Journal of Pharmacoeconomics & Pharmaceutical Management

Journal Homepage: jppm.tums.ac.ir

Per Capita Consumption and Distribution Pattern of Antibiotic in Khuzestan Province From 2016 to 2017

Rezvan Hallaj[1], Behzad Sharif Makhmalzadeh[2], Leila Kouti[3*], Janet Soleymani[4], Hossein Barzegar Bafrooei[4], Farideh Younesi[4], Kaveh Eslami[5]

1. Student Research Committee, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.
2. Nanotechnology Research Center, School of Pharmacy, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.
3. Department of Clinical Pharmacy, School of Pharmacy, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.
4. Food and Drug Deputy, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.
5. Department of Clinical Pharmacy, Faculty of Pharmacy, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

Use your device to scan and read the article online

Citation Hallaj R, Sharif Makhmalzadeh B, Kouti L, Soleymani J, Barzegar Bafrooei H, Younesi F, et al. Per Capita Consumption and Distribution Pattern of Antibiotic in Khuzestan Province From 2016 to 2017. Journal of Pharmacoeconomics and Pharmaceutical Management .2018; 4(1-2):25-31.

Running Title Per Capita Consumption and Distribution Pattern of Antibiotic

Article Type Original Article

Article info:

Received: 18.07.2017

Revised: 22.09.2017

Accepted: 07.11.2017

Keywords:

Drug resistance, Antibiotics, Distribution, Consumption, Food & drug depuy

ABSTRACT

Background: The overuse and misuse of antibiotics contribute to the development of antibiotic resistance, increase the incidence of adverse drug reactions, and impose high costs on the healthcare system. In Iran, the Food and Drug Administration is responsible for the surveillance of drug consumption. The aim of the present study is to assess the distribution pattern of 10 most commonly used antibiotics from drug distribution companies to private and national health pharmacies supervised by the Food and Drug Deputy of Ahvaz Jundishapur University of Medical Sciences in 2016. The administration rate of these antibiotics was also assessed by a survey of prescriptions documented by the Social Security Organization and Health Insurance.

Methods: The distribution pattern of 10 antibiotics was obtained from pharmaceutical distribution companies. The per capita consumption of antibiotics with and without prescription was determined by the Social Security Organization and Health Insurance.

Results: More than half of the total distributions of all antibiotics in the cities of Khuzestan Province were related to private pharmacies. Many surveyed cities had a high percent of antibiotic consumption without prescription.

Conclusion: The accurate recording of the distribution of antibiotics by pharmaceutical companies and the submission of monthly and annual reports to food and drug deputies are necessary. It is also necessary to increase the surveillance of pharmacies and the process of antibiotic provision.

*** Corresponding Author:**
Leila Kouti, PhD.
Address: *Department of Clinical Pharmacy, School of Pharmacy, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.*
E-mail: *lkouti.pharmacotherapy@gmail.com*

1. Introduction

Antibiotics are an important class of drugs that cure many previously fatal infectious diseases. But in the past 20 years, bacterial resistance to these drugs has emerged. This problem is partly because of the irrational use of these drugs, the prescribers' malpractice, the unnecessary use of these agents, or the patients' insistence to get antibiotics. Antibiotic use and resistant infections increase healthcare costs [1, 2].

Studies on antibiotic surveillance are an important source of information to identify the current problems and developing strategies to control them. The world health organization has classified antibiotic resistance as a serious global threat [3]. The use of antibiotics should be based on the approved guidelines. Regulatory and antibiotic stewardship plans can help to minimize the improper use of these drugs [4].

Self-medication with antibiotics is a serious issue that predisposes patients to bacterial resistance and imposes several problems on the community and healthcare system. In some pharmacies, antibiotics are bought and used without a prescription for self-diagnosed or recurrent illnesses. Some patients also take unused previous antibiotics stored at home or share medicines with friends or relatives [5].

Various determinants of self-medication of antibiotics such as age group, sex, educational level [6], lack of health insurance, cost of medical consultation [7], type of disease [8], knowledge about the consequences of self-medication [9], and over-the-counter sale of antibiotics [4, 7] are identified in different studies. A study among highly educated people in Shiraz, Iran, showed that the irrational use of antibiotics was common in this population [10]. Another study showed that knowledge about some illnesses that resolve on their own is associated with more appropriate antibiotic cognition and health-seeking behavior [9].

