 1. Bar Chart of number of inpatients and outpatients and hospitalization rate by months (1 March- 30 November 2020). It can be said that the overall number of patients increased generally during the period between March 11, when the first COVID-19 case was seen in Turkey, and November 30, 2020. The low number of tests in the first months of the disease and the fact that the first months coincide with the

**Table 1.** Comparison of hospitalization rates of COVID-19 patients according to demographic and medical features

Patient Groups	Outpatient Treatment (n / %)	Inpatient Treatment (n / %)	Total (n / %)	$\chi^2$	df	p
Female	56110 / 43.8	2983 / 44.9	59093 / 43.9	2.806	1	0.048*
Male	71883 / 56.2	3663 / 55.1	75546 / 56.1			
<50 age	97281 / 76.0	2160 / 32.5	99441 / 73.9	6192,928	1	<0.001*
≥50 age	30712 / 24.0	4486 / 67.5	35198 / 26.1			
Hypertensive Diseases (no)	125051 / 97.7	6144 / 92.4	131195 / 97.4	699,936	1	<0.001*
Hypertensive Diseases (yes)	2942 / 2.3	502 / 7.6	3444 / 2.6			
Ischemic Heart Diseases (no)	127006 / 99.2	6424 / 96.7	133430 / 99.1	468,641	1	<0.001*
Ischemic Heart Diseases (yes)	987 / 0.8	222 / 3.3	1209 / 0.9			
Malignant Neoplasms (no)	127584 / 99.7	6542 / 98.4	134126 / 99.6	258,129	1	<0.001*
Malignant Neoplasms (yes)	409 / 0.3	104 / 1.6	513 / 0.4			
Diabetes Mellitus (no)	125651 / 98.2	6218 / 93.6	131869 / 97.9	666,392	1	<0.001*
Diabetes Mellitus (yes)	2342 / 1.8	428 / 6.4	2770 / 2.1			
Chronic Renal Failure (no)	127565 / 99.7	6476 / 97.4	134041 / 99.6	706,427	1	<0.001*
Chronic Renal Failure (yes)	428 / 0.3	170 / 2.6	598 / 0.4			
Total	127993 / 100.0	6646 / 100.0	134639 / 100.0			

\*p&lt;0,05

**Table 2.** Clinical and intensive care treatment distributions according to the demographic and medical characteristics of the patients

Patient Groups	Clinic (n / %)	Clinic + Intensive Care (n / %)	$\chi^2$	df	p	
Female	2686 / 90.0	297 / 10.0	2983 / 100.0	16.553	1	<0.001*
Male	3180 / 86.8	483 / 13.2	3663 / 100.0			
<50 age	2035 / 94.2	125 / 5.8	2160 / 100.0	109.340	1	<0.001*
≥50 age	3831 / 85.4	655 / 14.6	4486 / 100.0			
Hypertensive Diseases (no)	5451 / 88.7	693 / 11.3	6144 / 100.0	16.405	1	<0.001*
Hypertensive Diseases (yes)	415 / 82.7	87 / 17.3	502 / 100.0			
Ischemic Heart Diseases (no)	5692 / 88.6	732 / 11.4	6424 / 100.0	21.665	1	<0.001*
Ischemic Heart Diseases (yes)	174 / 78.4	48 / 21.6	222 / 100.0			
Malignant Neoplasms (no)	5788 / 88.5	754 / 11.5	6542 / 100.0	17.943	1	<0.001*
Malignant Neoplasms (yes)	78 / 75.0	26 / 25.0	104 / 100.0			
Diabetes Mellitus (no)	5523 / 88.8	695 / 11.2	6218 / 100.0	29.142	1	<0.001*
Diabetes Mellitus (yes)	343 / 80.1	85 / 19.9	428 / 100.0			
Chronic Renal Failure (no)	5732 / 88.5	744 / 11.5	6476 / 100.0	15.009	1	<0.001*
Chronic Renal Failure (yes)	134 / 78.8	36 / 21.2	170 / 100.0			
Total	5866 / 88.3	780 / 11.7	6646 / 100.0			

