http://jhmi.sums.ac.ir
J Health Man & Info 2020, 7(2), 107–116

JHMI
Journal of Health Management and Informatics

Original Article

Interpretive Structural Modeling of the Factors Affecting Induced Demand for Health Services

Vahideh Rostami[1], Payam Shojaei[2], Jamshid Bahmaei[3]*

[1]Student Research Committee, School of Management and Medical Informatics, Shiraz University of Medical Sciences, Shiraz, Iran
[2]Department of Management, Shiraz University, Shiraz, Iran
[3]Student Research Committee, School of Management and Medical Informatics, Shiraz University of Medical Sciences, Shiraz, Iran

Abstract

Introduction: Induced demand is an important challenge in national healthcare systems, and can waste their resources. The likelihood of induced demand and the intensity of its effects are the results of an interaction between a wide range of factors. Therefore, this study was designed for structural modeling of the factors affecting induced demand.

Methods: This applied study was carried out using a descriptive-analytic design. First, the factors affecting induced demand were identified by a thorough literature review. Then, using interpretive structural modeling (ISM), the relationship between the factors was determined and categorized, and the final model developed. In addition, using MICMAC analysis, the types of variables have been identified with respect to their driving and dependency power.

Results: Lack of clinical guidelines, increased number of providers, weakness of education system, weakness of Health Supervisory System, poor supervision of insurance companies, improper payment system, providers' insufficient knowledge, skills and clinical uncertainty, defensive medicine, patient preferences, information asymmetry, the collusion of service providers, and their incentives to earn more income were identified as the most important factors affecting management and control of induced demand.

Conclusion: Induced demand reduction requires finding the relationships between the key factors to provide a clear framework for determining the best controlling policies, thereby preventing the loss of healthcare resources. This study provided a new insight into the factors affecting induced demand leading to prioritization of decision-making and policymaking measures.

Keywords: Interpretive Structural Modeling, Induced Demand, MICMAC Analysis, Healthcare System

Article History:
Received: 29 January 2020
Accepted: 11 April 2020

Please cite this paper as:
Rostami V, Shojaei P, Bahmaei J. Interpretive Structural Modeling of the Factors Affecting Induced Demand for Health Services. J Health Man & Info. 2020; 7(2): 107-116.

***Correspondence to:**
Jamshid Bahmaei,
Student Research Committee, School of Management and Medical Informatics, Shiraz University of Medical Sciences, Shiraz, Iran
Tel: +98 9168721061
Email: Jamshid_b1388@yahoo.com

Introduction

Healthcare system is among the most important service sectors and the main axis of social welfare and development (1). Financing and preventing increased costs are among the main challenges of healthcare systems around the world (2). Therefore, the factors determining health expenditures have received much attention by economists, planners and policymakers in the healthcare sector (3). Physician-induced demand is a factor affecting health expenditures (4).

Induced demand is defined as care or sale of unnecessary services to patients that is implemented by applying the power and order of specialists (5, 6). With unlimited demands and limited resources, induced demand increases public share of treatment costs, undermines efficient resource allocation, reduces the cost-effectiveness of resources allocated to the healthcare sector, and causes imbalance of supply and demand for healthcare services, increases the health sector costs, and sometimes leads to the prevalence of medical complications in healthcare clients (7).

Shain and Roemer (8), and Roemer (9) conducted the first studies on induced demand by healthcare providers. They found a positive correlation between bed supply in hospitals and number of hospitalization days. Following studies by Roemer, theoretical analysis of induced demand in the health service market by Panahi *et al.*, Sekimoto and Masako,

Yuda, Nassiri and Rochaix confirmed Roemer's law (10-13). Fuchs also interviewed 46 prominent people in the US health economics (24 economic theorists and 22 physicians). About two thirds of health economists and physicians and three fourths of economic theorists believed in induced demand, arguing that physicians have the power to influence their patients to use services, and the majority of the respondents believed that physicians induced demands (14). In a study on complementary health insurance and induced demand in chemical warfare victims, Mahbubi *et al.* concluded that earning profits from insurance services induced unreal demands to patients (15). Crivelli *et al.* also confirmed the supplier-induced demand using regional data from 26 districts in Switzerland (16). Similarly, Varhami showed that a 1% increase in the number of physicians led to 12% and 1% increase in demand for hospital and outpatient services, respectively (17).

In summary, induced demand may impose many challenges on the healthcare system and more importantly on patients by affecting access to essential and required services, while the likelihood of an induced demand and significance of its effects are the result of interaction between a wide range of factors (7). Accordingly, the present study was designed for structural modeling of factors affecting induced demand to provide a clear framework for determining the best policies to control and manage induced demand and ultimately prevent the loss of healthcare resources.

Methods

This study was conducted in two phases in 2018. In the first phase, literature was thoroughly reviewed to identify factors affecting health provider-induced demand. Interpretive structural modeling was utilized in the second phase to investigate the relationships between the factors and determine the most effective variables.

