Araştırma Makalesi ● Research Article

The Burden of Covid-19 Cases on the Payer Institution: The Case of Aydın Provincial Ambulance Service

Covid-19 Vakalarının Ödeyici Kurum Üzerindeki Yükü: Aydın İl Ambulans Servisi Örneği

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Abstract: The study aims to analyze the economic burden of Covid-19 cases on the payer using ambulance services and to investigate the factors affecting costs. Data were obtained from Aydın Provincial Ambulance Service. Ethical approval was received from social research ethics committee (2022/08-11; 26.04.2022). Descriptive statistics were used for findings. The logistic regression model was used to examine the factors affecting costs. Covid-19 cases posed a significant economic burden. The cost per case was 466.40 TL, which was higher with additional diagnoses. The pandemic created a higher economic burden in 2020. Covid-19 cases accounted for 14.92% of the cases and 14.75% of the costs, with a cost per case of 447.12 TL. In the second year (2021), the burden decreased significantly. The share of Covid-19 cases was 7.69%, while the cost was 7.12%. The average cost was 503.6 TL. Age, triage, call reason, urban & rural, and region variables had a significant effect. A significant relationship existed between older age and higher costs. The implementation of principles and practices including risk and crisis management will contribute to reducing costs.

Keywords: Covid-19, Ambulance Service, Payer Institution, Economic Burden

Öz: Çalışmanın amacı Covid-19 vakalarının ödeyici kurum üzerindeki ekonomik yükünü ambulans servisi hizmetleri bağlamında değerlendirmek, maliyetleri etkileyen faktörleri araştırmaktır. Veri Aydın İl Ambulans Servisi'nden temin edilmiştir. Sosyal araştırmalar etik kurulundan etik onay alınmıştır (2022/08-11; 26.04.2022). Tanımlayıcı bulgular için kümülatif sıklık, kümülatif yüzde ve ortalama (standart sapma) istatistikleri kullanılmıştır. Maliyetleri etkileyen faktörlerin incelenmesi amacıyla lojistik regresyon modeli kullanılmıştır. Covid-19 vakaları, önemli ölçüde ekonomik yük oluşturmuştur. Vaka başına maliyet yaklaşık 466,40 TL olup ek tanılar ile birlikte bu tutar daha yüksek olmuştur. Pandemi 2020 yılında daha fazla ekonomik yük oluşturmuştur. Buna göre, Covid-19 vakaları, vaka sayısının %14,92'sini, maliyetlerin ise %14,75'ini oluşturmuş, vaka başına ortalama maliyet 447,12 TL olmuştur. İkinci yılda (2021) pandeminin ekonomik yükü önemli ölçüde azalmıştır. Buna göre, Covid-19 vakalarının payı %7,69 iken maliyet payı ise %7,12 olmuştur. Söz konusu yılda ortalama maliyet 503,6 TL olmuştur. Yaş, triaj, çağrı nedeni, kent & kır ve bölge değişkenleri maliyetler üzerinde anlamlı

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etkiye sahiptir. İleri yaşta bulunma ile vaka başına yüksek maliyetler arasında istatistiksel olarak anlamlı ilişki bulunmaktadır. Risk ve kriz yönetimi ile ilgili ilke ve uygulamaların hayata geçirilmesinin maliyetlerin düşürülmesine katkı sağlayacağı değerlendirilmektedir.