\*p&lt;0,05

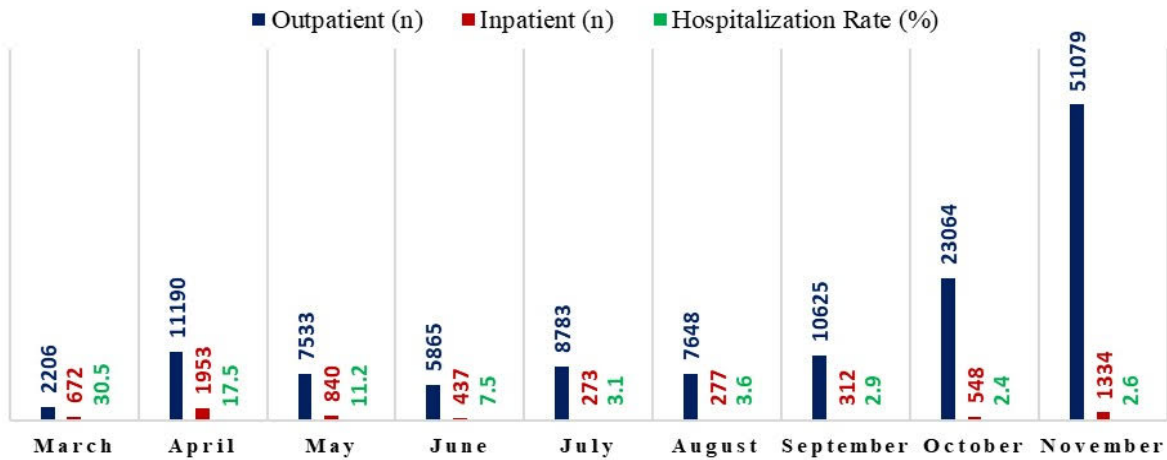


Figure 1. Bar chart of number of inpatients and utpatients and hospitalization rate by months (1 March - 30 November 2020)

summer months may be a partial explanation for the prevalence of the disease and the low number of patients seen in the first months. However, it is evident that the disease started to increase rapidly in the autumn months. When we look at the rates of inpatient treatment in patients with COVID-19, it is seen that there is a decrease over the months. Uncertain situations such as the disease being new worldwide and not knowing how to treat it can be said to be effective in this (See, Fig 1).

When the invoices of the inpatients who received no intensive care treatment were examined (See Table 3), it is found that the amounts of the invoices of male patients, patients aged over 50 years, and patients with hypertensive disease, ischemic heart disease, malignant neoplasm disease, diabetes and chronic kidney failure in diagnosis groups were higher than those of the opposite group patients. It was concluded that the average bill amount of the female patients was higher than that of the male patients, and the bills of the patients aged over 50 years were higher than the patients aged under 50 years in the patient groups treated in the intensive care unit. However, the difference between the invoice amounts of the patients with hypertension disease, ischemic heart disease, malignant neoplasm disease,

diabetes and kidney failure disease and those who do not have was found to be not statistically significant.

Comparison of patient costs by patient groups is given in Table 4. For patients who received only clinical treatment, the difference between the costs of male and female patients was not statistically significant. Despite that, the costs of the patient groups aged over 50 years, patients with hypertension, heart disease, neoplasm, diabetes, and chronic renal failure were higher than the opposite groups. In the patient groups receiving intensive care treatment, only the cost of patients aged over 50 years was found to be higher and statistically significant compared to patients under 50 years. On the other hand, the cost differences in the other groups were not statistically significant.

The results pertaining to the average invoice amounts by patient groups and their average costs calculated according to SUT prices along with cost coverage rates of patient invoices of the patients who received COVID-19 treatment are given in Table 5. While cost coverage rates of invoices are around 93% in patients receiving only clinical treatment, this rate is around 79% in patients receiving both clinical and intensive care treatment. It was found that the average bill amount was higher than the average

costs (approximately 121%) in patients who received treatment only in the clinic and were diagnosed with malignant neoplasms. In all other patient groups, it

has been determined that the invoice amounts are below the patient costs, that is, the invoice amounts do not cover the patient costs.

**Table 3.** Comparison of invoice amounts of patients receiving treatment only in clinics and both clinical and intensive care according to patient groups

