

Mapping the social networks of key actors in the development of health technology assessment in Iran

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Keywords

Health Technology Assessment • Social network analysis • Iran • Stakeholder analysis • Health policy

Summary

Background. Health Technology Assessment (HTA) is vital for evidence-based policymaking and resource allocation. In Iran, HTA development involves diverse actors with varying levels of power, influence, and support. Understanding their interactions is key to strengthening HTA processes.

Methods. We applied Social Network Analysis (SNA) to map relationships among 27 stakeholders identified through document review and expert interviews. Data were collected via an online questionnaire completed by 83 experts (response rate: 72.2%), assessing five dimensions: power, position, interest, influence, and support. Network metrics, including degree, closeness, betweenness, and eigenvector centrality, were analyzed using R Version 4.4.1.

Results. The Ministry of Health and Medical Education, Food

and Drug Administration, Insurance Organizations, and Parliament were perceived as the most influential actors. The Plan and Budget Organization (degree centrality 0.34) and National Institute of Health Research (0.26) emerged as key connectors with high bridging roles. Overall, the network exhibited low density (0.13) and limited clustering (0.11), indicating sparse connectivity. Peripheral actors, such as the Chamber of Commerce, were largely disconnected from the network.

Conclusion. HTA development in Iran is shaped by a few central institutions, but weak connectivity and limited engagement of peripheral actors hinder collaboration. Strengthening stakeholder communication, enhancing inclusiveness, and securing sustainable funding are critical for more effective HTA implementation and evidence-informed health policy.

Introduction

Across health systems, demand for medicines and technologies exceeds available resources, making efficient allocation essential [1]. In low- and middle-income countries (LMICs), this often requires prioritizing cost-effective interventions and protecting vulnerable populations from financial risk [2]. Transparent reimbursement processes and stakeholder engagement not only enhance public trust but also safeguard decision-makers from conflicts of interest [3].

Health Technology Assessment (HTA) has become a cornerstone of evidence-informed health policy by systematically evaluating the clinical, economic, social, and ethical implications of health technologies [4]. Its success, however, depends not only on methodological rigor but also on the dynamics of the networks of actors that influence its development and implementation [5, 6]. In Iran, HTA has gained prominence as a tool for guiding resource allocation and improving the quality of care [7]. Yet, the process is shaped by a complex

web of policymakers, regulators, insurers, researchers, clinicians, and industry representatives [8]. Previous studies have examined the institutional and policy challenges of HTA in Iran, but little is known about how relationships and power structures among these actors influence its trajectory [9]. This gap is critical, as strong or weak linkages between stakeholders can determine whether HTA is effectively institutionalized and integrated into policy.

This study aims to map the social networks of key actors involved in HTA development in Iran using Social Network Analysis (SNA). Specifically, we explore the structure and connectivity of these networks, identify central and peripheral actors, and assess how dimensions of power, interest, influence, position, and support shape HTA processes. By highlighting both strengths and gaps in the stakeholder landscape, this research provides evidence to inform strategies for more inclusive, coordinated, and effective HTA implementation in Iran, with implications for other LMICs facing similar challenges.

Methods

We used SNA, a method that explores the patterns of relationships and interactions between entities within a network [10]. SNA provides a detailed view of how these connections affect behavior, information flow, and resource distribution. Healthcare systems are intricate networks involving various participants: patients, providers, institutions, and policymakers linked through referrals, communication, and collaboration [11]. Traditional approaches often focus on isolated components, potentially missing the complex and interconnected nature of these relationships. SNA allows visualization of these dynamics by mapping the connections among actors [12]. This helps identify key nodes (*e.g.*, influential organizations) and understand how information and resources circulate. It also highlights critical areas for intervention and opportunities for improved communication or resource allocation [13]. By analyzing the roles of central and peripheral actors, SNA can guide strategies to enhance coordination and efficiency across the system.

IDENTIFICATION OF KEY ACTORS

To ensure data validity, we employed multiple sources, including interviews, questionnaires, and document review. First, we examined reports, legal documents, scientific articles, and other HTA-related publications. Official sources, such as Ministry of Health reports, outputs from research institutions, and documents from international health organizations, were prioritized. Next, we conducted in-depth interviews with 13 HTA experts to identify influential actors in HTA development and institutionalization. Participants were purposively selected using snowball sampling, ensuring diversity in gender, academic background, employment status, and executive experience. Each interview lasted 15–30 minutes and was conducted between January and March 2024 by two trained researchers (one with a PhD in health policy, the other in health economics). Interviews were carried out in person or via Skype, transcribed verbatim, and analyzed to capture the roles and relationships of different actors. Finally, we compiled a comprehensive list of actors from both document review and interviews. Duplicates were removed, and the final list included government institutions, regulatory agencies, insurers, universities, research centers, and professional associations involved in HTA policymaking, implementation, or research.

DATA COLLECTION

We created a questionnaire featuring a list of key actors. A structured questionnaire was developed for this study to assess the perspectives of key stakeholders on the development of HTA in Iran. The questionnaire consisted of five items evaluating power, position, interest, influence, and level of support. Since no validated questionnaire addressing these specific dimensions of HTA development in Iran was available, we designed a new questionnaire tailored to the study objectives. The

questionnaire was developed based on a literature review and expert consultations, ensuring content validity. It was then pretested with a small group of experts to refine clarity and relevance before distribution. The final English version of the questionnaire is provided as a **Supplementary 1**. Participants were asked to score each factor on a scale from 1 to 10, with 1 representing the minimum and 10 representing the maximum. As a pilot test, the questionnaire was shared with 5 experts in the field of HTA to gather their feedback. Their expertise was used to refine the questionnaire, making any necessary corrections before finalizing it. The internal reliability of the questionnaire was assessed using Cronbach's Alpha coefficient, which yielded a value of 0.87. Additionally, we utilized triangulation and involved multiple researchers in the data analysis to enhance the robustness of our findings. A secure link to the questionnaire was emailed to 115 experts in Iran's health system who were knowledgeable about health technology assessment. Detailed instructions on how to complete the questionnaire were provided, and consent was obtained from each participant, with assurance that their responses would be kept confidential by the researchers. The questionnaires were gathered between April 2024 and June 2024.

STATISTICAL ANALYSIS

SNA metrics were used to describe both network structure and individual actors.

Network structure metrics:

- *Density* quantified the proportion of realized connections.
- *Diameter* measured the longest shortest path between two nodes, reflecting maximum distance.