Anahtar Kelimeler: Covid-19, Ambulans Servisi, Ödeyici Kurum, Ekonomik Yük

Introduction

The coronavirus disease 2019 (Covid-19), caused by the transmission of the SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2) virus, has had a challenging impact on healthcare systems and payers worldwide since its emergence and continues to threaten public health globally (Abiad, et al, 2020; Li, et al, 2020a). When the course of the pandemic worldwide is examined as of 5 April 2022, 490.853,129 cases and 6.155,344 deaths attributed to the pandemic were reported. In terms of Turkey, the number of Covid-19 cases was 14.907,378 and the number of deaths attributed to the disease was 98.197 as of 5 April 2022 (WHO, 2022). While increasing costs and budget pressures, as well as limited resources in the field of healthcare services, are intensely experienced, the disease, which was declared a pandemic by the World Health Organization (WHO) in March 2020, has brought about cost increases that have the potential to have profound effects in the field of healthcare services (Gray, et al, 2011; Ajmal, et al, 2021: 291). The disruptions in the supply chain, which is closely related to healthcare delivery, the increase in the burden of disease attributed to Covid-19 disease and the dramatic increase in healthcare expenditures reveal the challenges for healthcare providers and payers (Ajmal, et al, 2021: 292). It is reported that the isolation of patients with symptoms of Covid-19 disease, and diagnostic intensive care services, when necessary, have significantly increased healthcare costs and the burden on payer institutions in Turkey as in the world (Cunninghom, et al, 2020: 91; Liew, et al, 2020: 83). In a study on the process after hospitalization of Covid-19 cases, it was reported that 41.8% (84 patients) of the examined patient cohort developed acute respiratory distress syndrome (ARDS) and 26.4% (53 patients) were admitted to the intensive care unit (Wu, et al, 2020: 58). Covid-19 disease, which brings with it intensive use of drugs, services, and materials in healthcare services, reveals that clinical management of Covid-19 cases in hospitals is very costly, and early intervention is critical to reducing the economic burden of these cases on payer (Yang, et al, 2020: 81; Li, et al, 2020b). In this regard, the critical importance of ambulance services, where Covid-19 cases are assessed with a proactive approach, comes to the fore. The services provided by the ambulance service are health services that protect the health of patients before the hospital, provide critical emergency health services to these patients, and try to prevent the progression of the patient's health condition until the hospital service is provided. In these services, which are carried out with a team approach, the main priority of ambulance service is transfer of patients in need of emergency health care to the appropriate health institution by providing optimal treatment, accompanied by the necessary first aid and emergency health care services (Göçen & Ateş, 2013: 98). Ambulance personnel taking the Covid-19 case into the ambulance with personnel protective equipment sets, firstly evaluating the fever pulse and blood pressure findings of the case, examining the saturation value, starting oxygen when deemed necessary, opening the vascular access of the case, starting isotonic serum if hypotensive, electrocardiography (ECG), administration of medication in case of any anomaly, interrogation of chronic conditions, administration of medication when deemed necessary after obtaining blood glucose levels, decontamination of the ambulance after delivery of the patient to the hospital are procedures performed for a typical Covid-19 case. This situation shows that the use of drugs, services, and especially materials is intensive while providing emergency healthcare services to Covid-19 cases, and therefore these cases constitute an economic burden for the payer (Tian, et al, 2020: 399). In Turkey, emergency health services are provided by the Provincial Ambulance Service Chief Physicians under the General Directorate of Emergency Health Services of the Ministry of Health. These services provided by the relevant Chief Directorates are within the scope of reimbursement and the cost incurred is largely invoiced to the Social Security Institution (SSI). It is reported that before the Covid-19 pandemic, the caseload on ambulance services, and therefore the cost burden on payer institutions, was significantly higher. With the pandemic, the caseload on ambulance services and the cost burden on payers have

increased dramatically. As a new experience for health systems, the findings obtained regarding the pandemic are expected to feed into the political decision-making processes for health systems and payer institutions in case of a new pandemic. Therefore, it is considered that this situation makes it a priority to investigate the economic impact of Covid-19 cases receiving services from provincial ambulance services. It is seen that there are different types of studies on Covid-19 disease in the literature (Li, et al, 2020b; Chen, et al, 2020). These studies generally draw attention to the costs of Covid-19 cases at the hospital level. However, when the literature findings are closely examined, it is understood that the findings revealing the costs of Covid-19 cases receiving emergency healthcare services from ambulance services are insufficient. To the knowledge of the researchers, there is no study that addresses the burden of Covid-19 cases receiving emergency healthcare services on the payer institution (Social Security Institution) in Turkey. Therefore, the aim of the study is to examine the cost burden of Covid-19 cases on the payer institution and to investigate the factors affecting these costs. The main motivations of the study are that the pandemic, which has created a significant strain on health systems and payer institutions worldwide and in Turkey, has been evaluated in the context of ambulance services, and the factors affecting the costs of Covid-19 cases have been addressed for the first time in Aydın Provincial Ambulance Service (APAS) in Turkey. It is considered that our study is unique in these aspects and will provide useful information for the healthcare system and payer institutions in case of a new pandemic.

Method

Aims

The study aims to examine the costs of Covid-19 cases receiving emergency healthcare services from the provincial ambulance service on the payer institution and to investigate the factors affecting these case costs.

Data Source

The case data used in the study were obtained using the APAS Emergency Automation System (EAS) database. Case data on emergency healthcare service use covers the dates 01.01.2020 - 31.12.2021. Social research ethics committee approval was provided from İzmir Katip Çelebi University (2022/08-11; 26.04.2022). In addition, administrative permission was obtained from Aydın Provincial Health Directorate.

Preliminary Analysis

Following the provision of data from APAS, the data obtained was subjected to a preliminary analysis process. In this process, the data was made ready for analysis by considering whether there were duplications in the cases, missing data, etc. in the data. To conduct in-depth research on the case data, the data in question was taken into the RStudio environment offered within the framework of the R programming language, and various research were conducted on the data. The findings obtained at the first stage were that Covid-19 cases were not entered homogeneously in EAS. While some cases were only included in the system as 2019-Ncov (Novel Coronavirus) Disease (Covid-19), it was understood that for some cases, the International Classification of Diseases 10 (ICD10) code was included as other observations for suspected diseases and conditions. The third author of the study, who works as an emergency medical technician in the field of emergency healthcare service delivery, stated that the cases whose ICD10 diagnosis code was entered as other observation for suspected diseases and conditions showed the same symptoms as Covid-19 cases and that these cases applied to ambulance services with Covid-19 complaints, but these cases did not have Covid-19 tests and/or test results. From this point of view, the research on the data showed that the average cost of cases with other observation diagnoses for suspected diseases and conditions (472.25 TL (81.98 TL)) was similar to the average cost of Covid-19 cases (466.40 TL (85.59 TL)), so these cases were accepted as Covid-19 cases and analyses were conducted.

