

The Impact of Economic Sanctions on Health and Strategies for Mitigation: A Glance at the Case of Iran

Abstract

Background: Sanctions can affect humanitarian, GDP growth, the value of the national currency, income inequality, poverty, food security, and health. This study aims to represent the relationship between sanctions and public health and the strategies to deal with it. **Methods:** The study used a mixed-methods approach. We used data and information from two sources: a scoping literature review and a survey on experts' opinions (10 participants from health policymakers, managers, and researchers). Inductive thematic analysis was adopted to analyze the qualitative data with the MAXQDA software version 10. **Results:** The international economic sanctions affect directly and indirectly on targeted population's right to access social welfare and health. The literature review about Iran showed that the sanction had affected public health in four general respects: Economic, Sociocultural, political, and direct health factors. The strategies to deal with sanctions categorized into two themes are the health sector and the health-related extra-sector. **Conclusions:** The devastating effects of economic sanctions directly and indirectly on health have significantly reduced financial and physical access to drugs and medical equipment in Iran, leading to a substantial decline in public health. The UN and the international community should anticipate these side-effects of sanctions to prevent further humanitarian catastrophes in the future.

Keywords: Economic depression, health impact assessment, Iran, population health

Introduction

The United Nations General Assembly declared the right to health as a universal standard in 1948, embedding this concept in international law.^[1,2] Human rights, including the right to health, are norms that dictate how governments and non-state actors interact with individuals and groups based on ethical principles grounded in national and international legal systems. Human rights' origin must be sought in the process of norm formation in national and international legal systems that provide formal validity of normative positions. These norms originate from ethical reasoning in moral philosophy, religious faith, or political claims driven by social mobilizations.^[3] Like other social and economic rights, the right to health is now recognized as an inalienable international human right.^[4] The inclusion of health-related goals in the sustainable development agenda reflects global commitment to realizing this right.^[5] Despite these commitments,

conflicts, and wars continue to have devastating direct and indirect effects on health worldwide.^[6]

In ancient times, if an army could not conquer a city surrounded by defensive walls, it would besiege the city and prevent it from providing the necessary equipment for its inhabitants. This strategy, now known as economic sanctions, has not changed significantly since then.^[7] Today, economic sanctions, dating back to at least 432 BC, are increasingly being used by some powerful nations. In the modern era, the United States was the first country to use economic sanctions in 1812. After the German invasion of Norway in 1940, the United States used sanctions to prevent the Nazis from using the occupied countries' assets. Then it expanded the sanctions by blocking Axis power's assets and prohibiting foreign trade and financial transactions with these countries. During the Cold War, sanctions were consistently used to destabilize governments, especially in Latin America. The use of economic sanctions leverage as a foreign policy tool, although not unknown, has become

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increasingly popular in recent years.^[8] By the 1950s, only five countries had been affected by economic sanctions, but that rose to 47 in the 1990s.^[9] The scope of sanctions varies from country to country and can even include policies to completely isolate a country and completely cut off economic and trade relations with that country. There are rare cases where a sanction has been imposed to sever all trade and economic interactions with a particular country.^[10]

In recent decades, Iran has been one of the countries that have always struggled with sanctions. Sanctions against the Islamic Republic of Iran have a long history dating back to 1979 to 1981.^[11] After the arrest of US embassy staff in Tehran in 1979, Carter imposed a growing set of sanctions against Iran by banning oil imports from Iran and then blocking all Iranian government assets in the United States (approximately \$ 12 billion). These initial sanctions were lifted following the release of the hostages following the 1981 Algerian agreement. Nevertheless, in the following years, sanctions were increasingly re-imposed under the pretext of Iran's activities.^[8] The goals of US sanctions against Iran have expanded over time. Economic sanctions were imposed in the mid-1980s to limit Iran's strategic power in the Middle East. Since the 1990s, US sanctions have also targeted Iran's oil sector and nuclear program to weaken Iran's economy. At the time, European countries avoided pursuing the US policy of imposing economic sanctions on Iran.^[12] However, in the 2000s, after uranium enrichment in Iran, the United Nations and the European Union joined the campaign to impose economic sanctions on Iran. As a result, the severity of the sanctions increased significantly. The international sanctions' primary purpose was to prevent Iran from gaining access to nuclear materials and pressure the Iranian government to end its uranium enrichment program and other nuclear weapons-related efforts.^[10] Finally, after almost 20 months of negotiations with the six richest countries globally (Germany, France, Britain, Russia, China, and the United States), in July 2015, a comprehensive joint plan of action (JCPOA) was reached to resolve Iran's nuclear dispute. Accurate assurances ensured that Iran's nuclear program would not be directed toward weapons targets. The highest level of transparency and inspection standards was agreed upon, leading to the lifting of sanctions on Iran's nuclear program by the United States and the United Nations. The agreement was welcomed by the international community and approved by the UN Security Council.^[13] A review of the history of sanctions shows that the initial US sanctions against Iran were not related to the recent nuclear weapons concerns, so the country announced its withdrawal from the JCPOA in May 2018 and again imposed economic sanctions with the strategy of exerting maximum

pressure on Iran.^[14] Economic sanctions inflict significant socioeconomic and political damage on target countries. In other words, economic sanctions can be a destructive tool in foreign policy because of the many destabilizing effects they have on the target countries.^[2]

Various studies indicate the impact of sanctions on various macroeconomic variables in Iran. EU and Japanese sanctions have hampered 57 percent of Iran's oil exports and negatively affected other macroeconomic indicators. Thus, total imports decreased by 20%, total exports by 16.5%, private consumption by 3.9%, capital income by 3.8%, and GDP by 3.2%.^[12] Sanctions imposed on Iran from 2012 to 2014 have significantly impacted Iran's exports to its trading partners. During these years, the value of Iran's exports has decreased by an average of 33% per year, and the resulting loss during these three years has been \$ 104 billion.^[15] The 2012 sanctions have had a direct and more robust impact on the exchange rate by imposing adverse shocks on foreign exchange receipts from oil exports and government budgets.^[16] Heavy economic sanctions destabilize the market exchange rate and widen the gap between the official exchange rate and the market exchange rate. It also increases the expected inflation rate among the people, which is the stimulus for rising inflation.^[17] International sanctions reduced the total welfare of Iranians by 14 to 15 percent. The rate of welfare losses due to sanctions in rural households was twice that of urban households. The most impoverished urban and rural households have experienced the most welfare losses.^[18]

The economic pressures created by sanctions can be one of the main drivers for changing the political behavior of the target states,^[12] but in addition to the mentioned economic effects, by reducing access to education and public health care, reducing their quality and deteriorating economic conditions also hurt the citizens of countries affected by sanctions.^[18]

Since the beginning of 2020, the world's population has been plagued by the Covid 19 respiratory pandemic, a disease that has infected 107,423,526 people and killed 2,360,280, according to the World Health Organization (Feb 2021).^[19] This disease becomes a socioeconomic crisis more than a health crisis, the economic impacts of COVID-19 lead the world economy to experience a recession.^[20] The Iranians faced the COVID-19 crisis in a situation plagued by tough US sanctions' economic and social consequences.^[21] In this context, the present study aims to represent the relationship between sanctions and public health and the strategies to deal with it.

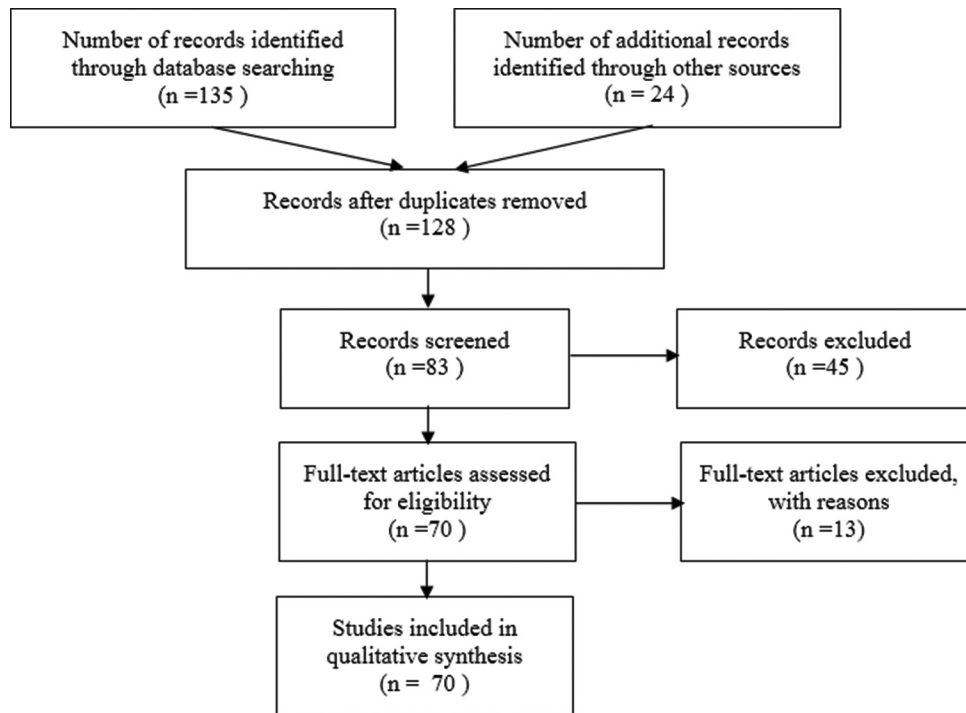


Figure 1: Flow diagram of study (PRISMA)

Methods

Study Design

The study used a mixed-methods approach, drawing data from two sources: a scoping literature review and a qualitative survey of experts' opinions. The methodology for both is detailed below:

Scoping review

We conducted a scoping review to identify the various dimensions of how sanctions impact Iran's health system and public health, as reported in scientific literature. The scoping review approach has a five-step framework^[22] that we have used in this phase. We followed the Preferred Reporting of Items for Systematic Reviews and Meta-Analyses (PRISMA)^[22] Statement. The eight-person study team performed five steps in order.