Actor-level metrics:

- *Degree centrality* reflected the number of direct connections.
- *Closeness centrality* indicated how quickly a node could access others, based on average shortest path length.
- *Betweenness centrality* assessed a node's bridging role in the network.
- *Eigenvector centrality* measured prominence by weighting connections to highly central nodes.

All metrics were normalized to allow comparison across actors. Data were organized in Excel and analyzed in R (Version 4.4.1) for both calculation and visualization of network properties.

Results

Twenty-seven actors were identified during the review of documents and interviews, as follows: Ministry of Health and Medical Education (MoHME), Food and Drug Administration (FDA), Vice Presidency for Science and Technology (VPST), National Institute of Health Research (NIHR), Plan and Budget Organization

(PBO), Insurance Organizations (IO), Social Security Organization (SSO), Universities and Academic Centers (UAC), Medical Council of Iran (Organization of the Medical System) (MCI), Supreme Council of the Cultural Revolution (SCCR), Ministry of Cooperatives, Labor, and Social Welfare (MCLSW), Supreme Council of Insurance (SCI), Islamic Consultative Assembly (Parliament) (Pr), Medical Equipment Importing Companies (MEIC), Supreme Council for Health and Food Security (SCHFS), Iranian National Standards Organization (INSO), Islamic Republic of Iran Broadcasting (IRIB), Central Bank of Iran (CBI), Chamber of Commerce (CC), Non-Governmental Organizations (NGOs) Supporting Patient Rights, Medical Scientific Associations (MSA), National Tax Administration of Iran (NTAI), Ministry of Industry, Mine, and Trade (MIMT), General Inspection Organization of Iran (GIOI), Medical Equipment Manufacturers' Trade Associations (MEMTA), Private Sector (PS) and Pharmaceutical Companies (PC). After distributing the questionnaire online and evaluating the identified actors based on five items (power, position, interest, influence, and level of support) a total of 83 participants completed the survey. This resulted in a response rate of 72.17%

INFLUENCE ANALYSIS

Participants identified the Ministry of Health and Medical Education, Food and Drug Administration, Insurance Organizations, and the Islamic Consultative Assembly (Parliament) as the most influential in HTA development. Ministry of Health and Medical Education, as Iran's primary health policy authority, sets HTA agendas and ensures alignment with national priorities, coordinating across healthcare sectors. The Food and Drug Administration influences HTA by regulating and approving health technologies, shaping what is assessed and adopted. Insurance Organizations impact HTA through reimbursement decisions based on cost-effectiveness, affecting technology accessibility. Parliament influences HTA through legislation and oversight, shaping the regulatory and financial framework for HTA and aligning it with national priorities.

INTEREST ANALYSIS

The Ministry of Health and Medical Education, Food and Drug Administration, National Institute of Health Research, and Plan and Budget Organization showed significant interest in HTA. The Ministry of Health and Medical Education uses HTA to guide health policy and resource allocation. The Food and Drug Administration relies on HTA for evidence to regulate technologies, ensuring public safety. The National Institute of Health Research values HTA for its role in research and evidence-based healthcare improvements. The Plan and Budget Organization is interested in HTA to evaluate cost-effectiveness and manage healthcare budgets efficiently, aligning expenditures with economic goals.

LEVEL OF SUPPORT ANALYSIS

The Ministry of Health and Medical Education, Insurance Organizations, Universities and Academic Centers, and Parliament provided strong support for HTA. The Ministry of Health and Medical Education supports HTA to integrate it into health policies and optimize resource use. Insurance Organizations back HTA to ensure financial sustainability and value for money in technology coverage. Universities and Academic Centers support HTA through research and training, developing the necessary methodologies and expertise. Parliament's support ensures legal and financial backing for HTA, influencing policy and resource allocation.

POSITION ANALYSIS

Universities and Academic Centers, the Supreme Council of the Cultural Revolution, the Islamic Consultative Assembly (Parliament), and the Central Bank of Iran held significant power in HTA development. Universities and Academic Centers generate HTA knowledge and train professionals. The Supreme Council of the Cultural Revolution influences HTA by shaping broader cultural and educational policies. Parliament holds legislative power, affecting HTA laws and funding. The Central Bank of Iran impacts HTA through its control over financial stability and government spending, indirectly affecting healthcare investment.

POWER ANALYSIS

The Ministry of Health and Medical Education, Food and Drug Administration, Plan and Budget Organization, and Parliament held the most power in HTA development. The Ministry of Health and Medical Education oversees healthcare management, including HTA policies and implementation. The Food and Drug Administration controls the market entry of health technologies, affecting their assessment and use. The Plan and Budget Organization manage healthcare funding, influencing HTA resource allocation. Parliament has legislative authority, shaping HTA through laws, budget approvals, and policy oversight, aligning HTA with national priorities and public interests. **Supplementary 2** provides the ranking of the actors according to participants' opinions on five items.

SNA ANALYSIS

The calculated social network metrics, such as degree centrality, closeness centrality, betweenness centrality, eigenvector centrality, hub, and page rank, are presented in Table I. The Plan and Budget Organization (0.34) and National Institute of Health Research (0.26) exhibit the highest degree centrality, suggesting they have numerous direct interactions with other actors. The Chamber of Commerce (0.00) is isolated, with no direct connections, indicating minimal or no engagement with other actors in the network. The Plan and Budget Organization (0.55) and National Institute of Health Research (0.50) have the highest closeness centrality,

Tab. I. Social network metrics.

