

# The human cost of economic sanctions and strategies for building health system resilience: A scoping review of studies in Iran

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## Abstract

**Objectives:** This review aimed to analyse the impacts of international economic sanctions on the overall health status of Iranians and the health system performance of Iran, in addition to identifying effective strategies for making the health system resilient to sanctions.

**Study design:** A scoping review.

**Methods:** Three databases and grey literature were reviewed, and additional papers were identified in the lists of references. Two authors reviewed papers to check duplications and screen through inclusion/exclusion criteria. Furthermore, a narrative approach was employed to synthesise the findings.

**Results:** Given overall health impacts, economic sanctions are believed to have adverse effects on Iranian's health and cause significant financial hardships in accessing healthcare services. These hardships mostly affect those in marginalised and vulnerable groups. Economic sanctions degrade Iran's health system by negatively impacting health services' availability. The detrimental effects of sanctions on economic and social circumstances were also documented. Economic sanctions could also adversely affect health research and education. Most strategies identified for health system

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resilience to sanctions are related to the health system governance.

**Conclusions:** Even if essential medicines and supplies are exempted from the sanction regime, the impact of economic sanctions on public health is unavoidable. The quantification of the effect economic sanctions on different health-related areas needs by further research. The measures identified for dealing with sanction can be considered in other countries but more work is needed to explore how health of people can be resilient against negative consequences of sanctions.

#### KEYWORDS

access to medicines, austerity, embargo, health policy, health system

#### Highlights

**Our recent review of the effects of international economic sanctions on Iran led to worthwhile findings:**

- There are no intelligent sanctions. The economic sanctions will inevitably affect public health even if essential medicines and supplies are exempted from the sanction regime.
- It is difficult to measure the effects of economic sanctions on health and their consequences. A rigorous research methodology is needed to analyse the specific effects of economic sanctions on various health outcomes.
- There is a shortage of solid evidence regarding effective and feasible measures to make the health system resilient against economic sanctions. The effectiveness and extent of these measures need to be evaluated—most of the measures found in the literature focus on strengthening the health system governance.

## 1 | INTRODUCTION

By definition, sanctions are considered peaceful alternatives to military actions to control governments, individuals, or groups. Generally, sanctions are intended to affect a target's behaviour through political and economic interventions without mass effects and other complications attributable to wars. There are various forms of sanctions. For instance, comprehensive sanctions deprive a target of international financial trade and service interactions. In contrast, targeted sanctions focus on individuals or groups with specific policies or behaviour.<sup>1-3</sup>

Given the Global Sanctions Data Base,<sup>4</sup> the use of economic sanctions as a foreign policy has increased over the last decades. The main objectives of these sanctions are related to democracy and human rights. They are also becoming more diverse, with the share of trade sanctions declining and the financial and travel sanctions increasing. Different countries and institutions employ sanctions as a tool. Of course, among all, sanctions imposed by the European Union (EU), the United Nations (UN), and the United States (US) are more frequent and more extensive

considering the range of foreign policy involvement of these. African countries have been the most frequent targets of different types of sanctions over the last decades; however, Cuba, Iran, North Korea, Russia, Syria, and Crimea are currently the targets of economic sanctions.<sup>5,6</sup> Studies have shown that sanctions hardly meet their goals of changing a target's political behaviour.<sup>6</sup> The success rate of sanctions is about 30% on average.<sup>4,7</sup> However, they can considerably impact social and economic indices<sup>7,8</sup> and violate fundamental human rights.<sup>9,10</sup>

Iran is the second-largest country, with nearly 85 million inhabitants in the Middle East. Over the past 50 years, two historically remarkable events were the Islamic Revolution in 1979 and Iran–Iraq War ending in 1988.<sup>11</sup> Iran has also been subject to several international sanctions.<sup>12</sup> The first economic sanctions against Iran were imposed in 1951, following the nationalisation of the oil industry and exit from the Anglo–Iran Oil Company.<sup>13</sup> However, most sanctions have been imposed since the Islamic Revolution. According to a report, Iran was the target of over 3853 sanction resolutions between 1979 and 2012, ranking Iran as the second most sanctioned country worldwide.<sup>14</sup> Since 2005 when the International Atomic Energy Agency (IAEA) reviewed Iran's atomic programme, sanctions have changed in form and intensity. The UN declared new sanctions for Iran's uranium enrichment programme.<sup>12</sup> In 2015, the Joint Comprehensive Plan of Action (JCPOA) was signed to relieve some of the sanctions. However, new US-issued sanctions have been imposed since 2018.<sup>11</sup> Sanctions against Iran are mostly related to the military industry, the Islamic Revolutionary Guard Corps, the nuclear industry, the energy/petroleum industry, banking, the shipping industry, and international trade insurance. Undoubtedly, sanctions have widely affected Iran's economic status with reductions in oil exports and devaluation of the Iranian rial.<sup>15,16</sup>

At first glance, it appears that sanctions only have economic effects on Iran; however, there is no doubt that sanctions have far more extensive impacts. Different studies have analysed the impacts of sanctions on the health sector in Iran. A few reviews have identified the humanitarian effects of sanctions on the rights of Iranians to health<sup>16</sup> and summarised the effects of sanctions on public health in Iran.<sup>15,17–19</sup> However, there is insufficient evidence regarding the exact impact of sanctions on Iran's public health and health system performance. Therefore, the current review was conducted to synthesise the results of earlier studies, analyse the effects of international economic sanctions on the Iran health system performance, and identify strategies implemented or suggested for making the Iran health system resilient to economic sanctions.

