PDF version

Research article

Mehrnaz Kheirandish[1,2], Vida Varahrami[3], Abbas Kebriaeezade[1] and Abdol Majid Cheraghali[4]

[1]Department of Pharmacoeconomics and Pharmaceutical Management, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran (Correspondence to: M. Kheirandish: mehrnazkheirandish@gmail.com). [2]Department of Assessment and Control on Prescribing and Use of Medicines and Health-Related Products, Iran Food and Drug Administration, Tehran, Islamic Republic of Iran. 3Department of Economics, University of Shahid Beheshti, Tehran, Islamic Republic of Iran.
[4]
Faculty of Pharmacy, Baqiyatallah University of Medical Sciences, Tehran, Islamic Republic of Iran.

Abstract

Background: It has been argued that economic sanctions and the economic crisis have adversely affected access to drugs.

Aim: To assess the impact of economic sanctions on the Iranian banking system in 2011 and Central Bank in 2012 on access to and use of drugs for noncommunicable diseases (NCDs).

Methods: An interrupted time series study assessed the effects of sanctions on drugs for diabetes (5 drug groups), asthma (5 drug groups), cancer (14 drugs) and multiple sclerosis (2 drugs). We extracted data from national reference databases on the list of drugs on the Iranian pharmaceutical market before 2011 for each selected NCD and their monthly sales. For cancer drugs, we used stratified random sampling by volume and value of sales, and source of supply (domestic or imported). Data were analysed monthly from 2008 to 2013.

Results: Market availability of 13 of 26 drugs was significantly reduced. Ten other drugs showed nonsignificant reductions in their market availability. Interferon α2b usage reduced from 0.014 defined daily doses per 1000 inhabitants per day (DID) in 2010 to 0.008 in 2013; and cytarabine from 1.40 mg per 1000 population per day in 2010 to 0.96 in 2013. Selective β2-adrenoreceptor agonists usage reduced from 8.4 to 6.8 DID in the same time period.

Conclusion: There is strong evidence that sanctions have had a negative effect on access to drugs, particularly those that depended on the import of their raw material or finished products.

Keywords: drug access, drug shortage, economic crisis, economic sanctions, noncommunicable diseases.

Citation: Kheirandish M, Varahrami V, Kebriaeezade A, Majid Cheraghali A. Impact of economic sanctions on access to noncommunicable diseases medicines in the Islamic Republic of Iran. East Mediterr Health J. 2018;24(1):42–51. https://doi.org/10.26719/2018.24.1.42

Received: 30/11/17; accepted: 13/02/18

Copyright © World Health Organization (WHO) 2018. Some rights reserved. This work is available under the CC BY-NC-SA 3.0 IGO license (https://creativecommons.org/licenses/by-nc-sa/3.0/igo)

Introduction

Access to drugs is one of the main goals of all health systems (1). Many countries face important challenges in the provision of access to drugs, particularly for the treatment of noncommunicable diseases (NCDs) (2). According to the World Health Organization (WHO), prevention and control of NCDs is a major challenge to achieve Sustainable Development Goals and universal health coverage (3). NCDs have a high prevalence and burden, therefore, ensuring access to essential drugs to control them is vital for health systems to achieve their objectives and reduce costs. Factors outside the health systems can negatively or positively affect access to drugs; however, such factors have not received adequate attention in research studies (4).

After the imposition of economic sanctions upon the Islamic Republic of Iran, concerns were raised about potential public health implications, and in particular, access to drugs. The sanctions were expanded and reached their height by targeting the banking system and the Central Bank of Iran (CBI) in 2011 and 2012, respectively. There were many reports of drug shortages and public concern about patients' difficulties in accessing essential drugs (5). Adequate access to drugs depends on a myriad of individual and systemic factors that include: individual need and demand for drugs; availability of drugs in the health sector; and appropriate distribution, prescribing and affordability of drugs at the time of use (6). The negative impact of economic hardship on health systems and public health has been reported in several countries, regardless of the source of the hardship (7). Despite the claim that sanctions only target political aspects, some studies have suggested that they may affect the general population (8–11). Although countries may use a plethora of policies to avert the negative impact of economic hardship on health systems and access to drugs, such policies may not succeed in ensuring continuation of access at the level achieved without economic hardship (7,12,13).