Analysis

To reveal the weight of Covid-19 cases within the cases, various codes and filters were used in RStudio to define the burden of Covid-19 cases on the payer using frequency, cumulative %, cost, cumulative %, and mean (standard deviation) statistics. At this stage, only the burden of Covid-19 cases in total cases was summarized. Then, for the years in question, cases with one or more diagnoses in addition to Covid-19 were evaluated. At this point, cases with Covid-19 and one or more diagnoses were evaluated similarly, and the weight of Covid-19 among these cases was summarized in detail with descriptive findings.

Modeling and Statistical Analysis

Logistic regression analysis was used to investigate factors affecting costs per Covid-19 case. The data obtained from AİAS consist of gender (male, female), age, region (in-region, out-of-region), urban & rural (urban, rural), the reason for call (medical, health measures, transfer, other, protocol), triage (code red, code yellow, code black, social indication, code green) and cost per case variables. Since the cost variable is measured continuously, it was reconstructed as low cost (average cost $\leq$ 466.40 TL) and high cost (average cost > 466.40 TL). Since the study investigated the burden of Covid-19 cases on the payer, the total costs per case were based on the costs invoiced to the payer by APAS. While the total cost per case for Covid-19 is the dependent variable of the study, all other variables except the ICD10 code are considered as independent variables. Chi-Square ($X2$) test was used to test the logistic regression analysis conducted to examine the effect of independent variables on the dependent variable. To test the significance of the model as a whole, the significance level (p) of the significance tests of the z value was taken as a basis. The significance level for statistical significance was set as 0.05. Tolerance and Variance Inflation Values (VIF) were also examined to investigate whether there is auto-correlation between independent variables and to evaluate whether there is any correlation between independent variables. According to these values, the yellow and black codes in the triage factor were found to be highly correlated with the other independent variables in the model, so these variables were removed from the model. Since the dependent variable (cost per case) was tried to be measured in the analyses, Cox and Snell R2 (R^2CS) and Nagelkerke R2 (R^2N) values were used to evaluate how much (%) of the variance in the dependent variable was explained by the independent variables included in the model. Regression coefficients and Odds ratio (OR) values were interpreted to investigate the effect of the variables in the model on the dependent variable in the presence of other variables. For Covid-19 cases, in the presence of other variables, the adjusted R^2N value was interpreted to reveal to what extent the change in the independent variables created a change in the variance of the costs per case. The jamovi package program was used in the logistic regression analysis process in order to reveal the factors affecting the costs incurred in terms of the payer institution in Covid-19 cases receiving emergency health services from APAS (Kuhn and Johnson, 2013; the jamovi project, 2022).

Findings

Descriptive findings of the cases are summarized in Table 1 below.

Table 1. Descriptive Findings Related to Covid-19 Cases

Variables/Statistics	F	%	Mean (Standard Deviation)
Gender			
Male	11.475	46,97	
Female	12.954	53,03	-
Age	-	-	49,66 (21,72)
Region			
Within Region	23.552	96,41	
Out of Region	877	3,59	-
City & Country			
Urban	18.479	75,64	
Rural	5.950	24,36	-
Call Reason			
Medical	22.958	93,98	
Health Measures	116	0,47	
Transfer	1.301	5,33	-
Other	53	0,22	
Protocol	1	0,00	
Triage			
Code Red	159	0,65	
Code Yellow	8.194	33,54	
Code Black	11	0,05	-
Social Indication	204	0,84	
Code Green	15.861	64,93	
Cost	-	-	466.40 TL (85.59 TL)

According to Table 1, there were a total of 24.429 cases who received emergency healthcare services with a diagnosis of Covid-19 from APAS. 46.97% (11.475 cases) were male and 53.03% (12.954 cases) were female. The mean age (standard deviation) of Covid-19 patients was 49.66 (21.72). Of the cases, 96.41% (23.552 cases) were intervened in the region and 3.59% (877 cases) were intervened outside the region. Of these cases, 75.64% (18.479 cases) were intervened in urban areas and 24.36% in rural areas. Approximately 94% of cases (22.958 cases) received services for medical reasons. 64.93% (15.861 cases) and 33.54% (8.194 cases) received services with code green and code yellow, respectively, while the remaining cases received services mostly with the social indication (0.84%; 204 cases), code red (0.65%; 159 cases) and code black (0.05%; 11 cases), respectively. The average cost for cases was 466.40 TL (85.59 TL). The frequency and cost findings regarding the cases receiving services from APAS are presented in Table 2 below.