## 2 | METHODS

A scoping review was conducted on the studies that analysed the impacts of international economic sanctions on the Iran health system and studied possible strategies for the health system responses to sanctions. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria were adopted to guide the methods and findings.<sup>20</sup>

### 2.1 | Study eligibility

The studies that met the following criteria were included: (1) providing sufficient data about the impacts of economic sanctions on the Iran health system and the strategies implemented or proposed to improve the Iran health system performance in response to sanctions; (2) primary or secondary studies; and (3) published in English or Persian. Moreover, the following categories were excluded: other types of publications (e.g., notes, editorials, commentaries, letters, conference proceedings, etc.), the studies for which full texts were unavailable, the studies that analysed the effects of sanctions and other reforms concurrently, and the studies that analysed the effects of economic/financial shocks/crises on healthcare services. This was done to increase the specificity of our search during the screening phase and to ensure that the studies we synthesised were directly relevant to our research question.

## 2.2 | Search strategy and information sources

We systematically searched two English databases (i.e., PubMed and Scopus) and one Persian database (i.e., [Scientific Information Database \(SID\)](http://www.sid.ir) at [www.sid.ir](http://www.sid.ir) to identify relevant studies from the inception times of these databases. The initial search process was performed in 2020 and then updated in 2021. The search was done through various combinations of keywords such as 'sanction', 'embargo', 'economic/financial shock', 'economic/financial crisis', 'financial hardship', 'health', 'medical', and 'Iran'. Some scholars use sanctions and economic/financial shocks interchangeably. Thus, we considered all relevant terms to increase the sensitivity of our search and ensure that all potentially relevant studies to our research question were retrieved. An example of our search strategy is presented in Supplementary File 1. We also conducted reference-scanning relevant papers and hand-searching key journals to find further documents and grey publications. Additional search attempts were made in Google Scholar with the exact keywords to avoid missing relevant documents. The results from the different databases were placed into a reference manager package (EndNote 20, Thomson Reuters, Carlsbad, CA, USA) to eliminate duplications.

## 2.3 | Selection of sources of evidence

Two authors analysed all identified studies independently (EE, FY). Both researchers first analysed the titles and abstracts of the identified studies for relevance. The full texts of the remaining studies were then scanned to decide which study was eligible to be included in the review concerning the inclusion criteria. In the case of a disagreement, a consensus was reached through discussion, or if necessary, a third reviewer was consulted.

## 2.4 | Data collection and analysis

Two authors (HSS, FY) used an Excel spreadsheet to extract data independently. Disagreements were then resolved by discussion. A narrative approach was employed to synthesise the results of the identified studies. We modified the WHO Health System Framework to create the categories and interpret the findings. Thus, the effects of sanctions were classified into the following categories: (1) overall health impacts (e.g., health, financial protection, responsiveness, and equity) and broader impacts (e.g., political, economic, social, and environment status); (2) intermediate outcomes of the health system (e.g., access, efficiency, and quality) and its functions (e.g., governance and leadership, financing, service delivery, health workforce, medicine, vaccine and technology, and health information). The WHO Health System Framework was employed to create tables and interpret findings.<sup>21</sup> Considering the Iran health system structure in which higher education is integrated into the administration of health services,<sup>22</sup> we also analysed the effects of sanctions on higher education and research in the health sector (e.g., publications, research budgets, collaboration, and laboratory materials). Finally, (3) strategies for the Iran health system's resilience to sanctions.

## 2.5 | Ethical issues/statement

This study was approved by the Ethics Committee of Tehran University of Medical Sciences (IR.TUMS.VCR.REC.1398.621). No patients were involved in the research process. Patients were not invited to comment on the study design and were not consulted to develop patient-related outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy. All methods were conducted under relevant guidelines and regulations.