NCD drugs have a critical role in attaining universal health coverage, which ensures access to effective, high-quality and affordable health services (3). According to the framework introduced by WHO, there are 4 factors that affect access to medicines: rational selection and use of drugs, affordable prices, sustainable financing and reliable health and supply systems (14). Economic sanctions can influence the size of an economy and lead to a downturn through limitation of import and export activities and creation of difficulties in financial transactions. Consequently, countries under economic sanctions will face a lack of sources in different areas including health, and several studies have illustrated direct and indirect impacts of the economic crisis on public health (9,13). Economic sanctions can also lead to inflation, decreased household spending and health insurance system dysfunction (due to financial pressure as a result of increasing costs). Although the Islamic Republic of Iran has its own domestic pharmaceutical industry that produces a large proportion of drugs for NCDs, and despite growth in recent years, it is still dependent on imported drugs, raw materials and intermediates (15). Import restrictions cause problems for the health sector in ensuring a sustainable supply system (16,17). Despite imposition of economic sanctions against other countries in recent decades, there is little to no robust research evidence assessing the impact of sanctions on access to drugs.

In this study, we used interrupted time series analyses to assess the impact of economic sanctions on access to NCDs medicines in the Islamic Republic of Iran.

Methods

Study design

Economic sanctions were imposed upon the Iranian banking system and CBI in 2011 and 2012,

respectively. An interrupted time series model was used to assess the immediate and gradual effects of these sanctions on the monthly availability of drugs.

Selection of therapeutic groups

As NCD drugs usually follow steady trends in utilization, any significant change could be a result of problems in their supply chain (18). To obtain a better picture of the impact of economic sanctions on access to drugs, we selected a sample of therapeutic groups based on the following criteria. (1) More prevalent diseases. Due to high utilization of drugs for such diseases, any drug shortages will have a negative impact on public health. (2) Requirement for expensive imported drugs, to assess the impact of sanctions on importation. (3) Existing domestic drug production, to assess the degree of independence of the domestic pharmaceutical industry. (4) Existence of reports about drug shortage (5,19). We selected 4 groups of drugs, for treatment of asthma, diabetes (20), cancer and multiple sclerosis (21,22).

Selection of drugs

Drugs that were available in the Iranian pharmaceutical market before 2010 were extracted from the national pharmaceutical sales statistics database (in Farsi known as: Amarnameh Daroii Iran) for selected NCD drugs. This was to ensure that the drugs were on the market prior to the sanctions. Monthly sales data for 2008–2013 were gathered for all important drugs for diabetes, asthma and multiple sclerosis. Cancer drugs were selected using a random stratified approach in which volume of sales, monetary value of sales, and domestic production or import of drugs were used for stratification.

Data sources

There are two reliable pharmaceutical databases: Iran Drug List and Amarnameh Daroii Iran, which are published by the Food and Drug Administration of the Islamic Republic of Iran (Iran FDA). We used the Iran Drug List to identify the drugs that are approved by Iran FDA, and we used Amarnameh Daroii Iran to obtain the monetary value and volume of sales of all selected NCD drugs, and whether they were recorded in generic or brand names.

Data preparation

Value and volume of sales for each drug in each month were harmonized based on the generic name, dosage form, dose and type of supply (domestic/imported). Data errors were identified and rectified. Defined daily dose (DDD) indicator was used to standardize the value and volume sales data. DDD for each drug was extracted from the latest version of Anatomical Therapeutic Chemical (ATC) Classification System and DDD assignment guidelines (2013) obtained from the WHO website (23). DDD alterations were considered using the list available on the WHO website (24). The only change in DDD was for gliclazide, which was modified to 60 mg from 160

mg in 2011. For each month, the number of DDDs per 1000 population per day (DID) was calculated as a proxy to assess the availability of drugs in the national market (25). For drugs in the cancer group, except tamoxifen, raloxifene and interferon α2b, there were no identified DDDs, therefore, according to the WHO recommendation, the daily consumption was calculated in milligrams per 1000 inhabitants (23). For combined inhalers that had no DDD, the unit dose index was obtained as described by the WHO (26).