Table 2. Frequency and Cost Findings for Cases

Case Name	F	Cumulative %	Cost (TL)	Cumulative %	x̄ (TL) ± s (TL)
Frequency and cost findings for cases (overall)					
2019-Ncov (Novel Coronavirus) Disease	24.429	11,30	11.393.775,00	10,57	466,40 ± 85,59
Anxiety Disorders, Other	6.185	14,16	2.437.677,50	12,83	394,12 ± 141,47
Nausea and Vomiting	4.956	16,45	2.383.548,00	15,04	480,94 ± 122,97
Acute Myocardial Infarction	4.010	18,30	2.324.793,00	17,20	579,74 ± 139,49
Essential (Primary) Hypertension	4.864	20,55	2.269.238,00	19,31	466,53 ± 130,71
.	.	.	.	.	.
.	.	.	.	.	.
General	216.254	100	107.784.499,28	100	498,41 ± 164,13
Frequency and cost findings for cases with Covid-19 and other diagnosis codes (overall)					
2019-Ncov (Novel Coronavirus) Disease	24.429	87,30	11.393.775,00	86,36	466,40 ± 85,59
2019-Ncov (Novel Coronavirus) Disease, Dyspnea	293	89,40	152.165,00	88,55	519,33 ± 100,2
2019-Ncov (Novel Coronavirus) Disease, Cough	295	88,35	137.068,00	87,4	464,63 ± 64,58
2019-Ncov (Novel Coronavirus) Disease, Nausea and Vomiting	274	90,38	132.977,00	89,56	485,31 ± 72,89
2019-Ncov (Novel Coronavirus) Disease, Respiratory Abnormalities	198	91,08	105.115,00	90,36	530,88 ± 139,92
.	.	.	.	.	.
.	.	.	.	.	.
General	27.984	100	13.192.627,50	100	471,43 ± 93,01
Frequency and cost findings for cases (2020)					
2019-Ncov (Novel Coronavirus) Disease	16.089	14,92	7.193.726,50	14,75	447,12 ± 72,65

Anxiety Disorders, Other	2.759	17,48	960.192,50	16,72	348,02 ± 100,33
Essential (Primary) Hypertension	2.400	19,70	994.034,00	18,76	414,18 ± 112,52
Nausea and Vomiting	2.228	21,77	959.849,00	20,72	430,81 ± 113,16
Acute Myocardial Infarction	1.894	23,53	1.006.695,50	22,79	531,51 ± 134,15
.	.	.	.	.	.
.	.	.	.	.	.
General	107.841	100	48.775.950,77	100	452,29 ± 149,76
Frequency and cost findings for cases (2021)					
2019-Ncov (Novel Coronavirus) Disease	8.340	7,69	4.200.048,50	7,12	503,60 ± 95,78
Anxiety Disorders, Other	3.426	10,85	1.477.485,00	9,62	431,25 ± 157,92
Nausea and Vomiting	2.728	13,37	1.423.699,00	12,03	521,88 ± 115,27
Essential (Primary) Hypertension	2.464	15,64	1.275.204,00	14,20	517,53 ± 127
Acute Myocardial Infarction	2.116	17,59	1.318.097,50	16,43	622,91 ± 129,72
.	.	.	.	.	.
.	.	.	.	.	.
General	108.413	100	59.008.548,51	100	544,29 ± 164,93

According to the findings, cases receiving services with Covid-19 diagnosis are in the first place. Accordingly, 11.30% (24.429 cases) of the cases receiving services in 2020 and 2021 were diagnosed with Covid-19. When the situation is examined in terms of costs, 10.57% (11.393,775.00 TL) of the total cost incurred for the years in question is composed of cases receiving services with the diagnosis of Covid-19. The average cost of cases receiving services with this diagnosis was 466.40 TL (85.59 TL). When the findings are closely examined, it is understood that Covid-19 cases receiving services from APAS show a heterogeneous structure. Accordingly, 87.30% of the cases (24.429 cases) received services with Covid-19 diagnosis, while 12.70% of the cases (3.555 cases) received services with other diagnoses in addition to Covid-19 diagnosis. In terms of total costs, cases diagnosed with dyspnea, cough, nausea and vomiting, respiratory abnormalities, malaise and fatigue, and essential (primary) hypertension in addition to the Covid-19 diagnosis were found to generate the highest costs, respectively. When the findings are evaluated in general, it is seen that the average cost for patients diagnosed with Covid-19 is 466.40 TL (85.59 TL), and when patients with other diagnoses are taken into consideration, it is seen that the average cost per case for the payer institution has increased by approximately 17%. According to the findings, the proportion of cases receiving services from APAS with Covid-19 diagnosis was 14.92% (16.089 cases) in 2020. The cost of cases receiving services with this diagnosis was 14.75% (7.193,726.50 TL). When examined in terms of frequency and total cost findings, it is understood that cases receiving services with Covid-19 diagnosis constitute a significant economic burden for the payer institution. On the other hand, although there is a significant cost burden

on the payer institution due to pandemic conditions, 85.25% (41.582,224 TL) of the costs incurred on the payer institution are due to cases with other diagnoses. For 2020, the average cost of cases receiving services with Covid-19 diagnosis was 447.12 TL (72.65 TL), similarly dominating other cases. On the other hand, in 2021, the proportion of cases diagnosed with Covid-19 from APAS decreased compared to 2020 and was 7.69% (8.340 cases). As can be understood, in 2021, there was a decrease of approximately 48.1% in the frequency of cases on APAS, and therefore on the payer. Although there was a downward trend in Covid-19 cases, it is understood that Covid-19 cases still created a significant cost burden on the payer in 2021. In terms of cost findings, the share of the cost of Covid-19 cases to the payer institution in 2021 was 7.12% (4.200,048.50 TL). The cost burden on the payer institution decreased by approximately 41% compared to 2020. Overall, the average cost of Covid-19 cases on payers was 503.60 TL (95.78 TL). The overall case cost for 2021 was 544.29 TL (164.93 TL). The findings of the logistic regression analysis are presented in Table 3 below.