Actors	Degree centrality	Closeness centrality	Betweenness centrality	Eigenvector centrality	Hub	Pagerank
Ministry of Health and Medical Education (MoHME)	0.1154	0.3846	0.0146	0.3829	0.3829	0.0317
Food and Drug Administration (FDA)	0.1923	0.4098	0.1193	0.479	0.479	0.0538
Vice Presidency for Science and Technology (VPST)	0.1923	0.4464	0.0345	0.7535	0.7535	0.0485
National Institute of Health Research (NIHR)	0.2692	0.5	0.146	0.9249	0.9249	0.0676
Plan and Budget Organization (PBO)	0.3462	0.5556	0.3178	1	1	0.0895
Insurance Organizations (IO)	0.1154	0.3378	0.0245	0.143	0.143	0.0347
Social Security Organization (SSO)	0.0769	0.3676	0.0081	0.2787	0.2787	0.0229
Universities and Academic Centers (UAC)	0.1923	0.431	0.0487	0.7194	0.7194	0.0486
Medical Council of Iran (Organization of the Medical System) (MCI)	0.1154	0.4098	0.0276	0.4578	0.4578	0.0314
Supreme Council of the Cultural Revolution (SCCR)	0.1538	0.431	0.1237	0.326	0.326	0.0472
Ministry of Cooperatives, Labor, and Social Welfare (MCLSW)	0.0769	0.3846	0.018	0.2227	0.2227	0.0234
Supreme Council of Insurance (SCI)	0.0385	0.2941	0	0.1036	0.1036	0.0149
Islamic Consultative Assembly (Parliament) (Pr)	0.0385	0.3623	0	0.2162	0.2162	0.0142
Medical Equipment Importing Companies (MEIC)	0.1154	0.431	0.0709	0.3584	0.3584	0.0333
Supreme Council for Health and Food Security (SCHFS)	0.1154	0.3676	0.0372	0.1789	0.1789	0.035
Iranian National Standards Organization (INSO)	0.0385	0.3049	0	0.0705	0.0705	0.0158
Islamic Republic of Iran Broadcasting (IRIB)	0.1923	0.3968	0.1198	0.2584	0.2584	0.0572
Central Bank of Iran (CBI)	0.1154	0.4167	0.0575	0.3043	0.3043	0.033
Chamber of Commerce (CC)	0	NA	0	0	0	0.0057
Non-Governmental Organizations (NGOs) Supporting Patient Rights	0.1538	0.3623	0.0321	0.364	0.364	0.042
Medical Scientific Associations (MSA)	0.0769	0.3846	0	0.4162	0.4162	0.0224
National Tax Administration of Iran (NTAI)	0.1538	0.463	0.1159	0.3662	0.3662	0.0426
Ministry of Industry, Mine, and Trade (MIMT)	0.1154	0.3623	0.0328	0.2279	0.2279	0.0332
General Inspection Organization of Iran (GIOI)	0.2308	0.5	0.1272	0.8062	0.8062	0.0587
Medical Equipment Manufacturers' Trade Associations (MEMTA)	0.1154	0.3906	0.044	0.2112	0.2112	0.0332
Private Sector (PS)	0.1538	0.3906	0.0458	0.224	0.224	0.0439
Pharmaceutical Companies (PC)	0.0385	0.2874	0	0.0559	0.0559	0.0155

indicating they are well-positioned to quickly access information or influence throughout the network. The Supreme Council of Insurance (0.29) and Iranian National Standards Organization (0.30) have lower values, suggesting they are less central and may face longer paths to interact with other actors. The Plan and Budget Organization (0.31) and National Institute of Health Research (0.14) exhibit the highest betweenness centrality, indicating they play significant roles in bridging different parts of the network. The Supreme Council of Insurance (0.00) and Iranian National Standards Organization (0.00) have zero betweenness centrality, implying they do not act as intermediaries or bridges between other actors. The Plan and Budget Organization (1.00), National Institute of Health Research (0.92), and Vice Presidency for Science and Technology (0.75) have the highest eigenvector

centrality, suggesting they are not only well-connected but also linked to other influential actors. The Chamber of Commerce (0.00) has no influence as it is isolated in the network. The Plan and Budget Organization (0.08), National Institute of Health Research (0.06), and Vice Presidency for Science and Technology (0.04) are prominent hubs, reflecting their central role in the network's structure. The Chamber of Commerce (0.00) has the lowest hub score, reinforcing its isolation and minimal influence. The Plan and Budget Organization (0.08) and National Institute of Health Research (0.06) show the highest PageRank scores, indicating they are central to the network's power structure. The Chamber of Commerce (0.00), with the lowest PageRank score, underscores its minimal impact and influence. Additionally, network and node-level metrics, including nodes, edges, density, diameter, and other related measures, are detailed in Table II.

Tab. II. Network and node-level metrics, including nodes, edges, density, clustering coefficient, degree, and connectivity measures.

	Value
Nodes	27
Edges	46
Density	0.13
Average Clustering Coefficient	0.11
Average Degree	3.40
Number of Triangles	7
Diameter	6
Average Path Length	2.56

The network, comprising 27 nodes and 46 edges, exhibits a density of 0.13, signifying a sparse structure with limited connectivity relative to all possible edges. The average clustering coefficient of 0.11 reflects a low tendency for nodes to form tight clusters. With an average degree of 3.4074, nodes have a moderate number of connections. The presence of 7 triangles indicates some local interconnectedness. The network's diameter of 6 and average path length of 2.56 suggest that, despite its sparsity, the network maintains relatively short paths between nodes,

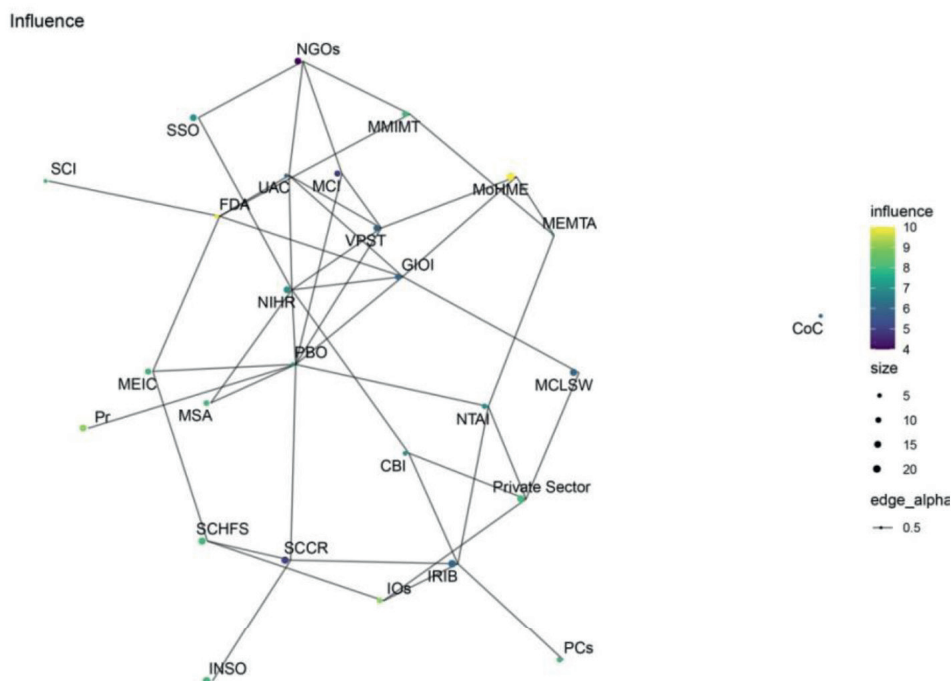
making it moderately efficient in terms of connectivity and information flow.