Taking into account the substitution probability of drugs with similar therapeutic effects, those for treatment of diabetes and asthma were assessed based on their ATC classification; for the multiple sclerosis group, interferon β2a and interferon β2b were analysed; and for the cancer group, due to different methods of use and treatment protocols, drugs were assessed individually (Table 1).

Data analysis

Our sample included 68 monthly data from 2008 to 2013; that is, 36 months before and 32 after the banking system sanctions, and 48 months before and 20 after the CBI sanctions. This enabled us to assess the immediate and gradual effects of sanctions on access to drugs using interrupted time series analysis. Several diagnostic analyses were conducted. The Durbin–Watson parameter between 1.88 and 2.08 was acceptable in this model (27) and parameters outwith this range were corrected using ARIMA (autoregressive integrated moving average) models. To determine the stationary status of the series we used the Dicky–Fuller test, and to assess heteroscedasticity in the residuals, the White test was applied. When heteroscedasticity was detected, the generalized least squares technique was used (28). The impact of each sanction in 2011 and 2012 was assessed separately. Markov and Chaw breakpoint tests were applied to determine which sanction had the greatest impact on drug availability. As the sale of drugs in the first month of each year (in Iranian calendar) significantly reduced due to the New Year holidays in the Islamic Republic of Iran, it was accounted as a dummy variable in the model.

Results

Twenty-six drugs (as identified according to ATC classification and International Nonproprietary Names) were entered in the model (Table 1): 14 had both domestic and imported types; 9 were solely imported with no local production; and the rest were produced locally. There was a significant reduction in the availability of 13 drugs, of which 6 were solely imported. The availability trends of these 13 drugs are shown in
Figure 1
(diabetes and asthma) and
Figure 2
(cancer). The average use of 26 samples based on October and November in each year is shown in

Table 2
. Ten other drugs showed reduced availability, although the reduction was not significant. The results of time series analysis for each therapeutic group were as follows.

Diabetes group

The thiazolidinediones were produced domestically, whereas the other drugs had both domestic and imported types (Table 3). The generalized least squares technique was applied for thiazolidinediones due to heteroskedasticity in the residuals. While there were no changes in availability of the 5 drug groups after banking system sanctions, 2 (sulfonylureas and other blood glucose lowering agents) demonstrated gradual reduction after CBI sanctions. No immediate reduction in availability was observed in this group.

Asthma group

Both domestic and imported types of all drugs were available (Table 3). The interrupted time series models for anticholinergics after both sanctions and adrenergics in combination with anticholinergics after the banking system sanctions were not significant, so their availability could not be assessed. The availability of 2 drug groups was reduced during sanctions. Selective β2-adrenoreceptor agonists were affected by both sanctions and showed gradual changes in availability. No immediate reduction in availability was observed for any of the drugs.

Multiple sclerosis group

Interferon β1a had both domestic and imported types, whereas merely imported type of interferon β1b had only an imported type before 2010 (Table 3). Although the availability of both interferons was reduced after the sanctions, the results were not significant.

Cancer group

Two of the 14 drugs were produced domestically; 4 were produced domestically and imported; and 8 were available as imported products only (Table 3). Regression models for daunorubicin after both sanctions and cytarabine after CBI sanctions were not significant, so their availability could not be assessed. Also, due to the abnormality of residuals in the raloxifene model after the CBI sanctions, the impact was not assessed. The availability of 9 drugs was reduced: 3 after the banking sanctions; 3 after the CBI sanctions; and 3 showed cumulative reductions after both sanctions. Of these 9 drugs, 6 were only available on the market in imported forms (i.e., no local production). Interferon α2b and cytarabine demonstrated immediate changes and the rest shown gradual changes in availability (
Table 3
). Four other drugs had reduced availability but the change was not significant.

