

Power Structure and Information Flow Analysis in the Health Tourism Network Using a Social Network Analysis (SNA) Approach

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ABSTRACT

This study aimed to analyze the structure of power and patterns of information flow among stakeholders in Tehran's health tourism network using Social Network Analysis (SNA). This quantitative, applied, cross-sectional study was conducted among 72 organizational actors involved in the health tourism network of Tehran, Iran. Participants included governmental and regulatory organizations, hospitals and specialized medical centers, health tourism facilitation agencies, physicians and clinical providers, medical travel agencies, hotels and accommodation providers, insurance-related organizations, and complementary service providers. Actors were selected using purposive and network-based sampling. Data were collected through a structured SNA questionnaire assessing directed information-exchange ties and perceived power, influence, and dependency relationships. Separate 72×72 adjacency matrices were constructed for information flow and power. Network-level indicators, including density, reciprocity, average geodesic distance, centralization, and component structure, as well as actor-level measures, including in-degree, out-degree, betweenness, closeness, and eigenvector centrality, were analyzed using UCINET and NetDraw. The information-flow network contained 1,094 directed ties and showed greater density (0.214) and reciprocity (0.410) than the power network, which contained 676 ties with a density of 0.132 and reciprocity of 0.290. In-degree centralization was substantially higher in the power network (61.80%) than in the information network (47.60%), indicating greater concentration of influence. The principal governmental/regulatory actor had the highest power in-degree (0.817) and eigenvector centrality (0.918), while a major health tourism facilitator demonstrated the highest betweenness centrality (0.203), identifying it as the principal broker. Governmental organizations and major hospitals formed the structural core, whereas facilitators occupied key bridging positions between clinical, tourism, and supporting sectors. Tehran's health tourism network demonstrated a moderately integrated core-periphery structure in which information exchange was broader and more reciprocal than the distribution of power, while governmental organizations, major hospitals, and facilitators played distinct but complementary roles in governance, resource control, and interorganizational brokerage.

Keywords: Health Tourism, Social Network Analysis, Power Structure, Information Flow, Network Centrality, Stakeholder Network, Tehran

1. Introduction

Health tourism has become an increasingly important component of the contemporary tourism and healthcare economy, bringing together medical services, travel, hospitality, transportation, insurance, communication, and destination management within a highly interconnected service environment. Although people have historically traveled in search of healing resources and medical care, the current form of health tourism is distinguished by the internationalization of healthcare services, the development of specialized medical destinations, greater patient mobility, technological advancement, and the increasing integration of healthcare with tourism-related services. The historical development of health tourism demonstrates a gradual transition from travel motivated primarily by natural therapeutic resources, spas, and climatic advantages toward a multidimensional industry incorporating medical treatment, preventive care, rehabilitation, wellness, and specialized clinical services (Baysal & Çimen, 2023). In this contemporary context, health tourism is not simply a transaction between a patient and a medical institution; rather, it constitutes a coordinated system in which numerous actors must exchange information, resources, referrals, and services throughout the tourist-patient journey. Consequently, the competitiveness and sustainability of health tourism destinations increasingly depend on the quality of relationships among stakeholders and on the efficiency with which information circulates across organizational boundaries.

Health tourism has also evolved under conditions characterized by heightened competition, economic uncertainty, global health crises, digital transformation, and changing expectations among international patients. The experience of recent years, particularly following the coronavirus pandemic, has demonstrated that health tourism systems must be resilient, adaptive, and capable of reorganizing service delivery in response to disruptions. Studies of the development of health tourism in challenging environments have emphasized the importance of institutional adaptability, destination-level coordination, and the capacity to maintain service continuity under changing external conditions (Dryglas & Smith, 2025). At the same time, service innovation has become a fundamental requirement for health tourism organizations seeking to respond to changing patient expectations and post-pandemic market conditions. Evidence from the health tourism industry suggests that innovation in service design,

organizational processes, communication, and interorganizational coordination can substantially strengthen the ability of destinations and providers to respond to emerging challenges (Bastani et al., 2025). These developments highlight the importance of analyzing health tourism not only through conventional indicators such as service quality, destination attractiveness, or patient satisfaction, but also as a dynamic relational system in which actors depend on one another for access to information, resources, legitimacy, and customers.

A distinctive characteristic of health tourism is the heterogeneity of the actors participating in its value chain. Hospitals and specialized medical centers provide diagnostic and therapeutic services, physicians supply professional expertise, health tourism facilitators connect patients with providers, travel agencies organize movement, hotels and accommodation providers support the patient's stay, insurance organizations address financial and risk-related issues, and governmental institutions influence licensing, regulation, destination promotion, and policy development. The internal management of health tourism within healthcare organizations is itself a complex leadership issue requiring coordination between clinical and non-clinical units and alignment between patient care, administrative procedures, international communication, and organizational strategy (Abela, 2023). In addition, specialized services such as nutrition and dietetics may form part of the broader treatment and recovery experience of international patients, illustrating the extent to which health tourism depends on an interconnected portfolio of professional services rather than isolated medical procedures (Kaya, 2023). This plurality of actors means that the performance of the system depends not merely on the capacity of individual organizations but also on how effectively relationships among them are structured.

The importance of coordination becomes especially evident when considering the movement of information through the health tourism system. International patients typically require information regarding physicians, hospitals, treatment quality, prices, waiting times, legal procedures, travel requirements, accommodation, post-treatment care, insurance, and destination characteristics before making a final decision. This information is rarely controlled by a single organization. Instead, it is distributed among multiple stakeholders and must be transmitted accurately and promptly across institutional boundaries. The quality of this information exchange can influence patient trust, perceived risk, service accessibility, continuity of care,

and the overall attractiveness of the destination. Developments in digital innovation have further transformed the mechanisms through which health tourism information is produced, processed, and disseminated. Digital platforms, artificial intelligence, customer relationship management systems, virtual communication, and data-driven marketing have created new opportunities for linking patients with service providers and improving the responsiveness of health tourism organizations (Emami et al., 2025). Digital and strategic innovation has similarly been emphasized as a major mechanism through which health tourism destinations can integrate resources, improve service coordination, and enhance competitiveness (Mochlasin et al., 2024; Spoladore et al., 2023).

Technology therefore affects not only marketing communication but also the architecture of relationships among stakeholders. Next-generation technologies can reshape patient interaction, service personalization, medical consultation, data exchange, organizational integration, and destination management (Baran & Karaca, 2023). Likewise, internet-based systems increasingly influence the development, distribution, and evaluation of health tourism products by facilitating information accessibility and allowing providers to identify and respond to tourists' preferences more systematically (Tang, 2022). In this environment, access to information becomes a source of strategic advantage. Organizations occupying central positions in information networks may gain greater visibility, become preferred referral points, influence the movement of patients, and obtain privileged access to market knowledge. Conversely, organizations positioned at the periphery may depend on intermediaries to obtain critical information or gain access to patients and decision-making centers. Therefore, the distribution of information is closely related to the distribution of power within the network.

Power in a health tourism network can originate from multiple sources. Governmental institutions may possess regulatory authority; hospitals may control specialized clinical resources and treatment capacity; physicians may possess professional prestige and scarce expertise; facilitators may control patient referrals and relationships with foreign markets; insurance organizations may influence financial access; and travel-related organizations may control logistical pathways. An organization's formal status, however, does not necessarily correspond to its actual structural influence within the network. Some actors may be powerful because many others depend on them, whereas others may become influential because they connect

otherwise disconnected stakeholder groups. This distinction is essential because brokerage, mediation, and control over communication pathways can generate network power even in the absence of formal hierarchical authority. Accordingly, an adequate analysis of health tourism governance requires attention to both formal institutional roles and actual relational positions.

Marketing research in health tourism has further reinforced the importance of relationships and interorganizational coordination. Health tourism marketing is substantially more complex than conventional destination promotion because medical tourists evaluate both clinical and tourism-related dimensions simultaneously. Factors such as professional competence, treatment cost, institutional credibility, destination image, accessibility, communication quality, supporting services, and trust can all influence destination selection. Research examining health tourism marketing in Tehran has shown that successful development requires a coordinated marketing framework that links organizational capabilities, environmental conditions, communication mechanisms, customer relationships, and destination-level strategies (Bagheri, Roustae, Forouzandeh, et al., 2023). A related grounded theory investigation of health tourism development in Tehran similarly emphasized the need for an integrated model in which multiple actors and contextual factors jointly shape the effectiveness of marketing and development activities (Bagheri, Roustae, Forouzandeh, et al., 2023). These findings imply that fragmented organizational behavior is unlikely to produce optimal destination outcomes when the tourist experience itself is generated through interactions among numerous stakeholders.