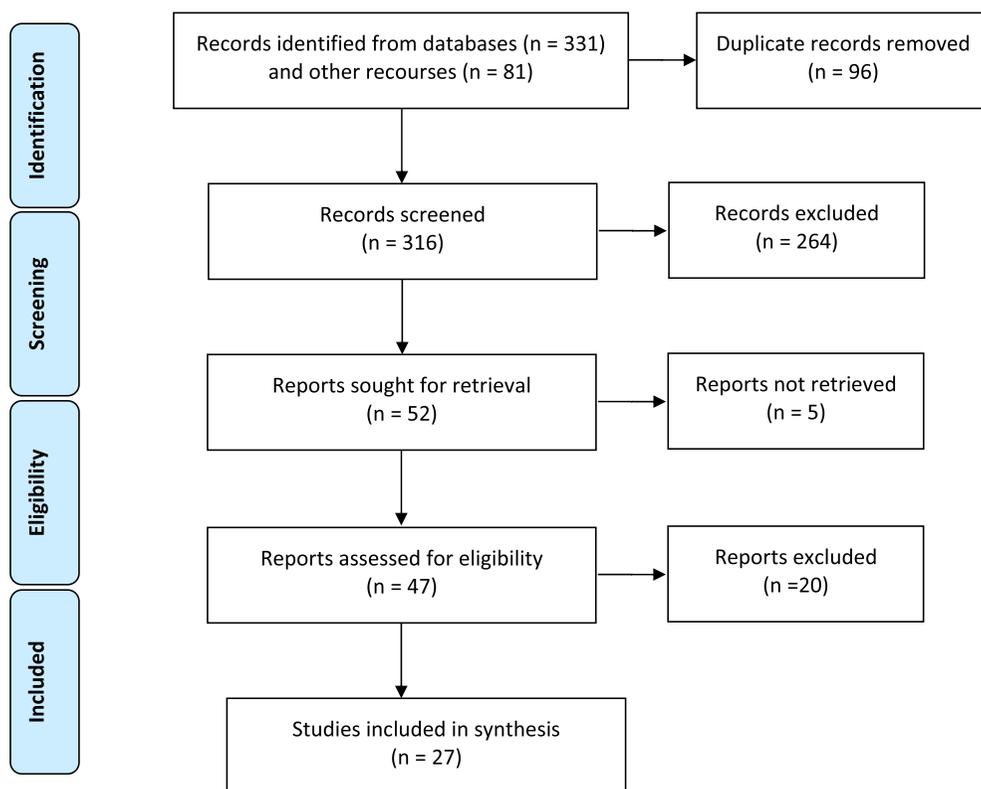
### 3 | RESULTS

#### 3.1 | Study selection

We retrieved 412 records, 96 of which were excluded due to duplication. In the initial stage, 264 references (e.g., letters to editors and papers addressing the effects of sanctions and coping strategies in areas other than health) were excluded with the examination of titles and abstracts. In the next stage, 47 papers were selected for full-text reading, of which 27 studies were included. Figure 1 demonstrates the selection process flowchart.

#### 3.2 | Study characteristics

Regarding the publication times of the included articles, there has been a growing interest in the effects of sanctions on Iran's health sector since 2015. Most papers (=19) focussed only on the effects of sanctions on Iran's health system.<sup>15,19,23-39</sup> Three papers aimed to identify the strategies for improving Iran's health system performance to cope with sanctions.<sup>17,40,41</sup> However, five studies aimed to identify the effects of sanctions on Iran's health system and the suitable strategies to improve Iran's health system performance in response to sanctions.<sup>16-18,42,43</sup> Five other papers were reviews,<sup>15-19</sup> and the rest (=22) were original studies. Moreover, 12 papers used the quantitative design,<sup>23,24,26,27,31,32,34-37,39,42</sup> whereas nine studies employed the qualitative design<sup>17,28-30,33,38,40,41,43</sup> and only one paper adopted the mix-methods approach.<sup>25</sup>



**FIGURE 1** The preferred reporting items for systematic reviews and meta-analyses flow chart of search, inclusion, and exclusion screening, and accepted studies of the review on impacts of economic sanctions on health and strategies for health system resilience in Iran.

### 3.3 | Impacts

Table 1 presents an overview of studies that analysed the impacts of sanctions on Iran's health sector and the health system. Sanctions have had adverse effects on Iranian health, for example, mortality rates,<sup>16,23,24</sup> the severity of illnesses,<sup>26,32</sup> mental health,<sup>15,17</sup> and child health.<sup>18</sup> Moreover, sanctions may not have short-term effects on the Iranian health status,<sup>23</sup> depending on the country health system's resilience.

Sanctions cause significant financial hardships to access healthcare services in Iran,<sup>17,19,26,37</sup> and the outcomes are more severe for those in marginalised and vulnerable groups.<sup>16,17,19,26,32</sup> Regarding the effects of sanctions on a broader socioeconomic status, many scholars documented the harmful effects on Iran, indirectly affecting health outcomes and the health system functions.<sup>15-17,19,24,36,38</sup> Moreover, a few studies reported the effects of sanctions on Iran's environmental status, increasing the risk of well-being and threatening public health<sup>16,19,36,42</sup> (Table 2).

### 3.4 | Health system

Sanctions have negatively affected Iran's health system performance differently. Regarding health outcomes, sanctions increased the likelihood of receiving low-quality treatments, medicines, or medical devices and law adherence,<sup>16,19,27,30,43</sup> mainly due to high costs. They restricted access to healthcare services.<sup>15,16,19,26,27,32-34,38</sup> Additionally, sanctions degraded Iran's health system with negative outcomes in the availability of medicines, vaccines, treatments, and other medical and public health products.<sup>15-17,19,26-28,30,31,33,34,37,38</sup> They also affected the availability of health workers<sup>17</sup> and the number and quality of health facilities and infrastructure throughout the country.<sup>38</sup> The economic hardships caused by sanctions might also reduce the financial resources available to deal with public health issues.<sup>16,19,38</sup>

Regarding the effect of sanctions on higher education and research in Iran's health sector, the review demonstrated that some scholars analysed how sanctions could negatively affect health research due to declines in publications, international collaboration, and funding.<sup>17,25,29,35,38,39</sup> These effects overshadow the academic capacity of the country in the long run. However, sanctions might motivate scholars to become more self-reliant<sup>25</sup> (Table 2).

A quick look at Table 2 demonstrates that scholars have less often studied the effects of sanctions on the responsiveness and efficiency of Iran's health system. Moreover, no evidence was retrieved to analyse the effects of sanctions on Iran's political contexts, health governance arrangements, and health information systems.