Figures 1-5 illustrate the network maps depicting the influence, interest, level of support, position, and power of the stakeholders involved in the development of HTA in Iran. Table III and Figure 6 present the ranking of actors involved in the development of health innovation, based on five items assessed by the participants. Based on composite scores, the top five actors ranked as follows: Ministry of Health and Medical Education, Food and Drug Administration, Islamic Consultative Assembly (Parliament), Insurance Organizations, and the Supreme Council of Insurance.

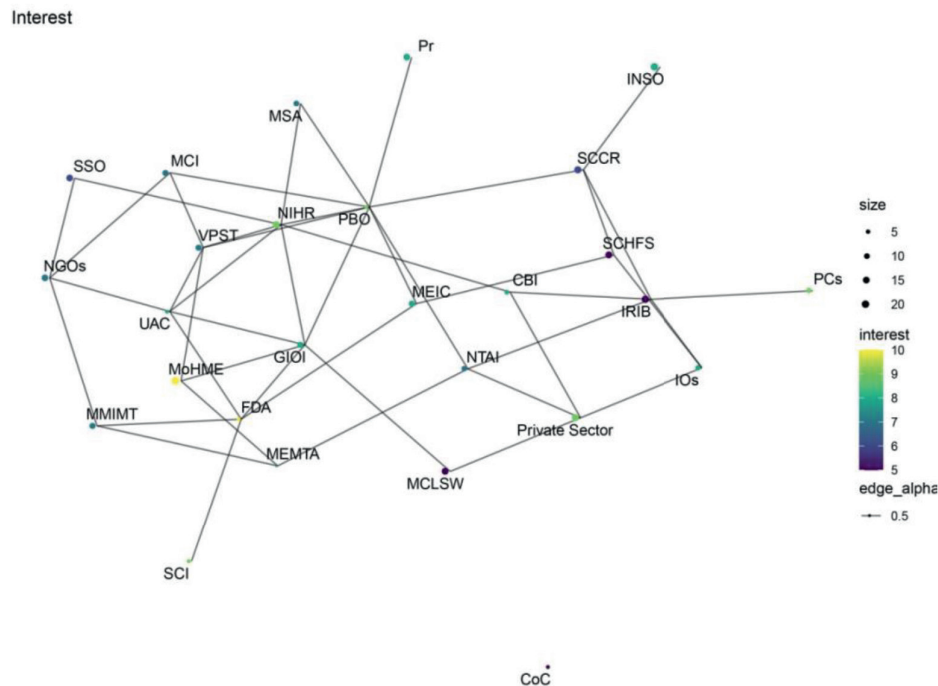
Discussion

This study mapped the social networks of key actors involved in HTA development in Iran, offering insights into influence, power, support, and connectivity. By applying SNA, we identified central institutions, highlighted gaps in communication, and revealed how power imbalances shape the HTA landscape.

Our analysis showed that the MoHME, FDA, Insurance Organizations, and Parliament are perceived as the most influential actors. This finding is consistent with their formal roles in health policy: MoHME sets the agenda,

Fig. 1. Network map based on the influence of stakeholders in the development of HTA in Iran.

Ministry of Health and Medical Education (MoHME), Food and Drug Administration (FDA), Vice Presidency for Science and Technology (VPST), National Institute of Health Research (NIHR), Plan and Budget Organization (PBO), Insurance Organizations (IOs), Social Security Organization (SSO), Universities and Academic Centers (UAC), Medical Council of Iran (MCI), Supreme Council of the Cultural Revolution (SCCR), Ministry of Cooperatives, Labor, and Social Welfare (MCLSW), Supreme Council of Insurance (SCI), Islamic Consultative Assembly (Parliament) (Pr), Medical Equipment Importing Companies (MEIC), Supreme Council for Health and Food Security (SCHFS), Iranian National Standards Organization (INSO), Islamic Republic of Iran Broadcasting (IRIB), Central Bank of Iran (CBI), Chamber of Commerce (CoC), Non-Governmental Organizations (NGOs) Supporting Patient Rights, Medical Scientific Associations (MSA), National Tax Administration of Iran (NTAI), Ministry of Industry, Mine, and Trade (MIMT), General Inspection Organization of Iran (GIOI), Medical Equipment Manufacturers' Trade Associations (MEMTA), Private Sector (PS), Pharmaceutical Companies (PCs).

Fig. 2. Network map based on the interest of stakeholders in the development of HTA in Iran.

Ministry of Health and Medical Education (MoHME), Food and Drug Administration (FDA), Vice Presidency for Science and Technology (VPST), National Institute of Health Research (NIHR), Plan and Budget Organization (PBO), Insurance Organizations (IOs), Social Security Organization (SSO), Universities and Academic Centers (UAC), Medical Council of Iran (MCI), Supreme Council of the Cultural Revolution (SCCH), Ministry of Cooperatives, Labor, and Social Welfare (MCLSW), Supreme Council of Insurance (SCI), Islamic Consultative Assembly (Parliament) (Pr), Medical Equipment Importing Companies (MEIC), Supreme Council for Health and Food Security (SCHFS), Iranian National Standards Organization (INSO), Islamic Republic of Iran Broadcasting (IIRIB), Central Bank of Iran (CBI), Chamber of Commerce (CoC), Non-Governmental Organizations (NGOs) Supporting Patient Rights, Medical Scientific Associations (MSA), National Tax Administration of Iran (NTAI), Ministry of Industry, Mine, and Trade (MIMT), General Inspection Organization of Iran (GIOI), Medical Equipment Manufacturers' Trade Associations (MEMTA), Private Sector (PS), Pharmaceutical Companies (PCs).

FDA regulates technology entry, insurers determine reimbursement, and Parliament shapes the legislative and financial framework. The dominance of these actors reflects similar patterns observed in other countries, where ministries of health and regulatory bodies are pivotal in HTA implementation [14, 15].

Insurance Organizations' strong influence aligns with experiences in countries such as Germany, the UK, and Canada, where reimbursement decisions are tightly linked to HTA findings [16–18]. In these settings, HTA outcomes directly affect technology adoption, underscoring the financial gatekeeping role of insurers. Similarly, in France and Australia, insurance organizations actively shape HTA policy to ensure technologies are both clinically valuable and financially sustainable [19, 20]. Our results suggest that Iranian insurers, though influential, must further institutionalize evidence-based reimbursement practices to maximize their impact.