Discussion

We observed significant changes in the market availability of half the drugs studied. While both sanctions resulted in significant shortages, the CBI sanctions on their own resulted in several additional shortages. Six of the affected drugs were only available as imports and not produced by local companies; 1 was produced domestically and there was no imported type on the market; and both domestic and imported types of the other drugs were present. Long-term reduction in drug availability was more frequent than immediate reduction after both sanctions. Iran FDA tried to maintain the drug supply system by implementing immediate and urgent policies, but continuing sanctions and their impacts on different sectors of the country affected availability of drugs in line with their dependency on imports and foreign transactions. Cancer and asthma groups showed the greatest reduction in drug availability. The availability of 10 other drugs was reduced but not significantly, which may have been due to the power of the model.

Our results demonstrated that access to drugs in the Islamic Republic of Iran has been affected by economic sanctions, and national/international news media have broadcast the problems that patients have in accessing drugs, especially for cancer and asthma (5). Our study backs the claims that economic sanctions and crises have negative impacts on the health sector and particularly on access to drugs, as suggested in previous studies from the Islamic Republic of Iran and other countries (5,8–11).

Economic sanctions have both direct and indirect negative impacts on health systems, which can be exacerbated by weaknesses in management (29). In the pharmaceutical sector, economic sanctions, in addition to influencing the size of the economy, could reveal other weak points, including inadequate supply management system, weaknesses in policy-making and public/private opportunism in drug supply. So, our findings could have been a result of the direct and/or indirect impacts of the economic sanctions. This is confirmed by the fluctuation in drug availability in the Iranian pharmaceutical market since 2011, which has led to lack of drug supply sustainability. However, some of the shortages could be prevented by appropriate management and applying the right policies. Previous studies have shown that adequate supply chain management can mitigate the negative impacts of sanctions in other countries such as Cuba (30,31).

Several studies have reported drug shortages in the Islamic Republic of Iran during the economic sanctions, and some have discussed patients' problems and lack of access to drugs (16,32–35). It is clear from our study that access to drugs has been affected by the recent economic sanctions in the Islamic Republic of Iran; availability of drugs for some diseases, such as asthma and cancer, has been affected more severely, causing major problems to patients. It

seems that the availability of these drugs was reduced dramatically due to their dependency on importing their raw materials or finished products.

Most of the previous studies that have assessed the impact of economic sanctions and crises on the health sector were descriptive. The present study is believed to be the first empirical study using robust research methods to measure the impact of economic sanctions on access to drugs. Time series methods are the strongest models to assess the impact of interventions on nonrandomized samples and this model enabled us to assess both immediate and long-term effects of economic sanctions on access to drugs. There were limitations to our study, including inability of the method to predict the future; the power of the model in some drug samples; and inability to distinguish between real drug shortages from those caused by demand due to market inflammation (i.e., limitation in drug availability due to overpurchasing or overprescribing as a result of concerns over future lack of drugs).

Conclusion

Our study showed that drugs cannot be separated from international economic sanctions and every economic crisis can affect public health and access to health care. It is worth noting that availability of some of the drugs was not reduced, so policy-makers should consider the whole market to gain an accurate picture. Sanctions and economic hardship affected access to drugs in two ways. First, sanctions may hamper an expected increase in the use of drugs. The use of many drugs has been increasing globally (including the Islamic Republic of Iran) as a result of improvements in access or increase in population needs (e.g., due to ageing). As we used a time-series approach, we were able to measure the likely increasing trends in drug use and the effects of sanctions on it. Second, sanctions may reduce the absolute availability and use of the drugs. Although we found that the impact of economic sanctions on access to drugs did not follow a general pattern, imported drugs and those with imported raw materials were more likely to be affected. Countries should have programmes to fortify their domestic pharmaceutical industry and to support them for production of essential drugs from start to finish, and identify alternative sources of supply in times of need. Appropriate supply chain management can reduce market inflammation, which can exaggerate drug shortages. We recommend assessing the availability of drugs in other therapeutic groups with other models that can predict the future market if economic sanctions continue.

Acknowledgements

The study was supported by the Tehran University of Medical Sciences as part of the PhD study of the first author. We are very grateful to Prof Arash Rashidian for conceiving and designing the research study and the analytical approaches, and supervising the study until 2015. We would like to thank Iran FDA and in particular Dr. F. Peiravian for the provision of access to the required data. We would also like to thank Dr. S. Nikfar at Tehran University of Medical

Sciences for her help in analyzing multiple sclerosis therapeutic group data.

