

Investigation of the Relationship between Pharmaceutical Expenditures and Some Health Resources: A Correlational Study on OECD Countries

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ABSTRACT: Pharmaceutical expenditures have an important proportion in health expenditures. Today, OECD countries transfer 1/5 of health expenditures to pharmaceutical expenditures on average, and this ratio is even higher in developing countries. Therefore, pharmaceutical expenditures are seen as an expenditure that needs to be controlled for countries. In this respect, the aim of this study is to examine the relationship between the number of hospital beds, physicians and nurses per 1000 people and pharmaceutical expenditures per capita. This cross-sectional study is a correlational research. In the study, secondary data of 29 Organization for Economic Co-operation and Development (OECD) countries, which have updated data, were used. Data was mainly obtained from OECD database. As a result of the analyzes, a statistically significant, positive and weak relationship was found between the number of nurses per 1000 people and pharmaceutical expenditures per capita. Considering that nurses do not have the authority to prescription, it is thought that nurses can induce non-prescription medications and this issue should be discussed separately in future studies.

Keywords: Pharmaceutical Expenditures, Number of Physicians, Number of Nurses, Number of Hospital Beds

JEL Code: I10, I18, I19.

İlaç Harcamaları ile Bazı Sağlık Kaynakları Arasındaki İlişkinin İncelenmesi: OECD Ülkeleri Üzerine Korelasyonel Bir Araştırma

ÖZ: İlaç harcamalarının sağlık harcamaları içerisinde önemli bir payı vardır. Bugün, OECD ülkeleri ortalama sağlık harcamalarının 1/5'ini ilaç harcamalarına ayırmaktadır ve bu oran gelişmekte olan ülkelerde daha da yüksektir. Bu nedenle, ilaç harcamaları ülkeler için kontrol edilmesi gereken bir harcama kalemi olarak görülmektedir. Bu bağlamda, bu çalışmanın amacı 1000 kişi başına düşen hastane yatağı, hekim ve hemşire sayısı ile kişi başına ilaç harcamaları arasındaki ilişkinin incelenmesidir. Kesitsel tipte olan bu çalışma korelasyonel bir araştırmadır. Araştırmada güncel verilerine erişilebilen 29 Ekonomik İşbirliği ve Kalkınma Örgütü (OECD) ülkesinin ikincil verileri kullanılmıştır. Veriler OECD veri tabanından elde edilmiştir. Analizler sonucunda 1000 kişi başına düşen hemşire sayısı ile kişi başına düşen ilaç harcaması arasında istatistiksel olarak anlamlı, pozitif ve zayıf bir ilişki bulunmuştur. Hemşirelerin reçete yazma yetkisine sahip olmadığı düşünüldüğünde, hemşirelerin reçetesiz ilaçların kullanımını teşvik edebileceği ve bu konunun ileriki çalışmalarda ayrıca irdelenmesi gerektiği düşünülmektedir.

Anahtar Kelimeler: İlaç Harcamaları, Doktor Sayısı, Hemşire Sayısı, Hastane Yatağı Sayısı

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1. Introduction

Health is one of the most important factors that directly affect human life. Throughout history, people have constantly sought various ways to be healthier, to improve their quality of life and their life span. Therefore, the demand for health care has continued throughout humanity and it is an undeniable fact that it will continue in the future.

Traditional technological methods of diagnosis and treatment were used before the industrial revolution and the technological developments have not yet taken place. Today, thanks to the extremely high technology achieved, the way healthcare services are provided has also changed. On the other hand, technological developments have led to changes not only in the provision of health services, but also in the demand side. Currently, healthcare users can quickly access information, communicate with healthcare providers and reflect their satisfaction to the community. At the point where these changes have reached, health service providers are trying to improve service quality and meet customer / patient requests and expectations and therefore, they consider quality indicators in service delivery processes. While such developments are experienced in the micro dimension, on the other hand, countries make efforts to raise the health level of the society, to provide effective and efficient health services, qualified health personnel, and to finance health in accordance with social requirements. Therefore, health indicators identified in the macro dimension are the most frequently used factors in understanding and interpreting the health level of a country. These are indicators that can be related to health finance and economy, health infrastructure, health manpower or social dimension of health. There are a number of health indicators identified by the World Health Organization to ensure standardization of health indicators (WHO 2018). Researchers often make some inferences from these indicators taking into account what is related to their field of study or research, and they give direction to future predictions. In addition, these indicators are used to measure the performance of health systems. In this study, the number of hospital beds, physicians and nurses per 1000 people, which are among the mentioned health indicators, were used and the relationship between these indicators and pharmaceutical expenditures which is an indicator related to health expenditures was investigated.