Identifying the initial research questions

The dimensions that formed our study questions were: how will the relationship between sanctions and public health and the health system appear? So, we put the following items on the agenda

- What aspects of public health have been affected by sanctions?
- What aspects of the national health system have been affected by sanctions?
- What are the crucial challenges around sanctions and health?
- Which diseases are most affected?
- What are the potential solutions?

- What organizations can play vital roles in controlling the situation?
- What is the potential of health diplomacy to fix the situation associated with sanctions?

Identifying relevant studies

We performed comprehensive literature searching in the major databases, including Scopus, PubMed, Web of Science, and Embase databases from January 1, 2012, to January 1, 2019, for English and Persian language articles in all types of research. A search strategy appropriated to each database regarding MeSH guidelines was developed and used. Main keywords include: "economic sanction," "oil sanction," "sanction," "impact," "public health," "macroeconomics," "household welfare," "medicine," "Iran." We also searched for data in grey literature.

Study selection

After searching the specified databases, we identified 135 articles. In the first level of screening (titles and abstract) irrelevant articles were excluded. After applying the inclusion and exclusion criteria, 70 studies were selected for final synthesis [Figure 1].

Data charting and collation

At this point (charting of selected articles), the data is extracted from the articles and prepared for interpretation. The study team developed a framework for this step based on the questions and the studies' dimensions. We summarized all selected articles in the developed Excel form. This form includes general details such as publication

date, country, authors, types of sanctions' impacts, outcome, and proposed solution. [Details of the final selected studies are available in Supplementary File 1].

Summarizing and reporting findings

The fifth and final step of the scoping review is summarizing the sum of the obtained data and reporting them, which we have dealt with in the findings section.

Qualitative phase

We used a set of interviews to explore the opinions of national health experts, policymakers, and managers about the impact of sanctions on the healthcare system of Iran and strategies to deal with them. We followed the Consolidated criteria for reporting qualitative research (COREQ)^[23] in this phase.

Study participants and setting

For the qualitative phase, the study team was formed, all of which had experience in qualitative research, for all qualitative phase stages, and they had university degrees in health policy, health economics, and health management. All study team members were PhD students or university professors, and there was no conflict of interest. We collected data through in-depth and face-to-face semi-structured interviews. Using purposive sampling (The interviewees were among the health-related sections most influenced by the sanctions, based on the scoping review) and snowballing recruitment, ten stakeholders, i.e. policymakers, health business owners, experts, and health professionals, were selected to be interviewed. The interviews were done between January and April 2020 at the interviewees' workplace, and 50 minutes was the median time for most interviews. During the interview, more details were asked for clarification whenever necessary. All interviews were recorded and transcribed verbatim.

Interview's guide, validity, and reliability

Before the interviews, the study team developed an interview guide based on a literature review that included specific cores, such as (economic and monetary, program implementation, access to medicine and facilities, general social health, and c); these cores obtained data more valid. Before conducting the interviews, we provided the interviewees with the information sheet and consent form. The interviewees' feedback regarding the interview results and their statements were officially received. Each verbatim transcript was indexed and coded by at least two authors. Illustrative quotations are presented within the results section to validate the findings.

Data analysis

Inductive thematic analysis was adopted to analyze the data by using the MAXQDA software version 10. Themes and their respective sub-themes were revised several times to

reduce the risk of bias and eventually determined through discussion between the research team. All data used to recognize the initial codes, through a scoping review, we deductively generated the initial themes regarding the effects of sanctions, and all obtained codes were used to evolve themes and sub-themes. During five group sessions, the research team members examined their understanding of the primary codes, and the disagreements were discussed until solidarity was obtained.

Results

Scoping review

Although the international economic sanctions have affected the government's micro policies, they, directly and indirectly, affect the targeted population's right to access social welfare and good health, contrary to universal human rights principles and values. The results of the present literature indicated that the sanction had affected public health directly and indirectly (through economic, political, and social-cultural factors) [Figure 2]. Finally, the potential strategies in two general groups including the health sector-related and macro environment were extracted according to the literature review.

In the following, the details of the impact of sanctions on the 4 mentioned dimensions will be explained [Table 1].

Economic factors

Although the United States announced exemptions for medicines and medical equipment amid unilateral international sanctions on Iran, it did not guarantee Iranians' access to critical goods like food, medicine, and medical equipment for Iranians.

Sociocultural factors

The social issues of poverty, unemployment, discrimination, social inequality, addiction, prostitution, and violence are particularly concerning in Iran compared to other countries.

In addition to many adverse effects on government policies and programs, sanctions, directly and indirectly, affect Iranian citizens and their right to health, contrary to the universal principles and values of human rights.

Political factors

The success or failure of a policy-making system depends on political, economic, social, and cultural factors. Disruption in any of these factors can undermine the entire policy cycle and lead to the interruption or non-implementation of many national policies, especially under ongoing economic sanctions.

Expert's opinions

Three key themes and five subthemes were identified to deal with the crisis caused by sanctions, which are:

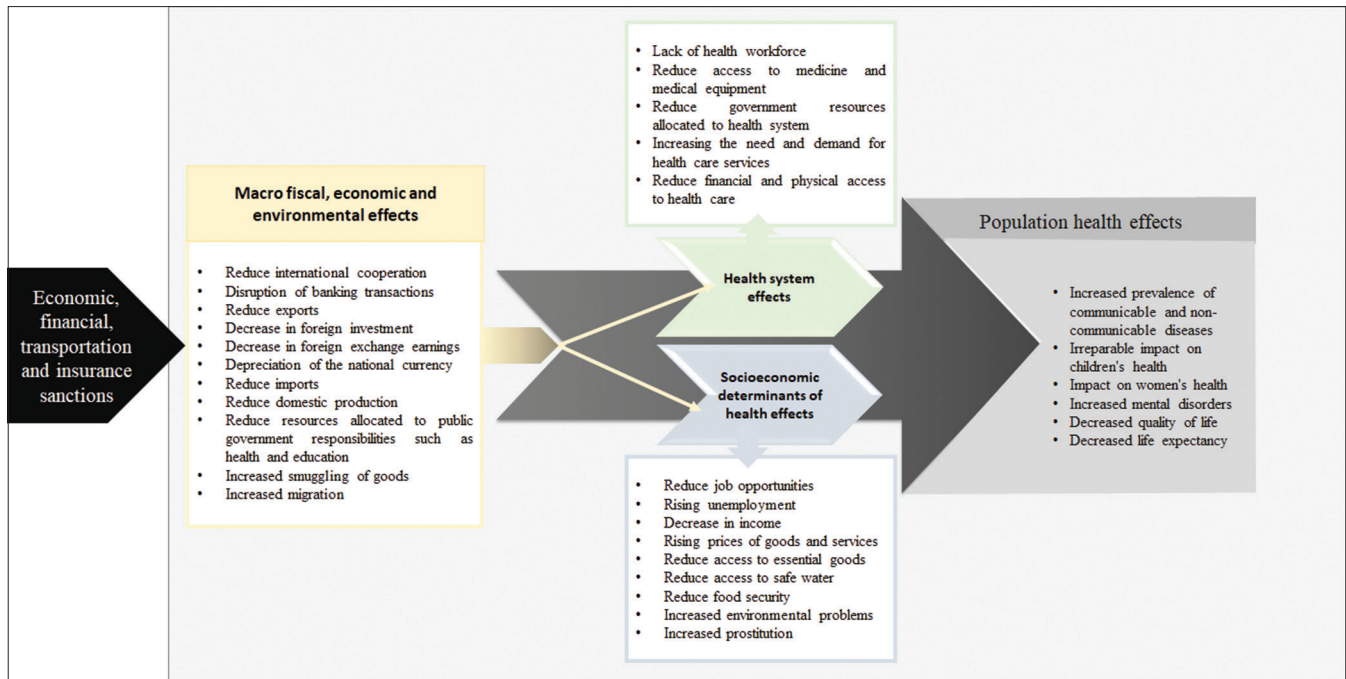


Figure 2: The sanction impacts on health

Theme one: Contribution of the service consumers

Education

The common theme among all interviewees was education. Education can help to increase the health system's resilience by changing behavior, reducing unnecessary hospital care utilization, rational use of medicines, avoiding self-medication, and purchasing domestically produced medical products.

Theme two: Contribution of government

Financial considerations:

To implement the health transformation plan, the government allocated 10% of the resources collected from the subsidy targeting program and 1% of the collected value-added tax revenue to the health leading to an increase in resources allocated to the health sector.

Medicines and medical equipment

The shortage of medicines and their high prices are the major problems caused by sanctions. Health policymakers should undertake all appropriate legislative, administrative, and other measures to implement health services and medication's rational use.

"Eliminate many expensive drugs that are ineffective and produce similar drugs that are cheaper... Moreover, Drug list restraining can play a successful role in a control policy." (p: 3).

Theme three: Contribution of health insurance organizations: Two subthemes

Financial considerations

Participants have stated that economic sanctions have

forced insurance companies to adopt a budget ceiling policy so that they are not allowed to spend more than the budget limit. With the implementation of the Means test law, people were obliged to pay insurance premiums according to their financial ability to cross-subsidize the poor. Interviewees believe that insurance organizations should also use international sources for financing in addition to domestic financing strategies.

Strategic purchasing

Compiling and implementing guidelines and reimbursement for providers according to guidelines are critical strategies. Participants confirmed that with these limited resources, the control of induced demand, consumption management, and rational drug prescribing should be considered.

Theme four: Legislative solutions

According to interviewees, an essential solution for decreasing the effects of sanctions is developing the appropriate national rules and laws.

Adapting financial policies

It is necessary to develop a clear plan for providing medicine and equipment through Nimai and government-subsidized currency. Moreover, special cash flow should be developed to act as a catalyzer between key organizations like the Ministry of Health and Medical Education and the Program and Budget Organization to provide the resources as soon as possible.

Another essential solution is to facilitate the coordination between financial institutions and the Ministry of Health and Medical Education to support drug production.