Funding: Small Grant from the Tehran University of Medical Sciences.

Competing interests: None declared.

Impact des sanctions économiques sur l’accès aux médicaments pour le traitement des maladies non transmissibles en République islamique d’Iran

Résumé

Contexte : Il est allégué que les sanctions économiques et la crise économique ont affecté négativement l’accès aux médicaments.

Objectif : Évaluer l’impact des sanctions économiques imposées au système bancaire en 2011, et à la Banque centrale en 2012, sur l’accès et sur l’utilisation des médicaments pour le traitement des maladies non transmissibles (MNT).

Méthodes : Une étude des séries chronologiques interrompues a permis d’évaluer les effets des sanctions sur les médicaments contre le diabète (cinq groupes de produits), l’asthme (cinq groupes de produits), le cancer (14 produits) et la sclérose en plaques (deux produits). La liste de médicaments qui se trouvaient sur le marché pharmaceutique en République islamique d’Iran avant 2011 pour chaque MNT sélectionnée, ainsi que les données sur le nombre de ventes par mois associées, ont été extraites des bases de données de référence nationales. Pour les médicaments anticancéreux, nous avons utilisé une méthode d’échantillonnage aléatoire stratifié par volume, valeur de ventes et source d’approvisionnement (domestique ou importée). Les données ont été analysées sur une base mensuelle entre 2008 et 2013.

Résultats : La disponibilité sur le marché de 13 échantillons sur 26 a été considérablement réduite. Dix autres médicaments ne montraient aucune réduction significative à cet égard. L’utilisation de l’interféron α-2B est passée de 0,014 dose journalière définie (DDD) pour 1000 personnes en 2010 à 0,008 en 2013. La cytarabine a quant à elle chuté de 1,40 milligramme pour 1000 personnes par jour en 2010 à 0,96 en 2013. De la même manière, l’utilisation d’agonistes β-2 adrénergiques sélectifs est passée de 8,4 DDD à 6,8 sur la même période de temps.

Conclusions : Des preuves solides montrent que l’accès aux médicaments a été négativement impacté, en particulier les médicaments qui dépendaient de l’importation de matières premières ou de produits finis.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] : [illegible] .[illegible] [illegible] 2012 [illegible] 2011 [illegible] .[illegible]

[illegible] : [illegible] .([illegible]) [illegible] (14 [illegible]) [illegible] (5 [illegible]) [illegible] (5 [illegible]) [illegible] 2011 [illegible] .[illegible] [illegible] .2013 [illegible] 2008 [illegible] .([illegible]

[illegible] (50%) 26 [illegible] 13 [illegible] .[illegible] (2 [illegible]) [illegible] .[illegible] (2- [illegible]) [illegible] 10 [illegible] .[illegible] 0.014 [illegible] 2 [illegible] .[illegible] [illegible] 2013 [illegible] 0.008 [illegible] 2010 [illegible] 1000 [illegible] 0.96 [illegible] 2010 [illegible] 1000 [illegible] 1.40 [illegible] 2- [illegible] .2013 [illegible] .[illegible] 6.8 [illegible] 8.4 [illegible]

[illegible] :

WHO EMRO | Impact of economic sanctions on access to noncommunicable diseases medicines in the Is

نمطاً عاماً، توجد أدلة قوية بأن العقوبات كان لها أثر سلبي على الحصول على الأدوية .
وعلى وجه التحديد، يقع الضرر الأكبر على الأدوية التي تعتمد على استيراد المواد الخام
المستخدمة في تركيبها أو على منتجات نهائية . ومن ثم، يمكن الاستنتاج بأن العقوبات
الاقتصادية من شأنها أن تحدث آثاراً سلبية على الحصول على الأدوية وصحة السكان .