The rational use of drugs is an important issue. Food and drug organizations and healthcare systems consider solutions to manage antibiotic use such as restricting the administration of antibiotics to some specialists (general practitioners are not allowed to prescribe some antibiotics) and providing some antibiotics only for hospitalized patients. It is critical to plan educational interventions for changing inappropriate prescribing and using antibiotics. Many other developed and developing countries have rational use of drug committees to achieve this goal.

Non-governmental organizations also have a significant role in the promotion of rational use of drugs [3]. In Iran, the Food and Drug Deputy of Ministry of Health and Medical Education established the National Committee of Rational Use of Drug (NCRUD) in 1996. NCRUD collects the prescriptions data from all around the country and analyzes them to evaluate the trend of prescription indicators and the pattern of drug consumption in the country. A prescription analysis program, Noskheh Pardaz, has been designed by NCRUD. Currently, medical sciences universities and health services are using this program all around the country [11].

Regarding the current controls on physicians' prescription patterns and training on rational drug administration, pharmacists should observe the consumption of Over-The-Counter (OTC) drugs and provide these medications to modify the use of antibiotics in the country. This research could help create new policies for the provision of antibiotics by urban and hospital pharmacies, observation upon pharmacies, and patients' education.

The aim of this study was to determine the rate of antibiotic consumption without prescription in the pharmacies of Khuzestan Province under the supervision of the Food and Drug Deputy of Ahvaz Jundishapour University of Medical Sciences in 2016.

2. Methods

This current research did not observe or evaluate the prescribing process by medical practitioners. Studies about the pharmacists' performance and the observation of providing antibiotics without prescription result in inaccurate referrals because of the lack of information and the possibility of achieving inaccurate information from pharmacies. in this study, the rate of antibiotic consumption without prescription in the pharmacies of Khuzestan Province under the supervision of the Food and Drug Deputy of Ahvaz Jundishapour University of Medical Sciences in 2016 was determined. The following steps are mentioned

Selecting the antibiotics

Ten antibiotics with the highest rate of consumption in 2016 in Iran were chosen based on Iran pharmaceutical statistics (2016) reported by Iran Food and Drug Administration. The antibiotics included Amoxicillin 500 mg capsule, Amoxicillin 250 mg/5 mL powder for suspension for 100 mL, Azithromycin Dihydrate 250 mg capsule, Cefazolin 1 g vial, Cefixime 100 mg/5 mL, Cefixime 400 mg tablet, Ciprofloxacin HCL 500 mg tablet, Co-

Amoxiclav 312 (250/62.5) mg powder for suspension, Co-Amoxiclav 625 (500/125) mg tablet, and Metronidazole 250 mg tablet.

Selecting the cities

Khuzestan Province has 27 cities, some of which are not under the supervision of the Food and Drug Deputy of Ahvaz Jundishapur University of Medical Sciences. So, they were excluded from the research; 17 cities were, then, studied. The included cities were Ahvaz, Mahshahr, Izeh, Andimeshk, Ramhormoz, Masjed Soleyman, Dasht-e Azadegan, Karun, Bagh-e Malek, Bavi, Omidiyeh, Ramshir, Andika, Hendijan, Hoveyzeh, Lali, and Haftkel.

Collecting the population of each city and the number of their pharmacies

The population of cities under the supervision of the Food and Drug Deputy of Ahvaz Jundishapur University of Medical Sciences was obtained from the Statistical Centre of Iran. The number of governmental and private pharmacies in each city was obtained from the Food and Drug Deputy of Ahvaz Jundishapur University of Medical Sciences.

Collecting the number of physicians

The number of physicians in each city under the supervision of the Food and Drug Deputy of Ahvaz Jundishapur University of Medical Sciences was obtained from the Medical Council of Iran.

Collecting information from pharmaceutical distribution companies

Among 45 pharmaceutical distribution companies in Khuzestan Province, some were not active or did not distribute antibiotics. After all, the information about 27 companies were collected.

Collecting information from the Social Security Organization and Health Insurance

The number and price of antibiotics prescribed by the healthcare professionals in the cities of Khuzestan Province under the supervision of the Food and Drug Deputy of Ahvaz Jundishapur University of Medical Sciences were determined based on the two health insurance organizations of Iran; the Social Security Organization and Health Insurance. According to the information on the Statistical Centre of Iran and Health Insurance, the population of Khuzestan Province was 4,700,000 individuals in 2016.