To identify the factors affecting induced demand, a scoping review was carried out on related articles, and extracted literature was then evaluated by content validity ratio (CVR). Content validity was used to identify and select the most important criteria for the process of the factors affecting induced demand for health services. For this purpose, a questionnaire including 34 extracted criteria was designed and the experts were asked to determine the importance of each of the criteria using a 3-point scale ("Necessary", "Effective but not necessary", and "Not effective"). Then, the CVR value was calculated according to the following formula:

$$CVR = \frac{(ne - N/2)}{N/2}$$

where n_E is the number of experts who selected "Necessary" choices, and N was the total number of the experts involved. Because the number of the specialists was 9, the criteria with a CVR greater than 0.7 were accepted (18). Finally, 13 factors affecting induced demand were identified (Table 3).

Table 1 shows the search strategy used in this study. A total of 5428 articles were extracted after searching the intended databases. After excluding similar items, the titles of the articles were screened and 732 articles were selected for abstract review. Thereafter, a total of 182 papers were selected for full-text examination. In the last step, a total of 74 articles were included for final analysis. All evaluations were performed by two reviewers and disagreements were examined by a third party (Figure 1).

In the second phase of the study, nine experts in health economics, health policy and health service management at Shiraz University of Medical Sciences were selected using purposeful non-random sampling to model factors affecting induced demand. The interpretive structural modeling (ISM) was used for investigating the relationships between the variables and determining their effectiveness through the following steps.

Determining of elements relevant to the problem. Starting point of ISM is the identification of elements relevant to the problem. In this research by using thorough review of literature, we can identify main factors of Influencing Induced Demand for Health Services.

Table 1: The search strategy in the database

Database	PubMed, Scopus, Web of Science, Embase, Wiley, Cochrane, Sciencedirect, Google Scholar
Limitation	Only studies with at least English abstracts were included in the study. • All studies were included in the research question until the end of December 2018 • Search was by title, abstract and keyword articles
Search strategy	#1 AND #2
#1	"Induced Demand" OR "Supplier Induced Demand" OR "Provider Induced Demand" OR "Irrational Prescription" OR "Irrational Medical Imaging" OR "Irrational Order" OR "Irrational Request"
#2	Causes OR Determinant Or Factors OR "Determinant Factors"

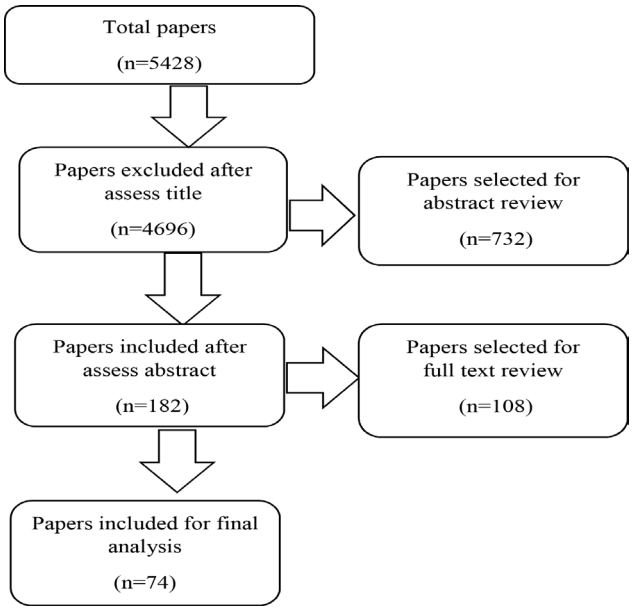

Figure 1: PRISMA flow diagram for systematic review

Creating a structural self-interactive matrix (SSIM) and completing it by all experts to determine the relationships between variables and creating an integrated structural self-interactive matrix based on mode in frequency of expert views.

Creating initial and final reachability matrix using data from integrated self-interactive matrix to define the relationships between the variables.

Determining the reachability set of each variable using the final reachability matrix for categorizing and modeling the variables.

Drawing a conceptual model derived from the final reachability matrix.

Drawing the driving power and dependence power diagram of variables (MICMAC).

In this phase, structural self-interactive matrix was first developed and completed by experts based on the factors affecting induced demand. Variables in this matrix were listed in rows and columns, respectively. The mutual relationships between the variables were then determined by symbols shown in Table 2. The integrated structural self-interactive matrix was drawn in the second step using data obtained from experts and mode of frequency of expert views. Then, the initial reachability matrix was obtained by converting the structural self-interactive matrix into a double value 0/1 matrix. To this end, if (i,j) is represented by V in the structural self-interactive matrix, (i,j) and (j,i) in the initial reachability matrix will be 1 and 0, respectively. If (i,j) is represented A in the structural self-interactive matrix, (i,j) and (j,i) in the initial reachability matrix will be 0 and 1, respectively. If (j,i) is denoted by x in the structural self-interactive matrix, (i,j) and (j,i) in the initial reachability matrix will be 1 and 1, respectively. Moreover, if (i,j) is represented by O in the structural self-interactive matrix, (i,j) and (j,i) will be 0 in the initial reachability matrix. The final reachability matrix was obtained after obtaining the initial reachability matrix by entering the transferability in the relationship between the variables. The reachability matrix was obtained using Euler's theorem in which the adjacency matrix was added to the single matrix. Then, this matrix was raised to the power of in the case of invariant entries. The reachability sets were then obtained for each variable using the final reachability matrix. After determining the reachability set for each variable, common elements were identified and these factors were then classified into different levels. According to the level of variables and the final reachability matrix, the initial model was drawn in the next step and the final model was obtained by removing transferability in the initial model. The driving power and dependence power diagram (MICMAC) was plotted in the last step. To draw MICMAC, the dependence of variables was obtained using the final reachability matrix through the input sum of 1 in each row of driving power and the input sum of 1 in each column. Accordingly, the variables were categorized into four classes based on the driving power and dependence power: (1) Autonomous variables with weak driving power and dependence power, (2) dependent variables with weak driving and dependence power, (3) linkage variables with high driving and dependence power and any change in them can affect the system, and (4) independent variables with high driving power and low dependence power. Therefore, the key factors