Studies focusing specifically on Tehran have identified a range of factors affecting health tourism marketing, including service characteristics, competitive advantages, communication, destination conditions, pricing, organizational capabilities, and institutional support (Saberi et al., 2023). Sustainable health tourism development in Tehran has likewise been associated with multiple interdependent economic, social, environmental, managerial, and infrastructural components, suggesting that long-term development cannot be understood through isolated organizational variables (Zarei, 2023). Supply-chain resilience represents another important dimension. The health tourism supply chain includes organizations that collectively contribute to patient acquisition, travel arrangements, service delivery, treatment, accommodation, follow-up, and return travel. Research conducted in Tehran

Province has demonstrated the importance of resilience within this service supply chain and the need for greater adaptability and coordination among organizations involved in health tourism (Marvi, 2023). From a network perspective, these issues are directly related to the number, strength, direction, and redundancy of connections among stakeholders. A highly centralized network may allow rapid coordination through powerful hubs but may simultaneously become vulnerable to disruption if central nodes fail, whereas a more distributed network may be resilient but potentially less coordinated.

Destination branding and image formation also depend substantially on networked interactions. Health tourists frequently make decisions in contexts characterized by uncertainty and information asymmetry because they may have limited direct knowledge of foreign healthcare systems. Destination image and brand credibility therefore become important mechanisms for reducing perceived risk and distinguishing one health tourism destination from another (Küçükambak, 2023). Yet the health tourism brand is rarely created by a single institution. Patients experience the destination through interactions with hospitals, physicians, facilitators, hotels, transportation companies, and public institutions. Inconsistency among these actors can weaken the overall image, while coordinated communication can strengthen trust and destination reputation. Thus, branding itself may be interpreted as a network outcome emerging from the collective behavior and communication of multiple stakeholders.

The development of health tourism also depends on local contextual conditions. Research in Iran has shown that local drivers such as natural and cultural resources, community capacities, organizational support, infrastructure, governance, and stakeholder participation can influence the development of community-based health tourism (Khazaei-Pool et al., 2024). Studies examining health tourism development more broadly have similarly indicated that economic conditions, infrastructure, service quality, policy support, human resources, marketing, and community-related factors influence the capacity of destinations to attract and retain health tourists (Rezapour et al., 2022). These findings reinforce the idea that health tourism operates as an ecosystem rather than as a collection of independent providers. When stakeholders are embedded within a common service system, their actions generate interdependencies, and the effectiveness of one actor may be conditioned by the behavior and resources of others.

Within Iran, policy and governance have been repeatedly identified as key determinants of health tourism development. Effective health tourism development requires coherent regulations, appropriate institutional responsibilities, investment in infrastructure, quality assurance, integration of tourism and healthcare policy, and the facilitation of international patient access. Recent research examining factors and policies influencing the development of health tourism in Iran has emphasized the importance of coordinated policymaking and the creation of supportive institutional conditions (Hosseiny et al., 2024). This is especially important because fragmented governance can create duplicated responsibilities, administrative delays, contradictory regulations, and uncertainty regarding the authority of different organizations. From a social network perspective, such governance problems can manifest as weak ties between institutions, excessive dependence on particular intermediaries, or highly centralized patterns of information and decision-making.

Marketing-oriented research in Iranian health destinations provides additional evidence of the need for integrated stakeholder relationships. Studies concerning health tourism in health villages have identified combinations of service quality, destination resources, promotion, institutional support, infrastructure, and market-oriented strategies as central to tourist attraction (Zekavati et al., 2023). More recent work has similarly proposed qualitative marketing models in which destination characteristics, stakeholder capabilities, environmental conditions, and strategic marketing mechanisms interact to influence tourist attraction (Zakavati et al., 2024). Research examining the development of health tourism in destinations such as Dehloran has also identified and prioritized a broad range of contextual, infrastructural, managerial, promotional, and service-related factors (Mohammadi & Ghaffarian, 2024). Although such studies substantially contribute to understanding which factors are important, factor-based models generally reveal less about the actual relational architecture connecting the organizations responsible for implementing these factors.

This distinction is methodologically important. Traditional surveys generally treat organizations or individuals as independent units of analysis and examine relationships among variables measured at the actor level. However, many of the most critical characteristics of health tourism are inherently relational. Referral, communication, information exchange, influence, coordination, collaboration, dependency, and brokerage cannot be fully

understood by examining actors in isolation. Social Network Analysis provides an appropriate framework for examining these phenomena because it focuses directly on the configuration of ties among actors. Rather than asking only which organizations are important, SNA makes it possible to determine why they are important structurally, which actors occupy central or peripheral positions, which organizations act as bridges, how concentrated the network is, and whether information and power are distributed symmetrically or unevenly.

Such an approach is particularly relevant in Tehran because the city constitutes a major center of specialized healthcare services, medical expertise, educational healthcare facilities, tourism-related businesses, and administrative institutions. Educational and marketing capacities within Tehran's health sector have themselves become a subject of investigation, including research emphasizing the development of e-learning models for health tourism marketing in the city's educational healthcare centers (Heidari et al., 2024). These developments indicate an increasingly information-intensive environment in which organizational learning and digital communication play important roles. At the same time, the size and complexity of Tehran's health tourism ecosystem can produce coordination challenges, especially when hospitals, facilitators, governmental agencies, travel businesses, and supporting service providers pursue different institutional objectives.

The increasing emphasis on service innovation, digitalization, marketing, destination branding, resilience, and policy integration suggests that information exchange has become one of the principal resources of the contemporary health tourism system. However, information is not distributed uniformly. Actors with numerous incoming ties may become recognized reference points, those with extensive outgoing ties may function as major disseminators, and organizations located between otherwise weakly connected groups may exercise substantial brokerage power. Network positions can therefore affect the capacity of actors to influence referral pathways, coordinate service delivery, obtain market intelligence, and participate in strategic decision-making. This relational conception of power is especially important in contexts where formal organizational responsibilities do not necessarily reflect the actual mechanisms through which coordination occurs.

Despite the expansion of Iranian research on health tourism marketing, sustainability, policy, development factors, service innovation, digitalization, community-based

tourism, and supply-chain resilience, comparatively limited attention has been given to the structural configuration of relationships among health tourism stakeholders. Existing studies have provided valuable evidence about the factors required for successful health tourism development, but they have generally not mapped how influence and information are actually distributed among participating organizations. Consequently, important questions remain regarding whether Tehran's health tourism system is centralized around a small group of institutional actors, whether facilitators function as critical brokers, whether governmental organizations simultaneously occupy informational and power centers, whether peripheral service providers have direct access to central actors, and whether the structure of information exchange corresponds to the structure of perceived power. Addressing these questions is essential because policy recommendations based exclusively on organizational characteristics may overlook relational bottlenecks and dependencies that influence system-level performance.

A network perspective also offers practical advantages for the governance of health tourism. Identifying central actors can help policymakers determine which organizations are capable of accelerating information diffusion and coordinating collaborative initiatives. Detecting high-betweenness actors can reveal brokers whose removal or dysfunction could fragment the system. Measuring density and reciprocity can indicate whether communication is sufficiently integrated and mutually reinforcing. Assessing centralization can reveal whether the network is excessively dependent on a limited number of institutions. Similarly, comparing information and power networks can distinguish organizations that are formally influential from those that exercise practical control through brokerage or communication. Such evidence can support the design of more resilient governance mechanisms, improve stakeholder coordination, reduce information bottlenecks, and facilitate more equitable participation across the health tourism ecosystem.

Furthermore, the strategic development of health tourism increasingly requires the integration of technological, managerial, and relational capabilities. Artificial intelligence-based customer relationship management, digital marketing tools, innovative healthcare services, e-learning, and next-generation technologies can improve performance only when organizations are sufficiently connected to exchange and utilize information effectively (Baran & Karaca, 2023; Bastani et al., 2025; Emami et al.,

2025). Likewise, destination development strategies and health tourism marketing models are unlikely to achieve their intended outcomes when stakeholders remain structurally disconnected or when essential information is concentrated within inaccessible institutional silos (Bagheri, Roustae, Forouzandeh, et al., 2023; Bagheri, Roustae, Forouzandeh, et al., 2023). The study of network structure therefore complements existing research by shifting attention from what factors should exist in a successful health tourism destination to how the organizations responsible for those factors are actually connected.

Accordingly, the aim of this study was to analyze the structure of power and the patterns of information flow among stakeholders in Tehran's health tourism network using Social Network Analysis (SNA).