Among this population, 2,700,000 individuals were covered by the Social Society Organization and 2,300,000 were covered by Health Insurance. About 300,000 individuals have two different insurances at the same time. It seems that the rate of prescriptions by other insurance organizations is not high and can be neglected. In 2016, the "health reform plan" was run in Iran and, consequently, each person could have a health insurance booklet; thus, the rate of non-insurance prescriptions containing antibiotics was so low that it could be neglected.

Determining the distribution rate and distribution pattern of antibiotics

The number and price of antibiotics supplied by the pharmacies of cities under the supervision of the Food and Drug Deputy of Ahvaz Jundishapur University of Medical Sciences were determined by obtaining the distribution rate and distribution pattern of antibiotics from pharmaceutical distribution companies in Khuzestan Province.

Determining the per capita consumption of antibiotics with the prescription

In different cities of Khuzestan Province, the prescriptions of the Social Security Organization and Health Insurance were determined by dividing the number of prescribed antibiotics achieved from insurance data centers into the population of each city.

Determining the per capita consumption of antibiotics without prescription

The difference between the number of distributed antibiotics from distribution centers and insurance organizations was considered as the number of antibiotic consumption without prescription. The per capita consumption of non-prescribed antibiotics in different cities of Khuzestan Province was determined by dividing the number of non-prescribed antibiotics into the population of each city.

The pattern of antibiotic distribution and antibiotic consumption was determined. The most distributed and bestselling antibiotics in cities of Khuzestan Province under the supervision of the Food and Drug Deputy of Ahvaz Jundishapur University of Medical Sciences were obtained, too. The city with the highest rate of antibiotic consumption with or without prescription was obtained based on population rate.

3. Results

The antibiotic distribution pattern among different cities of Khuzestan Province was determined. Table 1 presents the total rate of antibiotic distribution in the governmental and private pharmacies of Khuzestan Province.

The number and price of antibiotic distribution among different cities of Khuzestan Province were determined based on the population of cities and the number of pharmacies. Table 2 presents the cities with the highest and lowest rate of antibiotic distribution.

The per capita consumption of antibiotics in different cities of Khuzestan Province prescribed by the Social Security Organization and Health Insurance was based on the population of the cities and the number of physicians determined in each city. Table 3 presents the cities with the highest and lowest rate of prescribed antibiotics.

The per capita consumption of non-prescribed antibiotics in different cities of Khuzestan Province was determined by dividing the number of non-prescribed antibiotics into the population of each city. The results are available in Table 4.

The pattern of antibiotic distribution in the governmental and private pharmacies of different cities of Khuzestan Province showed that the 10 antibiotics were mostly distributed to private pharmacies. Governmental pharmacies did not have a high distribution rate in any of the cities. Amoxicillin 250 mg/5 mL 100 mL powder had the highest rate of distribution based on the population of cities in governmental pharmacies (42.29%).

Andika had the lowest rate of per capita consumption of the prescribed antibiotics among different cities of Khuzestan Province based on their population in all of 10 antibiotics. Haftkel had the highest rate of per capita consumption of prescribed antibiotics based on the population of cities in Cefixime 100 mg/5m L 100 mL powder for suspension, Cefixime 400 mg tablet, and Co-Amoxiclav 625 (500/125) mg tablet.

Hendijan had the highest per capita consumption of non-prescribed Cefixime 400 mg tablet (46.53%), Co-Amoxiclav 312 (250/62.5) powder for suspension (66.06%), and Co-Amoxiclav 625 (500/125) mg tablet (52.6%) among different cities of Khuzestan Province. Hoveyzeh had the highest per capita consumption of non-prescribed Amoxicillin 250 mg/5 mL 100 mL powder (91.76%) and Ciprofloxacin HCL 500 mg tablet (85.26%).

Karun had the lowest per capita consumption of non-prescribed Amoxicillin 500 mg capsule, Amoxicillin 250 mg/5 mL 100 mL powder, Cefazolin 1 g vial, Ciprofloxacin HCL 500 mg tablet, Co-Amoxiclav 625 (500/125) mg tablet, and Metronidazole 250 mg tablet.