Table 2: The contextual relationship for each variable

Symbol	Context symbol
V	the relation from i to j but not in both directions
A	the relation from j to i but not in both directions
X	both direction relations from i to j and j to i
O	the relation between the elements does not appear to be valid

with high driving power were identified to be used in developing appropriate policies for reducing the induced demand.

Prior to inclusion of experts, the research objectives were explicitly explained to the experts and they participated in the study with full consent.

Results

After a thorough review of literature and evaluation by CVR, 13 factors affecting induced demand were identified and listed in Table 3. A structured self-interactive matrix was developed using the identified factors and given to nine experts to obtain the required information. After completing the questionnaire, the corresponding structural self-interactive matrix shown in Table 4 was obtained. In the next step, the structural self-interactive matrix was converted into an initial reachability matrix (Table 5). After obtaining the initial reachability matrix, the final reachability matrix was obtained by adding transferability to the relationships between variables (Table 5). Using the final reachability matrix, the reachability set for each variable was obtained and reachability matrix was classified into different levels. As clearly seen, the factors affecting induced demand are classified into six levels (Table 6). In the next step, with respect to the variable levels and the final matrix, an initial model was drawn, and the final model was obtained by eliminating transferability in the initial model (Figure 1). The relationships between the criteria of various levels are apparent in the final model. Here, lack of clinical guidelines and increased number of providers are at the lowest levels. Weakness of education system, weakness of health supervisory system, poor supervision of insurance companies, and improper payment system were at the 5th level. The providers' insufficient knowledge and skills and clinical uncertainty were at the 4th level and defensive

Table 3: Identification of key factors in the induced demand

Factors Number	Factors	Frequency (References)	CVR
1	Incentives to earn more	8 (18-25)	0/83
2	providers' insufficient knowledge and skills	7 (19, 21, 22, 24, 26-28)	1
3	Information asymmetry	19 (17, 19, 22, 24-27, 29-40)	1
4	Collusion of service providers	4 (19, 21, 24, 41)	0/94
5	Weakness of Health Supervisory System	7 (19, 22, 24, 25, 42-44)	0/79
6	Improper payment system	13 (4, 19, 22, 25, 26, 28, 30, 37, 45-49)	0/81
7	poor supervision of insurance companies	8 (19, 22, 24, 25, 27, 36, 50, 51)	1
8	Increase in the number of provider	16 (2, 4, 12, 19, 22, 24, 26, 43, 51-58)	0/78
9	Weakness of education system	7 (19, 22, 24, 25, 27, 35, 43)	1
10	Patient preferences	9 (24, 25, 27, 36, 43, 59-62)	0/75
11	Lack of clinical guidelines	12 (18, 22, 24, 25, 28, 54, 59, 63-67)	0/78
12	Defensive Medicine	9 (21, 24, 68-74)	0/83
13	Clinical uncertainty	7 (22, 24, 30, 43, 52, 60, 62)	0/76

Table 4: Structural self-interaction matrix

Factors	13	12	11	10	9	8	7	6	5	4	3	2	1
1	o	o	A	o	o	o	A	A	A	X	A	o	
2	o	V	A	o	A	o	A	o	A	o	o		
3	o	o	o	X	o	o	o	o	o	V			
4	o	o	A	o	o	A	A	A	A				
5	o	V	o	V	A	A	X	V					
6	o	V	A	v	V	o	X						
7	o	o	A	V	o	o							
8	o	o	o	V	o								
9	o	V	A	o									
10	o	A	A										
11	o	V											
12	A												
13													

"X": when i (row) and j (column) will influence each other; "O": when i and j are unrelated; "A": when i will be influenced by j; "V": when i will influence j

Table 5: Final reachability matrix

Factors	1	2	3	4	5	6	7	8	9	10	11	12	13	Driving
1	1	0	0	1	0	0	0	0	0	0	0	0	0	2
2	1	1	1	1	0	0	0	0	0	1	0	1	0	6
3	1	0	1	1	0	0	0	0	0	1	0	0	0	4
4	1	0	0	1	0	0	0	0	0	0	0	0	0	2
5	1	1	1	1	1	1	1	0	1	1	0	1	0	10
6	1	1	1	1	1	1	1	0	1	1	0	1	0	10
7	1	1	1	1	1	1	1	0	1	1	0	1	0	10
8	1	1	1	1	1	1	1	1	1	1	0	1	0	11
9	1	1	1	1	1	1	1	0	1	1	0	1	0	10
10	1	0	1	1	0	0	0	0	0	1	0	0	0	4
11	1	1	1	1	1	1	1	0	1	1	1	1	0	11
12	1	0	1	1	0	0	0	0	0	1	0	1	0	5
13	1	0	1	1	0	0	0	0	0	1	0	1	1	6
Dependency	13	7	11	13	6	6	6	1	6	11	1	9	1	-----