Table 1: Various dimensions of the impact of sanctions on health

Dimension	Sub-dimensions	Description
Political	National policies	The adverse effects of sanctions on Iran's national cancer program in prevention, treatment, and equipment have led to increased cancer deaths. On the other hand, reduced resources allocated to public government responsibilities such as health and education have short-term and long-term impacts on population welfare and quality of life. Besides, If the government fails to meet its social responsibilities, such as providing essential goods or controlling the prices of goods and services, the likelihood of rebellion in society increases. ^[24,25]
economic factors	Export and Import	Economic sanction increases the prices of imported goods since the exchange rate was increased. Besides, the countries that imported oil and its derivatives from Iran reduced their oil import significantly. On the other hand, after the US left the JCPOA, the number of foreign investment companies that are leaving Iran is increasing ^[12,26-28]
	Financial transportation	Since the imposition of economic sanctions against Iran, the financial turnover and industry cycle have been disrupted, the medical equipment companies have difficulty in their financial interactions, and the amount of dollars and euros available for import goals has declined. The swift banking network suspended its banking services to several Iranian banks. ^[29,30]
	Physical and financial access	Since much of the Iranian government's budget was dependent on oil export, due to the unpredictable and uncontrollable effects of global economic sanctions, the public budget was declined; therefore, the allocated budget to all parts of the government, especially the Ministry of Health, was reduced and, the supply chains were damaged. ^[30-33]
	Transportation	US unilateral sanctions against Iran's economy, besides banking and various industries, also target the transportation industry. The sanctions were imposed on Iranian shipping and shipbuilding departments. Further, these sanctions have affected customs clearance, and many goods were deposited. ^[34-36]
Sociocultural factors	Economic Policy	The negative economic strategies have affected the unemployment rate and led to a shrinking economy.
	Education and Research	The pressure on Iran is not limited to economic issues and is trying to limit its leverage, So the access to reliable articles was limited; on the other hand, the number of submitted articles with invalid profiles was reduced, and the number of admitted graduate students decreased because of budgetary constraints. ^[37-41]
	human resources	Economic sanctions against Iran resulted in increasing the unemployment rate and incomparable welfare and earnings of counterparts in foreign countries have dissatisfied the elites and caused them to despair, complain, and finally migrate. ^[35,42,43]
	Depravity	Financial sanctions have short-term and long-term consequences on the lives of all segments of society, especially female-headed households, as the unemployment rate will increase among them; therefore the reduction in their incomes can increase the possibility of depravity. ^[35,36]
Health factors	Corruption	Some beneficiary people have taken advantage of the sanction's space and destroyed billions of dollars of the country's currency under the pretext of circumventing sanctions. ^[35,36]
	Medicines and Medical Equipment	Sanctions effectively hampered the import of medicines and medical equipment by boycotting communication channels and placing Iranian banks on the blacklist. Although nearly 95% of medicines are produced domestically, about 50% of their raw materials are imported, so access to medicines has become a challenge, incredibly, the lack of medicines for specific diseases (hemophilia, Thalassemia, cancers, &c.). ^[24,25,26,27,30,33-36,38,41,44-63]
	Nuclear medicine	Delayed problems in the supply of raw materials used in the preparation of nuclear medicines are very problematic because they usually have a very short lifespan and must be transported very quickly. ^[30,34,64]
	Mental illness	In addition to the stress that patients and their families endure, they also have to worry about the future. On the other hand, decreasing incomes and increasing the price of goods and services put people under psychological pressure and increase the incidence of depression and suicide. ^[35,62]
	Women Health	As mentioned, women's health is one of the most important factors affected by the US sanctions, as the economic problems have led to a reduction in human resources in the manufacturing sector, mainly the female workforce, so the probability of depravity among them have increased. ^[27,35,39,60,65]
	Infants and Children Health	Children are the most vulnerable people in human society. Under economic sanction, the rate of infants and children's infectious diseases and, as a consequence, the mortality rate of them have increased. Another problem is the increasing number of working children to help their families' incomes. ^[36,65-67]
	Public Health	By imposing sanctions, food security, access to preventive care, and health care were reduced as the sanctions affected inflation, affordability, access to health care, air pollution, &c.. ^[35,37,52,66,68,69]
	Environment	One of the most critical issues that Iran has faced is severe air pollution in large cities because of low-quality gasoline; controlling and resolving such a considerable problem requires financial resources and scientific and technical assistance, which are limited due to sanctions. ^[25,26,27,36,70]
	Nutrition	From a welfare economy perspective, the impact of sanctions shock on household welfare, such as food security, poverty, and inequality, is usually significant. Evidence showed that sanctions reduce household calories and increase malnutrition. Another effect is reducing drinking water access due to chlorine deficiency. ^[35,39,42,52,66-68,71]

According to interviewees, generating extra financial resources is a way to decrease the deficiencies. It is recommended to increase the consumption and sale tax on cigarettes and other tobacco and soft drinks and increase customs duties on cosmetics and other harmful goods. Increasing the allocation of VAT revenue to the health system from 1 percent of the whole country to 2–5 percent is another solution that will make more than 3000 million dollars for every one percent increase in the health system.

Developing appropriate rules

According to interviewees, removing or modifying the rules that are barriers to sanctions could have positive effects.

“Unfortunately, half the time, our health professionals generate unnecessary costs for health organizations. This behavior can waste limited resources!” (P: 9)

Furthermore, formulating the rules for health workers’ compulsory training about resource management and rational prescribing of diagnostic and therapeutic services can be effective. Finally, developing the guidelines for integrating the databases, and validating and establishing them as a basis for continuous monitoring and correction will facilitate evidence-based decision-making.

Using the potentials of human resources

According to interviewees, separating the policy-making body and the executive body in health clearly and operationally might improve the quality of decisions in the long term. Besides, establishing a team of skilled and experienced people to monitor unmet needs and resolve import and export challenges can be helpful.

Evaluation of developing strategies to deal with sanctions (in the health sector and the health-related Extra-Sector).

Health sector

The health sector activity is divided into stewardship/governance, research, and health education.

Stewardship/governance of the health system

Establishing a drug information center to address drug needs through regular meetings between manufacturers, importers, and the Food and Drug Administration. Some practical and beneficial actions include:

- Policymakers’ support for patients and insurance companies.
- The private sector’s participation in the supply of medical goods and equipment: In this regard, Logically Choosing and using drugs can promote the use of generic medicines and design and utilize clinical guidelines to address the effects of sanctions.
- Reform in the payment strategies for performance to providers using a cost-effective drug.
- Hold workshops to raise public awareness that generic drugs and brands are similar except in their price.

- Increasing the ability to pay for medicines through drug pricing mechanisms, using financial protection from the poor such as subsidies, registering patients and infants to receive medicine.^[72]
- Ensure a reliable supply system for the drug and medicines.
- Prepare the single drug with the primary goal of reducing or preventing drug waste.
- Sustainable finance for medicines by the mobilization of resources for the pharmaceutical sector, the efficient allocation of pharmaceutical resources, and the use of economic assessments to include drugs in the country’s pharmaceutical list.^[43]
- Efficient allocation of pharmaceutical resources. To this end, encourage and support the use of domestically produced drugs instead of imported drugs, import of generic drugs instead of branded drugs, and provide positive lists for repayment through insurance coverage or other financing models.^[55]
- Consumer financial protection on the financial consequences of drug use by improving insurance repayments
- Make policies on the level of payment and independence of drug suppliers, actual drug prices, reasonable drug prices, competitive drug prices, and c.^[61]

Health Research and Education

Examining possible ways to support low-income and vulnerable groups in using health services, evaluating and developing effective strategies and programs to improve the supply chain, and finding Sustainable ways to avoid sanctions and reduce their effects can be done through in-depth research.

Health-related extra-sector

The health-related extra-sector includes two areas: international politics, and national politics.

International politics

These policies require the cooperation of other countries and international bodies. Adopting new policies to protect civilians from violating their rights through the development of constructive engagement with other countries, especially neighboring countries, has been accepted as an international strategy to counter-sanctions.^[48]

Alternative measures include interaction with international economic networks, blacklisting of economic agents, reciprocal economic sanctions, reciprocal measures, a ranking of goods and trade, the prohibition of transactions, blocking of assets, and Demonstrating power to counter international threats is an alternative mechanism.

National policy

Fight against economic corruption, production of domestic goods, protection of national products, consumption

management, and prevention of consumerism by creating a culture of resistance economy, optimizing renewable energy sources was suggested as policies require national decisions. Other suggested policies moved towards the non-oil economy by using participatory economic mechanisms such as multinational corporations investing in production instead of oil revenue in production, employing knowledge-based economies and creating infrastructure, and developing entrepreneurial and third-generation universities.^[28,29,44,48,49,52,73]

Discussion

This study investigated the impact of sanctions on Iran's public health and health system. The findings reveal those economic sanctions have both direct and indirect effects on the health of Iranians. These impacts are categorized into four main groups: economic, socio-cultural, health, and political factors. The results of this study, in line with past and subsequent studies, have pointed out the harmful and multidimensional effects of sanctions on health.^[74-78] Chaufan and his colleagues have concluded in a systematic review that due to the intertwining of the global economy, it is impossible to design sanctions that will provide the objectives of the sanctions but do not cause significant harm to civilians. Therefore, using sanctions as a tool threatens global health.^[75] Yazdi-Feyzabadi and colleagues have also divided the effects of sanctions on health into two categories: direct (access to essential medicine, medical products, vaccines, and technologies, financing, and financial risk protection, health workforce, service delivery, research and health information systems and health outcomes) and indirect (socioeconomic status; food and agricultural products; stress; early life conditions; high-risk behaviors and addiction; and transport).^[77]

Health is a universal right encompassing primary care, medical care, education, and other underlying socioeconomic determinants.^[79] While medical care can extend survival after illness, it is not the sole determinant of a population's health, socioeconomic factors play a more critical role.^[80] Over 70% of health outcomes are influenced by factors beyond healthcare.^[81]

Recessions and economic crises have many direct and indirect destructive effects on health.^[82-85] Sanctions affect main macroeconomic variables such as export and import, foreign exchange rate, fiscal status, access to global financial markets, and economic growth widely). Economic sanctions have a significant negative impact on the countries' GDP; for example, UN sanctions from 1976 to 2012 led to a 25% reduction in the nation's per capita GDP.^[86]