### 3.5 | Strategies for health system resilience to sanctions

Table 3 presents an overview of studies that identified or proposed strategies for Iran's health system to respond to sanctions. The studies were summarised and classified into three main categories based on their target functions (Table 4). Accordingly, we identified 32 strategies to improve Iran's health system performance in response to sanctions. Most of these strategies (60%) concerned the health system governance,<sup>16-18,40,41,43</sup> whereas nearly 28% of them focussed on the health service delivery arrangement,<sup>16,17,41,42</sup> and 12% of them concerned health financing.<sup>17,40,41</sup>

## 4 | DISCUSSION

This review aims to analyse the evidence regarding the effects of sanctions on public health in Iran and the country's health system and identify the necessary strategies to make Iran's health system resilient to sanctions.

### 4.1 | Current evidence

The findings of our review displayed several points in terms of the current evidence regarding the impacts of sanctions on the Iran health system and strategies to make it resilient to sanctions. First, despite the long history of sanctions

TABLE 1 Characteristics of included studies to review the impacts of economic sanctions on Iran's health.

First author	Year	Type of study	Design	Main findings
Karimi M	2014	Original	Quantitative	<ul style="list-style-type: none"> <li>- Access to medicine in patients declined over the period of sanction.</li> <li>- A significant deterioration of arthropathy and a significant increase in serum ferritin levels was reported.</li> <li>- Poorer patients were feeling the impact more acutely.</li> </ul>
Mostafavi SM	2014	Original	Quantitative	<ul style="list-style-type: none"> <li>- Economic sanctions have had a significant relationship with CH<sub>4</sub>, CO<sub>2</sub>, and NO<sub>x</sub> air pollutants.</li> <li>- There is a significant unidirectional causality from economics sanction to macroeconomic factors.</li> </ul>
Shahabi S	2015	Review	-	<ul style="list-style-type: none"> <li>- Increase in medicines' price and the bankruptcy of pharmaceutical factories had led more than 6 million patients with non-communicable diseases not to get high-quality treatment for their disease.</li> <li>- The use of benzene containing gasoline has raised people's exposure to carcinogenic agents.</li> <li>- It has substantial deficits, including prevention, diagnosis/treatment, palliative care, monitoring, and technology, with a serious drug shortage for cancer care.</li> <li>- Sanctions lead to disruption of health services through complications in transportation, transferring currencies, or lack of money.</li> <li>- Economic effects of sanctions were evident.</li> <li>- There is increasing evidence that sanctions harm vulnerable populations, while blocking globalisation and not creating political or social change quickly.</li> </ul>
Kheirandish M	2015	Original	Qualitative	<ul style="list-style-type: none"> <li>- Sanctions negatively affect access to medicines in Iran.</li> <li>- An increase in the number of news media reporting a shortage in Iran after the sanctions was reported.</li> </ul>
Deilamizade A	2015	Original	Qualitative	<ul style="list-style-type: none"> <li>- A sharp rise in drug prices has encouraged drug users to use less expensive and more harmful drugs.</li> <li>- The price of drugs and other goods and services has increased and significant changes in drug use patterns, and an increase in drug use-related harms, can be expected to occur soon.</li> </ul>
Asadi-Pooya AA	2016	Original	Quantitative	<ul style="list-style-type: none"> <li>- Reduction in drug adherence was close to being significant, despite some drugs being unavailable after sanctions, and others were much more expensive.</li> <li>- The price of some antiepileptic drugs increased up to 300% after intensifying the sanctions.</li> <li>- Some drugs were not available or difficult to be accessed during and after sanction.</li> </ul>
Ghiasi G	2016	Original	Quantitative	<ul style="list-style-type: none"> <li>- While before the sanctions, 60% of the pharmacies could provide all the essential asthma medicines, this number reduced to 28% after the sanctions.</li> </ul>
Almasi K	2016	Original	Mix	<ul style="list-style-type: none"> <li>- Sanctions have had adverse effects on the institute's research activities and production activities, including the decline in scientific communication and the difficulty of research activities.</li> <li>- Sanctions have also had positive effects, such as raising the profile of domestic researchers to turn the constraints into opportunities for further scientific growth.</li> </ul>

(Continues)

TABLE 1 (Continued)

First author	Year	Type of study	Design	Main findings
Kokabisaghi F	2018	Review	-	<ul style="list-style-type: none"> <li>- Economic sanctions decreased the revenues of Iran's government and its ability to invest in the health, education, and social security of Iranians.</li> <li>- The share of health services costs increased, adversely affecting access to healthcare.</li> <li>- The impacts of sanctions were more immense on the lives of the poor, patients, women, and children.</li> <li>- Sanctions resulted in shortages, high prices, and difficulties accessing medicines, vaccines, and medical equipment.</li> <li>- Drug users tend to decrease spending on their family's life and use cheaper substances.</li> <li>- Air pollution and unsafe flights are other examples of sanction consequences that threaten the population's health.</li> </ul>
Kheirandish M	2018	Original	Quantitative	<ul style="list-style-type: none"> <li>- Some drugs groups were in severe shortage in Iran's pharmaceutical market.</li> <li>- Market availability of 13 of 26 drugs was significantly reduced.</li> <li>- Sanctions have harmed access to drugs.</li> </ul>
Kokabisaghi F	2019	Original	Quantitative	<ul style="list-style-type: none"> <li>- Iranian scholars were increasingly denied opportunities to publish scientific findings, attend scientific meetings, access essential medical and laboratory supplies and information resources.</li> </ul>
Asadi-Pooya AA	2019	Original	Quantitative	<ul style="list-style-type: none"> <li>- Around 37.7% had significant difficulty obtaining their drug and 15.2% said their drugs was not accessible.</li> <li>- Around 72% of those receiving imported drugs and 30% of those receiving homemade drugs had significant hardship obtaining their drugs.</li> <li>- About 36% of those reported significant hardship and 22% of those did not perceive breakthrough seizures or worsened their seizures.</li> <li>- Sanctions have significantly affected ordinary people, especially those who are vulnerable.</li> </ul>
Aloosh M	2019	Review	-	<ul style="list-style-type: none"> <li>- Sanctions caused a decrease in drugs availability.</li> <li>- The GDP and employment rate have been lowered, and the death rate due to self-harm and admissions for mental health issues has risen in the sanction period.</li> <li>- The Gini coefficient of household expenditure has increased from 37% to 41% since 2012.</li> <li>- Access to the essential and lifesaving medication has been compromised.</li> </ul>
Mehtarpour M	2020	Original	Qualitative	<ul style="list-style-type: none"> <li>- The sanctions were identified as predisposing factors underlying antimicrobial resistance management in Iran.</li> </ul>
Zolotarev O	2020	Original	Quantitative	<ul style="list-style-type: none"> <li>- The publication activity of Iranian scientists has significantly decreased after the imposition of sanctions against Iran.</li> <li>- Scientists were deprived of access to the latest scientific achievements.</li> </ul>
Madani-Lavassani Y	2020	Review	-	<ul style="list-style-type: none"> <li>- Sanctions are likely harming the health of the Iranian children.</li> </ul>
Shahabi S	2020	Original	Qualitative	<ul style="list-style-type: none"> <li>- Sanctions caused challenges including socioeconomic challenges; education challenges; international challenges; and service delivery challenges.</li> </ul>