Table 3. Logistic Regression Analysis Findings

Variables	B	SE	Z	p	95% Confidence Level		OR	95% Confidence Level	
					Lower Limit	Upper Limit		Lower Limit	Upper Limit
Constant	-6.57	72.46	-0.09	0.92	-148.60	135.44	0.00	2.90e-65	6.68e+58
Gender									
Male	0.00	0.02	0.33	0.73	-0.04	0.06	1.00	0.95	1.06
Age	0.00	0.00	7.99	**0.00**	0.00	0.00	1.00	1.00	1.00
Urban & Rural and Regional									
Urban	-1.24	0.03	-37.05	**0.00**	-1.30	-1.17	0.28	0.2700	0.308
Intra-region	-0.94	0.09	-10.18	**0.00**	-1.12	-0.76	0.38	0.3250	0.467
Call Reason									
Medical	8.33	72.46	0.11	0.90	-133.68	150.36	4176.06	8.71e-59	2.00e+65
Health Measures	8.41	72.46	0.11	0.90	-133.60	150.44	4528.34	9.44e-59	2.17e+65
Transfer	8.73	72.46	0.12	0.90	-133.29	150.75	6191.12	1.29e-58	2.97e+65
Other	8.04	72.46	0.11	0.912	-133.98	150.07	3117.60	6.50e-59	1.50e+65
Protocol	-0.65	0.0292	-22.37	**0.00**	-0.70	-0.59	0.52	0.49	0.551
Triage									
Red	0.53	0.17	3.00	**0.00**	0.18	0.88	**1.71**	1.20	2.43
Social indication	-2.25	0.82	-2.72	**0.00**	-3.87	-0.63	0.10	0.02	0.53
Green	-0.96	0.16	-5.94	**0.00**	-1.28	-0.64	0.38	0.27	0.52
χ^2=2781 df=12 p < 0.001 R²CS=0.108 R²N=0.144									

According to Table 3, the model as a whole is significant (χ^2=2781; df=12; p < 0.001). When the effect of the variables in the model on costs per case was examined, age (Z=7.99; OR=1.00; p<0.00), code red (Z=3.00; OR=1.71; p<0.00), social indication (Z=-2.72; OR=0.10; p<0.00), urban (Z=-37.05; OR=0.28; p<0.00) and intra-regional (Z=-10.18; OR=0.38; p<0.00) variables on costs per case were found to be statistically significant. The effect of other variables in the model on costs per case was not statistically significant. Since the coefficients for age and code red variables are positive, it is understood that these variables are significant predictors of the increase in costs per case. The negative coefficients for the urban and intra-regional variables indicate that these variables are significant predictors of the decrease in costs. Accordingly, the cost of urban interventions is significantly lower than the cost of rural interventions and this difference is found to be significant. On the other hand, the cost of Covid-

19 cases intervened within the region is significantly lower than the cost of cases intervened outside the region and the difference is significant. When the situation is evaluated in terms of the risk they pose to the increase in costs, it is understood that Covid-19 cases with code red are the most important risk factor for the payer (OR=1.71, 95% CI [1.20-2.43]). Overall, R^2CS and R^2N values were 0.108 and 0.144, respectively. These findings showed that approximately 14% of the variance in costs per case was explained by the independent variables in the model.

Discussion

This study investigated the costs of Covid-19 cases receiving emergency healthcare services from APAS on payers and the factors affecting these costs. The findings of the study, which were obtained with the case-cohort specifically addressed in APAS, clearly showed that Covid-19 disease poses a significant economic burden on the payer institution. The findings showed that the share of Covid-19 cases in the total number of cases was 11.30%, while its share in total costs was 10.57%. The total budget impact of Covid-19 cases in Aydın province was 11.393,775.00 TL and the average cost per Covid-19 case was 466.40 TL (85.59 TL). Of the cases with one or more diagnoses in addition to the Covid-19 diagnosis, 12.7% had at least one additional diagnosis. The share of this case-cohort in total costs was 13.64% and the total budget impact of these cases was 13.192,627.50 TL. The average cost for the cohort was 471 TL (93.01 TL). This finding can be evaluated that the total and average costs per case increase according to the severity of the disease in cases. When evaluated annually, the share of Covid-19 cases in the total number of cases in 2020 was 14.92% and the share of Covid-19 cases in total costs was 14.75%. The total budget impact of Covid-19 cases for 2020 was 7.193,726.50 TL, while the average cost per case was 447.12 TL (72.65 TL). In 2021, the share of Covid-19 cases in the total number of cases was 7.69% and the share of Covid-19 cases in total costs was 7.12%. The total budget impact of Covid-19 cases for 2021 was 4.200,048.50 TL and the average cost per case was 503.60 TL (95.78 TL). This finding clearly shows that the caseload and costs decreased by almost 50% in the second year of the pandemic. However, the average cost per case in the second year of the pandemic was 503.60 (95.78) TL. This finding can be seen as a surprise finding for the study. In the case of a new pandemic, it can be seen as normal within the framework of the learning curve approach that costs increase up to a certain point in the early stages of the fight against the pandemic due to lack of experience. However, in the first year of the pandemic, when the case density was dramatically high, ambulance personnel gained a significant amount of experience, and therefore the average costs per case should decrease in the second year of the pandemic compared to the previous year, again in the context of the learning curve approach. At this point, in the second year of the pandemic, the average cost per case was 503.60 TL (95.78 TL), an average increase of 12% compared to the previous year, while the case density decreased by half. The research conducted on the invoices issued to the payer institution showed that the increase in Health Implementation Communiqué (HIC) prices were a determinant in the increase in average costs per case. In other words, the change in the prices of services provided within the scope of ambulance services with the change in HIC prices emerged as the determining factor in the variation in costs per case during the pandemic. The extent to which the change in HIC prices caused a change in costs per case is presented in detail in Table 4 below.