The history of past political sanctions imposed against Iran shows a significant negative impact of these sanctions on Iran's exports.^[15] Also, Sanctions reduce the import of capital goods and significantly affect GDP for years after

the sanctions. A 1% decrease in imports of capital goods in a given year causes a reduction of 0.68% of GDP over eight years.^[87] Economic sanctions are causing inflation in the country by creating instability in the exchange rate and increasing the people's expected inflation rate.^[16,17] Contraction of 15% to 20% of Iran's economy (2015), loss of \$ 160 billion in oil revenues (2012), reduction of total imports by up to 20% (2015), reduction of total exports by up to 16.5% (2015), reduction of capital income up to 3.8% (2015) and reduction of GDP up to 3.2% (2015) show the negative impact of sanctions on macroeconomic indicators in Iran.^[12,88]

Although various sanctions have been imposed over the past four decades, since May 2019, unilateral US sanctions against Iran have increased dramatically to almost a complete economic lockdown.^[21] So, Iran could not bear a proportionate share of financial capacity to health shocks like the recent outbreak of the coronavirus epidemic, leading to an inability to contain it.^[89] Many health sector activities that require financial exchanges and transactions are often not possible due to the government's limited ability to raise funds or import essential goods due to sanctions.^[90] Meanwhile, the US unilateral economic sanctions against Iran restricted imports of essential goods, and Iran is unable to import medical supplies from any other country,^[91] so lack of medical, pharmaceutical, and laboratory equipment such as protective clothing and medicines can increase the epidemic burden and the number of casualties.

In the economic crisis, most countries face the double challenges of fighting unemployment while limiting social spending. Decreased expenditure and unemployment have a direct and indirect impact on health-related decisions. This effect heterogeneously distributed among different social groups, and therefore, not only the level of health is endangered, but its distribution is jeopardized.^[92] government revenues fell from 40% to 50% Due to the negative impact of sanctions on the country's oil sector, and international sanctions reduced the total welfare of Iranians by 14% to 15%. The most impoverished urban and rural households have experienced the most welfare losses due to sanctions; likewise, the rate of welfare losses in rural households was twice that of urban households.^[18]

An economic crisis like sanctions does not affect everyone and every part equally; the extent to which it affects each individual depends on the interaction between social class, age, ethnicity, gender, and the type of work lost. There is sound evidence that people with low socioeconomic status are more likely to lose their jobs during a recession than those with high socioeconomic status.^[93] Through affecting the individual and society's employment status, macroeconomic phenomena can have significant psychological effects on individuals and increase psychological injuries. Economic instability is one of the main factors affecting the hospitalization

rate due to psychological problems, and there is a significant relationship between economic crises and psychological conditions such as suicide.^[85] the study of Veisani *et al.* Shows a positive relationship between income inequality and suicide in Iran.^[94] Moreover, the survey of Mohamadnejad shows a negative relationship between poverty and mental health in all age groups and both sexes.^[95]

In the current situation, many people have lost their incomes due to the COVID-19 pandemic in Iran, but due to the severely restricted financial resources, the government is unable to compensate them. Hence, the US unilateral economic sanctions are one of the critical factors that contributed to the premature lifting of Iran's lockdown.^[96]

The evolution of health systems is closely linked to governments' economic performance, which supports a large percentage of healthcare spending. There is a direct relationship between the health system and the financial situation. In other words, in times of economic crisis, public health costs are usually reduced, and the recession has devastating effects on many health indicators.^[85] In addition to the impact of unilateral economic sanctions on the country's revenues and reducing the share of health budgets, economic sanctions lead to reduced access to health services, drugs, and medical equipment. The results of Aloush study are also consistent with the current study.^[62]

Sanctions have affected all sectors of the economy. However, they increasingly affect vulnerable patients by blocking the delivery of drugs and raw materials to Iranian pharmaceutical companies and medical equipment for hospitals. Although drugs and medical supplies are not included in the sanctions, there are shortages of certain medicines and medical equipment, which lead to a sudden 50% increase in the price of medicine. Problems with drug export licenses, financial transactions, currency transfers, transportation, pharmaceutical companies, and international banks' fears of possible US penalties are some of the reasons for this impact.^[28,48,97]

With the decrease in access to medicine, Iranian healthcare professionals determine resource allocations based on needs. Nevertheless, resources are limited even for the neediest patients like lethal diseases and emergency surgery.^[33,41,49,98] That is to say, sanctions weaken Health infrastructure, which causes the health system to be disabled to provide services and respond to health crises.^[48] Strategies to address this challenge include: strengthening domestic and local production of healthcare services, medicines, and health equipment. This work can be done by mobilization of resources and their efficient allocation. Besides consumer protection from the financial consequences of receiving health care services by improving insurance repayments, increasing repayment can help. Providing documents and objections to the secondary effects of sanctions on the Iranian people's fundamental rights to present for international

organizations and pursuing the authorization of banking transactions in areas related to health, can take guarantees for compensation due to contradictory sanctions on Iran.

Conclusion

This study has comprehensively examined the profound impact of economic sanctions on Iran's public health and healthcare system. The findings indicate that these sanctions have led to significant challenges, including reduced access to essential medicines and medical equipment, heightened economic and social inequalities, and deteriorating health outcomes. The sanctions' effects are multifaceted, impacting economic, sociocultural, political, and health factors, which collectively contribute to a substantial decline in public health.

The strategies identified to mitigate these adverse effects underscore the importance of both national and international efforts. At the national level, strengthening domestic healthcare infrastructure, enhancing health-related policies, and improving resource allocation are critical steps. Internationally, there is a pressing need for the UN and the global community to recognize and address the humanitarian consequences of sanctions, ensuring that essential health services and supplies remain accessible even under restrictive measures.

In conclusion, while economic sanctions are intended as tools of political leverage, their unintended consequences on public health can be severe and far-reaching. Both policymakers and international organizations must anticipate and mitigate these effects to prevent further deterioration of public health in sanctioned nations like Iran. Future strategies should prioritize the protection of health as a fundamental human right, ensuring that political actions do not come at the cost of human lives and well-being.

Authors' contributions

All authors have contributed to this study.

- Substantial contributions to the conception or design of the work (MM, STR, SN, SD, MA, HM, TN, MG, LS, NJ), acquisition, analysis, or interpretation of data for the work (MM, STR, SN, SD, MA, HM, TN, MG, LS, NJ).
- Drafting the work or revising it critically for important intellectual content (MM, STR, SN, SD, MA, HM, TN, MG, LS, NJ)
- Final approval of the version to be published (NJ, SD)
- Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved (NJ).

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Conflicts of interest

There are no conflicts of interest.

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Supplementary File 1

The impact of Economic Sanctions on health and Strategies for Mitigation: a glance at the case of Iran

Note: Table of included literature

Authors	Title	Impact	Strategies
Hai-Jeon Yoon, Seon Hee Woo, Daehee Kim, Ju Hyun Um, Sae Hyun Park, Ah Ram Seo	Changes in medical research trends in North Korea after economic sanctions	<ul style="list-style-type: none"> - small number of pages of articles published - deterioration of the level of North Korean's health - the most common type of article on Korean Medicine was laboratory studies, Clinical trials took up the second highest proportion, but all were nonrandomized - The proportion of literature reviews has increased sharply since the economic sanctions began. These changes likely resulted from the deterioration of the medical study environment caused by economic sanctions. - In 2015, the articles belonging to the medicine and pharmacy categories were considerably decreased in numbers and the articles belonging to the natural science category increased sharply in number as compared with before 2015. 	N/A
Yiyeon Kim	Economic sanctions and child HIV	Economic sanctions increase the new HIV infection rate by 2.5% and the AIDS-related death rate by about 1% among children.	<p>leader in a country targeted by sanctions should consider extending programs in response to children's HIV/AIDS both during and after sanctioning;</p> <p>- policymakers for international HIV resources should pay more attention to children in targeted countries in terms of supporting intervention for the prevention of MTCT, treatment of pediatric HIV, and care for orphans.</p>
Yiyeon Kim	Economic sanctions and HIV/AIDS in women	sanctions increase women's HIV rate by decreasing female labor participation. These findings are in line with previous findings that sanctions negatively affect public health	N/A

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Authors	Title	Impact	Strategies
Maryam Sha'bani, Hojat Mahkoei, Elahe Ghorbani	Investigating Socioeconomic Challenges of Iran During Sanctions	<ul style="list-style-type: none"> - The population of Iran is more than a factor of cultural enrichment because of the opportunities and favorable conditions abroad that attract the most attention as a major threat to the national security of ethnic groups to the outside world therefore; this leads to a decrease in the geopolitical weight of the country. - The economic and social situation of Iranians is affected by sanctions in recent years. Iran faces various challenges such as unemployment, inflation and depression, immigration and the problem of marriage, Brain drain, and economic stagnation. Rural migration and migration from province to province do not predict a good future for development and national security. - Brain drain due to lack of proper and efficient research space in Iran, weak economic system and improper use of experts, inability to create new educational conditions for all volunteers, structure Economic and interest management in the country, unemployment - Poverty and injustice and their main role in the development process of Iran (distribution of Unequal income and wealth, poverty, housing, and access to food) - Irregular population growth - Unemployment growth despite increased employment - Incompatibility with the global economy (government-based economy, domination of traditional behaviors, reliance on export products, especially raw materials, lack of cost system, low productivity and incompatibility with alternative programs Money and credit with coins and bills (paper money), low ratio of trade growth to GDP growth, low value of domestic trade and reliance on oil industry, weakness in foreign investment. - Inflation and increase in prices and decrease in sales 	Poor management and inefficiency of the government, curbing population growth, supporting policies to encourage domestic investment, drafting laws to facilitate domestic investment and inviting Iranian investors, and emphasizing efficiency in the social security system
Ali Asadi1, Mojtaba Maleki Shahrivar, S.Meisam Esmaili	Passing Through Sanctions By Resistive Economy	Sanctions have created economic instability by restricting international communications, increasing investment risks, reducing technological imports, and crippling the bank. Inflation, unemployment, dependence on crude oil, massive imports, and shortages in some structures	Refusal to sell crude oil and move towards a non-oil economy, maximum use of domestic products, and resistance economy. Improving the country's education system in the field of culture-building of the resistance economy.