TABLE 1 (Continued)

First author	Year	Type of study	Design	Main findings
Hejazi J	2020	Original	Quantitative	<ul style="list-style-type: none"> <li>- A significant increase in the prices of all food groups occurred in the year after the re-imposition of sanctions.</li> <li>- The annual average cost of a healthy diet for a sample Iranian family increased.</li> <li>- After the re-imposition of US sanctions against Iran, food insecurity has increased.</li> </ul>
Abhari B	2020	Original	Quantitative	<ul style="list-style-type: none"> <li>- The impact of sanctions on public health was not significant in the first year and the following year, and its effect in the second year was negative and positive in the third year.</li> </ul>
Akbarialiabad H	2021	Review	-	<ul style="list-style-type: none"> <li>- Sanctions have increased anxiety disorders, antisocial behaviour, and many other stress-related diseases.</li> <li>- Prices of all goods have multiplied by at least 3 or 4 times, imposing catastrophic expenditures on the families, endangering the patients' health, and increasing the gap and tension between socioeconomic classes in Iran.</li> <li>- Sanctions have led in a severe shortage of many drugs and medical supplies, the availability of vital health maintenance, such as childhood vaccines and adequate protection equipment to health care workers.</li> <li>- Sanctions have also affected research activities and jeopardised scientific collaborations between Iranian scientists and the outside world.</li> </ul>
Dehghani M	2021	Original	Qualitative	<ul style="list-style-type: none"> <li>- Impacts of sanctions on Iran's health research system were financial issues, challenges in supplying laboratory materials, challenges in supplying laboratory equipment, other issues faced by researchers and disruption in international research collaboration and activities.</li> </ul>
Abhari B	2021	Original	Quantitative	<ul style="list-style-type: none"> <li>- The sanctions imposed on the central bank, growth of age dependency ratio, government expenditure, and imports increased mortality.</li> </ul>
Azami SR	2021	Original	Qualitative	<ul style="list-style-type: none"> <li>- The sanctions have adverse effects on procurement of capital medical equipment, repairing and after sales services of capital medical equipment</li> </ul>
Sahraian MA	2021	Original	Quantitative	<ul style="list-style-type: none"> <li>- The sanctions can impose greater stress and hardship on patients due to the unavailability and costs of medicines.</li> </ul>

in Iran, there is insufficient evidence to quantify the effects on the health sector, consequent outcomes in the health system, and the necessary actions to manage the effects. Most studies concerning the sanctions imposed on Iran and its health system were published after 2015 with the escalation of sanctions. The reason behind the evidence gap needs further analysis. Lack of interest and support in researching sanctions might be one reason. According to previous studies, the lack of interest of health policymakers was among the barriers to producing evidence.<sup>44</sup> Agreement on the Joint Comprehensive Plan of Action (JCPOA) in 2015 and the intensification of sanctions during the Trump administration in 2018 motivated health policymakers to call for more rigorous evidence regarding the harmful effects of sanctions on public health in Iran. It is evident from the official requests of research granting that the issue of sanctions and health were prioritised in the country for research and allocation of financial resources.<sup>45</sup>

Second, most of the studies focussed on a particular area of Iran's health system to analyse the effects of sanctions, for example, impacts on public health, access to medicines, vaccines, or health services, availability of medical equipment and medicines, vaccines, and infrastructure, and financial aspects. The lack of a well-defined research

TABLE 2 Summary of the effects of sanctions on Iran's health system according to reviewed evidence.