References

1. Cameron A, Ewen M, Ross-Degnan D, Ball D, Laing R. Medicine prices, availability, and affordability in 36 developing and middle-income countries: a secondary analysis. Lancet. 2009 Jan 17;373(9659):240–9. https://doi.org/10.1016/S0140-6736(08)61762-6 PMID:19042012

2. Wirtz VJ, Hogerzeil HV, Gray AL, Bigdeli M, de Joncheere CP, Ewen MA, et al. Essential medicines for universal health coverage. Lancet. 2017 Jan 28;389(10067):403–76. https://doi.org/10.1016/S0140-6736(16)31599-9 PMID:27832874
3. What is universal coverage? World Health Organization (http://www.who.int/health_financing/universal_coverage_definition/en/, accessed 11 March 2017).
4. Rashidian A, Jahanmehr N, Jabbour S, Zaidi S, Soleimani F, Bigdeli M. Bibliographic review of research publications on access to and use of medicines in low-income and middle-income countries in the Eastern Mediterranean Region: identifying the research gaps. BMJ Open 2013; 3:10 e003332. https://doi.org/10.1136/bmjopen-2013-003332.
5. Kheirandish M, Rashidian A, Bigdeli M. A news media analysis of economic sanction effects on access to medicine in Iran. J Res Pharm Pract. 2015 Oct–Dec;4(4):199–205. https://doi.org/10.4103/2279-042X.167042 PMID:26645026
6. Yaghoubifard S, Rashidian A, Kebriaeezadeh A, Majdzadeh R, Hosseini SA, Akbari Sari A, et al. Developing a conceptual framework and a tool for measuring access to, and use of, medicines at household level (HH-ATM tool). Public Health. 2015 May;129(5):444–52. https://doi.org/10.1016/j.puhe.2015.01.026 PMID:25769347
7. Kheirandish M, Rashidian A, Kebriaeezade A, Cheraghali AM, Soleymani F. A review of pharmaceutical policies in response to economic crises and sanctions. J Res Pharm Pract. 2015 Jul-Sep;4(3):115–22. https://doi.org/10.4103/2279-042X.162361 PMID:26312250
8. Lewis M, Verhoeven M. Financial crises and social spending: the impact of the 2008–2009 crisis. Washington: World Bank; 2010.
9. Petrescu IM. The Humanitarian impact of economic sanctions. Job Market Paper. 2007.
10. Garfield R. The impact of economic sanctions on health and well-being. Overseas Development Institute; 1999.
11. Gibbons E, Garfield R. The impact of economic sanctions on health and human rights in Haiti, 1991–1994. Am J Public Health. 1999 Oct;89(10):1499–504. https://doi.org/10.2105/AJPH.89.10.1499 PMID:10511830
12. Vogler S, Zimmermann N, Leopold C, de Joncheere K. Pharmaceutical policies in European countries in response to the global financial crisis. South Med Rev. 2011 Dec;4(2):69–79. https://doi.org/10.5655/smr.v4i2.1004 PMID:23093885
13. Garfield R, Devin J, Fausey J. The health impact of economic sanctions. Bull N Y Acad Med. 1995 Winter;72(2):454–69. PMID:10101382
14. Access to medicines. Statement: 13 March 2009. World Health Organization (http://apps.who.int/medicinedocs/en/d/Js2296e/1.html, accessed 28 February 2018).

11 / 13

15. Kebriaeezadeh A, Koopaei NN, Abdollahiasl A, Nikfar S, Mohamadi N. Trend analysis of the pharmaceutical market in Iran; 1997-2010; policy implications for developing countries. Daru. 2013 06 28;21(1):52. https://doi.org/10.1186/2008-2231-21-52 PMID:23805853

16. Cheraghali AM. Impacts of international sanctions on Iranian pharmaceutical market. Daru. 2013 Jul 31;21(1):64. https://doi.org/10.1186/2008-2231-21-64 PMID:23902642

17. The impact of sanctions on Iranian people healthcare. Institut International pour la Paix, la Justice et les Droits de l'Homme. 2013.