2. Methods and Materials

This study employed a quantitative, applied, cross-sectional research design based on Social Network Analysis (SNA) to investigate the structure of power and patterns of information flow within the health tourism network in Tehran, Iran. Social Network Analysis was selected because the primary unit of analysis was not merely the individual characteristics of stakeholders but the relational structure connecting organizations and actors involved in the provision, coordination, regulation, and facilitation of health tourism services. Accordingly, the study focused on identifying the position of actors within the network, the concentration or dispersion of power, the extent of dependence among stakeholders, the pathways through which information circulated, and the extent to which particular actors functioned as influential, intermediary, or structurally critical nodes. The study population consisted of organizations and key institutional actors actively involved in Tehran's health tourism sector, including hospitals and specialized medical centers providing services to international patients, International Patient Departments, medical tourism agencies and facilitators, travel agencies involved in medical travel, physicians and specialized clinical service providers, hotels and accommodation providers working with international patients, insurance-related organizations, governmental and regulatory institutions, tourism organizations, and other organizations directly involved in coordinating health tourism services.

A total of 72 organizational actors were included in the final network. Because network-based research requires comprehensive identification of relevant actors and accurate

specification of relationships among them, participants were selected through purposive and network-based sampling rather than conventional probability sampling. The initial list of actors was developed through a review of the institutional structure of health tourism in Tehran, consultation with experts familiar with medical tourism activities, and identification of organizations formally or operationally involved in serving international patients. Subsequently, a snowball procedure was used to identify additional stakeholders that had substantial communication, referral, coordination, regulatory, or information-exchange relationships with the initially identified organizations. Inclusion criteria consisted of direct involvement in health tourism activities in Tehran, at least one year of organizational or professional experience related to international patients or medical tourism, sufficient familiarity with interorganizational relationships in the health tourism sector, and willingness to participate in the study. For organizational actors, the questionnaire was completed by an informed representative, such as a manager, International Patient Department director, health tourism officer, senior expert, agency manager, or another individual with adequate knowledge of the organization's relationships with other network members. Actors whose activities were unrelated to health tourism, those without identifiable relationships with other members of the network, and organizations whose representatives were unable to provide reliable relational information were excluded. Data collection continued until the network boundary was considered sufficiently saturated and no additional actor with a substantial role in the Tehran health tourism network was identified. The final network therefore comprised 72 nodes, each representing an organizational actor participating in the health tourism ecosystem of Tehran.

Data were collected using a structured Social Network Analysis questionnaire specifically developed to measure interorganizational power relationships and information flows among stakeholders in the health tourism network. The questionnaire consisted of three main components. The first component collected background information concerning each actor, including organizational type, principal area of activity, duration of involvement in health tourism, organizational role in serving international patients, and the respondent's position within the organization. These characteristics were used to describe the composition of the network and to interpret differences in structural positions among various categories of stakeholders. The second component measured information relationships among

network members. Respondents were provided with a roster of identified health tourism actors and were asked to indicate the organizations with which their organization exchanged information relevant to health tourism activities. Information exchange included the transmission or receipt of information concerning international patients, treatment services, patient referrals, medical documentation, travel arrangements, accommodation, pricing, regulations, administrative procedures, visas, insurance, service availability, and coordination of treatment-related activities. For each possible relationship, respondents indicated whether a meaningful information-exchange tie existed between their organization and the other actor. The direction of information flow was also recorded so that outgoing and incoming information relationships could be distinguished. This procedure generated a directed adjacency matrix in which rows represented information-sending actors and columns represented information-receiving actors.

The third component of the instrument was designed to assess relational power and dependence within the network. Power was conceptualized structurally as the ability of an actor to influence decisions, control access to strategically important resources or information, coordinate the activities of other organizations, act as an indispensable intermediary, or occupy a position upon which other network members depended. Respondents were therefore asked to identify actors that played an influential role in decision-making, referrals, coordination, access to international patients, provision of specialized services, regulatory approval, or the distribution of critical information. These relational responses were converted into a separate actor-by-actor matrix reflecting perceived influence and dependency relationships. The questionnaire was reviewed by experts in health tourism, tourism management, healthcare administration, and Social Network Analysis to evaluate the relevance, comprehensiveness, clarity, and appropriateness of the network questions. Revisions were made to remove ambiguity and ensure that all relevant forms of interorganizational communication and influence were adequately represented. Prior to the main data collection, the instrument was administered on a limited pilot basis to several individuals familiar with the health tourism sector to assess the comprehensibility of actor definitions, relationship criteria, and response procedures. Because the principal measures were relational rather than conventional multi-item psychological constructs, reliability assessment focused primarily on the consistency of network nominations and verification of reported relationships rather

than internal consistency coefficients. Where possible, reported ties were cross-checked using reciprocal nominations from other actors, and discrepancies were reviewed to improve the accuracy of the final network matrices.

Data were collected through direct contact with organizational representatives. Respondents were first informed about the objectives of the study and were provided with a clear definition of each type of relationship before completing the network questionnaire. Particular emphasis was placed on distinguishing routine or superficial contact from meaningful organizational relationships relevant to health tourism. Respondents were asked to report relationships on behalf of their organization rather than their personal professional relationships. To minimize missing data, questionnaires were reviewed after completion, and incomplete relational sections were followed up when necessary. Actor names were coded before analysis, and organizational identities were treated confidentially in the reporting of research findings. The finalized datasets consisted of square 72×72 adjacency matrices representing the presence and direction of information-exchange and power-related relationships among the 72 actors.

Data analysis was conducted using Social Network Analysis techniques at both the whole-network and actor levels. After coding and data cleaning, the relational data were transformed into adjacency matrices in which each row and column represented one of the 72 organizational actors. Directed matrices were used because the existence of a relationship from actor A to actor B did not necessarily imply the presence of an equivalent relationship from actor B to actor A. Separate matrices were constructed for information flow and power-related relationships to allow comparison between communication structure and structural influence. The matrices were initially examined for missing values, isolated nodes, duplicate actors, inconsistencies in actor identification, and logically incompatible nominations. Network visualization and quantitative network indicators were then used to evaluate the overall structure of relationships and determine the positions occupied by different actors.

At the whole-network level, network size, number of ties, density, reciprocity, average degree, network centralization, connectedness, and component structure were calculated. Network density was used to determine the proportion of observed relationships relative to all theoretically possible relationships and therefore provided an indication of the overall level of interaction among health tourism

stakeholders. Reciprocity was examined to determine the extent to which information exchange was mutual rather than unilateral. Network centralization was calculated to assess whether relationships and influence were concentrated around a small number of dominant actors or distributed more evenly across the network. Components and isolates were examined to identify actors or subgroups that were weakly connected to the broader health tourism system. Geodesic distances and average path length were also considered in interpreting the efficiency with which information could move across the network. These indicators collectively provided evidence regarding the degree of integration, fragmentation, concentration, and accessibility within Tehran's health tourism network.

At the actor level, degree centrality, in-degree centrality, out-degree centrality, betweenness centrality, closeness centrality, and eigenvector centrality were calculated. In-degree centrality was used to identify actors receiving information or influence nominations from a large number of other network members and was interpreted as an indicator of prominence, attractiveness, or recognized importance within the network. Out-degree centrality reflected the extent to which an actor actively communicated with, influenced, referred to, or established relationships with other stakeholders. Betweenness centrality was particularly important for identifying brokerage and gatekeeping positions because actors with high betweenness were located on a relatively large number of shortest paths connecting other actors and could therefore facilitate, mediate, or potentially restrict the flow of information between otherwise less directly connected sections of the network. Closeness centrality was examined to assess how rapidly an actor could potentially reach all other actors through direct and indirect network paths. Eigenvector centrality was used to identify actors whose importance was derived not only from the number of their connections but also from their relationships with other highly influential actors. The combination of these centrality measures was used to construct a multidimensional interpretation of structural power rather than equating power with a single network index.

The analysis of information flow focused on identifying major information sources, information recipients, intermediaries, communication bottlenecks, and potentially vulnerable pathways within the network. Actors with high out-degree in the information network were interpreted as major information disseminators, whereas actors with high in-degree were considered major recipients or reference

points for network information. High-betweenness actors were interpreted as information brokers connecting different stakeholder groups. The power network was analyzed in parallel to determine whether the actors occupying structurally influential positions were also those controlling or mediating information exchange. Comparison of centrality rankings across the two networks enabled the identification of actors possessing both informational and structural power, actors with formal influence but limited communication reach, and actors that were not necessarily institutionally dominant but nevertheless occupied strategically important brokerage positions.