The number of hospital beds (per 1000 people) is one of the main indicators related to health infrastructure from health resources. "This indicator provides a measure of the resources available for delivering services to inpatients in hospitals in terms of number of beds that are maintained, staffed and immediately available for use. Total hospital beds include curative care beds, rehabilitative care beds, long-term care beds and other beds in hospitals. The indicator is presented as a total and for curative (acute) care and psychiatric care. It is measured in number of beds per 1 000 inhabitants." (OECD, 2019a).

The number of doctors indicator is one of the main indicators related to the health workforce among health resources. "Doctors are defined as "practising" doctors providing direct care to patients. However for some countries, due to lack of comparable data, the figures correspond to "professionally active" doctors, including doctors working in the health sector as managers, educators, researchers, etc. Doctors are usually generalists who assume responsibility for the provision of continuing care to individuals and families, or specialists such as paediatricians, obstetricians/gynaecologists, psychiatrists, medical specialists and surgical specialists. This indicator is measured per 1 000 inhabitants." (OECD, 2019b).

The number of nurses is also related to the health workforce, as is the number of doctors. Here too, nurses working as managers, trainers and researchers in the sector are included in the calculations due to lack of data and expressed as per 1000 inhabitants (OECD, 2019c).

Health expenditures are mainly made for the purpose of protecting and improving health. The increase in these expenditures increases the life expectancy and has a positive effect on the quality of life. There is a relationship between health expenditures and the level of development of countries and the share of GDP for health is higher in developed countries than that of developing countries (Akar, 2014). Health expenditures not only increase public health and protect the labor force, but also provide savings on health expenditures by prevent potential health problems in the future and make it possible to use these resources more effectively and efficiently (Yumuşak and Yıldırım, 2009). Therefore, it is stated that there is a relationship between health expenditures and economic growth (Hayaloğlu and Bal, 2015). Health expenditures consist of general diagnosis and treatment expenditures, rehabilitation

services and material and pharmaceutical expenditures. Individuals can apply to health services for various purposes. First of all, people can benefit from these services when they think they have lost their health. However, there are applications that are not of vital importance and are made with aesthetic concerns. When the health services are applied, a number of diagnostic and treatment processes operate and medical and/or surgical methods can be conducted. It is an undeniable fact that drugs have an important place in medical treatment. The use of medicines when necessary and with proper amounts has vital importance in health services (Göçgeldi et al., 2009; Hatipoğlu and Özyurt, 2016). In this context, it is possible for individuals to become physically and mentally well with the use of pharmaceuticals, while inappropriate use of them can affect both the health of individuals and society. Turkey is known that there are some difficulties related to the proper use of medicines. In particular, excessive and/or inappropriate dosage antibiotic use comes into prominence. This situation may cause negative effects such as antibiotic resistance and threatens public health (Çelik, 2011). Another consideration that should be taken into account in the case of pharmaceutical use is pharmaceutical expenditures. Pharmaceutical expenditures have a high share in health expenditures. In fact, OECD countries used \$800 billion for pharmaceutical expenditures in 2013, which means 1/5 of health expenditures and it is expected to increase (OECD, 2015).

In the light of this information, the basic research question of this study is; “What is the relationship between the number of hospital beds, physicians, nurses and drug expenditures?” The aim of the study is to investigate the relationship between the number of hospital beds, doctors, nurses and drug expenditures.