Table 6: Iterations and level partitions

Factors	Reachability set	Antecedent Set	Intersection Set	Levels
1	1,4	1,2,3,4,5,6,7,8,9,10,11,12,13	1,4	I
2	2	2,5,6,7,8,9,11	2	IV
3	3,10	2,3,5,6,7,8,9,10,11,12,13	3,10	II
4	1,4	1,2,3,4,5,6,7,8,9,10,11,12,13	1,4	I
5	5,6,7,9	5,6,7,8,9,11	5,6,7,9	V
6	5,6,7,9	5,6,7,8,9,11	5,6,7,9	V
7	5,6,7,9	5,6,7,8,9,11	5,6,7,9	V
8	8	8	8	VI
9	5,6,7,9	5,6,7,8,9,11	5,6,7,9	V
10	3,10	2,3,5,6,7,8,9,10,11,12,13	3,10	II
11	11	11	11	VI
12	12	2,5,6,7,8,9,11,12,13	12	III
13	13	13	13	IV

medicine was at the 3rd level; patient preferences and information asymmetry were at the 2nd level, and the collusion of service providers and their incentives to earn more income were at the 1st level. Despite the impact of all these indicators on induced demand, the factors with a higher level of interpretive structural modeling were strongly affected, while lower level factors strongly affected the induced demand.

In the last step, the driving and dependence power diagram of variables was drawn using the analysis of driving and dependence power (Figure 2). Therefore, the key factors with a greater impact were identified to be used in developing appropriate policies to reduce the induced demand. Lack of clinical guidelines, weakness of education system, inefficient monitoring system, weak insurance supervision, increased number of suppliers, and improper payment system are the key factors affecting induced demand with a great impact on the induced demand control and management.

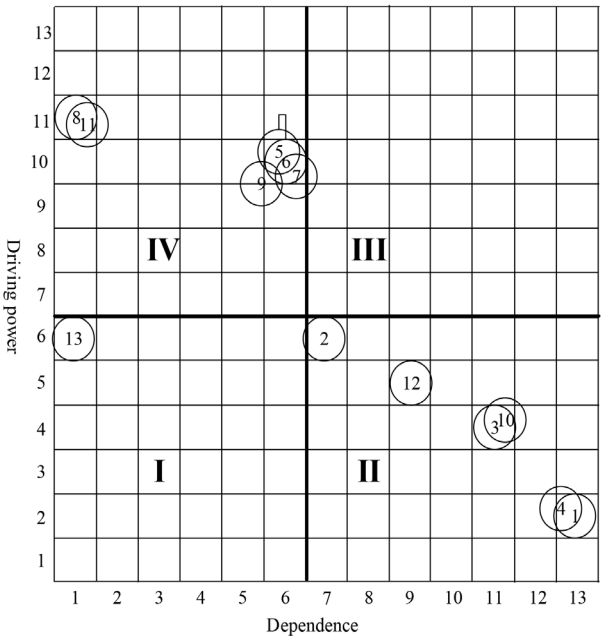

Figure 1: MICMAC

Discussion

Induced demand is a major challenge in the national healthcare system. National practices are compromised due to induced demand and national income is not allocated cost-effectively (19). Induced demand reduction requires finding the relationships between the key factors to provide a clear framework for determining the best controlling policies, thereby preventing the loss of healthcare resources. This study provided a new insight into the factors affecting induced demand for prioritization of decision-making and policymaking measures.

The results on interpretive structural modeling and MICMAC matrix indicated high driving and dependency power in terms of influence and effectiveness, lack of clinical guidelines, weakness of education system, weakness of health supervisory system, weak insurance supervision, increased number of suppliers, and improper payment system. A lower dependency power indicates the independence degree of these variables, so that a smaller power indicates a more independent variable. These variables in turn affect other factors influencing the induced demand.

Highly influential variables are referred to as key variables. They fall into one of the two groups of independent or linkage variables, given the lack of associated variables in this study. Therefore, lack of clinical guidelines, weakness of education system, inefficient monitoring system, weak insurance supervision, increased number of suppliers, and improper payment system are the key factors affecting the induced demand with a great impact on the induced demand control and management. Therefore, one should pay attention to the special role and place of these factors to control the induced demand.

The lack of clinical guidelines is another key factor affecting the induced demand. Clinical guidelines are a systematic set of the latest and most reliable scientific evidence describing the clinical approach to a patient classified according to priorities, effectiveness, and cost-effectiveness. It seems that lack of access to valid and evidence-based clinical guidelines to direct service providers regarding the limitations and boundaries of diagnostic tools for related diseases and preventing them from requesting ineffective diagnostic services for patients provides the grounds for offering unnecessary or expensive healthcare services to patients. Various studies have suggested clinical guidelines as an important factor in induced demand (18, 22, 24, 25, 28, 54, 59, 63-67).