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Authors	Title	Impact	Strategies
Bastani P, Dinarvand R, SamadBeik M, Pourmohammadi K	Pharmaceutical strategic purchasing requirements in Iran: Price interventions and the related effective factors	Currency fluctuations, penalties for the transportation system and banks resulting from sanctions affect the rate of drug production, the likelihood of new technology's final and hidden drug prices (costs based on activity, raw materials, and imported drugs), and drug quality. Strategic purchases are carried out by insurance companies	the central bank has to allocate a certain amount of government-issued currency to pharmaceutical companies - policymakers support patients and insurance companies (performance and cost indicators, patient ability to cooperate in payment, bargaining power, and negotiation, policy making For the level of payment and independence of drug suppliers, real drug prices, reasonable drug prices, competitive pharmaceutical prices, etc.) - Evidence shows that labor, innovation, capital market infrastructure, competitive strategic backgrounds, globalization of trade, activity Organizational practices and macroeconomic policies can create competitive environments in industries Create a pharmaceutical market and set competitive prices N/A
Sajjad Faraji Dizaji, Peter A G van Bergeijk	potential early phase success and ultimate failure of economic sanctions: A approach with an application to Iran	- The decline in Iran's revenues limited the government's financial ability to pay for health, education, and social security, and to pay for its employees who have damaged the standard of living of Iranians. Shortage of imported goods due to lack of export earnings - Government per capita consumption, per capita imports, and per-capita GDP are declining - Evidence of the effect of sanctions on consumer price levels and the real exchange rate is weak at best (does not matter) - The decline in economic growth is generally accompanied by worse performance in indicators of human development such as life expectancy, child mortality	

Contd...

Authors	Title	Impact	Strategies
Taghdisinejad AS.	The impact oil embargo on economic security of Iran	<p>the decline in GDP and the shortage of dollars in the foreign exchange market led to the following:</p> <ul style="list-style-type: none"> -Decreased income of high-income families during the oil sanction – - Reduction of GDP to 5.8% means a 6% decrease in Iranian income in one year - Reduction of GDP to 0.2-20% decrease in imports and 16.5% in exports Increases net indirect taxes in Iran by approximately 23.6% <p>Decrease in oil revenues causes:</p> <p>A decrease in imports along with an increase in the exchange rate, worsens the import situation.</p> <ul style="list-style-type: none"> - Household consumption is a representative of private sector consumption. Import prices have increased and their income has decreased. 	<p>Increasing tax efforts or subsidizing reforms if they do not lead to political instability - the ratio of capital to the total factor used</p> <p>The oil industry is about 98%, and this ratio is 76% for other industries. As a result,</p> <p>Assuming full employment, the price of capital decreases due to an excess supply of capital</p> <p>The market for this cheap capital provides a good opportunity for other industries</p>
Sayed Mahdi Mostafavi, mahdi ghaemi asl, ali hoseini	An investigation for causality relationship among Economic sanctions, Macroeconomic factors, and environmental polluters in Iran	<ul style="list-style-type: none"> -Economic sanctions, a significant causal relationship with polluting gases (methane, carbon dioxide, nitrogen dioxide) <p>In a way, economic sanctions can have a significant impact on the level of pollution.</p> <ul style="list-style-type: none"> - Economic sanctions move production models from clean production techniques to unhealthy production. <p>This led to the use of older technologies and air pollution. Economic sanctions have a significant causal relationship with macroeconomic variables so economic sanctions can add sector value (industry and oil) and GDP (without oil) to Significantly affect</p>	<p>the elimination of technical-value-added problems and as a result of advanced commercial production growth caused by sanctions, can not only increase the value added of the industry and mining sector but also ultimately reduce gross domestic product without oil. It also brought about the environment. On the other hand, easing the tensions of international organizations due to sanctions could pave the way for environmental support for international legal institutions in the field of environmental clean-up and the availability of pollutant-absorbing technical systems.</p>

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Authors	Title	Impact	Strategies
Seyd Fazollah Mousavi , Fazlollah Jokar , Omran Mohammadi	Us Unilateral Sanctions Against Iran; Contradiction in Slogan and Conduct, Extreme Politisization of Human Rights	<p>- The existence of recession and inflation means a decrease in the purchasing power of the people and an increase in public poverty and inability to meet the necessities of life. Revenues allocated to the purchase of drugs (especially cancer, asthma, MS and Parkinson's) and medical equipment (nuclear and radiotherapy) drastically reduced</p> <p>-Many people with certain diseases do not have access to any of the medicines and equipment needed for treatment. Items imported from other countries are not only unusable due to technical defects, but also pose a risk to patients' lives.</p> <p>-Inability of government and insurance To support certain patients such as cancers due to reduced incomes</p> <p>- high treatment costs, lack of healthy equipment, insufficient government assistance, defective equipment imported from other countries, partial closure of private treatment centers due to lack of patients and as a result Lack of access for wealthy patients</p> <p>- a serious increase in transaction costs, including transportation and the like, overselling by foreign vendors due to awareness of restrictions, moving to pure exchanges with a few restricted countries and abuses of business, reduced transparency in purchases And the use of multiple intermediaries to circumvent sanctions, the impossibility of using banking, insurance and guarantee instruments for import and export, and the misuse of trade risk to Iranian traders and the severe problems of the government budget - the ban on buying and selling some Goods made in Iran and banned Selling tools of some important industries to the country</p> <p>It has caused some factories to shut down or semi-shut down (unemployment and poverty).</p>	N/A

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Authors	Title	Impact	Strategies
Ali Mashhadi, Mahnaz Rashidi	The Effects of Imposed Sanctions against Iran on Environment, Energy & Technology Transfer in International Law	<p>-Restrictions on the sale of oil and related environmental bio-industries can be sanctioned in cases such as restrictions on imports of environmentally friendly technologies.</p> <p>-Old technologies such as technology and environmental pollution, violation of the right to a healthy environment of citizens, violation of international environmental obligations regarding financial, technical and scientific assistance to the sanctioned country and the inability of the sanctioned country to raise its standards and restrictions.</p> <p>-By imposing restrictions on exports and imports, it creates problems for the supply of foodstuffs, safe drinking water, medicine and medical equipment, fuel, etc., of the target country.</p> <p>-US sanctions on Cuba lead to malnutrition of women and children, poor water quality and lack of access to medicines and medical equipment</p> <p>- lack of access to technology</p> <p>- Decrease in the value and credibility of the national currency, reduction of economic growth, inflation, unemployment, reduction of the government's ability to provide welfare to members of society, etc.</p> <p>- Iran energy sanctions can lead Creating energy crisis, riots and dissatisfaction and political and economic crises in the world, because the lack of energy supply causes industrial work to be suspended and consequently unemployment, inflation and dissatisfaction . and also violates the obligations of oil exporting countries.</p>	<p>- Political, legal and economic methods such as continuing negotiations with the P5+1 group, reviewing the possibility</p> <p>Fighting against sanctioned sectors such as oil, gas, petrochemical, shipping companies, etc.</p> <p>- The international effort to sue the European Court of Justice as well as the European Court of Human Rights</p> <p>- To attract foreign investment through the use of economic methods, the use of resources</p> <p>Renewable energy such as solar energy, wind energy, etc., instead of dependence on sources of oil and gas,</p> <p>- Investing in sectors that are not subject to sanctions and Iran can succeed in producing them. It works like pistachios, saffron, carpets, etc., in order to reduce Iran's dependence on energy resources.</p>
Hossein Marzban , Ali Hossein Ostadzad	The Impact of Economic Sanctions on Gross Domestic Product and Social Welfare for Iran: Generalized Stochastic Growth Model	<p>- A contractionary policy, such as a reduction in banks' lending capacity or an increase in producer costs as a result of sanctions circumvention processes, leads to a reduction in activity in the real sector of the economy.</p> <p>-The impact of oil sanctions on consumer goods is a boycott on consumer goods, intermediary and capital and production as oil sanctions increase, reducing government revenues to household revenues, reducing government revenues, reducing household income. The volume of capital will be reduced at steady situatin by imposing sanctions on consumer, intermediary and capital goods.</p> <p>-The decrease in the volume of production capital is also reduced. By decreasing production, the long - term household income will be reduced and thus consumption is reduced by steady situtation that reduces the consumption of social welfare.</p>	<p>In Iran the only way to deal with an oil embargo reduce dependence on household welfare to oil revenues, the oil revenues to invest in production and to [replace transfer payments, revenues from manufacturing to household accrues, the direct effect of oil sanctions on welfare will be reduced</p>