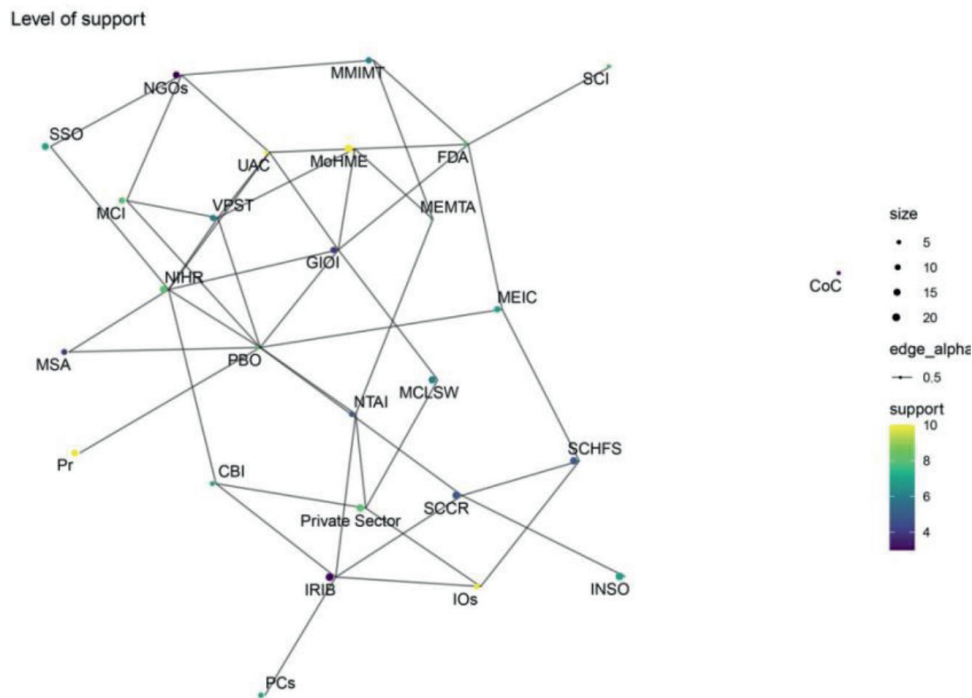
Universities, the NIHR, and the Vice Presidency for Science and Technology were also identified as strong supporters of HTA. Their contribution to training, research, and evidence generation highlights the importance of scientific capacity in sustaining HTA. Internationally, bodies such as the UK's NIHR or HITAP in Thailand play similar roles, bridging research and

policymaking [21–25]. Iran's universities and research centers are well positioned to strengthen HTA through methodological innovation and capacity building.

The network analysis revealed a sparse structure, with low density (0.13) and clustering coefficient (0.11). This indicates weak collaboration across actors and limited subgroup formation, which can slow down the circulation of evidence and reduce policy coherence. Despite this, the relatively short average path length (2.56) suggests that information can still travel efficiently when connections exist. However, reliance on a few central actors, such as the PBO and NIHR, poses risks of bottlenecks. Strengthening ties among peripheral actors could improve resilience and inclusiveness [26, 27].

The isolation of the Chamber of Commerce and limited engagement of the private sector suggest that industry perspectives are underrepresented in Iran's HTA network. While private sector involvement must be carefully managed to avoid conflicts of interest, structured engagement could improve alignment between innovation, regulation, and patient needs [28, 29].

The power analysis highlighted MoHME, FDA, PBO, and Parliament as highly authoritative, reflecting their control over policy, regulation, finance, and legislation. Yet, such concentration of power also risks imbalances and conflicting priorities—for example,

Fig. 3. Network map based on the level of support of stakeholders in the development of HTA in Iran.

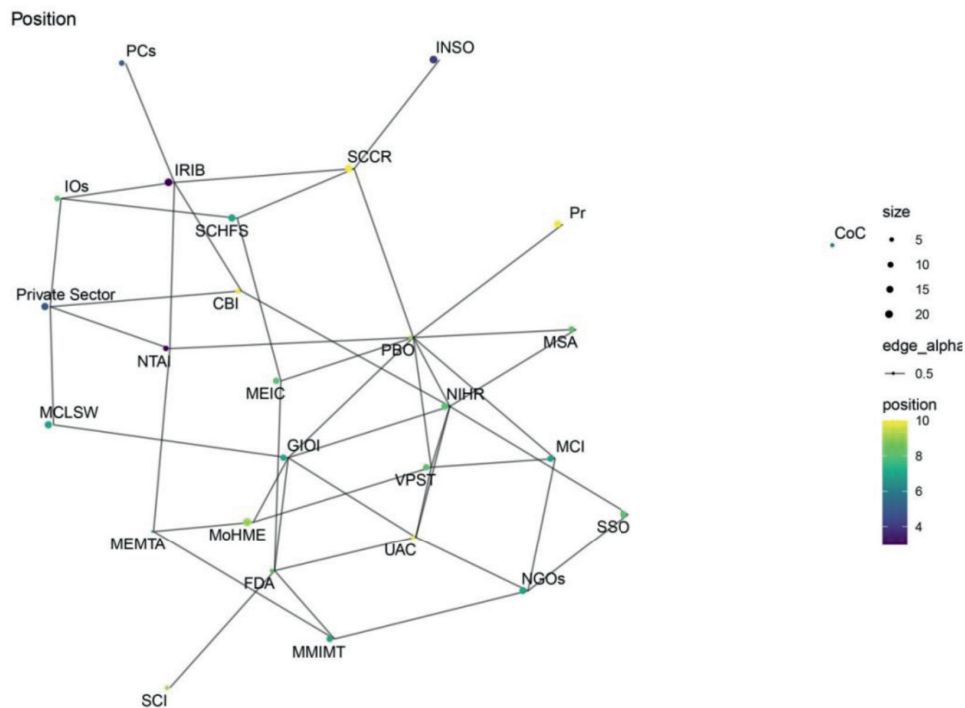
Ministry of Health and Medical Education (MoHME), Food and Drug Administration (FDA), Vice Presidency for Science and Technology (VPST), National Institute of Health Research (NIHR), Plan and Budget Organization (PBO), Insurance Organizations (IOs), Social Security Organization (SSO), Universities and Academic Centers (UAC), Medical Council of Iran (MCI), Supreme Council of the Cultural Revolution (SCCR), Ministry of Cooperatives, Labor, and Social Welfare (MCLSW), Supreme Council of Insurance (SCI), Islamic Consultative Assembly (Parliament) (Pr), Medical Equipment Importing Companies (MEIC), Supreme Council for Health and Food Security (SCHFS), Iranian National Standards Organization (INSO), Islamic Republic of Iran Broadcasting (IRIB), Central Bank of Iran (CBI), Chamber of Commerce (CoC), Non-Governmental Organizations (NGOs) Supporting Patient Rights, Medical Scientific Associations (MSA), National Tax Administration of Iran (NTAI), Ministry of Industry, Mine, and Trade (MIMT), General Inspection Organization of Iran (GIOI), Medical Equipment Manufacturers' Trade Associations (MEMTA), Private Sector (PS), Pharmaceutical Companies (PCs).