	Impact						Health system function	
	Health	Equity	Financial protection	Economic	Social	Environment	Access	Quality
Karimi M	*	*					*	
Mostafavi SM				*		*		
Shahabi S		*	*	*	*	*	*	*
Kheirandish M							*	
Deilamizade A								*
Asadi-Pooya AA							*	*
Ghiasi G								
Almasi K								
Kokabisaghi F	*	*		*	*	*	*	*
Kheirandish M							*	
Kokabisaghi F								
Asadi-Pooya AA	*	*	*				*	
Aloosh M	*	*		*	*		*	
Meh tarpour M								*
Zolotarev O								
Madani-Lavassani Y	*							
Shahabi S				*	*		*	
Hejazi J						*		
Abhari B	*							
Akbarialiabad H	*		*	*	*			
Dehghani M								
Abhari B	*			*				
Azami SR								
Sahraian MA			*					

agenda to identify and prioritise the existing knowledge gaps in this area led to an insubstantial approach to generating evidence. Given the need for further analysis of the effects of sanctions on the health sector and the importance of defining a research agenda, preparing a research map regarding sanctions and health systems is recommended.

Third, although several studies showed the severity of sanction effects, it is impossible to clearly and quantitatively determine the impacts of sanctions on the Iran health system. The reason for this is a methodological problem in that this type of study is observational and lacks a comparison group. Additionally, during the period of sanctions, the country has experienced various other events (such as direct cash transfer of subsidies) that make it impossible to attribute changes in health indicators solely to the sanctions. Therefore, evaluating the effects of sanctions requires a specialized methodology, and it is impossible to generalize their effects.<sup>46</sup> Further studies should be conducted through more rigorous methodologies to demonstrate the magnitude and severity of the impacts on the health sector by sanctions. Another reason might be the lack of an active data collection system that can determine the impacts of sanctions. As highlighted by many studies, although it is inevitable to monitor the effects of sanctions on the health

Health workforce	Medicine, medical devices, technology	Infrastructure	Financing	Publication	Research budget	Collaboration	Laboratory material
	*		*				
	*						
	*						
	*						
	*			*		*	*
	*		*				
	*			*		*	*
	*						
	*			*		*	
	*						
	*	*	*			*	
*	*			*		*	*
				*	*	*	*
	*						
	*						

sector,<sup>46-49</sup> there is limited evidence regarding how these processes can be performed. There are no comprehensive approaches to monitoring the effects of sanctions on healthcare services and health systems.

Furthermore, the health outcomes of embargoes are similarly challenging to specify, and the public reactions to an embargo may confound its effects on the health sector. Moreover, statistics generated in situations conditioned by conflicts and solid political contestations should always be interpreted meticulously due to the possibility of deception. The report on Iraq's child mortality rates and economic sanctions is a good example. According to the 1999 UNICEF/Government of Iraq Survey results, it is widely believed that child mortality rates in Iraq from 1991 to 2003 were unusually higher than the rates in the 1980s. Nevertheless, surveys undertaken since 2003 have found no evidence regarding high child mortality rates from 1991 to 2003.<sup>50</sup> These pitfalls highlight the necessity of establishing a monitoring mechanism for tracing the effects of sanctions on the health system.<sup>46</sup>

**TABLE 3** Characteristics of included studies to identify strategies for the resilience of the Iran health system to combat sanctions.

First author	Year	Type of study	Design	Main findings
Kokabisaghi F	2018	Review	-	<ul style="list-style-type: none"> <li>- Providing a national policy with suitable measures to prevent the suffering of people from the adverse effects of sanctions</li> <li>- Preventing third parties; black market dealers, pharmacies, and health facilities that provided unsafe medicines, as well as smugglers who sent scarce medicine to neighbouring countries</li> <li>- Refraining from imposing embargos and other measures that restrict the supply of medicine and medical equipment</li> <li>- Developing policies and laws to alleviate the negative impacts of their agreements on the human rights of the population in the target country</li> <li>- Designing some international intermediate organisations and certain companies and financial institutions to facilitate the implementation of exemptions</li> <li>- Monitoring human rights situations and utilising the maximum resources available to eliminate suffering with low-cost programs, international assistance, and cooperation</li> <li>- Assess the effects of the policies and international agreements on the health of people in the target country</li> <li>- Observing the situation of human rights and implementing humanitarian and human rights laws</li> <li>- Protecting vulnerable groups of the population, such as children and the poor</li> <li>- Facilitating the delivery of necessary items for life and health, such as medicine, food, and medical equipment</li> </ul>
Yousefi N	2019	Original	Qualitative	<ul style="list-style-type: none"> <li>- Establishing the anti-sanction action-committee</li> <li>- Determining memorandum of understanding (MOU) between the IFDA and the Central Bank of Iran;</li> <li>- Determining memorandum of understanding (MOU) between the IFDA and health insurance organisations</li> <li>- Supporting of local production</li> <li>- Price reduction of imported medicines</li> <li>- Permitting immediate release of medicines from customs by minimum financial documents</li> <li>- Proactive inventory control</li> <li>- Developing the national essential medicines list</li> <li>- Employing cost-effectiveness evidence for pricing and reimbursement</li> <li>- Developing an integrated information system for monitoring the market</li> <li>- Providing clinical guidelines for rational prescribing</li> </ul>
Mehtarpour M	2020	Original	Qualitative	<ul style="list-style-type: none"> <li>- Using use all available political and legal means, such as health diplomacy, to establish humanitarian channels to enhance global convention and remove possible barriers as the sanctions and reduce their adverse consequences for antimicrobial resistance control</li> </ul>

TABLE 3 (Continued)