According to the results, increased number of skilled and expert staff is also a key factor affecting induced demand. Increased number of healthcare staff may lead to a supply-demand imbalance in the health market. They attract the patients even by providing unnecessary services to maintain their position in the healthcare market. Approving the above results, other studies confirmed increased number of skilled and expert staff of important factors affecting the induced demand (4, 11, 12, 19, 22, 24, 26, 43, 51-58).

Lack of clinical guidelines and increased number of skilled and expert staff as the basis of the final model derived in this study were at the lowest level. One should start from these variables and then extend to other ones to control the factors affecting the induced demand.

Weakness of educational models also affects induced demand. Weak educational models and inappropriate teaching and learning practices result in the lack of ability and skill in diagnosing illness and health problems. Consequently, physicians use induced demand as a tool for gaining more experience and information. Results of other studies also confirmed the weakness of educational models and inappropriate teaching and learning practices as important factors affecting induced demand (19, 22, 24, 25, 27, 35, 43).

Weakness of health supervisory systems is another key factor affecting the induced demand. Monitoring the performance of service providers by competent authorities can control and reduce unnecessary medical services. Weakness in enforcement of regulatory rules is among the factors affecting the effectiveness of the regulatory system and can lead to disproportionate use of services. Other studies also confirmed the lack of accurate monitoring as an important factor affecting the induced demand (19, 22, 24, 25, 42-44).

Poor supervision of insurance companies in contribution payment is another key factor affecting the induced demand. Insurance companies are not capable of proper supervision over health-care providers. Usually, they do look at what the physician prescribes and never check the validity of their prescription. Supervision of insurance companies is limited to the quantity of liability services, and the quality is often neglected. Supervision by insurance companies is performed after providing healthcare services to the patients, leading to a gap in the permanent monitoring process. Failure to buy strategic healthcare services by insurance companies is another factor contributing to the inadequacy of this monitoring and control system. Other studies

also confirm the above results, indicating the role of insufficient supervision and control of insurance companies in contribution payment in induced demand (19, 22, 24, 25, 27, 36, 50, 51).

Improper payment system was identified as another factor affecting the induced demand. An inappropriate payment mechanism leads to more intention to induce unnecessary services. Because of the obvious excellence in medical knowledge about patients, physicians may induce demand in a variety of ways and use this power to increase their revenues. Various studies have suggested inefficient compensation system as an important factor affecting the induced demand (4, 19, 22, 25, 26, 28, 30, 37, 45-49).

According to the results, inadequate knowledge and skills of suppliers, defensive medicine, patient preferences, information asymmetry and collusion of the suppliers, and the desire for more revenues are more effective than the other factors. In other words, despite the role of multiple factors in creation and promotion of these variables, they less likely change and affect the induced demand control.

Clinical uncertainty was included in autonomous variables. They are among relatively non-related variables to the system with low influence, dependence, and relationship with other variables.

Conclusion

According to the results, lack of clinical guidelines, failure of the educational model, inefficient monitoring system, weak insurance supervision, increased number of suppliers, and inefficient payment system were identified as the most important factors affecting management and control of the induced demand. To overcome these barriers, managers and policymakers should focus on other factors that lead to the emergence of these barriers. This enables them to prioritize, design and implement control and intervention programs for the above-mentioned factors, thereby managing the induced demand.

Limitations

Despite all advantages of this method, ISM has its own limitations. Conceptual relationships between the variables always depend on the experts' knowledge that affect the results.

Acknowledgments

Hereby, the contributions of all reverend participants to the data collection process are deeply appreciated.

Funding sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical issues

Shiraz University of Medical Sciences Ethics Committee approved the study (Approval No 98-01-07-20215).

Competing interests

Authors declare that they have no competing interests.

Knowledge Translation (KT) Section

What is "already known" in this topic: Induced demand is one of the controversial topics in health economics. In fact, they call for the induction, care, or sale of unnecessary service to health system clients that is associated with the exercise of power by service providers.

What this article adds: The present study was designed for structural modeling of the factors affecting the induced demand to provide a clear framework for determining the best policies to control and manage the induced demand and ultimately prevent the loss of healthcare resources.

Conflict of Interest: None declared.