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Authors	Title	Impact	Strategies
Ali Mohammad Ahmadi, Mohammad Meskarpour-Amiri	The public health effects of economic sanctions as a global concern in 21th century: Why the economic sanctions is a cruel strategy	Endangering the general health of the community increases the mortality of the strata of the danger range	The Iranian government should use every means necessary to protect the public against the negative effects of sanctions/ However, some effects such as disability and death cannot be offset. In the future, before imposing sanctions, decision-makers must draw up international guidelines to prevent such effects on the population of target countries.
JOY GORDON	Crippling Iran: The UN Security Council and the Tactic of Deliberate Ambiguity	Impact on Imports, Exports, Foodstuffs, Medicines, Medical Equipment, Needed Goods	The international community had to anticipate the possible human impact of the sanctions and use whatever means were needed to prevent them.
Sajjad Faraji Dizaji, Peter A G van Bergeijk	Potential early phase success and ultimate failure of economic sanctions: A VAR approach with an application to Iran	Stagnation and destruction of economy and trade, political effects on the state system	N/A
Farzanegan, Mohammad Reza; Mohammadikhabbazan, Mohammad; Sadeghi, Hossein	Effect of oil sanctions on the macroeconomic and household welfare in Iran: New evidence from a CGE model	Negative Impact on Exports, Imports, Government Income, Decreasing Family Income of 1-10 Urban and Rural Decades	Presenting a Proposed Model on How to Investigate the Impact of Oil Sanctions on the Economy and Household Income
Mohammad Kordzadeh Kermani	Immorality and Illegality of Sanctions and Iranian Response	Declining rial value, declining government revenue, lack of access to medicine and medical equipment, etc., Production boom and domestic science	Termination or amendment of the policy, insertion of warranties, and remedies have been proposed by Iran for human rights violations by the HRIA.
Anuradha M. Chenoy	Gender and Human Rights Violations as structural part of UCMs	Crisis and economic downturn, emphasis on sanctions violations, in particular violations of women's rights and vulnerability to workplace adjustment, exclusion from graduate school, exposure to malnutrition and nutritional insecurity	Forming a committee of women members of the United Nations and other members tasked with collecting background studies and the fact-finding mission on the human rights dimensions at UCM and informing the international community.
Aziz Rezapour, Farbod Ebadifard Azar, Saber Azami Aghdash Asghar Tanoomand, Nahal Ahmadzadeh, Ali Sarabi Asiabar	Inequity in household's capacity to pay and health payments in Tehran-Iran-2013	Inflation and rising costs of the health care system, lowering the income of the community, especially the low-income strata, lowering the income of the Ministry of Health, and having a negative impact on growth and development and the ability to support low-income strata in health care.	Investigate possible ways to support low-income groups in health care
Morteza Ebrahimi1, Askar Jalalian1, Leila Esfandyari	The impacts of economic sanctions on human rights in countries of Iran and Iraq	Increasing unemployment, poverty and class gap - Decreasing government incomes and inability to provide basic living, social services, food and medicine and education and development conditions - Increasing malnutrition - Decreasing community health.	N/A

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Authors	Title	Impact	Strategies
Matthias Neuenkirch, Florian Neumeier	The impact of US sanctions on poverty	Increased Poverty - Lack of access to clean water and food - Restricted access to medicines, medical equipment, neonatal deaths - Decreased life expectancy	Investigate effective strategies to support and reduce the impact of sanctions on the poor
SANGITHA PALANIAPPA	SANCTIONS WITHOUT HUMANITARIAN IMPLICATIONS—AN IMPOSSIBLE FEAT	Impact of economic sanctions on three Iranian countries, Cuba. Iraq was surveyed/areas of influence in Iran, including economic, health and medicine, and nutrition, which were highly affected and had little effect on education.	In the case of Iran, humanitarian exemptions were decided too late, and the process of implementing the exemptions was unclear. Before sanctions are imposed, an international directive must be put in place to protect the people, and some international intermediaries and companies and financial institutions must be appointed to facilitate the implementation of the exemptions.
Ehsan Shakeri, Bela Vizvari, Ramtin Nazerian	The Impacts of Economic Sanctions on Supply Chain Management: Empirical Analysis of Iranian Supply Chains	Widespread Negative Impact on Supply Chain, Country Turnover, Industry Cycle and Microeconomics/Increased Export Import Costs/ Negative Impact on Medicines Trade Supplying Equipment & Medicines/Increasing Currency Price/Material Price Fluctuations/Supply Bankruptcy	Investigating the role of government and its policies on reducing and increasing the impact of sanctions, especially in the category of supply chain/ Evaluating and developing effective strategies and programs to help improve supply chain/ Investigating the objective effects of sanctions on other security and development activities And the country's economy
UNHCR - The UN Refugee Agency	ISLAMIC REPUBLIC OF IRAN	International sanctions and the effects of inflation continue to affect the delivery of humanitarian assistance as well as operational costs for UNHCR (The UN Refugee Agency) and other organizations.	N/A
Human Rights Council	Report of the Secretary-General on the situation of human rights in the Islamic Republic of Iran	-sanctions chiefly affected the general population, particularly the distribution of medical and pharmaceutical supplies	N/A

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Authors	Title	Impact	Strategies
UNICEF Annual Report	UNICEF Annual Report 2012 for Iran (Islamic Republic of) MENA	<p>-unilateral sanctions impact the environment, public health, and several aspects of the socio-economic life of ordinary people, including children</p> <p>- In 2012 the real GDP of Iran declined by 3 per cent as oil exports and foreign investments dropped significantly due to sanctions</p> <p>- Iran is now locally producing poorly refined fuel that is seriously polluting the air and endangering public health</p> <p>- The Department of Environment and Sustainable Development of Tehran municipality revealed that in the last Iranian year around 45,000 deaths were directly or indirectly connected to air pollution. Other reports in local media linked lung cancer cases among children to the worsening airpollution.</p> <p>- Despite UNICEF's tireless efforts, the tightened sanctions and the political isolation of Iran have translated into a reluctance among donors to allocate resources for development activities, impacting UNICEF's ability to raise funds.</p> <p>- Due to sanctions, the price of the imported and locally produced goods with imported raw materials increased noticeably in 2012. Some prices more than doubled.</p> <p>Several goods either disappeared from the shelves or the quality became questionable</p> <p>- As a consequence of the wide fluctuation of the newly introduced non-reference exchange rate, the validity of price quotations by suppliers shortened significantly (in some cases quoted prices changed within hours).</p>	N/A
Hossein Zare Antonio J Trujillo Eva Leidman Christine Buttorff	Income elasticity of health expenditures in Iran	The sanctions have the potential to disrupt allocations across government services, including the health sector. This can cause further strain on household budgets where more than 51% of care is financed out of pocket	N/A
Amir Hashemi-Meshkini	Making the Public Health and Industrial Objectives Balanced; the Big Challenge of Iran's Food and Drug Organization	The recent financial sanction and limitation on international trade revealed the weaknesses of our domestic industry in meeting the medical needs of society in political and international crisis	N/A

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Authors	Title	Impact	Strategies
Mehrnaz Kheirandish Arash Rashidian Abbas Kebriaeezade Abdol Majid Cheraghali Fateme Soleymani	A review of pharmaceutical policies in response to economic crises and sanctions	<p>Economic crises in a country inevitably may affect the priorities of the country for investment and expenditure. The affected countries may need to implement certain strategies to shorten the crisis period and expedite the economic recovery. The countries may also redirect financial resources from certain public responsibilities, such as healthcare or education, to more “pressing needs.”</p> <p>within a crisis both the government’s and the household’s ability to provide and pay for health care will be affected, a crisis may potentially damage the household’s access to required health care and medicines, and increase the frequency of observed drug shortages. In summary, while access to medicines has been one of the most important concerns at national and international levels, and remains a top priority for the World Health Organization (WHO) and other international organizations with similar mandates, economic crises may prevent countries from achieving their desired health care goals, including households’ access to required medicines</p>	<p>-Promoting prescribing and use of generic medicines</p> <p>-Developing clinical guidelines: One important way to ensure the rational use of medicines is developing and using clinical guidelines along with effective implementation strategies that help physicians to prescribe the appropriate medicines for the right patients based on health</p> <p>-Provider pay for performance strategies: One method to control medicine’s expenditures is preventing the induced demand for less-effective or expensive medicines by using “pay for performance” models that support the prescribing of more cost-effective medicines. This method in addition to cost saving has resulted in promoting rational use of medicines, ...</p>
Ali A. Asadi-Pooya Bitra Tavana Bahareh Tavana Mehrdad Emami	Drug adherence of patients with epilepsy in Iran: the effects of the international economic sanctions	<p>- These sanctions caused significant socioeconomic hardship for the general population of the Iranian people</p> <p>- Compared to the first time period, the price of some antiepileptic drugs (e.g., levetiracetam) increased up to 300% in the second time period and after intensifications of the international economic sanctions against Iran.</p>	N/A
Abbas Deilamizade Sara Esmizade	Economic Sanctions Against Iran, and Drug Use in Tehran, Iran: A 2013 Pilot Study	<p>when the price of drugs increases, some drug users tend to use cheaper drugs, which are more harmful, use more harmful routes of administration, such as injecting drugs, sharing needles, and make money illegally.</p> <p>As an important consequence of these economic sanctions, the price of drugs, as well as other goods and services, have increased in Iran in recent years</p>	N/A
Sufian Jusoh Tamat Sarmidi	Letter to the Journal Unilateral Economic Sanctions: Constructive Engagement as an Alternative?	The sanctions which have a negative impact on the economic sovereignty of the sanctioned countries and third countries will lead these countries to seek alternative ways and means to continue their trade and investment relations. Thus, it would be beneficial for countries to start looking at constructive engagement, either with the State or the private parties concerned, as an alternative to unilateral economic sanctions.	constructive engagement can be an alternative to the unilateral economic sanction.
Mehrnaz Kheirandish, Arash Rashidian, Maryam Bigdeli	A news media analysis of economic sanction effects on access to medicine in Iran	Evidence suggests a decline in access to and use of the drug during economic crises. Sanctions have similar effects to economic crises, and similar effects that have been proven in the European Union due to the recession may have occurred in Iran following the imposition of sanctions.	Holding regular meetings between manufacturers, importers, and the Food and Drug Administration is one of the solutions, establishing a direct telephone to announce drug shortages is another measure.