Table 4. Change in Costs for Covid-19 Cases (2020 and 2021)

Process Name	Amount	Unit Price (TL)		Cost (TL)		Change
		2020	**2021**	**2020**	**2021**	
Case assessment fee (examination fee)	1	33,00	36,00	33,00	36,00	%9,09
Emergency ambulance assignment price	1	198,00	216,00	198,00	216,00	%9,09
Ambulance fee per kilometer in and out of the city	8	2,00	2,00	16,00	16,00	%0,00
Transcutaneous measurement of pao ^{2}	1	19,00	21,00	19,00	21,00	%10,53
Vascular access	1	17,00	21,00	17,00	21,00	%11,76
Decontamination fee	1	155,00	169,00	155,00	169,00	%9,03
Covid-19 (except code red)				**438,00**	**479,00**	**%9,36**
Case assessment fee (examination fee)	1	33,00	36,00	33,00	36,00	%9,09
Emergency ambulance assignment price	1	198,00	216,00	198,00	216,00	%9,09
Ambulance fee per kilometer in and out of the city	3	2,00	2,00	6,00	6,00	%0,00
Blood glucose measurement	1	3,00	3,00	3,00	3,00	%0,00
Transcutaneous measurement of pao ^{2}	1	19,00	21,00	19,00	21,00	%10,53
Electrocardiogram	1	31,00	34,00	31,00	34,00	%9,68
Monitoring	1	37,00	40,00	37,00	40,00	%8,11
Vascular access	1	17,00	19,00	17,00	19,00	%11,76
Decontamination fee	1	155,00	169,00	155,00	169,00	%9,03
Covid-19 + Hypertension				**499,00**	**544,00**	**%9,02**
Case assessment fee (examination fee)	1	33,00	36,00	33,00	36,00	%9,09
Emergency ambulance assignment price	1	198,00	216,00	198,00	216,00	%9,09
Ambulance fee per kilometer in and out of the city	45	2,00	2,00	90,00	90,00	%0,00
Blood glucose measurement	1	3,00	3,00	3,00	3,00	%0,00
Transcutaneous measurement of pao ^{2}	1	19,00	21,00	19,00	21,00	%10,53
Intravenous drug infusion	2	12,50	14,00	25,00	28,00	%12,00
Medicated intervention	2	62,00	68,00	124,00	136,00	%9,68
Vascular access	1	17,00	19,00	17,00	19,00	%11,76
Monitoring	1	37,00	40,00	37,00	40,00	%8,11
Electrocardiogram	1	31,00	34,00	31,00	34,00	%9,68
Oxygen inhalation therapy	1	3,00	3,00	3,00	3,00	%0,00
Decontamination fee	1	155,00	169,00	155,00	169,00	%9,03
Covid-19 (Code Red)				**735,00**	**792,00**	**%7,76**

According to Table 4, it is understood that the transaction prices for the services provided for a standard Covid-19 case increased for almost all transactions compared to the previous year. In the first year of the pandemic, the total invoice price for the said service package was 438.00 TL, while in the second year of the pandemic, the price of the said package increased by approximately 9.36% to 479.00 TL. On the other hand, similarly, the total cost of the case diagnosed with hypertension in addition to the Covid-19 diagnosis increased by 9.02% compared to the previous year. These findings clearly show that the changes in HIC prices created a significant economic burden on the payer budget in the context of Covid-19 cases. Logistic regression analysis findings showed that age, code red, social indication, code green, urban & rural and region variables were the most important factors in estimating costs. Accordingly, each unit increase in age leads to a statistically significant increase in costs. Within triage,