Table 1. The total rate of antibiotic distribution based on the population of cities in the governmental and private pharmacies of Khuzestan Province

Drug	%	
	Distribution Rate in Governmental Pharmacies	Distribution Rate in Private Pharmacies
Amoxicillin 500 mg capsule	26.71	73.29
Amoxicillin 250 mg/5 mL 100 mL powder	42.29	57.71
Azithromycin Dihydrate 250 mg capsule	30.23	69.77
Cefazolin 1 g vial	23.06	72.94
Cefixime 100 mg/5 mL 100 mL powder for suspension	14.98	85.02
Cefixime 400 mg tablet	20.59	79.41
Ciprofloxacin HCL 500 mg tablet	29.59	70.41
Co-Amoxiclav 312 (250/62.5) powder for suspension	22.56	77.44
Co-Amoxiclav 625 (500/125) mg tablet	18.17	81.83
Metronidazole 250 mg tablet	20.72	79.28

Table 2. Cities with the highest and lowest number of antibiotic distribution among different cities of Khuzestan Province under the supervision

Drug	The Highest Number of Distributed Antibiotic / Population of the City	The Lowest Number of Distributed Antibiotic / Population of the City	The Highest Number of Distributed Antibiotic / Number of Pharmacies	The Lowest Number of Distributed Antibiotic / Number of Pharmacies
Amoxicillin 500 mg capsule	Omidiyeh (10.85)	Hoveyzeh (1.17)	Ramhormoz (82653.85)	Karun (13623.53)
Amoxicillin 250 mg/5 mL 100 mL powder	Hoveyzeh (0.128)	Andika (0.014)	Hoveyzeh (4290.42)	Karun (116.82)
Azithromycin Dihydrate 250 mg capsule	Masjed Soleyman (2.17)	Andika (0.27)	Masjed Soleyman (17523.21)	Bavi (2864.45)
Cefazolin 1 g vial	Masjed Soleyman (0.76)	Lali (0.028)	Masjed Soleyman (6137.64)	Karun (741.53)
Cefixime 100 mg/5 mL 100 mL powder for suspension	Omidiyeh (0.125)	Andika (0.016)	Lali (2398)	Karun (217.41)
Cefixime 400 mg tablet	Hendijan (2.42)	Lali (30230)	Andika (0.179)	Karun (3255.65)
Ciprofloxacin HCL 500 mg tablet	Omidiyeh (0.757)	Lali (45540)	Hoveyzeh (1.55)	Karun (1649(
Co-Amoxiclav 312 (250/62.5) powder for suspension	Dasht-e Azadegan (0.094)	Lali (1125)	Haftkel (0.03)	Haftkel (161)
Co-Amoxiclav 625 (500/125) mg tablet	Haftkel (3.40)	Lali (43280)	Andika (0.43)	Karun (5096.47)
Metronidazole 250 mg tablet	Majed Soleyman (7.92)	Izeh (80783.33)	Hendijan (1.24)	Hendijan (817.67)

4. Discussion

It seems that using antibiotics without a prescription is a common problem in many cities of Khuzestan Province. Food and drug administrations should increase surveillance over pharmacies. In the research of Santa et al. in Mexico and Brazil in 2013, the impact of policies to provide antibiotics on OTCs was similar in both countries. In Brazil, the increasing trend of antibiotic use was reduced following the implementation of OTC drug restriction policies. Also, the decreasing trend increased in Mexico [12]. Public awareness should increase so that people notify the consequences of the irrational use of antibiotics. A study on the knowledge and behavior of people about the use of antibiotics in 6 European countries in 2009 showed that how people behave in relation to antibiotics in all countries depends on their knowledge [13].

On the other hand, in some cities, the number of antibiotics registered by the Social Security Organization or Health Insurance documents was higher than the number of distributed antibiotics in pharmacies of the same cities. This might be partly because of the inaccurate information received from drug distribution companies and the depot of antibiotics in some pharmacies.

5. Conclusions

The rate of antibiotic consumption without prescription was high in most cities of Khuzestan Province. The food and drug deputies are suggested to increase their surveillance over pharmacies and drug distribution companies and track their activities regularly.

Ethical Considerations

Compliance with ethical guidelines

This theses was submitted in Ethical Committe of Ahvaz Jundishapur University of Medical Sciences' Research & Technology deputy with ethical code of IR.AJUMS.REC.1396.937.