Clinic Patient Groups	N	Mean (\$)	Sum (\$)	U	z	p
Female	2686	845.7	2271611.3	4098976	-2.658	0.008*
Male	3180	941.2	2992952.2			
<50 age	2035	552.4	1124047.7	2419721	-23.945	<0.001*
≥50 age	3831	1080.8	4140515.8			
Hypertensive Diseases (no)	5451	872.7	4757102.7	822980	-9.264	<0.001*
Hypertensive Diseases (yes)	415	1222.8	507460.8			
Ischemic Heart Diseases (no)	5692	880.8	5013248.4	335269	-7.268	<0.001*
Ischemic Heart Diseases (yes)	174	1444.3	251315.1			
Malignant Neoplasms (no)	5788	886.3	5130034.2	159375	-4.466	<0.001*
Malignant Neoplasms (yes)	78	1724.7	134529.3			
Diabetes Mellitus (no)	5523	866.9	4787756.9	648903	-9.801	<0.001*
Diabetes Mellitus (yes)	343	1390.1	476806.6			
Chronic Renal Failure (no)	5732	881.6	5053498.8	254842	-6.667	<0.001*
Chronic Renal Failure (yes)	134	1575.1	211064.7			
<b>Total</b>	<b>5866</b>	<b>897.5</b>	<b>5264563.5</b>			
Clinic + Intensive Care Patient Groups	N	Mean (\$)	Sum (\$)	U	z	p
Female	297	2580.0	766268.6	66219	-1.802	0.070
Male	483	2117.8	1022912.7			
<50 age	125	1614.9	201865.2	28076	-5.572	<0.001*
≥50 age	655	2423.4	1587316.1			
Hypertensive Diseases (no)	693	2290.4	1587277.1	28053	-1.056	0.291
Hypertensive Diseases (yes)	87	2320.7	201904.2			
Ischemic Heart Diseases (no)	732	2309.9	1690829.7	16879	-0.456	0.649
Ischemic Heart Diseases (yes)	48	2049.0	98351.6			
Malignant Neoplasms (no)	754	2295.3	1730647.1	9227	-0.509	0.611
Malignant Neoplasms (yes)	26	2251.3	58534.2			
Diabetes Mellitus (no)	695	2262.3	1572274.7	26753	-1.420	0.156
Diabetes Mellitus (yes)	85	2551.8	216906.6			
Chronic Renal Failure (no)	744	2287.5	1701933.0	12647	-0.564	0.573
Chronic Renal Failure (yes)	36	2423.6	87248.3			
<b>Total</b>	<b>780</b>	<b>2293.8</b>	<b>1789181.3</b>			

\*p<0,05

**Table 4.** Comparison of costs of patients receiving treatment only in clinics and both clinical and intensive care according to patient groups

Clinic Patient Groups	N	Mean (\$)	Sum (\$)	U	z	p
Female	2686	910.8	2446354.0	4218573	-0.807	0.420
Male	3180	1006.5	3200739.1			
<50 age	2035	637.6	1297610.7	2717129	-19.128	<0.001*
≥50 age	3831	1135.3	4349482.3			
Hypertensive Diseases (no)	5451	936.4	5104057.6	876920	-7.642	<0.001*
Hypertensive Diseases (yes)	415	1308.5	543035.4			
Ischemic Heart Diseases (no)	5692	944.9	5378178.8	365389	-5.899	<0.001*
Ischemic Heart Diseases (yes)	174	1545.5	268914.2			
Malignant Neoplasms (no)	5788	956.5	5536191.6	182643	-2.900	0.004*
Malignant Neoplasms (yes)	78	1421.8	110901.4			
Diabetes Mellitus (no)	5523	935.2	5165197.2	700325	-8.112	<0.001*
Diabetes Mellitus (yes)	343	1404.9	481895.8			
Chronic Renal Failure (no)	5732	945.3	5418584.8	269908	-5.890	<0.001*
Chronic Renal Failure (yes)	134	1705.3	228508.2			
<b>Total</b>	<b>5866</b>	<b>962.7</b>	<b>5647093.0</b>			
Clinic + Intensive Care Patient Groups	N	Mean (\$)	Sum (\$)	U	z	p
Female	297	2986.6	887011.1	66204	-1.807	0.071
Male	483	2825.2	1364587.0			
<50 age	125	2352.9	294110.0	29297	-5.043	<0.001*
≥50 age	655	2988.5	1957488.0			
Hypertensive Diseases (no)	693	2890.6	2003209.0	29773	-0.188	0.851
Hypertensive Diseases (yes)	87	2855.0	248389.0			
Ischemic Heart Diseases (no)	732	2905.0	2126423.6	16898	-0.443	0.658
Ischemic Heart Diseases (yes)	48	2607.8	125174.4			
Malignant Neoplasms (no)	754	2847.3	2146840.2	8849	-0.844	0.399
Malignant Neoplasms (yes)	26	4029.1	104757.8			
Diabetes Mellitus (no)	695	2907.1	2020432.3	27970	-0.799	0.424
Diabetes Mellitus (yes)	85	2719.6	231165.7			
Chronic Renal Failure (no)	744	2886.8	2147770.2	13190	-0.153	0.878
Chronic Renal Failure (yes)	36	2884.1	103827.8			
<b>Total</b>	<b>780</b>	<b>2886.7</b>	<b>2251598.0</b>			