between cost containment (PBO) and technology adoption (FDA). Managing these tensions requires transparent processes, clear role definitions, and mechanisms for accountability. Our findings have implications beyond Iran. Many LMICs face similar challenges of fragmented networks, dominance of a few actors, and limited integration of peripheral stakeholders. Strengthening communication channels, fostering inclusive stakeholder forums, and building stable funding mechanisms are strategies that can enhance HTA institutionalization across diverse contexts. Finally, the study highlights a central tension: while Iran has strong institutional anchors for HTA, weak connectivity and lack of collaboration limit its effectiveness. Addressing these gaps will require deliberate efforts to foster dialogue, integrate peripheral actors, and align interests across sectors. By doing so, HTA can move from being a policy tool concentrated within a few institutions to a system-wide mechanism for evidence-informed decision-making.

LIMITATION

This study provides valuable insights into the social networks of key actors in HTA development in Iran,

but several limitations should be considered. First, the identification of actors relied on interviews, questionnaires, and document review, which may introduce selection bias. Although purposive and snowball sampling helped capture diverse perspectives, less visible but potentially influential stakeholders may have been overlooked. Second, the study relied on self-reported data, which carries risks of response bias. Participants' assessments of their own or others' power, influence, or support may not fully reflect actual dynamics. Social desirability bias may also have led some respondents to overstate their contributions. Third, the cross-sectional nature of the analysis captures a snapshot of the HTA landscape at one point in time. Given the dynamic nature of health policy, relationships and influence among actors may evolve, meaning our findings may not represent longer-term trends. Future studies using longitudinal SNA could better capture these shifts. Fourth, while SNA is a powerful tool, it cannot fully capture informal networks, hidden alliances, or qualitative aspects such as trust and personal relationships, which can significantly affect HTA processes. Our reliance on quantitative centrality metrics may therefore miss some nuances. Fifth, the study primarily focused on formal institutions and organizations. The roles of individual clinicians,

Fig. 4. Network map based on the position of stakeholders in the development of HTA in Iran.

Ministry of Health and Medical Education (MoHME), Food and Drug Administration (FDA), Vice Presidency for Science and Technology (VPST), National Institute of Health Research (NIHR), Plan and Budget Organization (PBO), Insurance Organizations (IOs), Social Security Organization (SSO), Universities and Academic Centers (UAC), Medical Council of Iran (MCI), Supreme Council of the Cultural Revolution (SCCR), Ministry of Cooperatives, Labor, and Social Welfare (MCLSW), Supreme Council of Insurance (SCI), Islamic Consultative Assembly (Parliament) (Pr), Medical Equipment Importing Companies (MEIC), Supreme Council for Health and Food Security (SCHFS), Iranian National Standards Organization (INSO), Islamic Republic of Iran Broadcasting (IRIB), Central Bank of Iran (CBI), Chamber of Commerce (CoC), Non-Governmental Organizations (NGOs) Supporting Patient Rights, Medical Scientific Associations (MSA), National Tax Administration of Iran (NTAI), Ministry of Industry, Mine, and Trade (MIMT), General Inspection Organization of Iran (GIOI), Medical Equipment Manufacturers' Trade Associations (MEMTA), Private Sector (PS), Pharmaceutical Companies (PCs).

patients, and grassroots groups were not examined in depth, despite their potential influence on HTA adoption and legitimacy. Expanding future research to include these actors would provide a more comprehensive picture. Finally, the context-specific focus on Iran limits the generalizability of the findings. While the results may offer lessons for other low- and middle-income countries, differences in political structures, health systems, and cultural contexts should be considered when applying these insights elsewhere.

POLICY RECOMMENDATIONS

Based on the findings of this study, several policy recommendations are proposed to strengthen the development and implementation of HTA in Iran.

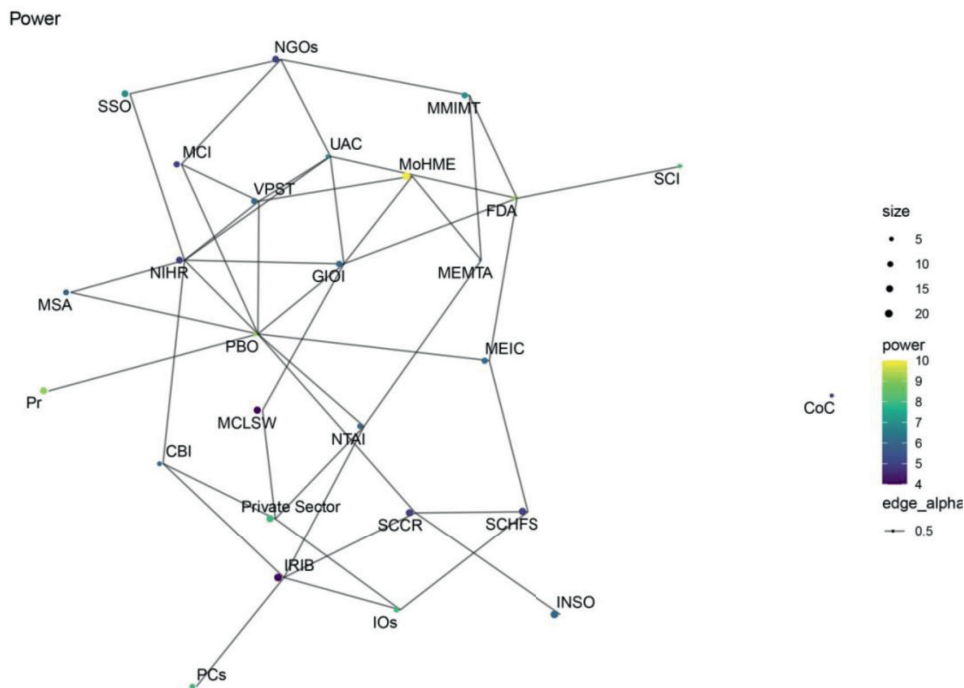
1. Strengthen Central Coordination and Leadership

- Clarify and reinforce the role of the Ministry of Health and Medical Education (MoHME) as the lead agency for HTA, ensuring alignment with national health priorities and cross-sectoral coordination.
- Establish a dedicated HTA body under MoHME to centralize activities, reduce fragmentation, and provide a unified framework for assessments.