Network graphs were generated using force-directed layouts in which nodes represented organizational actors and ties represented reported relationships. Node size was adjusted according to relevant centrality scores to facilitate interpretation of differences in structural prominence, while the direction of ties was preserved to illustrate the movement of information or influence. Organizational categories were distinguished during network interpretation to examine whether hospitals, health tourism facilitators, governmental institutions, travel-related organizations, or other stakeholder groups occupied systematically different network positions. Where appropriate, subgroup and community structures were examined to identify clusters of actors with relatively dense internal relationships and weaker connections with the remainder of the network. Brokerage patterns and structural gaps were also evaluated to identify organizations serving as bridges between institutional clusters.

The final interpretation integrated whole-network indicators, actor-level centrality measures, visual network patterns, and the comparison between power and information-flow matrices. Particular attention was given to identifying whether the health tourism network exhibited a centralized or decentralized power structure, whether information was distributed efficiently across stakeholder groups, whether dependence on a small number of actors created potential bottlenecks, and which organizations occupied strategic positions capable of coordinating or controlling network interactions. Statistical and network analyses were conducted using UCINET software, while network visualization was performed using NetDraw. Descriptive analyses of actor characteristics and supporting data preparation were conducted using IBM SPSS Statistics. The interpretation of results was based on the structural meaning of the network indices and their relative distribution across actors rather than relying exclusively on conventional

significance testing, because the primary objective of the study was to map and explain the relational architecture of the complete identified health tourism network.

3. Findings and Results

A total of 72 representatives of organizations and institutions active in the health tourism network of Tehran participated in the study and provided complete relational data. Of the 72 respondents, 45 (62.50%) were men and 27 (37.50%) were women. Their mean age was 42.61 years ($SD = 7.84$), with ages ranging from 29 to 61 years. The participants had an average of 11.47 years ($SD = 5.76$) of general professional experience and 6.83 years ($SD = 3.91$) of direct experience in health tourism or the provision of services to international patients. Regarding organizational position, 21 participants (29.17%) were senior managers or executive administrators, 15 (20.83%) were directors or managers of International Patient Departments, 20 (27.78%) were senior experts or health tourism coordinators, 10

(13.89%) were owners or managers of health tourism or travel agencies, and 6 (8.33%) were governmental or regulatory officers. In terms of organizational affiliation, the network consisted of 18 hospitals and specialized medical centers (25.00%), 14 health tourism facilitation agencies (19.44%), 10 physicians or specialized clinical service providers (13.89%), 9 travel agencies involved in medical travel (12.50%), 7 governmental or regulatory organizations (9.72%), 6 hotels or accommodation providers (8.33%), 4 insurance-related organizations (5.56%), and 4 organizations providing complementary services such as transportation, visa assistance, interpretation, or logistical support (5.56%). All 72 identified actors provided usable information regarding their network relationships; consequently, the final analytical matrices contained 72 rows and 72 columns and no actor was excluded because of incomplete organizational identification. The resulting dataset therefore provided a comprehensive representation of the principal relational structure identified within the health tourism ecosystem under investigation.

Table 1

Overall Structural Characteristics of the Information-Flow and Power Networks

Network indicator	Information-flow network	Power network
Number of nodes	72	72
Number of directed ties	1,094	676
Network density	0.214	0.132
Mean out-degree	15.19	9.39
Reciprocity	0.410	0.290
Average geodesic distance	2.34	2.71
Network diameter	5	6
Number of weak components	1	1
Number of strong components	3	7
Number of isolates	0	2
In-degree centralization	47.60%	61.80%
Out-degree centralization	42.90%	46.30%
Betweenness centralization	35.70%	39.60%

As shown in Table 1, the information-flow network contained 1,094 directed relationships among the 72 actors, corresponding to a network density of 0.214. This finding indicates that 21.40% of all theoretically possible directed information relationships among the participating organizations were actually present. The average out-degree of 15.19 further indicates that, on average, each actor transmitted information to approximately 15 other actors in the network. In comparison, the power network contained only 676 directed relationships and had a substantially lower

density of 0.132, with an average out-degree of 9.39. Thus, relationships involving the exchange of operational or strategic information were considerably more widespread than relationships involving perceived influence, dependency, or control. The difference between the two networks was also evident in their levels of reciprocity. Reciprocity in the information-flow network was 0.410, indicating that approximately 41% of directed information relationships were reciprocated. In contrast, reciprocity in the power network was only 0.290, suggesting that power

and dependency relationships were more frequently asymmetric. This pattern is consistent with the hierarchical nature of influence, because actors identified as important sources of regulation, patient access, specialized medical services, or coordination were not necessarily dependent on the actors that nominated them as influential.

The information-flow network also displayed a shorter average geodesic distance of 2.34 compared with 2.71 in the power network, demonstrating that information could generally pass between two network actors through slightly more than two intermediary steps. The information network diameter was five, whereas the longest shortest path in the power network consisted of six steps. Both networks constituted a single weakly connected component, meaning that all actors were connected to the broader system when tie direction was disregarded. Nevertheless, the information-flow network contained three strongly connected components, whereas seven were observed in the power network, suggesting greater fragmentation when the direction of influence and dependency was taken into

consideration. No actor was completely isolated from the information network; however, two actors occupied isolated positions within the power network, indicating participation in information exchange without a clearly recognized role in the distribution of influence. Particularly important was the difference in in-degree centralization. The power network demonstrated an in-degree centralization of 61.80%, considerably higher than the 47.60% observed in the information network. Therefore, although information exchange was relatively dispersed across different stakeholders, perceived power was concentrated around a smaller number of actors. Betweenness centralization was also higher in the power network (39.60%) than in the information network (35.70%), suggesting that a limited group of actors played a disproportionate role in connecting otherwise weakly linked sections of the system. Overall, Table 1 demonstrates that the health tourism network was structurally connected but moderately centralized, with power being considerably more concentrated than routine information exchange.

Table 2

Centrality Measures of the Ten Most Structurally Important Actors in the Information-Flow Network

Actor code and organizational role	In-degree centrality	Out-degree centrality	Betweenness centrality	Closeness centrality	Eigenvector centrality
G1 – Principal governmental/regulatory organization	0.761	0.648	0.173	0.612	0.842
H1 – Major tertiary hospital	0.704	0.620	0.151	0.598	0.794
F1 – Major health tourism facilitator	0.620	0.676	0.198	0.621	0.731
H2 – Specialized international-patient hospital	0.662	0.577	0.127	0.583	0.748
G2 – Tourism/health policy organization	0.606	0.563	0.114	0.571	0.692
F2 – Health tourism facilitation agency	0.535	0.606	0.161	0.592	0.658
H3 – Specialized medical center	0.577	0.521	0.093	0.554	0.641
T1 – Medical travel agency	0.465	0.549	0.106	0.561	0.533
I1 – Insurance-related organization	0.493	0.437	0.082	0.526	0.557
C1 – Specialized clinical provider	0.451	0.479	0.074	0.539	0.506

Table 2 presents the actors occupying the most prominent structural positions in the information-flow network. The principal governmental or regulatory organization, coded G1, had the highest normalized in-degree centrality (0.761), indicating that it received health-tourism-related information from a larger proportion of network members than any other actor. Its high eigenvector centrality of 0.842 further demonstrated that G1 was not merely connected to numerous actors but was linked to other highly connected and influential organizations. This position established G1 as an important informational reference point in the network. The

major tertiary hospital, H1, also occupied a highly central position, with an in-degree centrality of 0.704, out-degree centrality of 0.620, and eigenvector centrality of 0.794. These values indicate that H1 functioned simultaneously as a major recipient and distributor of information and was embedded within the core of the network rather than operating as a peripheral clinical service provider. The specialized international-patient hospital H2 displayed a similar, although slightly weaker, pattern, confirming the centrality of hospitals with substantial International Patient

Department activities in the communication architecture of the network.

The most distinctive brokerage position belonged to the health tourism facilitator F1. Although its in-degree centrality of 0.620 was lower than that of G1 and H1, F1 had the highest out-degree centrality (0.676), the highest normalized betweenness centrality (0.198), and the highest closeness centrality (0.621) among the ten leading actors. This combination indicates that F1 was particularly important for the active dissemination and mediation of information. Its high betweenness score demonstrates that many shortest communication pathways between otherwise less directly connected actors passed through this organization. Therefore, F1 functioned as an informational broker connecting clinical institutions, travel-related organizations, international patients' service intermediaries, and other supporting actors. The second health tourism facilitator, F2, displayed a similar pattern, with relatively high out-degree (0.606) and betweenness centrality (0.161). These results demonstrate that facilitation agencies derived their structural importance less from formal authority and more from their capacity to bridge organizational boundaries.