2. Materials and Methods

The relationship between the number of hospital beds, physicians, nurses and pharmaceutical expenditures, which are some of the main health indicators, has been evaluated in the study. Secondary data related to these variables have been used in the study. In this context, data on the number of hospital beds per 1000 inhabitants, number of doctors per 1000 inhabitants and number of nurses per 1000 inhabitants have been examined. The data has been obtained from the OECD website (OECD, 2019d). 29 countries with current data on variables have been included in the study. Because there is not any current data on OECD web site about pharmaceutical expenditures for Turkey, the per capita pharmaceutical expenditure in 2016 has been accepted as 170 dollars (as Turkey Pharmacists Association Chairman Erdogan Colak stated) (Çolak, 2017). When the data of 29 countries were examined, it was found that the most recent data belonged to 2016. Therefore, 2016 data of the countries have been included in the study. Finland's most recent data on the number of nurses and doctors per 1000 inhabitants and Israel's pharmaceutical expenditures are from 2014. USA's most recent data on the number of hospital beds per 1000 inhabitants, Sweden's and Denmark's most recent data on the numbers of doctors per 1000 inhabitants are from 2015, so the study has been based on these dates. The research data has first been transferred to the excel and edited. Then, it has been transferred to SPSS 20.0 package program for statistical analysis and analyzed. Firstly descriptive statistics have been conducted in the analysis of the research data and then the relationships between the variables have been examined by correlation analysis. The suitability of the research data to the normal distribution has been examined by Kolmogorov Smirnov and it has been found that the distribution of the variables are normal ($p > 0.05$). Pearson Correlation analysis has been used and $p < 0.05$ has been considered significant.

Ethics committee approval has not been required due to the fact that secondary data have been used in the study and these data are available to the public.

3. Results

The data used in the study are shown in the table (Table 1).

Table 1. Research Data

COUNTRIES	Hospital Bed per 1000 inhabitants	Number of Doctors per 1000 inhabitants	Number of Nurses per 1000 inhabitants	Pharmaceutical expenditures per capita (Dollars)
Mexico	1.5	2.4	2.9	232
Sweden	2.3	4.3	11.1	524
Canada	2.6	2.7	9.9	860
UK	2.6	2.8	7.9	476
Denmark	2.6	3.7	16.9	335
Turkey	2.8	1.8	1.9	170
Ireland	2.9	2.9	1.9	676
Spain	3	3.8	5.5	621
Israel	3	3.1	5	315
Iceland	3.1	3.9	14.7	488
Italy	3.2	4	6.5	607
Norway	3.7	4.5	17.7	471
Finland	4	3.2	14.3	516
Slovenia	4.5	3	9.7	507
Switzerland	4.5	4.3	17	1080
Estonia	4.8	3.5	6.1	378
Luxembourg	4.8	2.9	11.7	554
Belgium	5.7	3.1	11.1	684
Latvia	5.7	3.2	4.6	452
Slovakia	5.8	3.5	5.7	566
France	6	3.4	10.5	663
Poland	6.6	2.4	5.2	369
Lithuania	6.7	4.5	7.7	541
Hungary	7	3.2	6.4	566
Austria	7.4	5.1	8	631
Germany	8.1	4.2	12.8	777
Korea	12	2.3	6.9	573
Japan	13.01	2.4	11.3	874
USA	2.8	2.6	11.6	1208

The data of the study are shown in the table and then summarized in terms of minimum, maximum values and mean and standard deviation (Table 2).

Table 2. Descriptive Statistics of the Research Data

Variables	Min	Max	Mean	SD
Hospital Bed per 1000 inhabitants	1.50	13.01	4.92	2.73
Number of Doctors per 1000 inhabitants	1.80	5.10	3.33	.791
Number of Nurses per 1000 inhabitants	1.90	17.70	9.05	4.42
Pharmaceutical expenditures per capita (Dollars)	170	1208	576.34	227.33

When the data obtained in the study is examined, it can be seen that the country with the highest number of hospital beds per 1000 inhabitants is Japan. There are 13.01 hospital beds per 1000 inhabitants in this country. The country with the lowest hospital bed per 1000 inhabitants stands out as Mexico with 1.5. When 29 countries included in the study are examined, it is found that the average number of hospital beds per 1000 inhabitants in 2016 is 4.92 ± 2.73 . Accordingly, Mexico is below the average and Japan is well above the average. The number of hospital beds per 1,000 inhabitants in Turkey is 2.8 in 2016 and this figure is below the average.

When the number of doctors per 1,000 inhabitants indicator is examined, it can be clearly seen that the lowest number of doctors per 1,000 inhabitants is in Turkey with 1.8. The highest number in this

field belongs to Austria with 5.1 doctors per 1,000 inhabitants. The average number of doctors per 1000 inhabitants is 3.33 ± 0.79 for all countries. Accordingly, Turkey remains below the average. Similarly, the country having the lowest number of nurses per 1,000 inhabitants is also Turkey. The average of this indicator is 9.05 ± 4.42 . The leading country in this field is Norway with 17.7 nurses per 1,000 inhabitants.