References

1. Rezapoor A, Ebadifard Azar F. Situation of resource allocation in Iranian, s health system. *Journal of Hospital*. 2013;11(4):53-64.
2. Panahi H, Fallahu F, Imani A, Nasibparast S. Investigating Psychiatrists Induced Demand in East Azarbayjan: The Approach of Hierarchical Linear Modeling (HLM). *Journal of Economic Modeling Research*. 2018;8(31):165-96. doi: 10.29252/jemr.8.31.165.
3. Ahmadi A, Taheri E. Factors affecting health expenditures of households in Iran: application of Ordered Probit model. *Journal of Health Administration*. 2017;20(67):89-98.
4. Golkhandan A, Fatholahi E. Offering and Testing a Model to Explain the Physician Induced Demand in Iran. *Journal of Healthcare Management (Journal of Health System)*. 2017;7(4):29-40.
5. Cawley J, Moriya AS, Simon K. The impact of the macroeconomy on health insurance coverage: Evidence from the great recession. *Health economics*. 2015;24(2):206-23.
6. Khorasani E, Karimi S, Keyvanara M, Etemadi M, Khorasani F. Identification of the healthcare

services with potential induced demand. *International Journal of Hospital Research*. 2015;4(2):47-54.
7. Keyvanara M, Karimi S, Khorasani E. Jafarian jazi M. Challenges resulting from healthcare induced demand: a qualitative study. *Health Inf Manage*. 2013;10(4):548.
8. Shain M, Roemer MI. Hospital costs relate to the supply of beds. *Journal of Occupational and Environmental Medicine*. 1959;1(9):518.
9. Romer MI. Bed supply and hospital utilization: A national experiment. *Hospitals, JAH A*. 1961;1961(35):988-93.
10. Nassiri A, Rochaix L. Revisiting phy sicians' financial incentives in Quebec: a panel system approach. *Health Econ*. 2006;15(1):49-64. doi: 10.1002/hec.1012.
11. Panahi H, Salmani B, Nasibparast S. Inductive effect of physicians number and hospital bed on health expenditures in Iran. *Quarterly Journal of Applied Theories of Economics*. 2015;2(2):25-42.
12. Sekimoto M, Ii M. Supplier-Induced Demand for Chronic Disease Care in Japan: Multilevel Analysis of the Association between Physician Density and Physician-Patient Encounter Frequency. *Value Health Reg Issues*. 2015;6:103-10. doi: 10.1016/j.vhri.2015.03.010.
13. Yuda M. Medical fee reforms, changes in medical supply densities, and supplier-induced demand: Empirical evidence from Japan. *Hitotsubashi Journal of Economics*. 2013:79-93.
14. Grytten J, Carlsen F, Skau I. The income effect and supplier induced demand. Evidence from primary physician services in Norway. *Applied Economics*. 2001;33(11):1455-67.doi: 10.1080/00036840010009883.
15. Mahbubi M, Ojaghi S, Ghiyasi M, Afkar A. Supplemental insurance and induce demand in veterans. *Med Veterans J*. 2010;2(8):18-22.
16. Crivelli L, Filippini M, Mosca I. Federalism and regional health care expenditures: an empirical analysis for the Swiss cantons. *Health Econ*. 2006;15(5):535-41. doi: 10.1002/hec.1072.
17. Varharami V. Evaluation of the Physician Induced Demand. *J Healthcare Manage*. 2010;2:3742.
18. Ayre C, Scally AJ. Critical values for Lawshe's content validity ratio: revisiting the original methods of calculation. *Measurement and Evaluation in Counseling and Development*. 2014;47(1):79-86.
19. Borhanzade A. Induced demand and the cost of tests and its impact on cost and family health. *Iranian Association of Clinical Laboratory Doctors*. 2011;11(1):17-22.
20. Johnson E, Culyer A. Physician-Induced Demand. Encyclopedia of Health Economics. *Elsevier*. 2014;3:77-82.doi: 10.1016/b978-0-12-375678-7.00805-1.
21. Karimi S, Khorasani E, Keyvanara M, Afshari S. Factors affecting physicians' behaviors in induced demand for health services. *International Journal of Educational and Psychological Researches*. 2015;1(1):43. doi: 10.4103/2395-2296.147469.
22. Keyvanara M, Karimi S, Khorasani E. Opinions of health system experts about main causes of induced demand: A qualitative study. *Hakim Research Journal*. 2014;16(4):317-28.
23. Khani M. Investigating Physician Induced Demand (Case Study: CSection in Iran). Faculty of Management and Economics: University of Sharif; 2013. Persian.
24. Khorasani E, Keyvanara M, Karimi S, Jazi MJ. Views of health system experts on macro factors of induced demand. *Int J Prev Med*. 2014;5(10):1286-98.
25. Riahi M, Molavi Taleghani Y, Salehiniya H, Vejdani M. Induced demand: A challenge on the way of Iran Health Revolution Program. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 2016;7(5):1827-35.
26. Ahmed J, Shaikh B. The many faces of supplier induced demand in health care. *Iranian Journal of Public Health*. 2009:139-41.
27. Mahmoudi G, Roohi G, Asadi M, Kalamaki FR, Abam S, Khojamli M, et al. Factors associated with induced demand for services in Iran's healthcare system. *F1000Research*. 2018;7(978):978.
28. Mohamadloo A, Ramezankhani A, Zarein-Dolab S, Salamzadeh J, Mohamadloo F. A systematic review of main factors leading to irrational prescription of medicine. *Iran J Psychiatry Behav Sci*. 2017;11(2):e10242. deoi: 10.5812/ijpbs.10242.
29. Pedersen LB, Hess S, Kjaer T. Asymmetric information and user orientation in general practice: Exploring the agency relationship in a best-worst scaling study. *J Health Econ*. 2016;50:115-30. doi: 10.1016/j.jhealeco.2016.09.008.
30. Broomberg J, Price MR. The impact of the fee-for-service reimbursement system on the utilisation of health services. Part I. A review of the determinants of doctors' practice patterns. *S Afr Med J*. 1990;78(3):130-2.
31. De Jaegher K, Jegers M. A model of physician behaviour with demand inducement. *J Health Econ*. 2000;19(2):231-58. doi: 10.1016/s0167-6296(99)00029-6.