A comparison of the five centrality indicators also reveals distinct forms of informational prominence. Governmental

organizations and hospitals generally achieved higher in-degree and eigenvector scores, demonstrating their status as recognized informational reference points and core institutions. By contrast, facilitation agencies and medical travel organizations tended to have relatively stronger out-degree and betweenness positions, indicating their role in transmitting information between sectors. The presence of T1, a medical travel agency, among the ten most central actors, with an out-degree centrality of 0.549 and betweenness centrality of 0.106, further demonstrates that non-clinical actors contributed materially to information circulation. The insurance organization I1 also occupied a meaningful intermediary position, particularly because of its relationships with clinical and administrative actors. Taken together, these results indicate that the information network did not have a single dominant hub. Instead, a small core comprising governmental organizations, major hospitals, health tourism facilitators, and selected travel and insurance actors collectively sustained the circulation of information. Nevertheless, the comparatively high betweenness values observed for F1 and F2 reveal a potential structural vulnerability: interruption of communication through these brokers could disproportionately reduce communication efficiency between some institutional clusters.

Table 3

Centrality Measures of the Ten Most Structurally Powerful Actors in the Power Network

Actor code and organizational role	In-degree centrality	Out-degree centrality	Betweenness centrality	Closeness centrality	Eigenvector centrality
G1 – Principal governmental/regulatory organization	0.817	0.493	0.184	0.594	0.918
H1 – Major tertiary hospital	0.746	0.451	0.148	0.571	0.842
G2 – Tourism/health policy organization	0.690	0.465	0.141	0.566	0.806
H2 – Specialized international-patient hospital	0.662	0.394	0.112	0.548	0.751
F1 – Major health tourism facilitator	0.606	0.535	0.203	0.585	0.714
H3 – Specialized medical center	0.563	0.366	0.091	0.527	0.662
G3 – Governmental administrative organization	0.549	0.408	0.096	0.532	0.641
F2 – Health tourism facilitation agency	0.493	0.507	0.172	0.557	0.587
I1 – Insurance-related organization	0.451	0.324	0.073	0.501	0.536
C1 – Specialized clinical provider	0.408	0.352	0.067	0.493	0.481

The distribution of centrality measures in Table 3 demonstrates a substantially more hierarchical structure for power than for information exchange. G1 emerged as the most powerful actor according to both in-degree centrality (0.817) and eigenvector centrality (0.918). The very high in-

degree score indicates that a large proportion of other network members recognized or depended upon G1 in relation to regulatory decisions, administrative coordination, access to institutional resources, approval procedures, or other strategically important functions. Its eigenvector score

further indicates that these nominations originated from actors that themselves occupied important positions in the power network. G1 can therefore be considered the principal structural center of institutional power in the health tourism network. H1 ranked second, with an in-degree centrality of 0.746 and eigenvector centrality of 0.842. The strong position of H1 indicates that major tertiary hospitals possessed substantial power because of their control over specialized clinical expertise, treatment capacity, international-patient infrastructure, physician networks, diagnostic and therapeutic resources, and the actual delivery of medical services for which international patients entered the network.

Governmental and policy-related organizations were especially prominent within the power network. G2 achieved an in-degree centrality of 0.690 and eigenvector centrality of 0.806, while G3 also appeared among the ten most structurally powerful actors. This concentration is consistent with the whole-network centralization results presented in Table 1 and indicates that formal institutional authority remained an important basis of power. However, the power network was not entirely determined by formal administrative status. F1 had the highest betweenness centrality of all actors (0.203) despite ranking below G1, H1, G2, and H2 on in-degree centrality. F1 therefore possessed a different form of structural power. Rather than deriving primarily from formal authority, its influence resulted from brokerage and control over connections between actors. Because F1 occupied numerous shortest pathways linking clinical, travel, accommodation, administrative, and patient-related stakeholders, it had considerable capacity to facilitate, redirect, accelerate, or constrain interactions between different sectors.

The same pattern was observable for F2, which had an in-degree centrality of 0.493 but an out-degree centrality of 0.507 and betweenness centrality of 0.172. Accordingly,

facilitation agencies could exercise substantial network influence even when they were not regarded as the most formally authoritative stakeholders. This distinction between positional authority and brokerage power is one of the principal findings of the study. Governmental organizations and major hospitals predominantly occupied high-status core positions based on incoming nominations and connections to other powerful actors, whereas facilitators occupied strategic bridging positions. In addition, the lower out-degree scores observed for some high-in-degree actors demonstrate an asymmetry in dependency: organizations frequently depended on or recognized certain institutional actors without those central actors exhibiting a comparable level of dependence on the remainder of the network. This structural asymmetry is also consistent with the lower reciprocity of the power network reported in Table 1.

Comparison of Tables 2 and 3 further reveals considerable but incomplete overlap between information centrality and power centrality. G1 and H1 occupied highly central positions in both networks, demonstrating that their power was accompanied by extensive informational embeddedness. In contrast, F1 was particularly prominent as an information broker and power intermediary without surpassing governmental organizations in formal structural prominence. This distinction indicates that power within the Tehran health tourism network was multidimensional. Some actors possessed institutional or resource-based power, reflected in high in-degree and eigenvector centrality, whereas others possessed brokerage power, reflected primarily in betweenness centrality and their capacity to connect otherwise separated stakeholder groups. Consequently, an analysis based exclusively on formal organizational authority would fail to identify several actors that were structurally indispensable to the functioning of the network.

Table 4

Sector-Level Distribution of Information and Power Centrality in the Health Tourism Network

Organizational sector	n	Mean information out-degree	Mean information betweenness	Mean power in-degree	Mean power eigenvector centrality
Governmental/regulatory organizations	7	19.43	0.089	0.654	0.611
Hospitals and specialized medical centers	18	17.94	0.074	0.531	0.504
Health tourism facilitation agencies	14	18.21	0.102	0.444	0.463
Physicians/specialized clinical providers	10	12.88	0.051	0.382	0.337

Medical travel agencies	9	12.00	0.043	0.267	0.251
Hotels/accommodation providers	6	10.50	0.031	0.214	0.196
Insurance-related organizations	4	11.50	0.049	0.355	0.323
Complementary/logistical service providers	4	8.50	0.022	0.183	0.164

The sector-level results shown in Table 4 provide additional evidence that information access and structural power were unevenly distributed across the different components of the health tourism system. Governmental and regulatory organizations demonstrated the highest mean information out-degree (19.43) among the institutional sectors, indicating extensive communication with other organizations. They also had the highest mean power in-degree (0.654) and mean power eigenvector centrality (0.611), clearly identifying them as the sector with the greatest concentration of formal and relational power. Hospitals and specialized medical centers occupied the second most influential sector-level position in terms of power, with a mean power in-degree of 0.531 and mean eigenvector centrality of 0.504. Their mean information out-degree of 17.94 further demonstrated that hospitals were deeply embedded in the communication structure. This combination of informational connectivity and power centrality confirms the dual role of hospitals as both providers of the principal health service and major institutional nodes within the wider tourism-health system.

Health tourism facilitation agencies demonstrated a distinct structural profile. Their mean information out-degree of 18.21 was close to that of governmental organizations and exceeded that of hospitals, whereas their mean information betweenness centrality of 0.102 was the highest of all sectors. Accordingly, facilitation agencies constituted the most important brokerage sector in the network. Their mean power in-degree of 0.444 was lower than that of governmental organizations and hospitals, but their comparatively strong eigenvector position indicates that they remained connected to powerful actors. This suggests that facilitation agencies occupied an intermediate layer between highly authoritative institutions and more peripheral service providers. Their network function was particularly important because they connected activities that would otherwise remain distributed across separate domains, including treatment selection, patient referral, travel planning, accommodation, interpretation, administrative