2. Improve Communication and Collaboration

Among Stakeholders

- Facilitate structured and regular dialogue through formal forums or working groups that bring together MoHME, FDA, insurers, Parliament, and other actors. This directly addresses the observed low network density (0.13).
 - Develop joint initiatives and collaborative projects that promote shared goals, enhance information exchange, and optimize resource use.
- #### 3. Enhance Stakeholder Engagement and Inclusiveness
- Actively involve peripheral and currently disconnected actors, such as the Chamber of Commerce and private sector, in advisory committees and working groups. Their inclusion could reduce network fragmentation and improve policy coherence.
 - Expand networks by including patient advocacy groups, professional associations, and NGOs to ensure diverse perspectives are considered in HTA processes.
- #### 4. Strengthen the Evidence Base and Methodologies
- Invest in universities and research institutions to support HTA-related research, methodology development, and training.
 - Improve national data infrastructure to ensure access to

Fig. 5. Network map based on the power of stakeholders in the development of HTA in Iran.

Ministry of Health and Medical Education (MoHME), Food and Drug Administration (FDA), Vice Presidency for Science and Technology (VPST), National Institute of Health Research (NIHR), Plan and Budget Organization (PBO), Insurance Organizations (IOs), Social Security Organization (SSO), Universities and Academic Centers (UAC), Medical Council of Iran (MCI), Supreme Council of the Cultural Revolution (SCCR), Ministry of Cooperatives, Labor, and Social Welfare (MCLSW), Supreme Council of Insurance (SCI), Islamic Consultative Assembly (Parliament) (Pr), Medical Equipment Importing Companies (MEIC), Supreme Council for Health and Food Security (SCHFS), Iranian National Standards Organization (INSO), Islamic Republic of Iran Broadcasting (IRIB), Central Bank of Iran (CBI), Chamber of Commerce (CoC), Non-Governmental Organizations (NGOs) Supporting Patient Rights, Medical Scientific Associations (MSA), National Tax Administration of Iran (NTAI), Ministry of Industry, Mine, and Trade (MIMT), General Inspection Organization of Iran (GIOI), Medical Equipment Manufacturers' Trade Associations (MEMTA), Private Sector (PS), Pharmaceutical Companies (PCs).

reliable clinical, economic, and patient outcome data, thereby reducing reliance on fragmented information.

5. Ensure Sustainable Funding and Resource Allocation

- Secure stable, long-term funding streams to avoid over-reliance on short-term or project-based financing. Sustainable resources will support institutional capacity, staff training, and continuous HTA activities.
- Establish transparent mechanisms for resource allocation to maximize the impact of limited budgets.

6. Enhance Transparency and Accountability

- Implement clear guidelines and processes for HTA decision-making, including transparent criteria for prioritization.
- Introduce monitoring and evaluation systems (e.g., regular audits, performance reviews) to ensure accountability and improve trust in HTA decisions.

7. Foster Innovation and Continuous Improvement

- Encourage methodological innovation, such as integrating horizon scanning and digital health assessments, to keep HTA relevant in a rapidly changing environment.
- Create feedback loops for continuous learning, ensuring stakeholder input is systematically used to refine HTA processes.

Priority should be given to building stronger central coordination, enhancing communication between key actors, and securing sustainable funding. Medium-term efforts should focus on inclusiveness, capacity building, and data infrastructure, while long-term strategies should foster innovation and adaptability. By following these steps, Iran can move toward a more integrated, transparent, and effective HTA system.

Conclusion

This study explored the social networks and influence dynamics among key actors involved in HTA development in Iran. Using SNA, we mapped relationships, power structures, and support mechanisms, revealing that MoHME, FDA, Insurance Organizations, and Parliament occupy central positions, while institutions such as the Plan and Budget Organization and NIHR act as key connectors. Despite these strong anchors, the overall network was sparse, with low density and limited clustering, indicating weak collaboration and underutilization of peripheral actors. This fragmentation constrains the effectiveness of HTA and limits its integration into broader health policy. To strengthen

Tab. III. Ranking of actors involved in the development of HTA, based on five items with composite score.

Name of actors	Composite score	Rank
Ministry of Health and Medical Education (MoHME)	1.63	1
Food and Drug Administration (FDA)	1.22	2
Vice Presidency for Science and Technology (VPST)	1.20	3
National Institute of Health Research (NIHR)	0.88	4
Plan and Budget Organization (PBO)	0.79	5
Insurance Organizations (IO)	0.78	6
Social Security Organization (SSO)	0.55	7
Universities and Academic Centers (UAC)	0.39	8
Medical Council of Iran (Organization of the Medical System) (MCI)	0.29	9
Supreme Council of the Cultural Revolution (SCCR)	0.28	10
Ministry of Cooperatives, Labor, and Social Welfare (MCLSW)	0.22	11
Supreme Council of Insurance (SCI)	0.19	12
Islamic Consultative Assembly (Parliament) (Pr)	0.01	13
Medical Equipment Importing Companies (MEIC)	-0.07	14
Supreme Council for Health and Food Security (SCHFS)	-0.16	15
Iranian National Standards Organization (INSO)	-0.19	16
Islamic Republic of Iran Broadcasting (IRIB)	-0.20	17
Central Bank of Iran (CBI)	-0.29	18
Chamber of Commerce (CC)	-0.44	19
Non-Governmental Organizations (NGOs) Supporting Patient Rights	-0.46	20
Medical Scientific Associations (MSA)	-0.57	21
National Tax Administration of Iran (NTAI)	-0.60	22
Ministry of Industry, Mine, and Trade (MIMT)	-0.75	23
General Inspection Organization of Iran (GIOI)	-0.90	24
Medical Equipment Manufacturers' Trade Associations (MENTA)	-1.06	25
Private Sector (PS)	-1.16	26
Pharmaceutical Companies (PC)	-1.59	27

HTA in Iran, strategies should prioritize improving communication between actors, engaging peripheral stakeholders, and ensuring stable funding mechanisms. Enhancing inclusiveness and transparency will also help balance existing power asymmetries and increase accountability. Looking ahead, longitudinal studies could track how these networks evolve over time, while comparative research across low- and middle-income countries may provide lessons for building more resilient and inclusive HTA systems. By addressing gaps in connectivity and coordination, Iran can move toward an HTA framework that is not only evidence-based but also collaborative, transparent, and responsive to national health priorities.