32. Delattre E, Dormont B. Fixed fees and physician-induced demand: a panel data study on French physicians. *Health Econ*. 2003;12(9):741-54. doi: 10.1002/hec.823.
33. Grossman M. The human capital model. Handbook of health economics. 2000; 1: 347–408.doi: 10.1016/s1574-0064(00)80166-3.
34. Hansen BB, Sørensen TH, Bech M. Variation in utilization of health care services in general practice in Denmark. *University of Southern Denmark, Institute of Public Health–Health Economics*. 2008.
35. Izumida N, Urushi H, Nakanishi S. An empirical study of the physician-induced demand hypothesis: The cost function approach to medical expenditure of the elderly in Japan. *Rev Popul Soc Policy*. 1999;8:11-25.
36. Keyvanara M, Karimi S, Khorasani E, Jazi MJ. Experts' perceptions of the concept of induced demand in healthcare: A qualitative study in Isfahan, Iran. *J Educ Health Promot*. 2014;3:27. doi: 10.4103/2277-9531.131890.
37. Labelle R, Stoddart G, Rice T. A re-examination of the meaning and importance of supplier-induced demand. *J Health Econ*. 1994;13(3):347-68. doi: 10.1016/0167-6296(94)90036-1.
38. Noguchi H, Shimizutani S. Supplier-induced demand in Japan's at-home care industry: Evidence from micro-level survey on care receivers. Dublin: Economic and Social Research Institute; 2005.
39. Tunis SR. Economic analysis in healthcare decisions. *American Journal of Managed Care*. 2004;10(5):301-4.
40. van Dijk CE, van den Berg B, Verheij RA, Spreeuwenberg P, Groenewegen PP, de Bakker DH. Moral hazard and supplier-induced demand: empirical evidence in general practice. *Health Econ*. 2013;22(3):340-52. doi: 10.1002/hec.2801.
41. Keyvanara M, Karimi S, Khorasani E, Jafarian Jazi M. Are Health Institutions Involved In Health Care Induced Demand?(A Qualitative Study). *Payavard Salamat*. 2014;8(4):280-93.
42. Amporfu E. Private hospital accreditation and inducement of care under the ghanaian national insurance scheme. *Health Econ Rev*. 2011;1(1):13. doi: 10.1186/2191-1991-1-13.
43. Bickerdyke I, Dolamore R, Monday I, Preston R. Supplier-induced demand for medical services. *Canberra: Productivity Commission Staff Working Paper*. 2002:1-113.
44. Falit BP, Gross CP, Roberts KB. Integrated prostate cancer centers and over-utilization of IMRT: a close look at fee-for-service medicine in radiation oncology. *Int J Radiat Oncol Biol Phys*. 2010;76(5):1285-8. doi: 10.1016/j.ijrobp.2009.10.060.
45. Ansari B, Bahadori M, Hosseini S. Determinats of Reduction of Induced Demand Inselected Hospitals That Affiliated with IUMS in 2017; A Qualitative Stady On Provider's View. *The J Urmia Nurs Midwifery Fac*. 2018;16(6):389-402.
46. Gruber J, Owings M. Physician financial incentives and cesarean section delivery. *Rand J Econ*. 1996;27(1):99-123.
47. Hemani ML, Makarov DV, Huang WC, Taneja SS. The effect of changes in Medicare reimbursement on the practice of office and hospital-based endoscopic surgery for bladder cancer. *Cancer*. 2010;116(5):1264-71. doi: 10.1002/cncr.24875.
48. Madden D, Nolan A, Nolan B. GP reimbursement and visiting behaviour in Ireland. *Health Econ*. 2005;14(10):1047-60. doi: 10.1002/hec.995.
49. Sada MJ, French WJ, Carlisle DM, Chandra NC, Gore JM, Rogers WJ. Influence of payor on use of invasive cardiac procedures and patient outcome after myocardial infarction in the United States. Participants in the National Registry of Myocardial Infarction. *J Am Coll Cardiol*. 1998;31(7):1474-80. doi: 10.1016/s0735-1097(98)00137-5.
50. Bazyar M, Soofi M, Rashidian A. Ways to control moral hazard in health system: demand-side and supply-side interventions. *Tolooebehdasht*. 2012;11(1):110-22. doi: 10.1007/s12513-012-0142-x.
51. Darzi RS, Shahnazi R, Niakan L, Kavosi Z. Physician-Induced Demand Hypothesis in Iran: Impact of the Physician Density on Treatment Costs. *Sanaat-E-Bimeh*. 2018;32(4):1-19.
52. Karimi S, Rezaei F, Kordi A. Utilization of magnetic resonance imaging in patient covered by Isfahan health care insurance, Iran. *Director General*. 2013;9(7):1146-51.
53. Kung PT, Tsai WC, Yaung CL, Liao KP. Determinants of computed tomography and magnetic resonance imaging utilization in Taiwan. *Int J Technol Assess Health Care*. 2005;21(1):81-8. doi: 10.1017/s0266462305050105.
54. Leonard C, Stordeur S, Roberfroid D. Association between physician density and health care consumption: a systematic review of the evidence. *Health Policy*. 2009;91(2):121-34. doi: 10.1016/j.healthpol.2008.11.013.
55. Lien HM, Albert Ma CT, McGuire TG. Provider-client interactions and quantity of health care use.

