

Governing Hospital Bed Allocation in Iran: A Stakeholder Network Analysis

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Summary

Hospital beds are usually treated as little more than a headcount – a number meant to signal how ready a health system is to absorb demand. But their real functional value depends on how well they are linked to workforce, governance, and the other building blocks of the system. In Iran, national-level equity indicators look reassuring on their own (Gini coefficient ≈ 0.24), yet they conceal sharp sub-national disparities, with city-level inequality reaching as high as 0.68–0.70 in Shiraz. What has been missing from this literature is any account of who actually makes bed-allocation decisions, and how the relationships among these actors shape the outcomes so often described in aggregate terms. This study combined 34 semi-structured interviews with policy-makers, university leaders, and hospital managers with Social Network Analysis (SNA) to map the stakeholder network governing hospital bed allocation in Iran. The resulting network comprised 17 actors connected through 81 directed ties (density=0.298). Medical Universities showed the highest betweenness centrality (0.289), positioning them as the network's principal structural

brokers, while the Ministry of Health held the highest weighted out-degree (27), reflecting its concentrated directive influence. Political-social ties dominated the network, accounting for 43.2% of all edges, while regulatory and oversight ties were comparatively scarce (9.9%). A series of robustness checks – including sensitivity analysis across evidence thresholds and a random edge-deletion perturbation analysis with 500 iterations – confirmed that both of these central findings held up under scrutiny. Taken together, the results suggest that Iran's coexistence of national equity and local inequity is not merely a statistical artifact of how the data happen to be aggregated, but reflects a genuine structural problem in governance: Medical Universities, the actors best positioned to observe local need, lack authority commensurate with that position, while independent regulatory oversight remains minimal. Addressing bed-allocation inequity, then, is likely to require structural reform of decision-making authority and oversight mechanisms – not simply expanding capacity.

Introduction

Hospital beds are often treated as a simple headcount – a number that signals how ready a health system is to absorb demand. But that framing misses something important. Resource generation functions like bed capacity only translate into actual service delivery when they are linked to workforce, governance, and the other building blocks of the system [1]. Strip away those supporting layers, and a bed count becomes a fairly hollow metric.

This becomes clear once you look at how differently countries handle it. A survey of decision-makers and academics across eighteen high-income countries found that resource allocation is still largely driven by historical patterns and ad hoc decisions rather than any consistent, evidence-based logic [2] – which goes a long way toward explaining why bed supply varies so much even among comparably wealthy systems. And more beds does not automatically translate into better performance: in a ten-country European comparison, once financing arrangements and physician remuneration systems were accounted for, expanding the number of beds had little

independent effect on occupancy rates or length of stay [3] – the health system's underlying institutional design mattered more than sheer capacity.

The same tension shows up when countries move in the other direction. Efficiency-driven reforms – trimming length of stay, shifting care toward outpatient and community settings – have often paid off on paper, but they have also exposed a real fragility. A county-level analysis in China illustrates this well: even as the national bed-to-population ratio grew by roughly 50% between 2000 and 2019, regional disparities in allocation not only persisted but continued to widen [4]. Supply and equity, in other words, do not automatically move together.

What ties these threads together is that allocation decisions are rarely just technical exercises. A study of priority-setting in two Kenyan hospitals described hospitals as complex adaptive systems in which outcomes depend as much on organizational “software” – relationships, norms, informal negotiation – as on formal rules or “hardware” like budgets and beds [5]. A recent scoping review of universal health system reforms across high- and upper-middle-income countries reinforces this: reform trajectories consistently reflect

the roles, relationships, and power dynamics among the actors involved, not a single centralized plan working itself out [6].

A related point comes from recent reflections on where health policy and systems research needs to go next: achieving health equity requires paying closer attention to how power is distributed among the actors who shape decisions – not just to the decisions themselves [7]. Some actors inevitably end up occupying more influential positions than others, acting as intermediaries or gatekeepers in how resources and decisions actually flow [8].

Yet despite this shift in the literature toward governance and relational thinking, most empirical work on hospital bed allocation still leans on aggregate indicators. A systematic review of governance frameworks found that most existing tools were designed to assess a single level of the system – national, regional, or facility – even though real decision-making authority is typically split across all of them, with formal and informal actors operating simultaneously at each level [9]. This gap is not merely theoretical; it shows up clearly once you look at how the literature on hospital bed equity in Iran itself has developed.