First author	Year	Type of study	Design	Main findings
Madani-Lavassani Y	2020	Review	-	- Determining the exact magnitude of the impact
Hejazi J	2020	Original	Quantitative	- Creating efficient food assistance programs by the government and the international community, funding food banks with the assistance of charities and non-governmental organisations, and participating individuals in nutritional education programs and learning how to plan a cheap and balanced diet
Akbarialiabad H	2021	Review	-	- Strengthening global health diplomacy
Taslimi MS	2021	Original	Qualitative	- Increasing managers' morale, knowledge, skills, and innovation can potentially increase resilience at the individual level - Measures such as reducing debt, increasing productivity through innovation, effective monitoring of the production process and reducing waste, increasing inventory levels, and supplying goods and services in other markets can be considered ways to improve resilience at the enterprise or organizational level - Efforts towards creating mutual trust between the cluster elements and consequently the pursuit of collective actions such as holding exhibitions, creating a joint financial fund, and buying and selling products in groups are effective action plans for realizing collective interests
Bastani P	2021	Original	Qualitative	- Optimising health policy and management - Utilising of potentials and infrastructure in Iran - Strengthening relations with other countries - Improving pricing processes - Engineering insurance organisations - Establishing integrated health information system - Mechanising the distribution system - Clarifying role of suppliers and manufacturers - Participating the medical community and consumers

## 4.2 | Impacts of sanctions on health

Considering the impact of sanctions on Iran's health system, the findings of our review also revealed that the available studies had addressed both the direct and indirect effects of economic sanctions on the health sector in Iran. The most tangible effect of sanctions and restrictions directly affecting the health system was the reduced availability of health services and goods, resulting in shortages of medicines, equipment, and health services. Low availability combined with public economic problems reduced public access to health services. Lack of access to health services or low-quality health services as a result of sanctions can harm public health in the long run, affecting the quality and safety of health services. Many scholars reported that sanctions would degrade health systems, limiting efforts to treat even common illnesses<sup>46,47,49,51-56</sup> and leading to deaths caused by diseases.<sup>57</sup>

According to the results of this review, another long-term effect of sanctions on the Iran health system was the weakening of health education and research. It is impossible to compensate for this shortcoming in the short run. Although some studies<sup>58,59</sup> indicated that the restrictions on sanctions for the provision of education and research in some cases led to the growth of self-sufficiency, the harmful effects of sanctions on this area appear to be manifold.

TABLE 4 An overview of strategies for the Iran health system resilience to sanctions.

Health system function	Strategy
Governance arrangement	<ul style="list-style-type: none"> <li>- Developing policies and laws to alleviate the negative impacts of agreements on the human rights of the public in the target country</li> <li>- Designing some international organisations and financial institutions to facilitate the implementation of exemptions</li> <li>- Providing a national policy with suitable measures to prevent people from suffering from the adverse effects of sanctions</li> <li>- Protecting vulnerable groups such as children and the poor</li> <li>- Refraining from imposing embargos and other measures that restrict the supply of medicine and medical equipment</li> <li>- Preventing third parties that provided unsafe medicines</li> <li>- Observing the impacts of sanctions on the public health in the target country through an integrated health information system</li> <li>- Establishing the anti-sanction action-committee</li> <li>- Determining the memorandum of understanding (MOU) between relevant organisations</li> <li>- Supporting of local production</li> <li>- Permitting the immediate release of medicines from the customs by minimum financial documents</li> <li>- Developing the lists of nationwide essential medicines</li> <li>- Strengthening the global health diplomacy</li> <li>- Improving managerial morale, knowledge, skills, and innovation can potentially increase resilience at the individual level.</li> <li>- Improving resilience at the enterprise or organisational level</li> <li>- Developing an integrated information system for market monitoring</li> <li>- Building mutual trust between cluster elements and pursuing collective actions</li> <li>- Optimising health policy and management</li> <li>- Allowing the participation of medical communities and consumers</li> </ul>
Service delivery arrangement	<ul style="list-style-type: none"> <li>- Facilitating the delivery of necessary items for life and health (e.g., medicine, food, and medical equipment)</li> <li>- Providing proactive inventory control</li> <li>- Providing clinical guidelines for rational prescription</li> <li>- Developing efficient food assistance programs by the government</li> <li>- Funding food banks with the assistance of charities and non-governmental organisations</li> <li>- Allowing the participation of individuals in nutritional education programs</li> <li>- Utilising potentials and infrastructure in Iran</li> <li>- Mechanising the distribution system</li> <li>- Clarifying the roles of suppliers and manufacturers</li> </ul>
Financing arrangement	<ul style="list-style-type: none"> <li>- Reducing the prices of the imported medicines</li> <li>- Employing cost-effectiveness evidence for pricing and reimbursement</li> <li>- Improving pricing processes</li> <li>- Engineering insurance organisations</li> </ul>

We found that sanctions also indirectly affect Iran's health system, which is considered a more severe threat to the health sector than direct effects. They affected the public health status (especially in the economic dimension). The harsh effects of sanctions on Iran's circumstances (e.g., political, economic, and social dimensions) were reported by many scholars,<sup>10,46,47,49,51–53,55,60–64</sup> Sanctions were gradually increasing constraints on Iran's health system, which is heavily dependent on oil revenues, creating difficulties in financing processes. This limitation and the low efficiency of the Iran health system caused severe problems. According to previous studies, economic hardships caused by sanctions reduced the financial resources available to deal with public health issues and exacerbated the unequal redistribution of scarce resources. Similar to what was reported by previous studies,<sup>51,53,56</sup> another long-term effect of sanctions was the deterioration and obsolescence of healthcare infrastructure, something which affected both the quality of services and their accessibility.