Table 3. The highest and lowest number of prescribed antibiotics in the Social Security Organization and Health Insurance among different cities of Khuzestan Province in 2016

Drug	The Highest Number of Prescribed Antibiotic / Population of the City	The Lowest Number of Prescribed Antibiotic / Population of the City	The Highest Number of Prescribed Antibiotic / Number of Physicians	The Lowest Number of Prescribed Antibiotic / Number of Physicians
Amoxicillin 500 mg capsule	Hoveyzeh & Dasht-e Azadegan (4)	Omidiyeh (1.6) Mahshahr & Hendijan (1.6)	Hoveyzeh & Dasht-e Azadegan (5854.97)	Omidiyeh (987.61)
Amoxicillin 250 mg/5 mL 100 mL powder	Izeh & Bagh-e Malek (0.029)	Omidiyeh (0.01)	Andimeshk (44.76)	Omidiyeh (6.97)
Azithromycin Dihydrate 250 mg capsule	Ahvaz & Karun & Bavi (1.39)	Mahshahr & Hendijan (0.57)	Izeh & Bagh-e Malek (1.08)	Masjed Soleyman & Lali& Andika (528.18)
Cefazolin 1 g vial	Andimeshk (0.399)	Izeh & Bagh-e Malek (0.124)	Masjed Soleyman & Lali & Andika (364.93)	Omidiyeh (98.03)
Cefixime 100 mg/5 mL 100 mL powder for suspension	Izeh & Bagh-e Malek (0.075)	Hoveyzeh & Dasht-e Azadegan (0.025)	Izeh & Bagh-e Malek (113.92)	Omidiyeh (31.31)
Cefixime 400 mg tablet	Ahvaz & Karun & Bavi (1.93)	Hoveyzeh & Dasht-e Azadegan (0.540)	Izeh & Bagh-e Malek (2233.05)	Omidiyeh (700)
Ciprofloxacin HCL 500 mg tablet	Izeh & Bagh-e Malek (1.372)	Mahshahr & Hendijan (0.466)	Izeh & Bagh-e Malek (2087.95)	Omidiyeh (343.74)
Co-Amoxiclav 312 (250/62.5) powder suspension	Hoveyzeh & Dasht-e Azadegan (0.054)	Masjed Soleyman & Lali & Andika (0.019)	Hoveyzeh & Dasht-e Azadegan (80.52)	Masjed Soleyman & Lali & Andika (15.052)
Co-Amoxiclav 625 (500/125) mg tablet	Andimeshk (2.18)	Mahshahr & Hendijan (0.781)	Izeh & Bagh-e Malek (2413.7)	Mahshahr & Hendijan (723.70)
Metronidazole 250 mg tablet	Izeh & Bagh-e Malek (3.77)	Omidiyeh (1.28)	Izeh & Bagh-e Malek (5730.66)	Omidiyeh (789.25)

Table 4. The per capita consumption of non-prescribed antibiotics in different cities of Khuzestan Province

Drug	The Highest Rate of Non-Prescribed Antibiotic / Population of the City	The Lowest Rate of Non-Prescribed Antibiotic / Population of the City
Amoxicillin 500 mg capsule	Omidiyeh (9.25)	Karun (-1.23)
Amoxicillin 250 mg/5 mL 100 mL powder	Hoveyzeh (0.12)	Karun (-0.03)
Azithromycin Dihydrate 250 mg capsule	Masjed Soleyman (1.15)	Ramshir (-0.52)
Cefazolin 1 g vial	Ahvaz (0.39)	Karun (-0.3)
Cefixime 100 mg/5 mL 100 mL powder for suspension	Shush (0.09)	Haftkel (-0.24)
Cefixime 400 mg tablet	Hendijan (1.13)	Haftkel (-1.24)
Ciprofloxacin HCL 500 mg tablet	Hoveyzeh (1.32)	Karun (-0.91)
Co-Amoxiclav 312 (250/62.5) powder for suspension	Hendijan (0.05)	Hoveyzeh (-0.06)
Co-Amoxiclav 625 (500/125) mg tablet	Hendijan (1.02)	Karun (1.01)
Metronidazole 250 mg tablet	Andimeshk (3.43)	Karun (-1.37)

Funding

This project was the financially supported by Ahvaz Jundishapur University of Medical Sciences