Iran offers a particularly instructive case, precisely because the evidence on outcomes is now fairly rich, while the evidence on the actors producing those outcomes is almost nonexistent. At the national level, the bed-to-population ratio has been found to vary so widely across provinces that its dispersion coefficient stood at 36% in 2015, with projections suggesting this would only fall to 19% by 2025 even under planned expansion [10]. Around the same period, a comparison of inequality across different health resources nationally found that hospital beds were in fact the most unequally distributed of all major resources – a Gini coefficient of 0.58, compared to 0.47 for physicians and 0.39 for paramedics [11]. More localized work tells a similar story: a regional analysis of Lorestan Province documented a moderate level of inequality (Gini=0.27) using the Gini coefficient and Lorenz curve, with certain cities such as Khorramabad and Aligudarz showing considerably worse imbalances than others [12]. Most recently, a systematic review and meta-analysis pooling thirty studies conducted between 2000 and 2025 found a national Gini coefficient of 0.24 – suggesting relative equity at the country level – while provincial figures ranged from 0.229 in South Khorasan to over 0.50 in Sistan and Baluchestan and Bushehr, and city-level inequality reached as high as 0.68–0.70 in Shiraz [13]. Taken together, these four studies tell a genuinely puzzling story: national-level equity appears reasonable, yet it conceals sharp and persistent sub-national disparities that none of these aggregate measures can, by design, explain. A parallel strand of Iranian research has approached the problem from the indicator side rather than the outcome side. One study identified 75 criteria affecting hospital bed allocation through a scoping review, narrowed these to 28 through an expert Delphi process, and used network analysis to determine which

factors most strongly drove distributional decisions – concluding that bed distribution in the region studied remained highly unequal and that a comprehensive monitoring and evaluation system was still lacking [14]. A follow-up study built a system dynamics model to predict future bed shortages and test policy scenarios, showing that government intervention aimed at simultaneously expanding beds and home-care services could meaningfully close projected gaps [15].

What none of these six Iran-focused studies do – and this is precisely the gap this study addresses – is examine who is actually making these allocation decisions, how they relate to one another, and whether the structure of those relationships helps explain why national equity and local inequity can coexist so persistently. Hospital bed allocation in Iran involves a genuinely complex mix of actors – policymakers, financial authorities, service providers, and socio-political stakeholders – but no study to date has systematically mapped how these actors interact or examined their relative influence through a network-based governance lens. This study addresses that gap directly: it analyzes the stakeholder network governing hospital bed allocation in Iran, with particular attention to how the structure of this network shapes equity and efficiency in the distribution of inpatient capacity.

Methods

This study examined the network of stakeholders involved in hospital bed allocation in Iran, combining a qualitative inquiry with Social Network Analysis (SNA). Rather than treating stakeholders as isolated actors, we modeled them as nodes within a directed network, with the ties between them representing the flow of authority, resources, and oversight. This dual design allowed us to move beyond a simple inventory of “who is involved” toward a structural account of how decisions about bed allocation actually move – and stall – across national, provincial, organizational, and sociopolitical levels.

STUDY SETTING

The research was situated within the governance system that shapes hospital bed allocation in Iran, spanning policy formulation, financing, regulation, service delivery, implementation, and oversight. The relevant institutional landscape included national ministries and agencies, the Plan and Budget Organization, medical universities, public and private hospitals, insurance bodies, the Social Security Organization, members of parliament, provincial health authorities, private-sector representatives, civil society organizations, and service users.

PARTICIPANTS AND SAMPLING

The aim of this phase was to identify the actors involved in hospital construction and bed-distribution policy, and to characterize the relationships among them. Rather than seeking self-reports from every actor in the system,

participants were purposively selected for their first-hand knowledge of how these decisions are actually made – that is, individuals whose institutional position gave them visibility into the actors, dependencies, and decision pathways governing hospital bed allocation, health financing, regulation, or broader health system governance. Eligibility required at least five years of relevant professional experience and direct engagement in decision-making, implementation, monitoring, or advisory functions related to healthcare resource allocation.

Because influence in this system is not always formally visible – much of the real decision-making occurs outside official titles – purposive sampling was supplemented with snowball sampling, allowing participants to point us toward further actors and relationships that shaped allocation outcomes without necessarily holding prominent formal positions themselves [16].