\*p&lt;0,05



Table 5. Cost coverage rates of patient invoices according to patient groups

Clinic Patient Groups	N	Mean (invoice) (\$)	Mean (cost) (\$)	Cost coverage ratio of the invoice (%)
Female	2686	845.7	910.8	92.86
Male	3180	941.2	1006.5	93.51
<50 age	2035	552.4	637.6	86.62
≥50 age	3831	1080.8	1135.3	95.20
Hypertensive Diseases (no)	5451	872.7	936.4	93.20
Hypertensive Diseases (yes)	415	1222.8	1308.5	93.45
Ischemic Heart Diseases (no)	5692	880.8	944.9	93.21
Ischemic Heart Diseases (yes)	174	1444.3	1545.5	93.46
Malignant Neoplasms (no)	5788	886.3	956.5	92.66
Malignant Neoplasms (yes)	78	1724.7	1421.8	121.31
Diabetes Mellitus (no)	5523	866.9	935.2	92.69
Diabetes Mellitus (yes)	343	1390.1	1404.9	98.94
Chronic Renal Failure (no)	5732	881.6	945.3	93.26
Chronic Renal Failure (yes)	134	1575.1	1705.3	92.37
<b>Total</b>	<b>5866</b>	<b>897.5</b>	<b>962.7</b>	<b>93.23</b>
Clinic + Intensive Care Patient Groups	N	Mean (invoice) (\$)	Mean (cost) (\$)	Cost coverage ratio of the invoice (%)
Female	297	2580.0	2986.6	86.39
Male	483	2117.8	2825.2	74.96
<50 age	125	1614.9	2352.9	68.64
≥50 age	655	2423.4	2988.5	81.09
Hypertensive Diseases (no)	693	2290.4	2890.6	79.24
Hypertensive Diseases (yes)	87	2320.7	2855.0	81.29
Ischemic Heart Diseases (no)	732	2309.9	2905.0	79.52
Ischemic Heart Diseases (yes)	48	2049.0	2607.8	78.57
Malignant Neoplasms (no)	754	2295.3	2847.3	80.61
Malignant Neoplasms (yes)	26	2251.3	4029.1	55.88
Diabetes Mellitus (no)	695	2262.3	2907.1	77.82
Diabetes Mellitus (yes)	85	2551.8	2719.6	93.83
Chronic Renal Failure (no)	744	2287.5	2886.8	79.24
Chronic Renal Failure (yes)	36	2423.6	2884.1	84.03
<b>Total</b>	<b>780</b>	<b>2293.8</b>	<b>2886.7</b>	<b>79.46</b>

### Strengths and limitations of the study

This is the first study to evaluate the costs in Turkey. Therefore, it is valuable in terms of guiding the planning. The first limitation of the research is that it is conducted in only one province. The second limitation is that treatment costs are calculated by SUT prices.

### DISCUSSION and CONCLUSION

The aim of the present study is to determine the frequency of outpatient, inpatient and intensive care treatment of COVID-19 cases to determine the factors affecting the rates of inpatient, and intensive care treatment, as well as examine the changes in healthcare costs according to patient characteristics.

The originality of the present study lies in the fact that as far as we know we are the first to study and examine the treatment costs, invoice amounts, demographic and medical data concomitantly related to COVID-19 patients in Turkey. In the city, with a population of more than one million, data on COVID-19 costs were obtained from all outpatient and inpatients from all primary, secondary and tertiary healthcare institutions. The comorbidities of the patients, which may have an impact on healthcare costs, were also evaluated. Similar to the literature, it has been found that patients with advanced age, hypertension, ischemic heart disease, cancer, diabetes, and chronic kidney disease have a high frequency of hospitalization, and factors such as these increase the need for intensive care. In the literature, the incidence of COVID-19 is similar in men and women, or slightly higher in men. The course of the disease is more severe in men (Wenham et al., 2020).

According to the results of the research, it can be said that COVID-19 disease is more common in men than women and this finding is compatible with the literature (Bhatt et al., 2020; Liu et al., 2020). Additionally, although the rate of male patients receiving inpatient treatment is lower than that of women, the disease progressed more severely in males and they received more intensive care treatment. This

finding is also compatible with the literature indicating the disease is more severe in male patients (Sharma et al., 2020; Wenham et al., 2020). Saying that the number of patients with at least one or more comorbidity is higher than male patients would be effective in this finding. The majority of COVID-19 patients are aged less than fifty years. It is noteworthy that the amount of the invoices of male patients receiving treatment only in clinics is higher than those of female patients, but the amount of the invoices of female patients receiving treatment in both clinic and intensive care are higher than those of male patients. In parallel with this, although the treatment costs of male patients who receive treatment only in the clinic are higher than the costs of female patients, it is observed that the costs of female patients receiving intensive care and clinical treatment are higher than the costs of male patients.