The average pharmaceutical expenditure in OECD countries is 576.34 ± 227.33 dollars. Turkey has 170 dollars per capita pharmaceutical expenditure and this amount is the lowest among OECD countries.

After the descriptive statistics, hypothesis tests have been conducted. Pearson Correlation analysis, which shows the relationships of research variables, has been performed. The results of the analysis are summarized in Table 3.

Table 3. The Relationships of Research Variables

Variables	M	SD	Hospital Bed per 1000 inhabitants	Number of Doctors per 1000 inhabitants	Number of Nurses per 1000 inhabitants	Pharmaceutical expenditures per capita (Dollars)
Hospital Bed per 1000 inhabitants	4,92	2,73	-			
Number of Doctors per 1000 inhabitants	3,33	,791	-,058	-		
Number of Nurses per 1000 inhabitants	9,05	4,42	,020	,432*	-	
Pharmaceutical expenditures per capita (Dollars)	576,3	227,3	,237	,147	,391*	-

*p<0.05.

As a result of the correlation analysis, it has been found that there is statistically significant, positive and weak relationship between pharmaceutical expenditure per capita and the number of nurses per 1000 inhabitants in 29 OECD countries ($p<0.05$, $r=0.39$). There is also a statistically significant, positive and moderate relationship between the number of nurses and doctors per 1000 inhabitants ($p<0.05$, $r=0.43$), but it has been ignored as it is not related with the purpose of the study. According to this results, it has been found that the increase in the number of nurses led to increasing pharmaceutical expenditures. This result is noteworthy because nurses do not have prescription authority. At this point, it is important to make investigations on prescription and over-the-counter medications.

After correlation analysis, the number of nurses per 1000 inhabitants and the per capita pharmaceutical expenditures variables, which have been found to be correlated and suitable for normal distribution, have been examined by regression analysis. Results are summarized in the table 4.

Table 4. Regression Analysis

Variables	B	S.E.	β	t	p	R	R ²	ΔR^2
Number of Nurses per 1000 inhabitants	20,084	9,08	0,391	2,210	0,036	0,391	0,153	0,122
Constant	394,552	91,287		4,322	0,00			
TOTALR ² =0,153, F=4,883, p<0.05								

Dependent variable: pharmaceutical expenditure per capita

As a result of the regression analysis, the model has been found to be significant ($p < 0.05$). The R^2 value indicates how much of the changes in the dependent variable is explained by the independent variable, while the corrected R^2 (ΔR^2) value indicates how much of the variance in the dependent variable is explained by the independent variable (Gürbüz and Şahin, 2017). Therefore, 15% of the change in drug expenditures is explained by the number of nurses per 1000 inhabitants. It has been found that 12% of the variance of drug expenditures is explained by the number of nurses per 1000 inhabitants.

4. Discussion

The pharmaceutical industry is a growing industry today, it is said to contribute to the gross domestic product, and at the same time, the major output (pharmaceuticals) of this industry is an important input used in health care. The important contributions of the pharmaceuticals to the improvement of public health cannot be ignored (Sloan and Hsieh, 2007).

Pharmaceutical expenditures are investments made with the expectation of return on health, and improper reduction of the amounts spent on the pharmaceutical industry may in fact lead to higher costs by preventing the emergence of pharmaceuticals that can prevent/treat future health problems or increase the use of the labor force. Studies examining the relationship between pharmaceutical expenditures and some health outcomes can be carried out at national or international level. In some of these studies, it was found that there are some relationships between drug expenditures and health outcomes, while in others were not found such relationships (Cremieux et al., 2007).

Babazono and Hillman (1994) did not find any relationship between pharmaceutical expenditures and health outcomes in their study, but in a similar study, with more control variables, it was found that there is a relationship between life expectancy and pharmaceutical expenditure (Frech and Miller, 1999). The results of another study also show that higher amounts of pharmaceutical expenditure lead to an increase in the life expectancy variable (Shaw et al., 2005). It is also possible to increase the number of similar studies, in which similar results can be obtained, examining the relationship between pharmaceutical expenditures, pharmaceutical innovation and health outcomes (Lichtenberg, 2003; Crémieux et al., 2005; Liu et al., 2008; Çalıřkan, 2009).

