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Factors Influencing Pharmaceutical Demand in Iran: Results from a Regression Study

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Abstract

Background and Objectives: Pharmaceutical expenditures constitute a major part of the health systems' cost. According to the World Health Organization (WHO), Iran is the first among the first countries in the world with respect to the rate of drug consumption. The first step in controlling the consumption of particular goods is to identify factors inducing the associated demands. Hence, this study aimed to identify the patterns and demand-inducing factors of drug consumption in Iran.

Methods: The time series data of pharmaceutical expenditures was acquired from the yearbooks of Iranian Ministry of Health and Medical Educations. The time series data of medicine price index and per capita income were obtained from the documentation of the Central Bank of Iran. Pharmaceutical demand was modeled as a function of economic variables using the logarithmic transformation of Cobb-Douglas demand function, and the function's coefficients were estimated, using regression analysis.

Findings: While per capita income and government's commitment to insurance showed positively relationship with pharmaceutical expenditure, price of medicines was showed a negative corresponding correlation. The elasticity of price and income was found to be less than one, suggesting medicine as an inelastic and normal good.

Conclusions: Our results highlight the notion that an accurate formulation of pharmaceutical insurance package is crucial for preventing the irrelevant increase of pharmaceutical expenditures.

Keywords: Pharmaceutical expenditures, Health system, Pharmaceutical demand, Health economics

Background and Objectives

Pharmaceutical expenditures are regarded as one of the greatest parts of health expenditure. According to the available data in 2006, about 19.7% of the health expenditures in high-income countries, and about 30.4% in low-income countries have been allocated to the pharmaceutical expenditures [1]. Many countries are finding the pharmaceutical expenditures an increasingly problematic economic concern [2]. In particular, in low-income countries, were a high proportion drug expenditures are paid out of pocket, patients are faced with a significant financial pressure for their treatment [2, 3]. Studies have shown that, in the low-income countries, 53 % of the health expenditures of households with an income less than one dollar per day were allocated to medicines [4]. Given the fact that medicine is amongst the main drivers of the health system expenditures, controlling the increase of pharmaceutical expenditures is one of the major tasks of the health systems [5, 6].

Control of expenditures for a specific good can be done by manipulating factors driving either the supply side or the demand side [7, 8]. Strategies such as setting measures for prices and profits, request for discount, and setting reference prices are used to manipulate the supply of pharmaceuticals. On the other hand, controlling the demand side of pharmaceutical expenditures require management of medicine consumption by patients [9].

According to the World Health Organization (WHO), Iran is the first among the 20 countries with high rate

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Table 1 The results of augmented Dickey-Fuller's unit root test for the studied time series

Variable	Co-integration rank	Number of lags		Critical values		Test statistic in data level	Test statistic in data difference
Log me	I(1)	1	4	-3.58	-2.98	-2.76	-4.39
Log y	I(1)	4	4	-2.97	-2.99	-1.5	-3.85
Log dpi	I(1)	1	1	-2.98	-2.62	-.72	-2.96
Log ie	I(1)	2	10	-2.63	-2.98	-.89	-3.14

of drug consumption [10]. Statistics show that the mean number of medicinal items in the prescriptions of the Iranian physicians is 2-3 time higher than the average global corresponding value. Excessive consumption of drugs, not only place un-necessary financial burden on the patients, but can lead to adverse effects that negatively impact the performance of the health system [11, 12].

These conditions indicate an urgent need for setting effective measures for controlling the pharmaceutical expenditure in Iran. Obviously, the first step in controlling demand is identifying the associate driving factors and the effect of these factors on medicine consumption. Thus, this study was aimed identifying the pattern of drug consumption and factors affecting pharmaceutical demand in Iran.

Methods

This retrospective study was conducted in 2012. Using stationary and co-integration tests, the long-term relationship between pharmaceutical expenditures (as dependent variable) and the gross national income, the medicine price index, and the medical commitments of insurances (as independent variables) was estimated.

The time series data of pharmaceutical price index and per capita income were acquired from the Central Bank of Iran. The time series data of pharmaceutical expenditures were acquired from the Pharmaceutical Statistics Yearbook of the Ministry of Health and Medical Education.

No auto-correlation was identified between the residuals, hence, the classic assumptions could be applied to our model. A logarithmic transformation of Cobb-Douglas' relationship was used as the demand function to allow estimation of coefficients using OLS method. Therefore, the proposed model for estimating the pharmaceutical demand function is as the following:

$$\text{Log}\,(M_e) = c + \alpha \log\,(DPI) + \beta \log\,(IE) + \rho \log(Y) \qquad (1)$$

where, M_e represents the pharmaceutical expenditures as dependent variable, Y is GDP, DPI represents, pharmaceutical price index, and IE denotes the pharmaceutical liability insurance. One of the key advantages of the linear Double-log function is that the estimated coefficients for each variable indicate the elasticity of dependent variables against the independent ones.