Recruitment and data collection continued until interviews and documents stopped surfacing anything new about the system: no new actor categories, no new recurring relationships, and no meaningfully different interaction patterns. In other words, sampling continued until the picture of the network itself, as reconstructed from participants' accounts, appeared to stabilize. Saturation was effectively reached at the 32nd participant, and the final two interviews (participants 33 and 34) were conducted mainly to confirm that saturation and to rule out the emergence of any new actor or pattern [17]. The characteristics of the participants are summarized in Table I.

DATA COLLECTION

Data were drawn from two sources: semi-structured interviews and document review. The document set included laws, regulations, national development plans, administrative and organizational reports, and academic literature relevant to the planning, financing, expansion, distribution, and monitoring of hospital beds in Iran.

The interview guide was built around five core lines of inquiry: who the key stakeholders are, what role each actor plays, whether and in which direction relationships exist between actors, what these relationships are based on, and where coordination problems or decision-making bottlenecks tend to arise. Interviews were conducted face-to-face or by telephone depending on participant availability, and all were audio-recorded with consent and transcribed verbatim before analysis.

STAKEHOLDER IDENTIFICATION AND NETWORK CONSTRUCTION

Stakeholder identification proceeded iteratively rather than as a single fixed step. An initial list of actors was compiled from documentary sources, earlier phases of the broader research program, and the first round of interviews, and this list was revised continuously as new data emerged. Actors who carried different titles but performed the same institutional function were merged into a single node; conversely, units with clearly distinct formal responsibilities – even within the same

organization – were retained as separate nodes.

The final network comprised the following 17 nodes: the Ministry of Health (MoH); Universities of Medical Sciences, including their affiliated public hospitals; the Plan and Budget Organization (PBO); the Currency Board; Basic Health Insurance Organizations; Provincial Governments and Local Authorities; Influential Politicians, including Members of Parliament and Government Officials; the State Organization for the Construction of Governmental and Public Buildings and Installations, a subsidiary of the Ministry of Roads and Urban Development; the Private Health Sector, including Private Hospitals and Healthcare Centers; the Social Security Organization (SSO), including its affiliated hospitals; Patients and the Public; Patient Support Groups and Non-Governmental Organizations (NGOs); Media; Military Health Facilities, including their affiliated hospitals; Medical Equipment Suppliers; Health Philanthropists; and Other Governmental and Public Bodies, including hospitals affiliated with other public institutions.

We used two structured recording forms to organize the raw data. The first captured each stakeholder's name, level of governance (national, provincial, or organizational), and functional role. The second recorded, for every identified relationship, the source actor, the target actor, the type of relationship, the direction of influence, the evidence supporting it, and two separately assigned scores – tie intensity and evidential corroboration (see Tie Weighting, below).

A tie was entered into the network only when the evidence pointed to a concrete, policy-relevant connection between two actors specifically in relation to hospital bed allocation – for instance, an actor issuing a binding directive, releasing or withholding budget, exercising formal regulatory review, or coordinating implementation with another actor. General institutional proximity or informal familiarity, without a demonstrable link to an allocation-relevant action, was not sufficient to establish a tie. Relationships were coded into four categories: financial and resource-provision, regulatory and policy-making, political-social pressure, and operational and service-delivery. Each tie was directed from the actor exercising influence toward the actor receiving or being affected by it.

DATA ANALYSIS

Interview transcripts and documents were analyzed using directed content analysis in MAXQDA 2020. Stakeholder names, institutional roles, and inter-organizational relationships were extracted and coded against the predefined categories described above, then converted into a node-edge matrix suitable for network analysis.

The resulting network was analyzed as a directed weighted multigraph in Gephi (version 0.10). Because some actor pairs were connected through more than one relationship type, parallel edges were retained to preserve distinct relational pathways between actors. Each edge represented a specific relationship type

and carried its own intensity weight. Three measures anchored the analysis: network density, to characterize overall connectedness; betweenness centrality, to identify intermediary actors and potential decision-making bottlenecks; and weighted out-degree centrality, to assess the extent of outward influence exercised by each stakeholder within the allocation process.

TIE WEIGHTING

Because the substantive strength of a relationship and the strength of the evidence supporting it are conceptually distinct, each tie was scored along two independent dimensions: tie intensity and evidential corroboration.