J Health Econ. 2004;23(6):1261-83. doi: 10.1016/j.jhealeco.2004.03.003.
56. Richardson JRJ, Peacock S. Supplier induced demand reconsidered. New Jersey: Citeseer; 1999.
57. Tsai W-C, Kung P-T, Liao K-P. The impact of physician supply on the utilization of ambulatory care under the National Health Insurance. *Mid-Taiwan Journal of Medicine*. 2004;9(1):27-37.
58. Yip WC. Physician response to Medicare fee reductions: changes in the volume of coronary artery bypass graft (CABG) surgeries in the Medicare and private sectors. *J Health Econ*. 1998;17(6):675-99. doi: 10.1016/s0167-6296(98)00024-1.
59. Bremberg S, Nilstun T. Justifications of physicians' choice of action. *Scand J Prim Health Care*. 2005;23(2):102-8. doi: 10.1080/02813430510018455.
60. Espeland A, Baerheim A. Factors affecting general practitioners' decisions about plain radiography for back pain: implications for classification of guideline barriers--a qualitative study. *BMC Health Serv Res*. 2003;3(1):8. doi: 10.1186/1472-6963-3-8.
61. Khorasani E, Keyvanara M, Karimi S, JAFARIAN JM. The Role of Patients in Induced Demand from Experts'perception: A Qualitative Study. *Journal of Qualitative Research in Health Sciences*. 2014;2(4):336-45. doi: 10.4103/2347-9019.138931.
62. Wilson IB, Dukes K, Greenfield S, Kaplan S, Hillman B. Patients' role in the use of radiology testing for common office practice complaints. *Arch Intern Med*. 2001;161(2):256-63. doi: 10.1001/archinte.161.2.256.
63. Coenen S, Michiels B, Renard D, Denekens J, Van Royen P. Antibiotic prescribing for acute cough: the effect of perceived patient demand. *Br J Gen Pract*. 2006;56(524):183-90.
64. Dosoretz AM. Reforming Medicare IMRT (intensity modulated radiation therapy) reimbursement rates: A study investigating increasing IMRT utilization rates and doctors' incentives: Tufts University; 2011.
65. Mao W, Tang S, Chen W. Does perverse economic incentive lead to the irrational uses of medicines? *Expert Rev Pharmacoecon Outcomes Res*. 2013;13(6):693-6. doi: 10.1586/14737167.2013.856266.
66. Simbar M, Nahidi F, Tehrani FR, Ramezankhani A. Fathers' educational needs for perinatal care in urban Iran: a qualitative approach. *J Biosoc Sci*. 2010;42(5):633-41. doi: 10.1017/S0021932010000167.
67. Yousefi N, Majdzadeh R, Valadkhani M, Nedjat S, Mohammadi H. Reasons for physicians' tendency to irrational prescription of corticosteroids. *Iran Red Crescent Med J*. 2012;14(11):713-8. doi: 10.5812/ircmj.2284.
68. Amiresmaili M, Nekoueimoghadam M, Moosazadeh M, Esmaili F, Mirtajeddini M. A survey on frequency of defensive medicine among general practitioners of Kerman city. *Journal of Payavard Salamat*. 2014;7(5):399-409.
69. Iversen T, Luras H. The effect of capitation on GPs' referral decisions. *Health Econ*. 2000;9(3):199-210. doi: 10.1002/(sici)1099-1050(200004)9:3<199::aid-hec514>3.0.co;2-2.
70. Mohr JC. American medical malpractice litigation in historical perspective. *JAMA*. 2000;283(13):1731-7. doi: 10.1001/jama.283.13.1731.
71. Studdert DM, Mello MM, Brennan TA. Medical malpractice. *N Engl J Med*. 2004;350(3):283-92. doi: 10.1056/NEJMhpr035470.
72. Studdert DM, Mello MM, Sage WM, DesRoches CM, Peugh J, Zapert K, et al. Defensive medicine among high-risk specialist physicians in a volatile malpractice environment. *JAMA*. 2005;293(21):2609-17. doi: 10.1001/jama.293.21.2609.
73. Summerton N. Positive and negative factors in defensive medicine: a questionnaire study of general practitioners. *BMJ*. 1995;310(6971):27-9. doi: 10.1136/bmj.310.6971.27.
74. Tussing AD, Wojtowycz MA. Malpractice, defensive medicine, and obstetric behavior. *Med Care*. 1997;35(2):172-91. doi: 10.1097/00005650-199702000-00007.