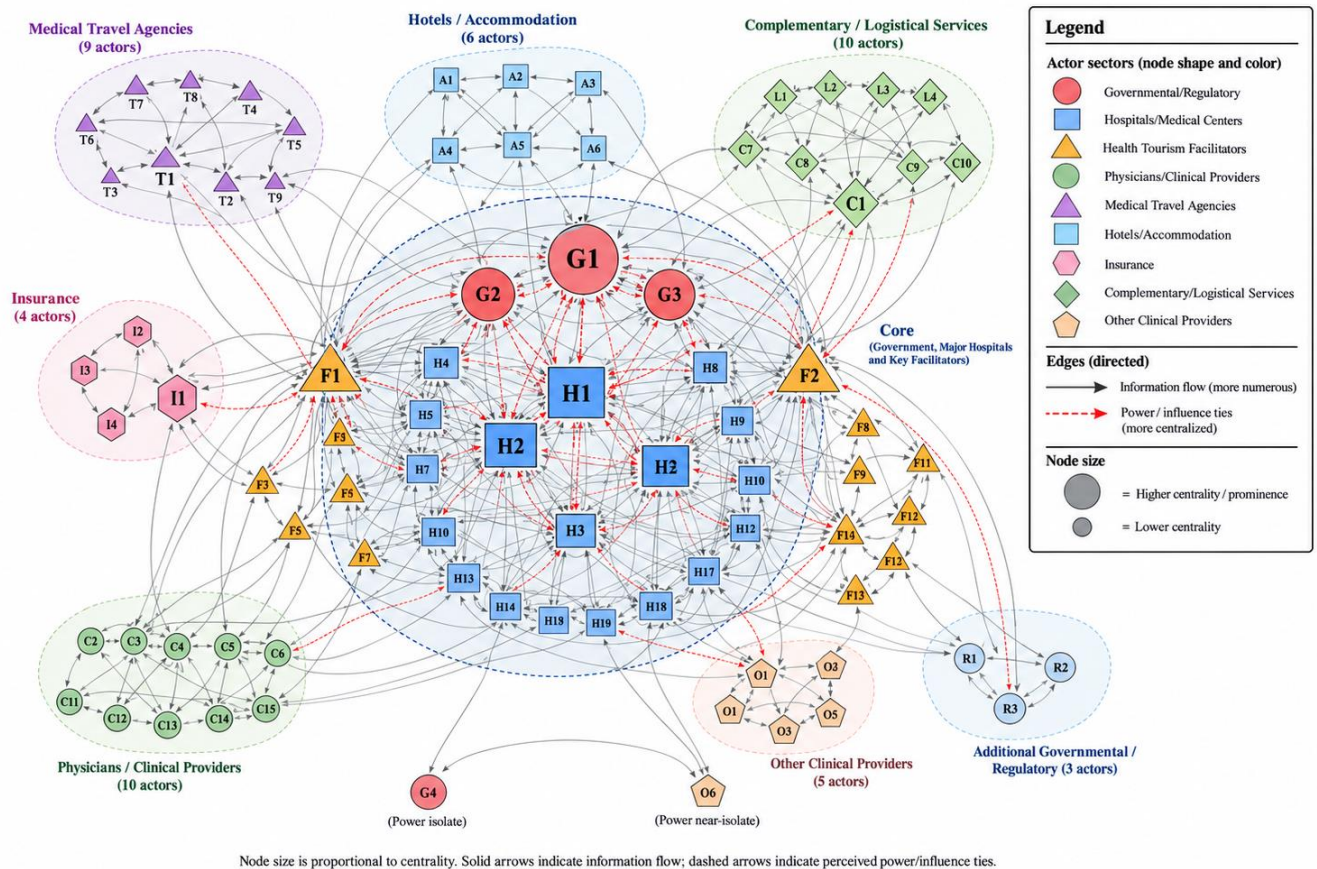
coordination, and communication between patients and healthcare institutions.

Physicians and specialized clinical providers occupied an intermediate position, with a mean power in-degree of 0.382 and mean information out-degree of 12.88. Although physicians represented the principal source of specialized medical expertise, their network-wide brokerage role was less prominent than that of hospitals and facilitation agencies. This suggests that specialized clinical providers were often embedded within referral and institutional pathways rather than functioning as system-level coordinators. Insurance organizations also occupied a moderate position, with a mean power in-degree of 0.355 and information betweenness of 0.049. Their influence was therefore narrower but potentially important in transactions involving financial coverage, authorization, reimbursement, or treatment arrangements.

Medical travel agencies, accommodation providers, and complementary service providers were comparatively peripheral. Medical travel agencies had a mean power in-degree of 0.267, while hotels and accommodation providers had a mean of 0.214. Complementary and logistical service providers exhibited the lowest values for information out-degree (8.50), information betweenness (0.022), power in-degree (0.183), and eigenvector centrality (0.164). These actors therefore participated in the network but had limited ability to shape its overall structure. The findings demonstrate a clear core–intermediate–periphery configuration. Governmental organizations and major hospitals formed the principal power core; health tourism facilitators constituted the principal brokerage layer; physicians, insurance organizations, and selected travel agencies occupied intermediate positions; and accommodation and complementary service providers were predominantly located toward the structural periphery. The existence of this differentiated configuration indicates that participation in the health tourism system did not automatically translate into equivalent access to information or decision-making influence.

Figure 1

Sociogram of Power Structure and Information Flow among the 72 Actors in the Tehran Health Tourism Network



The network visualization represented in Figure 1 further demonstrates the structural configuration identified by the quantitative network indicators. The sociogram revealed a relatively dense central core surrounded by actors with progressively fewer direct connections. Governmental and regulatory organizations, major tertiary hospitals, and several health tourism facilitation agencies were positioned close to the center of the network because of their high degree, eigenvector, closeness, and/or betweenness centrality. In particular, G1 and H1 were located within the central institutional core and maintained direct or short-path relationships with actors from several organizational sectors. F1 and F2 occupied bridging positions between this institutional core and clusters composed of travel agencies, accommodation providers, specialized clinical actors, and complementary service organizations. The graphical structure therefore supported the numerical finding that formal power and brokerage power were related but not identical dimensions of network position.

The distribution of ties in the sociogram also indicated that information did not flow exclusively through a single vertical hierarchy. Instead, several overlapping pathways

connected the principal sectors. Hospitals communicated directly with governmental actors, facilitators, physicians, insurance-related actors, and travel organizations, while facilitators established connections across nearly all stakeholder categories. Nevertheless, a substantial proportion of cross-sector pathways converged on a limited group of central actors. This configuration created an efficient communication structure in which most actors could reach each other through relatively short paths, but it simultaneously produced potential bottlenecks. If one or more high-betweenness actors were removed or became inactive, some peripheral actors would require longer pathways to reach the network core, and communication between specific institutional clusters could become more fragmented.

The peripheral zone of the sociogram consisted predominantly of smaller accommodation providers, complementary service organizations, selected travel agencies, and a limited number of specialized clinical actors. Although these actors had connections to the network and therefore were not generally isolated in terms of information flow, their relationships were frequently concentrated

around one or two intermediaries rather than distributed across multiple sectors. This pattern indicates a form of structural dependency in which peripheral stakeholders gain access to information and decision-making centers primarily through brokers. The two actors identified as isolates in the power matrix were nevertheless connected in the information network, confirming that operational participation does not necessarily imply recognized influence. In other words, an organization may receive or exchange information necessary for providing a service while having little ability to affect policy, resource allocation, referral patterns, or interorganizational decisions.

Considered collectively, the findings demonstrate that the Tehran health tourism network had a connected but unequal structural architecture. Information exchange was broader, denser, more reciprocal, and less centralized than the distribution of power. The power network, in contrast, was more hierarchical, less reciprocal, and more concentrated around governmental organizations, major hospitals, and a small number of structurally important intermediaries. Formal institutional actors derived power principally from regulatory authority, clinical resources, organizational legitimacy, and their connections to other central actors, whereas facilitation agencies derived a substantial part of their influence from brokerage between otherwise differentiated sectors. The coexistence of these two forms of power created a network in which no single organization controlled all interactions, but a relatively small core had a disproportionate capacity to shape access to resources, information, patients, and interorganizational coordination.

Another important finding was the distinction between informational prominence and decision-making power. While the most powerful actors were generally also well connected informationally, the reverse relationship was not always observed. Certain facilitators and travel-related organizations had extensive information networks and considerable brokerage centrality but lower power in-degree than governmental organizations and hospitals. This result demonstrates that an actor's visibility and communication activity cannot be interpreted automatically as institutional dominance. Conversely, high in-degree and eigenvector scores in the power network indicated that some actors were regarded as important even when they were not the most active information disseminators. Therefore, the relational structure of Tehran's health tourism sector appears to be based on an interaction between formal authority, control over specialized resources, access to international patients, and brokerage across organizational boundaries.

Finally, the combination of network density, centralization, reciprocity, centrality distributions, and the sociogram indicates that the network had both integrative strengths and structural vulnerabilities. Its principal strength was the absence of complete fragmentation in the information network and the relatively short average distance separating actors, which supported rapid diffusion of operational information. Its principal vulnerability was dependence on a limited number of central organizations and brokers. The relatively high centralization of the power network and the concentration of cross-sector communication around a small number of actors suggest that coordination efficiency was achieved partly through structural dependence. Consequently, the same actors that facilitated integration could also become bottlenecks when information was delayed, selectively transmitted, or interrupted. The overall findings therefore characterize Tehran's health tourism network as a moderately integrated, core-periphery system in which power is more concentrated than information, governmental organizations and major hospitals constitute the principal institutional core, and health tourism facilitators perform a critical bridging function between clinical, administrative, tourism, and supporting service sectors.