Authors contributions

Performed the study, collected and analyzed the data, performed the analytic calculations, wrote the manuscript with support and input from other authors: Rezvan Hallaj; Verified the analytical methods, contributed substantially to the conception and design of the study, the acquisition of data, or the analysis and interpretation: Behzad Sharif Makhmalzadeh; Supervised the project, contributed substantially to the conception and design of the study, the acquisition of data, or the analysis and interpretation, co-wrote the manuscript, provided final approval of the version to publish, in charge of overall direction and planning: Leila Kouti; Conceived of the presented idea, designed the study, developed the theory and performed the computations, worked on the legal permissions, supervisory authority of the study: Janet Soleymani; The deputy commissioner of Food and Drug Affairs at Ahvaz Jundishapur University of Medical Sciences, was responsible for the ethical and legal aspects of the study, contributed substantially to the conception and design of the study, helped with the formal permissions to have access to the confidential data of drug companies and insurance companies: Hossein Barzegar Bafrooei; Gathered the data, assisted with the technical details, consulted with the pharmacies, physicians and drug companies as well as insurance authorities: Farideh Younesi; Provided final approval of the version to publish, helped supervise the project, developed the theoretical framework, aided in interpreting the results and worked on the manuscript: Kaveh Eslami; Discussed the results and commented on the manuscript: All authors.

Conflict of interest

The authors declared no conflict of interest

Acknowledgements

This study was the result of a research proposal financially supported by Ahvaz Jundishapur University of Medical Sciences. Some data were collected from the Food and Drug Deputy of Ahvaz.

References

[1] Gualerzi CO, Brandi L, Fabbretti A, Pon CL. Antibiotics: Targets, mechanisms and resistance. Hoboken: John Wiley & Sons; 2013. [DOI:10.1002/9783527659685]

[2] Roller L, Gowan J. Disease state management: Antibiotic resistance. AJP. 2016; 97(1153):64-72.

[3] World Health Organization (WHO). Antimicrobial resistance: Global report on surveillance. Geneva: World Health Organization; 2014.

[4] Volpato DE, Souza BVd, Dalla Rosa LG, Melo LH, Daudt CAS, Deboni L. Use of antibiotics without medical prescription. Braz J Infect Dis. 2005; 9(4):288-91. [DOI:10.1590/S1413-86702005000400004] [PMID]

[5] World Health Organization (WHO). Guidelines for the regulatory assessment of Medicinal Products for use in self-medication. Geneva: World Health Organization; 2000.

[6] Čižman M, Haaijer-Ruskamp F, Grigoryan L. Samozdravljenje z antibiotiki v Sloveniji. Zdrav vestn. 2005; 74(5):293-7.

[7] Grigoryan L, Burgerhof JG, Degener JE, Deschepper R, Lundborg CS, Monnet DL, et al. Determinants of self-medication with antibiotics in Europe: The impact of beliefs, country wealth and the healthcare system. J Antimicrob Chemother. 2008; 61(5):1172-9. [DOI:10.1093/jac/dkn054] [PMID]

[8] Moghadam Nia A, Ghadimi R. Self-medication of patients with common cold among 15-45 year old individuals, Babol, 1998. J Babol Univ Med Sci. 2000; 2(1):26-32.

[9] Tan Y, Hong C, Chong P, Tan E, Lew Y, Lin R. Knowledge that upper respiratory tract infection resolves on its own is associated with more appropriate health-seeking behaviour and antibiotic cognition. Singapore Med J. 2006; 47(6):518-24.

[10] Askarian M, Maharlouie N. Irrational antibiotic use among secondary school teachers and university faculty members in Shiraz, Iran. Int J prevent Med. 2012; 3(12):839-45. [DOI:10.4103/2008-7802.104854] [PMID] [PMCID]

[11] Soleymani F, Valadkhani M, Dinarvand R. Challenges and achievements of promoting rational use of drugs in Iran. Iran J Pub Health. 2009; 38(1):166-8.

[12] Santa-Ana-Tellez Y, Mantel-Teeuwisse AK, Dreser A, Leufkens HG, Wirtz VJ. Impact of over-the-counter restrictions on antibiotic consumption in Brazil and Mexico. PLOS One. 2013; 8(10):e75550. [DOI:10.1371/journal.pone.0075550] [PMID] [PMCID]

[13] Radošević N, Vlahović-Palčevski V, Benko R, Peklar J, Miškulin I, Matuz M, et al. Attitudes towards antimicrobial drugs among general population in Croatia, Fyrom, Greece, Hungary, Serbia and Slovenia. Pharmacoepidemiol Drug safe. 2009; 18(8):691-6. [DOI:10.1002/pds.1768] [PMID]