18. Mendis S, Fukino K, Cameron A, Laing R, Filipe A Jr, Khatib O, et al. The availability and affordability of selected essential medicines for chronic diseases in six low- and middle-income countries. Bull World Health Organ. 2007 Apr;85(4):279–88. https://doi.org/10.2471/BLT.06.033647 PMID:17546309

19. Ghiasi G, Rashidian A, Kebriaee A, Dorkoosh FA, Salamzadeh J. Access to Asthma Medicines in Tehran; Iran. Value Health. 2014 Nov;17(7):A781. https://doi.org/10.1016/j.jval.2014.08.375 PMID:27202896

20. Haghdoost AA, Rezazadeh-Kermani M, Sadghirad B, Baradaran HR. Prevalence of type 2 diabetes in the Islamic Republic of Iran: systematic review and meta-analysis. East Mediterr Health J. 2009 May-Jun;15(3):591–9. PMID:19731775

21. Kolahdoozan S, Sadjadi A, Radmard AR, Khademi H. Five common cancers in Iran. Arch Iran Med. 2010 Mar;13(2):143–6. PMID:20187669

22. WHO country cooperation strategy at a glance: Islamic Republic of Iran. World Health Organization; 2017 (http://apps.who.int/iris/bitstream/10665/136898/1/ccsbrief_irn_en.pdf, accessed 21 February 2018).

23. Guidelines for ATC classification and DDD assignment 2013. Oslo: WHO Collaborating Centre for Drug Statistics Methodology; 2012 (https://www.whocc.no/filearchive/publications/1_2013guidelines.pdf, accessed 21 February 2018).

24. DDD alterations from 2005-2018. Oslo: WHO Collaborating Centre for Drug Statistics Methodology (https://www.whocc.no/atc_ddd_alterations__cumulative/ddd_alterations/, accessed 28 February 2018).

25. Sarayani A, Rashidian A, Gholami K. Low utilisation of diabetes medicines in Iran, despite their affordability (2000-2012): a time-series and benchmarking study. BMJ Open. 2014 10 16;4(10):e005859. https://doi.org/10.1136/bmjopen-2014-005859 PMID:25324322

26. List of DDDs combined products. Oslo: WHO Collaborating Centre for Drug Statistics Methodology (http://www.whocc.no/ddd/list_of_ddds_combined_products/, accessed 21 February 2018).

27. Wagner AK, Soumerai SB, Zhang F, Ross-Degnan D. Segmented regression analysis of interrupted time series studies in medication use research. J Clin Pharm Ther. 2002 Aug;27(4):299–309. https://doi.org/10.1046/j.1365-2710.2002.00430.x PMID:12174032

28. Webel K. Greene, WH. Econometric analysis. Statistische Hefte. 2011;52(4):983–4.

29. Bessler M, Garfield R, McHugh G. Sanctions assessment handbook. United Nations and the Inter-Agency Standing Committee; 2004.

30. Van der Stuyft P, De Vos P, Hilderbrand K. USA and shortage of food and medicine in Cuba. Lancet. 1997 Feb 1;349(9048):363. https://doi.org/10.1016/S0140-6736(05)62872-3 PMID:9024412

31. Garfield R. USA and shortage of food and medicine in Cuba. Lancet. 1997 Feb 1;349(9048):363. https://doi.org/10.1016/S0140-6736(05)62871-1 PMID:9024411

32. Shariatirad S, Maarefvand M. Sanctions against Iran and the impact on drug use and addiction treatment. Int J Drug Policy. 2013 Nov;24(6):636–7. https://doi.org/10.1016/j.drugpo.2013.04.003 PMID:23683411

33. Karimi M, Haghpanah S. The effects of economic sanctions on disease specific clinical outcomes of patients with thalassemia and hemophilia in Iran. Health Policy. 2015 Feb;119(2):239–43. https://doi.org/10.1016/j.healthpol.2014.12.011 PMID:25564279

34. Gorji A. Sanctions against Iran: the impact on health services. Iran J Public Health. 2014 Mar;43(3):381–2. PMID:25988101

35. Namazi S. Sanctions and medical supply shortages in Iran. Wilson Center; 2013 (http://www.wilsoncenter.org/publication/sanctions-and-medical-supply-shortages-iran, accessed 21 February 2018).

Wednesday 10th of July 2024 11:03:26 PM