Although it is clearly seen that the importance given to the pharmaceutical sector and the development of medical technologies increase health expenditures, when the return of these expenditures is evaluated it can be seen that the return of these expenditures provides a decrease in other items of health expenditures. Civan and Köksal (2010) state that the 1-year decrease in the average age of medicines reduces per capita health expenditures by as much as \$ 45.43 and the largest decrease occurs in expenditures on hospital care due to new drugs.

Countries, like individuals, seek maximum benefit when using scarce resources and providing resources in various fields. The resources allocated to the health field should also be used in such a way as to provide the highest return. At this point, besides the aims of protecting public health, providing access to health and improving the quality of health services, countries desire that expenditures in these areas do not increase in a way that will negatively affect the country and exploit resources in other areas. One of these areas is pharmaceutical expenditures. OECD countries are making efforts to control increasing pharmaceutical expenditures. However, it is important to note that reducing pharmaceutical expenditures may lead to adversities such as increased hospitalizations (Kanavos et al., 2005).

Among the OECD countries, Denmark has the lowest rate of pharmaceutical expenditures in health expenditures (6.6% in 2016), while Hungary has the highest rate (28.8% in 2018). Most recent data in OECD dataset of Turkey belongs to the 2000 and the rate of pharmaceutical expenditures in health expenditures is 27.81% in this year (OECD, 2019e). It was found that pharmaceutical expenditures increased by 12% annually in Latin America and the Caribbean between 2013 and 2017 and pharmaceutical expenditures in Europe and North America increased proportionally in these years (Izquierdo et al., 2018). 1.30% of gross domestic product was allocated to pharmaceutical expenditures between the years 2002-2014 in Turkey (Gürsoy, 2016).

When the data obtained in this study is considered, it can be seen that the country with the highest number hospital beds per 1000 inhabitants is Japan with 13.0, and the country with the lowest number is Mexico with 1.5. Considering the average number of hospital beds (4.92), Turkey fall behind the

average with 2.8. When it comes to the number of doctors per 1000 inhabitants, mean number is 3.33, Turkey has the lowest figure and the highest number of doctors per 1000 inhabitants is in Austria with 5.1. Turkey has also the lowest number of nurses per 1000 inhabitants. The mean is 9.05 for this indicator and the highest number is observed in Norway. Turkey fall behind the mean number for all three indicator and has the lowest number of doctors and nurses per 1000 inhabitants. The mean of pharmaceutical expenditures is 576 dollars and Turkey has the lowest per capita pharmaceutical expenditure. The highest pharmaceutical expenditure is in USA with 1208 dollars.

Each of the variables examined in this study is an indicator in itself and is generally desirable to be close to or above the OECD average. However, due to the geographical characteristics, population structure, cultural habits, structure of the health sector, economic system, etc., each country may have differences between its inputs and outputs in the field of health. For this reason, the inclusion or examination of many other elements in the future analysis for OECD countries allows for more efficient interpretation of the health outcomes of these countries. Therefore, while each of these indicators provides valuable data for countries, their impact on health outcomes can be realized at different levels.

5. Conclusions

This research is limited to 29 OECD countries, which, for the purpose of the research, have accurate data on the variables used in the research. Variables used in the study is the other limitation. Number of hospital beds, nurses and doctors per 1000 inhabitants are independent and per capita pharmaceutical expenditures is dependent variable. Countries' most up-to date data have been tried to be reached and it has been determined that almost all countries' data for 2016 are available and the data for this year have been evaluated.

As a result of the research, it has been found that there is a statistically significant, positive and weak relationship between pharmaceutical expenditures per capita and the number of nurses per 1000 inhabitants in 29 OECD countries. As a result of the regression analysis, it has been found that 15% of the change in pharmaceutical expenditures is explained by the number of nurses per 1000 inhabitants. Considering that nurses do not have the prescription authority, pharmaceutical expenditures should be examined separately for prescription and non-prescription medicines in order to interpret the relationship. It is also necessary to focus on the possibility of nurses to guide/encourage the use of over-the-counter medications.

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