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Authors	Title	Impact	Strategies
Dara Mohammadi	US-led economic sanctions strangle Iran's drug supply	<ul style="list-style-type: none"> - Patients are faced with increasing drug prices. - 60% of cancer patients have problems and cannot receive timely chemotherapy - People travel to neighboring countries to solve the problem of lack of access to medicine, it is necessary to provide special exemptions in this area. - The supply of medicine before the sanctions was not great, but these sanctions have created problems, most of the challenges are on vital and high-tech drugs, people are drawn to the black market (Nasser Khosrow), and we do not have quantitative data in this regard. 	N/A
Erica S. Moret	Humanitarian impacts of economic sanctions on Iran and Syria	<ul style="list-style-type: none"> - Sanctions have affected the health and well-being of ordinary citizens in Iran and Syria. - In 1995, 500,000 children died in Iraq due to malnutrition caused by international sanctions. - The effect of sanctions on the success rate of treating Iraqi children with cancer has also been proven. - Increased anemia in pregnant women, typhoid, liver fibrosis, water-borne diseases, and hospital-related infections have also been reported in Iraq. - In the former Yugoslavia, Serbia and Montenegro, tuberculosis and measles have been reported to increase following sanctions. - Problems in the provision of basic goods due to sanctions are associated with increased malnutrition, breastfeeding, as well as increased prostitution. - Sanctions affect the production, import and distribution of medicine and food. - The sanctions affected Iraq's water chlorination system and reduced access to clean water. - The deterioration of health care knowledge and the lack of access to the most up-to-date research, as well as the departure and migration of health workers in the embargoed countries, have also exacerbated the situation. - Civil unrest, war, infrastructure collapse and environmental degradation are other effects of sanctions. - In Iran, sanctions have led to a sharp rise in the price of domestically produced drugs, a sharp rise in drug and food smuggling from Turkey, and the challenges of fraud, leading to corruption. - In Syria, sanctions have had the following effects: economic crisis, declining wages, rising commodity prices, unwillingness to trade with Syrian companies, rising production costs, declining social support schemes, declining domestic drug production, Increased depression, suicide and domestic violence associated with decreased social and economic well-being. 	Targeted to comprehensive sanctions can better address humanitarian issues. However, recent studies have shown that targeted sanctions in North Korea and Myanmar have increased public poverty.

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Authors	Title	Impact	Strategies
Siamak Namazi	Sanctions and Medical Supply Shortages in Iran	<ul style="list-style-type: none"> - There are skeptics who have reservations about the root cause of the crisis at hand, pointing to Tehran's own mismanagement, along with other factors, rather than American and European sanctions, as the real culprit behind medicine and medical supplies shortages in Iran. Broadly speaking, the skeptics rest their conclusion on three pillars. - Mismanagement: During the pre-JCPOA sanctions, mismanagement was cited as one of the causes of drug shortages, and a number of interviewees stated how it is possible to buy luxury goods and cars but not for drugs. - Even during the most severe sanctions, there is no de jure ban on humanitarian trade with Iran. -Iran could solve its problem by importing even more medical supplies from India 	<ul style="list-style-type: none"> - Contradictions in the various US and European sanctions laws must be resolved. - Authorized humanitarian trade can take place without the need for a third party or financial transferor. - Most importantly, the United Nations must make it clear that US and third-country financial institutions are fully permitted to participate in the transfer of humanitarian aid funds. - After years of forced US involvement with governments and banks around the world to persuade them to stop doing business with Iran, active diplomacy is needed to reassure financial institutions that no punitive action will be taken. - Exemption conditions for purchasing Iranian crude oil must be considered to provide the necessary resources for humanitarian purchases.
Narges AKBARPOUR ROSHAN, Shirin MEHRBOD , Mohsen ABBASSI	The Impacts of Economic Sanctions on Sustainable Development: Focusing on Labor	<ul style="list-style-type: none"> - Sanctions have affected population health indicators, drugs and treatment, food security, and air and environmental pollution, which affect the health of the community, which is essential for sustainable development. <p>Despite the pressures of sanctions, most health indicators in Iran are still improving. Sanctions have threatened the food security of Iranian society. Exports of pharmaceuticals and medical equipment to Iran have declined as a result of sanctions and in some cases have endangered the lives of patients.</p>	
Sogol Setayesh and Tim K. Mackey	Addressing the impact of economic sanctions on Iranian drug shortages in the joint comprehensive plan of action: promoting access to medicines and health diplomacy	<ul style="list-style-type: none"> - Sanctions have led to the use of low-quality raw materials in Iran's pharmaceutical industry, making it even more difficult to produce local generic drugs and challenging the access of nearly 6 million people to their medicines. - There are 73 shortages of drugs in the country, 44% of which were also classified as essential medicines by the World Health Organization. 	Use of health diplomacy at the heart of the 5+1 negotiations.
Shahabi, S., Fazlalizadeh, H., Stedman, J., Chuang, L., Shariftabrizi, A., & Ram, R.	The impact of international economic sanctions on Iranian cancer healthcare	Iran's National Cancer Program in the fields of prevention, treatment, equipment and technology, manpower, palliative care, pharmaceutical technology and import and knowledge management has faced the negative effects of sanctions. Improving the achievements of this program due to sanctions imposed on The Iranian economy, which has created obstacles for this area, is not possible and the health status of cancer patients will be declining.	N/A

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Authors	Title	Impact	Strategies
Amirhossein Takian	Diabetes Dictating Policy: An Editorial Commemorating World Health Day 2016 UN Economic and Social Council. Concluding observations on the second periodic report of Iran	Achieving the goals set for the management of non-communicable diseases faces many challenges, including sanctions.	N/A
General Assembly UN	Situation of human rights in the Islamic Republic of Iran	<ul style="list-style-type: none"> - Sanctions reduce the quality of life of people by reducing economic growth and increasing inflation. - Exemptions for the food and drug trade have reportedly not been effective. The most important drug deficiencies were cancer, heart disease, thalassemia, HIV/AIDS, haemophilia and multiple sclerosis. - The amount of dollars and euros available to importers of pharmaceuticals and pharmaceutical raw materials has declined and is in trouble. - UNICEF is concerned about the growing number of homeless children, working children, the elderly in need of care and sleeping on the streets. There has also been an increase in prostitution in the community. The budgets of organizations supporting such people have also been reduced. - The use of low-quality gasoline has increased air pollution in cities. Designated currencies are not allocated for pharmaceutical affairs and are allocated to other affairs 	N/A
M. Aloosh A. Salavati. A. Aloosh	Economic sanctions threaten population health: the case of Iran	<ul style="list-style-type: none"> - 40% inflation rate - 200% depreciation of Iranian currency - Increased living costs and unemployment - 11.8% reduction in gross domestic production growth in 2012 - Endangering social determinants of health (SDH) such as income, employment, and individual coping skills - Negative impact on mental health - Impairment of access to essential and life-saving medication (a study has reported a shortage of 73 drugs, 44% of which were essential and another study showed a significant reduction in the availability of 13 of the 26 life-saving drugs) - Expanding the economic and health inequality gap 	N/A

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Authors	Title	Impact	Strategies
Ali A. Asadi-Pooya Reza Azizimalamiri Reza Shervin Badv Bahram Yarali Marjan Asadollahi Maryam Homayoun Samira Sharifi	Impacts of the international economic sanctions on Iranian patients with epilepsy	<ul style="list-style-type: none"> - Many patients with epilepsy (53%) expressed significant hardship and frustration obtaining their drugs during the past six months and after the reimposition and intensification of the economic sanctions on Iran. - After the reimposition of the economic sanctions some drugs (e.g., ethosuximide, vigabatrin, and zonisamide) were not available in the market. - after the reimposition of the economic sanctions some widely used imported drugs (e.g., Tegretol and Depakine) were scarcely available. In addition, the prices increased dramatically, sometimes more than 250% in the black market. - The Iranian pharmaceutical market has faced significant difficulties in importing finished products and raw materials (active ingredients). - Sanctions have jeopardized medical research and science in Iran 	Purely from a clinical and patient care perspective, politicians on both sides must facilitate decisions that make the health and well-being of ordinary people more affordable and without hardship
Fatemeh Kokabisaghi, Andrew C Miller, Farshid R Bashar, Mahmood Salesi, Ali A K Zarchi, Abdalsamad Keramatfar, Mohammad A Pourhoseingholi, Hosein Amini, Amir Vahedian-Azimi	Impact of United States political sanctions on international collaborations and research in Iran	<ul style="list-style-type: none"> - Iran's international research collaboration rate rose over recent periods of increased sanctions; however, evidence suggests that factors other than economic restrictions may be influencing this. - Iran's publication rates have risen during recent periods of increased sanctions; however, its quantitative and qualitative metrics are discordant. - increased indexing of Iranian journals in scholarly databases 	N/A
Dursun Peksen	Political Effectiveness, Negative Externalities, and the Ethics of Economic Sanctions	<ul style="list-style-type: none"> - Creating economic dislocation and financial crises - Sanctions increased levels of poverty and income inequality, and threatened public health conditions by reducing access to medicine and disrupting health services - Reduce access to medical equipment such as X-ray facilities, ambulances, etc. 	Better understanding of the consequences of sanctions on the tourism sector to minimize its effects
Siamak Seyfia & C, Michael Hall	Sanctions and tourism: Conceptualisation and implications for destination marketing and management	<ul style="list-style-type: none"> - Sanctions have significant implications for travel and tourism and increase unemployment in related jobs - Increasing poverty - Reluctance of international partners to cooperate companies 	N/A
Siamak Seyfi & C. Michael Hall	Sanctions and tourism: effects, complexities and research	<ul style="list-style-type: none"> - Severely restrictions of international travels - Disruption of financial investment and supply chains - Significant reduction in travel and tourism 	N/A
Inwook Kim and Jung-Chul Lee	Sanctions for Nuclear Inhibition: Comparing Sanction Conditions between Iran and North Korea	<ul style="list-style-type: none"> - Disruption of trade - Cutting ties to international economic opportunities - Reducing oil revenues and reducing the level of foreign trade by about 50% - Increasing the cost of foreign trade 	N/A