code red emerged as the most important risk factor for high costs per case. This finding shows that Covid-19 cases with code red create a significant economic burden on the payer. In Covid-19 cases, code red cases consist of cases with respiratory arrest or oxygen saturation levels around 50-60, and therefore more services are provided for these cases, such as the procedures in Table 4 for a code red Covid-19 case. This shows that red coded Covid-19 cases require more resources to be used, thus the economic burden of these cases is much higher. In Table 4, the fact that the amount of services provided for the case in question was 735.00 TL in the first year of the pandemic, and that this amount increased by approximately 7.7% to 792.00 TL in the second year of the pandemic with the changes in HIC prices, clearly demonstrated that Covid-19 cases with code red are an important risk factor in terms of economic burden on the payer institution. In this case, it is considered to be very important to implement policies to reduce the number of code red patients who need urgent intervention in case of a new pandemic. On the other hand, while the costs of Covid-19 cases intervened in urban areas were low, the costs of cases intervened in rural areas were found to be high. It is thought that this finding points to the need to reduce the mobility of people between urban and rural areas as well as mobility within the city during the pandemic period. This finding is also valid for Covid-19 cases intervened within and outside the region. While cases intervened within the region had a decreasing effect on costs, cases intervened outside the region had an increasing effect on costs. The urban & rural and regional findings clearly show the importance of the spatial effect on the course of costs per Covid-19 case. On the other hand, Li et al. reported that the costs incurred in Covid-19 cases did not differ statistically according to gender and urban/rural variables, but showed statistically significant differences according to age, comorbidity and disease severity (Li, et al., 2020: 1198). The findings obtained in our study are partially similar to the findings obtained in the aforementioned study. On the other hand, studies in the literature show that comorbidity is considered as an important predictor of increasing disease severity and thus costs per case (Jordan, et al., 2020; Guan, et al, 2020). The findings obtained from our study are similar to the findings in the literature. In our study, while the average cost for Covid-19 cases was 466.40 TL, it was observed that the average cost per case was over 500 TL when other diagnoses were taken into consideration. On the other hand, the modeling findings of our study revealed that patients with code red, i.e. patients who require urgent intervention and have a high severity of illness, are the most important risk factor in the increase in costs. Therefore, the findings of our study clearly revealed that the increase in costs per case was accompanied by an increase in disease severity. In the study conducted by Broughel and Kotrous, it was reported that the infection fatalities rate in Covid-19 cases increased significantly with age. When comorbidity status is taken into account, it has been reported that resource use is higher in older cases and those with one or more diseases, thus the costs incurred in this patient population are significantly higher (Broughel and Kotrous, 2021). Furthermore, the study conducted by Wu et al. shows that older age poses a greater risk for the development of ARDS and death in Covid-19 cases, thus making these cases more costly for the payer (Wu, et al, 2019). As revealed by the logistic regression model in our study, older age has an increasing effect on the costs per case. Therefore, the findings obtained from our study are significantly in line with the findings in the literature that the presence of comorbidities and/or the increase in disease severity have an increasing effect on the costs per case in Covid-19 cases. Although the representativeness of the findings of this study in terms of the economic burden of Covid-19 cases in Turkey is an uncertain issue that is open to improvement, since this study was conducted only in Aydın province, the fact that it addresses the economic burden of the case-cohort addressed through a single province on the payer institution reveals the importance of the study. On the other hand, not all variables that may have an impact on the research question were taken into account in the modeling process. In the modeling process, all variables included in the EAS database and assessed by the researchers to be effective in the costs per case were included in the study. The research was conducted with the assumption that the data obtained from APAS is reliable. Although there are various limitations in terms of the study, it is thought that this study will provide very useful information for decision-makers and policymakers, especially for the Ministry of Health, General Directorate of Emergency Health Services, and especially for the payer.

The case-cohort examined in this study, which is specific to APAS, clearly showed that the budget impact of Covid-19 cases was 11.393,775.00 TL, thus the pandemic created a significant economic burden on the payer institution. While the burden of Covid-19 cases on the payer institution was significantly high in the first year of the pandemic, it was revealed that the burden of cases and costs decreased by approximately 50% in the second year. The modeling findings revealed that Covid-19 cases that were of advanced age, red-coded, rural, and out-of-region were the determinants of the increase in costs. In conclusion, the Covid-19 pandemic has created a significant economic burden for the payer in the context of APAS. It is considered that the implementation of principles and practices related to risk and crisis management for provincial ambulance services under the coordination of the General Directorate of Emergency Medical Services will contribute to reducing costs. Therefore, it is thought that the findings of the study will be useful for other decision-makers and policymakers, especially the payer institution. In this study, the burden of Covid-19 cases intervened by the APAS on the payer institution was investigated. However, the findings of Wu et al. that antiviral and antibiotic drug treatments were predominantly administered in the Covid-19 patient cohort admitted to hospitals clearly show that the burden of Covid-19 cases on payers is much higher in the context of hospitals. Given the high cost of antibiotics and antiviral drugs, it is clear that Covid-19 cases constitute a critical economic burden for payers in the context of hospitals. Therefore, since the use of services, medicines, and materials is much more intensive in hospital services, it is necessary to investigate the hospital costs of these cases in Turkey in order to accurately determine the extent to which Covid-19 cases create an economic burden on the payer. In future studies, it is suggested that much more useful results can be obtained for the payer institution by revealing the economic burden on the payer institution of the cases admitted to the hospital through ambulance services in revealing the hospital costs of Covid-19 cases.