### 4.3 | Resilient health system to combat sanctions

Considering the strategies for making the health system resilient against sanctions, the review findings revealed that most of these interventions require changes in the health system's governance. Strengthening the governance arrangements for health system rebuilding or preparedness has been recommended by many scholars.<sup>65</sup> However, making governance arrangements changes is tough and requires a strong commitment and long-term plans. Since a few studies have identified appropriate solutions and (most importantly) analysed their effectiveness in reducing the effects of sanctions on the health system, further studies should be conducted to determine what interventions are to be made at various organizational, national, and international levels to counteract the health system in response to sanctions. The importance of designing and implementing these interventions has become even more remarkable since the COVID-19 pandemic. Iran's experience with COVID-19 at a time when it was under pressure from sanctions indicated an urgent need to redesign a resilient health system.<sup>66</sup>

### 4.4 | Implications for practice

Sanctions have profoundly impacted population health in many countries beyond Iran. In Iraq, sanctions led to a significant deterioration in the country's health system, resulting in poor health outcomes for the population. Infant mortality rates in Iraq increased sharply during the 1990s, rising from 47 deaths per 1000 live births in 1990 to 108 deaths per 1000 live births in 1995.<sup>67</sup> Venezuela's health system also faced numerous challenges due to sanctions, including a shortage of medicine and medical equipment and increasing mortality rates.<sup>68</sup> Similarly, North Korea experienced a rise in malnutrition among children under 5 years of age due to the impact of sanctions on food security.<sup>69</sup>

Cuba faced significant challenges due to sanctions, including difficulties in procuring medical supplies and equipment, resulting in shortages and reduced access to medical care.<sup>51</sup> In Libya, years of conflict and sanctions have resulted in declining healthcare access, with many primary healthcare centres remaining closed in 2021. In some areas, up to 90% of PHC centres were shut down, while one-third of all health facilities in the south and east of the country were not operational. The situation is further compounded by a lack of essential medicines, with 80% of functioning PHC centres lacking essential medications.<sup>70</sup> In addition, economic sanctions imposed on Syria have significantly negatively affected the country's economy and people's health. The sanctions have caused the value of the Syrian Pound to increase, resulting in higher prices for essential items such as food and medicine while decreasing the purchasing power of salaries. Power supply disruptions have also occurred, which have impacted the cold vaccine chain and caused interruptions in the vaccination programme. Additionally, the sanctions have prevented essential medical supplies for chronic conditions, such as cancer, diabetes, and heart disease, from entering the country, thus harming those who rely on these medications for treatment.<sup>55</sup>

Haiti's healthcare system has been negatively impacted by sanctions, causing limited access to essential medicines, medical equipment, and humanitarian aid. It has increased diseases like tuberculosis, HIV/AIDS, and cholera. Sanctions have also intensified poverty and unemployment rates, increasing the healthcare system's strain. As a result, Haiti's vulnerable population, including infants and mothers, has suffered from malnutrition and high mortality rates.<sup>71</sup> Sudan has been severely impacted by sanctions on public health, with limited access to essential medicines, medical supplies, and equipment.<sup>72</sup>

However, Russia's health system has remained relatively stable despite the imposition of sanctions due to the country's high level of self-sufficiency in producing essential medicines and medical equipment.<sup>73</sup> Authors have not faced evidence that sanctions have affected the Russian health system.

It is crucial to conduct further research on the effects of sanctions on health systems, focussing on understanding the specific indicators of public health that are most affected. In addition, countries should prioritise building resilient health systems that can withstand the impacts of sanctions by investing in essential medicines, medical supplies, equipment, training, and retaining qualified health personnel. These efforts will ensure that populations have access to the healthcare they need and minimise the negative impacts of sanctions on population health.

## 5 | CONCLUSIONS

Generally, sanctions are imposed to change a target country's political behaviour by exerting economic pressure on people. Although there is scarce evidence regarding quantifying the potential impacts of sanctions on different dimensions of Iranian health, economic sanctions restrict people's income and wealth and affect healthcare services directly and indirectly. Therefore, it is strongly recommended that policymakers prioritise the important actions to improve the health system's resilience to sanctions based on the current evidence and tacit knowledge. Moreover, we call for scholars to analyse the exact effects of economic sanctions on different health-related areas by rigorous research methodologies. Additional analyses are required to find effective and feasible strategies to improve the health system's resilience to sanctions.

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### CONFLICT OF INTEREST STATEMENT

The authors declare that they have no competing interests.

### DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

### ETHICS STATEMENT

The approval for this study was granted by the ethics committee of Tehran University of Medical Sciences (Approved number: IR.TUMS.VCR.REC.1398.621).

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**Reza Majdzadeh** is a dedicated teacher and researcher with a portfolio of nearly 350 peer-reviewed papers. As the founder of the Knowledge Utilization Research Center and the Community-Based Participatory Research Center at Tehran University of Medical Sciences, Reza has played a crucial role in institutionalizing this area of work within the country. Previously, Reza served as the head of Iran's National Institute of Health Research, where he was responsible for monitoring the country's health sector reform. Additionally, he has collaborated with the WHO's Eastern Mediterranean Office in the region's low- and low-middle-income countries aimed at achieving universal health coverage and sustaining essential health services during the COVID-19 pandemic. Reza's ongoing research in the Global Public Health program at the University of Essex focuses reflects his unwavering commitment to promoting equitable health outcomes through evidence-informed approaches.

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