It can be said that the rate of inpatient treatment in patients aged 50 years and over is approximately six times higher than the rate of inpatient treatment within the age group under than 50. This is in line with the literature (Garg et al., 2020; Grasselli et al., 2020)

Likewise, it was found that patients aged 50 years had a high rate of intensive care treatment. Patient invoices and patient costs were found to be higher in patients  $\geq 50$  years of age, as expected. This situation can be explained by the higher rates of comorbidity in patients  $\geq 50$  years of age. Comorbidities such as hypertension, ischemic heart disease, cancer, diabetes, and chronic kidney disease are known to affect hospitalization rates and the course of the disease (Garg et al., 2020; Grasselli et al., 2020; Liu et al., 2020; Sharma et al., 2020). In this study, it was observed that comorbidities increase the rates of inpatient treatment and the need for intensive care treatment. In other words, it was found that the disease progressed more severely in these patients. In parallel with these, it was observed that the invoice amounts were generally higher in the patient groups with comorbidities who received both only clinical and clinical and intensive care treatment together. In this respect, the invoice amount of the patient groups is higher in the patient groups with

comorbidity that receive only clinical treatment and both clinical and intensive care treatment.

When the cost data of the patients are examined, it is seen that comorbidities increase the treatment costs of patients who receive both clinical and intensive care treatment. Although the bills of the group without heart and cancer disease were found to be lower in the patient bills, it is seen that the costs of cancer patients were higher. Although the costs of patients with cancer disease are high, the lower invoice amounts are due to the invoicing criteria determined by the SUT in the country.

When the first documented cases of COVID-19 in Turkey are examined, there was a relative decline in the frequency of hospitalization with the escalation of cases in October in comparison with the spring and summer periods. It can be said that this is related to the increase in knowledge about the disease and its treatment, as well as the reduction of the indications for inpatient treatment and the constant hospital bed capacities despite the increase in the number of cases.

In this study, only the treatment costs of COVID-19 were included in the scope of the evaluation, and the expenditures made by the hospitals due to COVID-19 disease other than the treatment against the high contagiousness of the disease and the risk of advanced life, the costs caused by the patients' out-of-pocket expenses and labor losses were not taken into consideration. In general, COVID-19 patient costs were higher than the invoice amounts in patients who received both clinical and intensive care treatment. On the contrary, it has been observed that the invoices of cancer patients who receive treatment only in the clinic are higher than the treatment costs. In other words, it can be said that health institutions operate at a loss in the COVID-19

battle except for the patients with cancer receiving treatment only in the clinic. Therefore, invoice amounts of the institutions providing health services should meet the treatment costs is paramount to the sustainability of health services, which is an urgent matter that health policymakers and reimbursement institutions should take the necessary steps.

On the other hand, the warnings to stay at home, which help enforce positive practices, and the fact that people do not leave the house with prohibitions, are among the positive aspects of the cost that should be taken into account. The fact that COVID-19 is seen more frequently over the age of 50 and is also seen in people of active working age are among financially negative aspects (Nurchis et al., 2020).

As a result, the rate of men getting the COVID-19 disease is higher than women. The disease is more severe in males in hospitalized patients, in  $\geq 50$  age group, and in patients with comorbidities. In parallel with these, the invoice amounts and costs of these patients are higher than the opposite groups. In general, the treatment costs of the patients are higher than the invoice amounts and they carry great risks for the future in ensuring the sustainability of the service. Ensuring sustainability in healthcare services depends on the ability of healthcare institutions to obtain invoices to cover their costs. COVID-19 not only creates a big economic burden for reimbursement institutions but also brings a great economic burden for the institutions that provide the service.

It may be suggested to make direct and indirect cost calculations for future studies. It is an inevitable fact for the sustainability of health services the payment for invoices by reimbursement institutions to the service providers would be at a rate that meets the minimum treatment costs.

#### ETHICS COMMITTEE APPROVAL

\* The study was approved by the Sakarya University Non-Invasive Ethics Committee of Medicine Faculty (Date: 04.09.2020 and Number: 715522473/050.01.04/467).

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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