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Ethics approval and consent to participate

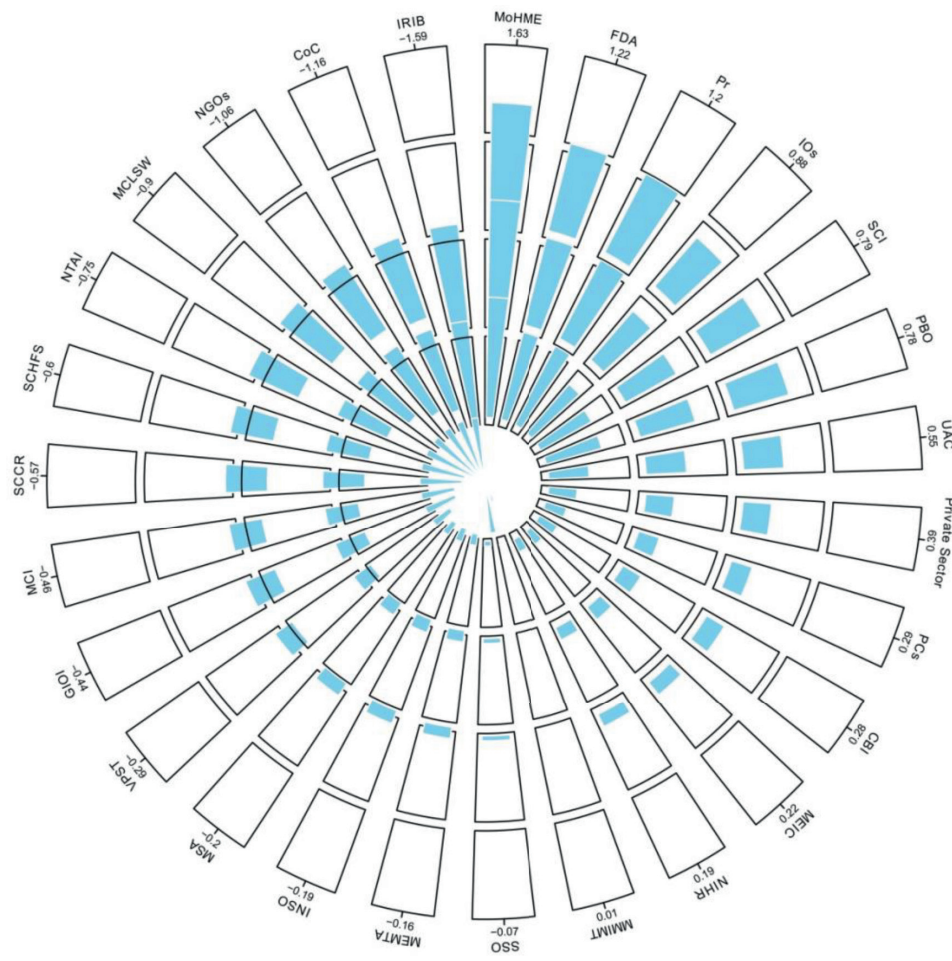
The study was approved by the ethical committee at Lorestan University of Medical Sciences (IR.LUMS.REC.1402.310). All participants were informed about the study objectives and procedures before participation. Written informed consent was obtained from each study participant before key informant interviews. Verbal informed consent was obtained from all participants before initiating the study. The study procedures and methods were conducted following the ethical principles and guidance of the World Medical Association Declaration of Helsinki. No waiver of consent was applied, and all participants provided informed consent before participation.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due but are available from the corresponding author on reasonable request.

Fig. 6. Ranking of actors involved in the development of HTA, based on five items.

Conflict of Interest statement

The authors declare that they have no competing interests.

Authors' contributions

MaB, MY, SA, MM, and AB contributed to the development of the idea for this article. MeB, AB, SS, MaB and BDT partook in the acquisition and analysis of data. All co-authors joined them in critically interpreting and discussing the data. MaB, SS, MM, BDT, and MM wrote sub-sections of this article and provided input into further sub-sections of the article, along with MaB, MeB, MM, AB, SA, MY and SS. All authors have critically revised content, have approved the submitted version of this article, and are accountable for the accuracy or integrity of any part of the work.

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Supplementary material

Tab. S1. Questionnaire for data collection.

Questionnaire on the Role of Stakeholders in Health Technology Assessment (HTA) Development in Iran
Introduction: This questionnaire aims to assess the role of various organizations in the development of Health Technology Assessment (HTA) in Iran. Please evaluate each actor based on their power, position, interest, influence, and level of support in HTA development. Your responses will be used for research purposes only and will remain confidential.
Section 1: Participant Information. What is your professional role? ☐ Health policymaker ☐ Researcher/academic ☐ Healthcare provider (physician, nurse, etc.) ☐ Government official ☐ Insurance professional ☐ Industry representative (pharmaceuticals, medical devices, etc.) ☐ Other (please specify): _____ Which sector do you primarily work in? ☐ Public sector ☐ Private sector ☐ Non-governmental organization (NGO) ☐ Academia Years of experience in health policy or related fields: ☐ Less than 5 years ☐ 5-10 years ☐ 11-20 years ☐ More than 20 years
Section 2: Assessment of Key Stakeholders in HTA Development. Please rate the following stakeholders on a 10-point scale based on their power, position, interest, influence, and level of support in HTA development in Iran.

Tab. S2. Ranking of actors based on participants' evaluations of power, position, interest, influence, and support in HTA development.

Actors	Power	Position	Interest	Influence	Level of support
Ministry of Health and Medical Education (MoHME)					
Food and Drug Administration (FDA)					
Vice Presidency for Science and Technology (VPST)					
National Institute of Health Research (NIHR)					
Plan and Budget Organization (PBO)					
Insurance Organizations (IO)					
Social Security Organization (SSO)					
Universities and Academic Centers (UAC)					
Medical Council of Iran (Organization of the Medical System) (MCI)					
Supreme Council of the Cultural Revolution (SCCR)					
Ministry of Cooperatives, Labor, and Social Welfare (MCLSW)					
Supreme Council of Insurance (SCI)					
Islamic Consultative Assembly (Parliament) (Pr)					
Medical Equipment Importing Companies (MEIC)					
Supreme Council for Health and Food Security (SCHFS)					
Iranian National Standards Organization (INSO)					
Islamic Republic of Iran Broadcasting (IRIB)					
Central Bank of Iran (CBI)					
Chamber of Commerce (CC)					
Non-Governmental Organizations (NGOs) Supporting Patient Rights					
Medical Scientific Associations (MSA)					
National Tax Administration of Iran (NTAI)					
Ministry of Industry, Mine, and Trade (MIMT)					
General Inspection Organization of Iran (GIOI)					
Medical Equipment Manufacturers' Trade Associations (MEMTA)					
Private Sector (PS)					
Pharmaceutical Companies (PC)					