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Authors	Title	Impact	Strategies
Iikka Korhonen, Heli Simola and Laura Solanko	Sanctions, counter-sanctions and Russia—Effects on economy, trade and finance	<ul style="list-style-type: none"> - Export and import of arms were forbidden, as was an export of dual-use goods for military use - Curtailing of long-term financing of Russian companies Reducing Russia's GDP growth rate - Investment in Russia fell below 13 	Replacing imports by upgrading domestic production, especially in the field of food security
Mohammad Reza Farzanegan	The effects of sanctions and their lifting in the Middle East: The example of Iran	<ul style="list-style-type: none"> - Decrease in GDP - Currency instability - Declining oil revenues - Significant budget deficit - Increase borrowing from the central bank - Increasing liquidity in the market Decreased supply due to sanctions 	N/A
Thabani Nyoni	The curse is real in Zimbabwe: economic sanctions must go	<p>Simple and treatable diseases have become life-threatening problems in Zimbabwe because of a perennially inadequate supply of Medicines and medical and pharmaceutical equipment.</p> <p>economic sanctions have significantly reduced available resources for Zimbabwe's health sector and as a result options for preventive care and curative medical services have become Unacceptably limited.</p>	<p>Take diplomatic steps to create an alliance with friendly countries such as China, Indonesia, Malaysia and Iran amongst others; in line with the Look East Policy.</p> <p>ii. Develop an import-substituting industry.</p> <p>iii. Divert Zimbabwe's trade to new trading partners.</p> <p>iv. Zimbabwe should engage "sanctions busters" in order to create and sustain loopholes in the sanctions and thus undermine their effectiveness.</p>
Goodarz Danaei, Iraj Harirchi, Haniye Sadat Sajadi, Faeze Yahyaei, Reza Majdzadeh	The harsh effects of sanctions on Iranian health	<ul style="list-style-type: none"> - Almost 6 million patients with non-communicable diseases have not received the treatment services they need because of sanctions prior to JCPOA. - A major problem was the scarcity of relief helicopters⁷ and the restricted ability to transfer monetary aid through the international banking system because of the sanctions. 	<ul style="list-style-type: none"> -the Ministry of Health and Medical Education set up a database for registering neonates and infants with metabolic disorders and stocked 10 months' worth of special formula, which was distributed at subsidized prices. -Iran has mobilized financial resources to subsidize prices for essential products and had planned for procurement and distribution of the medicines in response to the new round of sanctions. -UNICEF has opened two accounts to receive financial aid in Europe
Jerg Gutmann Matthias Neuenkirch Florian Neumeier	Sanctioned to Death? The Impact of Economic Sanctions on Life Expectancy and its Gender Gap	<ul style="list-style-type: none"> - an average episode of UN sanctions reduces life expectancy by about 1.2–1.4 years - women are affected more severely by the imposition of sanctions. -an increase in child mortality and Cholera deaths - a decrease in public spending on health care are transmission channels through which UN sanctions adversely affect life expectancy 	countries with a better political environment are less heavily affected by economic sanctions

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Authors	Title	Impact	Strategies
Kyung-ok Do Sangme Baek	The Impact of Sanctions on the Enjoyment of Human Rights	<p>Cuba:</p> <p>In the medical sector, more children with heart disease had to wait for their treatment due to sanctions on the purchase of medical equipment used for such a purpose in healthcare facilities. Also, medical institutions stopped treating children diagnosed with tumors as necessary equipment such as scanners for radiation therapy could no longer be purchased.</p> <p>MYANMAR</p> <p>Most residents had symptoms of key protein deficiency; malnutrition was observed in more than one-third of the entire children.</p> <p>Iran:</p> <p>around 6 million patients with asthma, hemophilia, primary immunodeficiency, AIDS and other illnesses struggled to secure medicines for their treatment.</p> <p>Lung cancer incidence shot up among children; around 45,000 died of the disease in one year.</p>	N/A
Zahra Baradaran-Seyed, Reza Majdzadeh	Economic sanctions strangle Iranians' health, not just drug supply	Sanctions against Iran's financial system made medicine inaccessible.	The international diplomacy must urgently take health into account
D Butler	Iran hit by drug shortage: sanctions cause increasing shortfall in medicines and vaccines	<p>Economic sanctions against Iran caused acute shortages of medicines, vaccines, and key medical supplies.</p> <p>Humanitarian exemptions on food and medicine did not work.</p>	<p>organized a letter — signed by scientists and physicians around the world — to UN secretary-general Ban Ki-moon asking him to address the situation.</p>
Abdol Majid Cheraghali	Impacts of International Sanctions on the Iranian Pharmaceutical Market	-Sanctions in foreign trade, financial, and banking services against Iran resulted in the inaccessibility of life-saving, medicines weakened the national health sector, and affected ordinary people.	N/A
Golbarg Ghiasi, Arash Rashidian, Abbas Kebriaeezadeh and Jamshid Salamzadeh	the impact of the sanctions made against Iran on the availability to asthma medicines in Tehran	Imported and locally produced asthma medicines were not accessible in community pharmacies of Tehran during 2012-2013 in which sanctions against Iran were intensified.	N/A
Samad EJ Golzari, Kamyar Ghabili, Hadi Mohammad Khanli, Parastou Tizro, Reza Rikhtegar	Access to cancer medicine in Iran	Economic sanctions against Iran had led to shortages of patented and generic cancer drugs while this country has the highest incidence of cancer in the Middle East.	N/A

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Authors	Title	Impact	Strategies
Ali GORJI	Sanctions against Iran: The Impact on Health Services	<ul style="list-style-type: none"> - Economic sanctions against Iran influenced all branches of Iranian economy and affected vulnerable patient. Unavailability of medicine and raw materials for domestic pharmaceutical companies and medical equipment for hospitals and unaffordability of medicines were big challenges of Iran during sanction's period. - The weakened medical infrastructure decreased the ability of the health system to provide services even in medical emergencies. 	<ul style="list-style-type: none"> - to ensure that medicine as well as medical and laboratory supplies and the associated banking transactions are indeed exempt from sanctions, the international community may use these assets to acquire medicine and medical supplies and send them to Iran to prevent a humanitarian crisis. - Establishing uniform operational criteria and definitions for exemptions of medicine and medical products from sanctions in the future sanction regimes is necessary. <p>N/A</p>
Mohammad Hajizadeh, Hong Son Nghiem	Hospital care in Iran: an examination of national health system performance	The quality of hospital care is different among different provinces of Iran. Economic sanctions seem to hurt Iran's healthcare delivery system. The new sanctions on Iran's oil and financial sectors have the potential to disrupt government-subsidized healthcare services	
Seyed Alireza Hosseini	Impact of Sanctions on Procurement of Medicine and Medical Devices in Iran; A Technical Response	<ul style="list-style-type: none"> - Because of sanctions on foreign trade, financial and banking services, Iran faced major difficulties for importing medicines and medical instruments. - Quality, accessibility and affordability of medicines decreased during sanction's period. <p>In a public health prospective, ordinary people and patients paid the cost of economic sanctions.</p>	<ul style="list-style-type: none"> - Assessment of pharmaceutical market needs in meetings with both pharmaceutical producing and importing companies Constant monitoring of the pharmaceutical market so an Information Center for Drug Shortages" has been established. - Revise Iran Drug List according to the current situation and needs A specific Society for Worldwide Interbank Financial Telecommunication (SWIFT) line is allocated for medical purposes and certain financial institutions, Iranian and foreign banks should be assigned for transferring money for medicine and medical devices. - A white list of Iranian pharmaceuticals and medical device importer companies together with their foreign counterparts are defined for procurement of medicines and medical needs of Iranian citizens. - Appropriate measures should be taken by the international community to facilitate access to medicine. - To facilitate the process of medicine's importation, defining a white list of Iranian pharmaceutical companies and their foreign counterparts is necessary.

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Authors	Title	Impact	Strategies
International Campaign for human rights in Iran	A Growing Crisis; The Impact of Sanctions and Regime Policies on Iranians' Economic and Social Rights	Economic sanctions against Iran and the country's policies resulted in a significant economic decline and deterioration of the living standards of Iranians. Sanctions decreased the affordability and accessibility of healthcare and medicine.	N/A
	The impact of sanctions on Iranian people healthcare	Sanctions in Iran have had destructive effects on the healthcare system, Iranian lives, and quality of life. Because of sanctions on the banking system, the import of medicines has become difficult. These are violations of the basic human rights.	N/A
Mehran Karimi, Sezaneh Haghpanah	The effects of economic sanctions on disease-specific clinical outcomes of patients with thalassemia and hemophilia in Iran	By adversely influencing the accessibility of medicines, sanctions had considerable effects on public health and the health of patients with thalassemia and hemophilia. Patients with thalassemia and hemophilia face a serious Wrestriction in the supply of iron chelators and coagulation factor concentrates	One possible solution might be to open an account, under international supervision, for the deposition of foreign aid and currency for buying for the specific purpose of purchasing life-saving drugs such as Iron chela-tores and lyophilized coagulation factors in this group of patients.
Ali Tabrizi	Impact of economic sanctions on orthopedic residency program (education & training)	Government hospitals are facing a lot of problems in providing equipment which directly affects the residency education and training program in the extended areas of Iran. Many surgical procedures are not carried out and the required training equipment is not available so the educational programs are at risk.	-
Kheirandish M, Varmaghani M, Kebriaeezadeh A, Cheraghali AM	Impact of economic sanctions on access to noncommunicable diseases medicines in the islamic republic of iran	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.	
Mehdi Aloosh	How Economic Sanctions Compromise Cancer Care in Iran	Sanctions compromised resources in a country that already lacks resources and faces several challenges in access to treatment. Moreover, on import materials, including Cobalt-60. adversely affected cancer prevention and health promotion programs. These programmes might be compromised in an economic crisis because resources would be allocated to areas of crucial momentary need, rather than prevention	

Authors	Title	Impact	Strategies
*Tanya L Zakrison, Carles Muntaner	US sanctions in Venezuela: help, hindrance, or violation of human rights?	<p>Caused the overall loss of \$38 billion in the past 3 years, more cuts in imports of medicine, food, medical equipment, and inputs necessary to maintain water, health, and sanitation infrastructure are foreseeable in the immediate future.</p> <p>Access to medication such as insulin has been curtailed because US banks refuse to handle Venezuelan payments for this. Thousands to millions of people have been without access to dialysis, cancer treatment, or therapy for hypertension and diabetes. Particular to children has been the delay of vaccination campaigns or lack of access to antirejection medications after solid organ transplants in Argentina.</p> <p>Children with leukemia awaiting bone marrow transplants abroad are now dying. Funds for such health assistance programs come from the PDVSA state oil company. Those funds are now frozen. 4 Food imports</p> <p>dropped by 78% in 2018 compared to 2013.2</p>	<p>we have been successful at building bridges of mutual respect and understanding between populations when government-level diplomacy has failed—for example in the case of Cuba. We agree with the open letter of</p> <p>American scholars call for the non-intervention of the USA in the internal affairs of Venezuela, an end to the sanctions, and a negotiated settlement free of foreign coercion.</p>