4. Discussion and Conclusion

The present study analyzed the structure of power and the pattern of information flow among 72 actors in Tehran's health tourism network using Social Network Analysis. The findings showed that the information-flow network was denser, more reciprocal, and less centralized than the power network, whereas power was concentrated around a smaller group of governmental organizations, major hospitals, and selected intermediary actors. The information network contained 1,094 directed ties with a density of 0.214, compared with 676 ties and a density of 0.132 in the power network. In addition, reciprocity was higher in the information network than in the power network, while in-degree and betweenness centralization were greater in the power network. These findings indicate that information circulates across a relatively broad set of organizational relationships, but the ability to influence decisions, control resources, shape referrals, and affect coordination is distributed less evenly. This pattern is consistent with the inherently multi-organizational nature of health tourism, in which operational communication must involve numerous actors while regulatory authority, clinical capacity, and

strategic resources remain concentrated within a smaller institutional core. Previous studies have emphasized that health tourism is built on complex interdependencies among healthcare providers, tourism organizations, facilitators, public institutions, and supporting services and therefore requires considerable coordination across organizational boundaries (Abela, 2023; Dryglas & Smith, 2025).

The greater density of the information network suggests that health tourism in Tehran operates through relatively extensive communication among stakeholders. This is plausible because the delivery of a complete health tourism service requires continuous exchange of information regarding treatment availability, patient documentation, referral procedures, travel arrangements, accommodation, cost, insurance, and administrative requirements. The current finding is aligned with research emphasizing the role of digital and strategic communication in contemporary health tourism. Digital technologies have increasingly become central to service coordination, patient communication, marketing, and customer relationship management, making information connectivity a core organizational capability (Emami et al., 2025; Spoladore et al., 2023). The expansion of digital tools and innovation practices can enhance communication among providers and improve the responsiveness of health tourism systems, while next-generation technologies can facilitate service integration and more personalized interaction with international patients (Baran & Karaca, 2023; Mochlasin et al., 2024). Thus, the relatively dense communication network observed in this study may reflect the operational necessity for stakeholders to remain connected in an increasingly information-intensive health tourism environment.

At the same time, the lower reciprocity and greater centralization of the power network demonstrate that influence was more asymmetric than information exchange. In other words, an organization could exchange information with another actor without having an equivalent level of influence over that actor. This is an important distinction because power within health tourism is related to control over scarce or strategic resources. Governmental organizations may control licensing, regulation, policy implementation, or authorization procedures, while major hospitals control specialized treatment capacity, clinical reputation, medical technology, and access to experienced physicians. These resources create dependency relationships that are not necessarily reciprocal. The findings therefore suggest that Tehran's health tourism network has a partially

hierarchical governance structure superimposed on a more distributed communication system. Previous Iranian research has similarly emphasized the substantial importance of policy support, institutional coordination, infrastructure, and governance in the development of health tourism (Hosseiny et al., 2024; Khazaei-Pool et al., 2024). Studies investigating development factors have also shown that health tourism is affected by combinations of governmental, organizational, infrastructural, and managerial variables rather than by market mechanisms alone (Mohammadi & Ghaffarian, 2024; Rezapour et al., 2022).

The centrality findings provided more detailed evidence of this power structure. The principal governmental or regulatory actor, G1, had the highest in-degree and eigenvector centrality in the power network and was also highly central in the information network. This indicates that G1 functioned simultaneously as a major informational reference point and as the most recognized source of institutional power. Its position suggests that governmental regulation remains deeply embedded in the relational architecture of Tehran's health tourism system. This finding is consistent with studies demonstrating that the development of health tourism depends heavily on supportive policies, coordinated governance, regulatory clarity, institutional responsibilities, and strategic planning (Hosseiny et al., 2024). Research on health tourism marketing and destination development in Iran has likewise shown that governmental support and institutional arrangements form part of the conditions needed for successful tourism attraction and service development (Zakavati et al., 2024; Zekavati et al., 2023). Accordingly, the network position of G1 suggests that policy institutions are not peripheral regulators operating outside the market but are structurally integrated into referral, information, and dependency relationships.

Major hospitals also occupied central positions in both the power and information networks. H1 and H2 had high in-degree, eigenvector, and closeness centrality, indicating that they were central because of both the number and strategic importance of their connections. This result can be explained by the central role of specialized medical centers in the health tourism value chain. International patients primarily travel for access to treatment, diagnosis, surgery, rehabilitation, or specialized clinical expertise, and hospitals therefore control the central service around which complementary tourism services are organized. Previous research on health tourism management has emphasized that

healthcare institutions must coordinate multiple internal and external functions, including clinical treatment, international patient management, communication, administrative procedures, and tourism-related support (Abela, 2023). Research conducted in Tehran has also demonstrated that the development and marketing of health tourism depend substantially on the organizational capabilities of healthcare institutions and their ability to interact effectively with broader tourism and service systems (Bagheri, Roust, Forouzandeh, et al., 2023; Bagheri, Roust, Forouzandeh, et al., 2023). The strong central position of hospitals observed in this study is therefore consistent with their simultaneous control over clinical resources, professional credibility, infrastructure, and patient outcomes.

One of the most important findings was the distinctive position of health tourism facilitators. F1 and F2 did not surpass governmental organizations and major hospitals in formal power in-degree, but they had particularly high betweenness and out-degree centrality. F1, in particular, had the highest betweenness centrality in both the information and power networks. This indicates that facilitation agencies derive considerable structural influence from their brokerage position. Such actors connect hospitals, physicians, travel agencies, accommodation providers, international patients, and governmental organizations and may therefore become indispensable even when they lack formal authority. This finding supports the broader understanding of health tourism as an interconnected service chain rather than a purely clinical transaction. Marketing studies in Tehran have repeatedly shown that health tourism development requires integration among communication, service delivery, customer relationships, destination management, and organizational cooperation (Bagheri, Roust, Forouzandeh, et al., 2023; Saberi et al., 2023). Similarly, research on supply-chain resilience in Tehran Province highlights the importance of coordination among different service providers and the capacity of the system to maintain continuity through interorganizational linkages (Marvi, 2023). The high brokerage centrality of facilitators observed here provides a structural explanation for why these actors can have a strong practical effect on the performance of the health tourism system.

The brokerage role of facilitators has both positive and potentially problematic implications. On the positive side, brokers can reduce coordination costs, connect otherwise disconnected sectors, speed up information exchange, and facilitate access to specialized services. They may help international patients navigate a system characterized by

linguistic, administrative, and informational complexity. However, excessive dependence on a small number of brokers can also generate bottlenecks and make the network vulnerable. If a central facilitator withdraws, delays communication, or selectively controls referrals, multiple peripheral actors may lose efficient access to the network core. This interpretation is consistent with the findings on network centralization and the sociogram, which showed that cross-sector communication frequently converged around a limited group of actors. Research on resilience suggests that health tourism systems require both coordination and redundancy so that service delivery does not become overly dependent on a narrow set of organizations (Marvi, 2023). Similarly, service innovation research has emphasized the need for adaptive organizational structures capable of sustaining performance under changing conditions (Bastani et al., 2025). Therefore, brokerage should be considered both a source of network efficiency and a potential source of structural vulnerability.

The sector-level analysis further revealed a clear core–intermediate–periphery configuration. Governmental organizations and major hospitals occupied the principal power core, facilitation agencies represented the most important brokerage layer, physicians and insurance organizations occupied intermediate positions, and travel, accommodation, and complementary service providers were more peripheral. This configuration appears compatible with the functional organization of health tourism. Governmental and clinical actors possess authority or scarce resources, while facilitators coordinate across sectors and supporting organizations contribute specific services without necessarily influencing system-wide decisions. Studies examining health tourism development in Iran have highlighted the importance of multiple layers of infrastructure, service quality, destination characteristics, organizational capacity, and institutional support (Mohammadi & Ghaffarian, 2024; Rezapour et al., 2022). The current results extend these findings by showing that the actors responsible for these factors are not equally positioned within the relational structure.

The more peripheral location of hotels, accommodation providers, and complementary service organizations does not imply that these actors are unimportant. Rather, it indicates that their influence is more specialized and that they often depend on central actors or intermediaries for access to patients and strategic information. Destination image research suggests that the overall experience of health tourists is shaped not only by treatment but also by

accommodation, mobility, hospitality, and the broader tourism environment (Küçükkambak, 2023). Similarly, the historical development of health tourism demonstrates that health-related travel has always involved combinations of therapeutic, environmental, and hospitality resources (Baysal & Çimen, 2023). The peripheral position of these sectors therefore suggests a possible governance gap: actors that substantially influence patient experience may have relatively limited participation in strategic decision-making. Better integration of these actors could potentially improve destination-level coherence and reduce the mismatch between clinical quality and the broader service experience.