Stationarity of the time series was examined using unit root test. Existence of real long-term relationship between the variables was identified was examined using co-integration model developed by Engle-Granger. After determining the long-term equilibrium relationships, the short-term elasticity of pharmaceutical expenditures was estimated, and the results were compared with the independent model variables as seen in the following equation (23):

(2)

where, Y denotes the logarithm of pharmaceutical expenditures, X, the logarithm of medicine price index and the logarithm of medical insurances expenditures, , the short-term elasticity of pharmaceutical expenditures compared with the independent variables, , the long-term elasticity. , is a coefficient of adjustment that indicates the speed of adjustment compared with the long-term equilibriums, which are signally negative.

Table 2 The effect of pharmaceutical price, income, and insurances commitments on the long-term pharmaceutical consumption (long-term elasticity)

C	Log(dpi)	Log(y)	Log(ie)
(t)	(t)	(t)	(t)
-7.08	-.16	.98	.55
(2.48)	(2.48)	(3.53)	(4.35)

Results

According to Table 1, the integration degree of model variables is of the first rank, and the integration degree of estimation residual is of the 0 rank. Therefore, the Engle-Granger's method showed that there is a long-term equilibrium relationship between the model variables. The results of estimation of the Engle-Granger's equation as well as the effects of price, income, and insurances' medical commitments on the long-term and short-term pharmaceutical expenditures are shown in Table 2 and Table 3, respectively. Since the estimated function is a double log model, its coefficients represent a long-term elasticity of the demand, as well. The demand elasticity of price shows that 1% increase in pharmaceutical prices leads to about 0.16% decrease in the demand. In addition, the income elasticity shows that by 1% increase of income, the medicine demand would increases by 0.98%. The fact that the elasticity of both income and price is less than one, indicates that drug is a necessary and inelastic good in the households' consumption basket.

On the other hand, 1% increase in the drug insurance commitments increases the medicine demand by a factor of 55%. As observed and expected, the short-term elasticity of pharmaceutical expenditures towards income is 0.68% which is less than that long-term elasticity.

Table 3 The effect of pharmaceutical price, income, and insurances commitments on the short-term pharmaceutical consumption (short-term elasticity)

C	Log(dpi)	Log(y)	Log(ie)
-6.24	-0.06	0.67	0.16

Discussion

Our regression analysis indicated that the elasticity of income is greater than that of other independent variables. Therefore, income is the most important factors influencing pharmaceutical consumption. On the other hand, the fact that income elasticity of drug demand was found to be < 1 indicates that drug is a "normal" and "essential" goods in Iran [13]. Therefore, the change in income would concurrently change both the pharmaceutical demand and consumption. In our previous study in Tehran, the income elasticity for OTC medicines was estimated to be 0.76 for prescribed medicines with long-term treatment and 0.55 for prescribed medicines with short-term treatment [14]. Results of our present and previous studies, hence, show that the households' income is one of the most important factors driving the drug demand. Therefore, any manipulation of the households' income and purchasing power, which are chiefly influenced by taxes or subsidies, can greatly impact their pharmaceutical consumption.

Our study identified the price elasticity of the pharmaceutical demands to be -0.16. Peter's study (2008), however, found corresponding price elasticity of -0.1 for the elderly [15] and wealthy Australian [16]. In the meanwhile, Goldman (2004) identified the elasticity of medicines used for chronic conditions to be -0.1 to -0.2 [17], and in Landsman (2005), found a corresponding value of was -0.3 to -0.6 [18].

Our results showed low price elasticity for presence of drugs in the households' consumption basket, suggesting that drug is an inelastic good. This inelasticity implies that households' reaction to the increase in pharmaceutical prices is weaker that their reaction to the fluctuations of the medicine price index.

Our study also showed that the commitments to the insurances by the government can highly influence pharmaceutical demand. Hence, based on the results of the present research, the increase of medicine consumption, and consequently, insurance costs can be alleviated by enhancing the financial resources of insurances through rationalizing the allocation of expenditures and providing appropriate pharmaceutical insurance packages based on the price of income elasticity of demand.

Conclusions

Our study showed that per capita income and commitments of the insurances by the government play an important role in increasing the pharmaceutical expenditures and consequently, inducing demand for medicines among Iranian households. Conversely, price of medicines showed a negative impact the pharmaceutical demand. The elasticity of price and income was found to be less than one, suggesting medicine as an inelastic and normal good. Our results, hence, imply that policies such as enhancing financial resources of insurance, rationalizing allocation of expenditures, provision of appropriate insurance packages based on the prices elasticity of demand, provision of premium insurance based on the type of the disease, and implementing coinsurance based on the type of pharmaceuticals would help the control of drug consumption.

Competing Interest

The authors declare that there is no conflict of interests.

Authors' Contributions

AR conceived and designed the study, and participated in revising the manuscript. SNM made the major contribution in collecting and analyzing the data, interpretation of the results and drafting and revising the manuscript. FL, HS, and MH contributed in collecting the data and preparing the manuscript. All authors read and approved the final manuscript.

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