References

Abiad, A., Arao, R. M., & Dagli, S. (2020). The economic impact of the COVID-19 outbreak on developing Asia. (Erişim: 10.04.2022), www.adb.org/publications/economic-impact-covid19-developing-asia

Ajmal, M. M., Khan, M., & Shad, M. K. (2021). The global economic cost of coronavirus pandemic: Current and future implications. *Public Administration and Policy*, 24(3), 290-305.

Broughel, J., & Kotrous, M. (2021). The benefits of coronavirus suppression: A cost-benefit analysis of the response to the first wave of covid-19 in the United States. *PLoS ONE*, 16(6), 1-20.

Chen, N., Zhou, M., Dong, X., Qu, J., Gong, F., Han, Y., … & Zhang, L. (2020). Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: A descriptive study. *Lancet*, 395(10223), 507-13.

Cunningham, A. C., Goh, H.P., & Koh D. (2020). Treatment of COVID-19: old tricks for new challenges. *Crit Care*, 24(1), 91.

Drummond, M. F., Sculpher, M. J., Claxton, K., Stoddart, G. L., & Torrance, G. W. (2015). *Methods for the economic evaluation of health care programmes*. United Kingdom: Oxford University Press.

Fox, J., & Weisberg S. (2022). Car: Companion to Applied Regression. [R package]. Retrieved from https://cran.r-project.org/package=car.

Göçen, A., & Ateş, M. (2013). Acil sağlık hizmetleri. (A. Göçen (Ed.), *Sağlık hizmetleri yönetimi içinde* (ss. 39-103). İstanbul: Beta Yayınları.

Gray, A. M., Clarke, P.M., Wolstenholme, J.L., & Wordsworth, S. (2011). *Applied methods of cost-effectiveness analysis in health care*. India: Oxford University Press.

Guan, W. J., Ni, Z. Y., Hu, Y., Liang, W. H., Ou, C. Q., He, J. X., … & Zhong, N. S. (2020). Clinical characteristics of coronavirus disease 2019 in China. *New England journal of medicine*, 382(18), 1708-1720.

Huang, C., Wang, Y., Li, X., Ren, L., Zhao, J., Hu, Y., … & Cao, B. (2020). Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *The lancet*, 395(10223), 497-506.

Jordan, R. E., Peymane, A., & Cheng, K. K. (2020). Covid-19: risk factors for severe disease and death. *The BMJ*, 368, 1-2.

Kraus, S., Thomas, C., Matthias, B., Johanna, G., Alessandro, Z., & Victor, T. (2020). The economics of Covid-19: Initial empirical evidence on how family firms in five european countries cope with the corona crisis. *International Journal of Entrepreneurial Behaviour and Research*, 26(5), 1067-92.

Kuhn, M., & Johnson, K. (2013). *Applied Predictive Modeling*. USA: Springer.

Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y., … & Feng, Z. (2020a). Early transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. *New England journal of medicine*, 382(13), 1199-207.

Li, X. Z., Jin, F., Zhang, J. G., Deng, Y. F., Shu, W., Qin, J. M., … & Pang, Y. (2020b). Treatment of coronavirus disease 2019 in Shandong, China: a cost and affordability analysis. *Infectious Diseases of Poverty*, 9(3), 31-38.

Liew, M. F., Siow, W.T., MacLaren, G., See, K. C. (2020). Preparing for Covid-19: early experience from an intensive care unit in Singapore. *Crit Care*, 24(1), 83.

R Core Team. (2020). R: A Language and environment for statistical computing. (Version 4.0) [Computer software]. Retrieved from https://cran.r-project.org. (R packages retrieved from MRAN snapshot 2020-08-24).

Sing, T., Sander, O., Beerenwinkel, N., & Lengauer, T. (2022). ROCR: Visualizing the Performance of Scoring Classifiers. [R package]. Retrieved from https://cran.r-project.org/package=ROCR.

The Jamovi Project. (2022). Jamovi. (Version 1.6) [Computer Software]. Retrieved from https://www.jamovi.org.

Tian, S., Hu, N., Lou, J., Chen, K., Kang, X., Xiang, Z., ... & Zhang, J. (2020). Characteristics of COVID-19 infection in Beijing. *Journal of infection*, 80(4), 401-406.

WHO. (2022). Novel coronavirus (Covid-19) situation report - 101. (Erişim: 30.04.2022), https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200430-sitrep-101-covid-19.pdf?sfvrsn=2ba4e093_2.

Wu, C., Chen, X., Cai, Y., Zhou, X., Xu, S., Huang, H., ... & Song, Y. (2020). Risk factors associated with acute respiratory distress syndrome and death in patients with coronavirus disease 2019 pneumonia in Wuhan, China. *JAMA Internal Medicine*, 180(7), 934-943.

Xie J, Tong Z, Guan X, Du B, Qiu H, Slutsky AS. (2020). Critical care crisis and some recommendations during the COVID-19 epidemic in China. *Intensive Care Med*, 46(5), 837-40.

Yang, X., Yu, Y., Xu, J., Shu, H., Liu, H., Wu, Y., ... & Shang, Y. (2020). Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. *The Lancet Respiratory Medicine*, 8(5), 475-481.