The findings concerning physicians and specialized clinical providers also warrant attention. These actors demonstrated moderate network centrality rather than occupying the very center of the interorganizational system. Although physicians possess considerable professional expertise and often strongly affect patient choice, they may operate through hospital-based referral structures or through facilitators rather than maintaining extensive direct organizational ties with all other sectors. This helps explain why their structural centrality was lower than that of major hospitals. Nevertheless, specialized clinical services remain central to the value proposition of health tourism, including areas such as nutrition, rehabilitation, and other professional services that contribute to treatment and recovery (Kaya, 2023). Therefore, their intermediate structural position should not be interpreted as low substantive importance but rather as a reflection of how professional expertise is institutionally embedded.

Another notable result was that information centrality and power centrality overlapped but were not identical. G1 and H1 were highly central in both networks, while facilitators had stronger brokerage positions relative to their formal influence. This supports a multidimensional conception of power. An actor may possess formal power because others depend on its authority or resources, or relational power because it controls pathways connecting other actors. Such differentiation is especially relevant in health tourism marketing, where organizations with strong communication reach may shape patient perceptions and referrals without having formal regulatory status. Previous studies have emphasized the strategic importance of branding, image, marketing communication, and digital customer relationships in health tourism (Emami et al., 2025; Küçükkambak, 2023). The present study suggests that these marketing capacities are partly embedded in structural

network positions, particularly where facilitators and other intermediaries connect patients and service providers.

The network results are also relevant to digital transformation. The centralization observed in the information network suggests that digital technologies could either reduce or reinforce existing inequalities. On one hand, integrated digital platforms may allow peripheral stakeholders to communicate directly with hospitals, patients, and regulators, reducing dependence on brokers. On the other hand, if digital infrastructure is controlled by a small number of central actors, technological innovation may consolidate their informational power. Research on next-generation technologies and digital health tourism emphasizes opportunities for improved integration, personalization, data management, and strategic coordination (Baran & Karaca, 2023; Spoladore et al., 2023). The development of artificial intelligence-based customer relationship management systems similarly reflects a shift toward technologically mediated relationships in the health tourism market (Emami et al., 2025). The structural findings of the present study suggest that future digital interventions should be evaluated not only in terms of technical efficiency but also in terms of how they redistribute access to information and influence.

The importance of learning and information capacity is further supported by research on e-learning for health tourism marketing in Tehran, which has emphasized the role of systematic education and knowledge transfer within healthcare organizations (Heidari et al., 2024). A network characterized by short average path lengths can facilitate the diffusion of knowledge, but only if information is shared accurately and consistently. The current finding that the information network was connected and relatively dense may therefore represent an important asset for organizational learning. However, the existence of peripheral actors and concentrated brokerage implies that diffusion may still be uneven. Strengthening cross-sector knowledge exchange could support more consistent marketing, service standards, and patient communication.

The current findings also align with the literature on sustainable health tourism. Sustainable destination development requires coordinated action across economic, social, service, infrastructural, and institutional domains (Zarei, 2023). Network fragmentation or excessive concentration can undermine such coordination. A highly centralized structure may facilitate rapid decision-making, but it may also marginalize smaller actors and reduce the diversity of perspectives entering policy processes.

Conversely, a completely decentralized network may lack strategic coherence. The moderate centralization observed in the information network, combined with greater concentration of power, suggests that Tehran's health tourism system contains both integrative and hierarchical characteristics. This may be advantageous when central actors provide coordination while communication remains sufficiently distributed, but it becomes problematic if decision-making authority is not accompanied by reciprocal information from peripheral sectors.

The relevance of local and community-level conditions should also be considered. Research conducted in Iran has shown that local drivers, stakeholder participation, infrastructure, governance, and community capacities are central to health tourism development (Khazaei-Pool et al., 2024). The current network analysis indicates that these factors cannot be separated from relational access. Stakeholders may possess useful local knowledge or specialized resources but remain unable to influence system development if they occupy peripheral positions. Similarly, qualitative marketing models for health villages have emphasized interactions among destination characteristics, institutional conditions, service capacity, and marketing strategies (Zakavati et al., 2024; Zekavati et al., 2023). The present results suggest that effective implementation of such models depends on whether the relevant actors are structurally connected and able to participate in information exchange and decision-making.

The results also have implications for destination competitiveness. Health tourism destinations compete not only through lower costs or clinical quality but also through their capacity to provide a coherent, predictable, and integrated patient journey. Fragmentation across organizations can create inconsistent information, duplicated procedures, administrative delays, and reduced patient confidence. In contrast, strong coordination among hospitals, facilitators, travel providers, accommodation services, and governmental actors can improve the overall destination experience. Marketing research in Tehran has identified communication, organizational capability, service quality, and strategic coordination as important determinants of health tourism development (Bagheri, Roustaei, Forouzandeh, et al., 2023; Saberi et al., 2023). The present study provides a structural perspective on these factors by showing which actors are positioned to coordinate them and where potential communication bottlenecks may arise.

Overall, the findings suggest that Tehran's health tourism network is neither fully hierarchical nor fully decentralized.

It is better characterized as a moderately integrated core-periphery network in which information circulates through multiple pathways but power remains concentrated among governmental actors, major hospitals, and a small number of brokers. This structure offers important functional advantages because central actors can coordinate complex activities and facilitators can bridge sectoral boundaries. At the same time, it creates vulnerabilities through dependence on a limited number of hubs. Strengthening the resilience of the system therefore requires preserving the coordinating role of central actors while increasing redundancy, reciprocal communication, and direct cross-sector linkages. This interpretation is compatible with broader research emphasizing innovation, resilience, governance, digital integration, and multi-stakeholder coordination as critical dimensions of contemporary health tourism development (Bastani et al., 2025; Dryglas & Smith, 2025; Marvi, 2023).

The present study has several limitations that should be considered when interpreting the findings. First, the analysis was cross-sectional and therefore represents the network structure during a specific period rather than changes in relationships over time. Second, the network boundary was defined around 72 identified actors in Tehran, and although purposive and network-based procedures were used to identify relevant organizations, some informal, newly established, or less visible actors may not have been included. Third, relational data were primarily obtained from organizational representatives and therefore may have been affected by recall bias, differences in organizational knowledge, or subjective perceptions of influence. Fourth, power was measured through reported dependency and influence relationships and should therefore be interpreted as relationally perceived power rather than as a direct measure of legal or financial authority. Fifth, organizational identities were coded to preserve confidentiality, which limited the possibility of discussing institution-specific contextual factors in detail. Finally, the findings are specific to Tehran and should not automatically be generalized to health tourism networks in other Iranian provinces or international destinations with different governance arrangements and market structures.

Future research should employ longitudinal Social Network Analysis to examine how health tourism relationships evolve in response to policy changes, market expansion, technological innovation, or external shocks. Comparative studies across different cities and provinces could determine whether Tehran's relatively centralized structure is unique or reflects a broader national pattern.

Future investigations could also use multiplex network analysis to distinguish referral, financial, regulatory, clinical, marketing, and digital communication ties rather than treating power and information as the only relational dimensions. Exponential random graph models, stochastic actor-oriented models, or network regression techniques could be applied to identify mechanisms associated with tie formation and network change. Studies should also examine whether centrality is associated with measurable organizational outcomes such as patient volume, financial performance, service quality, patient satisfaction, or international market reach. Incorporating qualitative interviews with actors from central and peripheral network positions could further clarify how organizations experience dependence, brokerage, trust, conflict, and coordination within the health tourism system.

From a practical perspective, policymakers and managers should use network-based evidence to strengthen coordination while reducing excessive dependence on a small number of central organizations. Formal mechanisms should be developed to promote direct and reciprocal communication among hospitals, facilitators, governmental agencies, physicians, insurers, travel organizations, accommodation providers, and complementary service actors. Shared digital platforms and interoperable information systems can reduce duplication and improve the speed and accuracy of information exchange, but governance arrangements should ensure that no single intermediary gains excessive control over patient access or strategic data. Peripheral actors should be incorporated more systematically into planning and coordination structures because they influence important parts of the international patient experience despite their lower structural power. Health tourism facilitators should be recognized as critical brokers, while contingency plans and alternative communication routes should be established to prevent system disruption when key intermediaries are unavailable. Finally, the network should be periodically mapped and evaluated so that emerging bottlenecks, isolated actors, and shifts in power concentration can be identified before they negatively affect service integration or destination competitiveness.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were considered.

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