Tie intensity reflects the strength of the relationship itself, based on the content of the interaction described in interviews and documents, independent of how many sources reported it. A weak tie (score=1) reflected an informal, advisory, or non-binding interaction, or one occurring on an irregular, ad hoc basis, with the target actor retaining full discretion over whether to act on it. A moderate tie (score=2) reflected interaction through an established, recurring institutional channel – such as periodic reporting or standing coordination mechanisms – in which the initiating actor's influence required negotiation or the counterpart's cooperation rather than unilateral authority. A strong tie (score=3) reflected the exercise of direct, binding, and largely unilateral authority with a demonstrable effect on a specific bed-allocation outcome, such as approving or withholding budget, issuing a binding regulatory directive, or a documented act of political intervention that altered an allocation decision. This intensity score was used as the final edge weight in network construction and in all centrality calculations reported below.

Evidential corroboration reflects how well a tie was supported across independent data sources, following established triangulation logic in qualitative research whereby independent corroboration is treated as evidence of a claim's validity rather than as a graded measure of its substantive strength (Denzin, 1978; Patton, 1999). It was scored using the same three-point structure applied in earlier coding: a score of 1 was assigned when a relationship appeared in a single interview or document without corroboration elsewhere; a score of 2 was assigned when the same relationship was independently confirmed across more than one source; and a score of 3 was reserved for relationships confirmed by multiple sources that also demonstrated direct relevance to a bed-allocation decision. This corroboration score did not contribute to network weighting; it was retained solely to define the progressively stricter evidentiary thresholds used in the sensitivity analysis reported below.

Two coders independently assigned both scores for every tie. Inter-coder agreement was assessed based on the initial independent ratings. Discrepancies were subsequently discussed and resolved through consensus before generating the final network dataset.

SENSITIVITY AND ROBUSTNESS ANALYSIS

Any network built this way carries some unavoidable

uncertainty – both the intensity and corroboration scores assigned to a tie reflect a judgment call, and thirty-four informants, however carefully chosen, are still a finite window onto a much larger system. We wanted to know how much that uncertainty mattered for our two main findings, so we tested it three ways. First, holding each tie's intensity score fixed, we rebuilt the network at progressively stricter evidential-corroboration cutoffs – keeping all ties regardless of corroboration, then only those independently confirmed by more than one source, then only the strongest, doubly-confirmed ties – and watched whether the same actors stayed on top. Second, we assessed robustness to random data loss through an edge-deletion perturbation analysis: across 500 iterations, we randomly removed 10% of the network's ties, recalculated centrality on the remaining edges, and tracked how much each actor's rank shifted relative to the full network, summarizing this with the mean rank, its spread, and a Spearman correlation against the original full-network ranking. Third, because betweenness centrality depends on a somewhat arbitrary choice – how each tie's intensity score gets converted into path “distance” – we recomputed it under three different conversions (inverse weighting, *i.e.*, distance=1/intensity; linear rank-inversion, *i.e.*, distance=4 – intensity; and unweighted topological distance, ignoring intensity entirely) to see which conclusions held up regardless of that choice and which didn't.

TRUSTWORTHINESS

Credibility and dependability were addressed through triangulation across interviews and documents, and through fixing the rules for stakeholder identification, relationship classification, tie direction, and weighting before the final round of analysis – rather than adjusting them retrospectively to fit emerging patterns.

Two researchers independently coded the data to minimize individual bias in the classification process. Inter-coder agreement was assessed across three dimensions of the coding process. Agreement on whether a tie existed between two actors – assessed across all candidate relationships screened by both coders, including those ultimately not retained – was evaluated using unweighted Cohen's kappa ($k=0.81$). Among the 81 retained ties, agreement on the assigned tie-intensity score was assessed using linearly weighted Cohen's kappa ($k_w=0.76$), and agreement on the assigned evidential-corroboration score was likewise assessed using linearly weighted Cohen's kappa ($k_w=0.79$). According to the standard interpretation guidelines proposed by Landis and Koch, agreement was almost perfect for tie identification and substantial for both tie-intensity and evidential-corroboration ratings [18]. Where disagreements arose, they were resolved through discussion between the two coders until consensus was reached. Prior to final analysis, the complete dataset was thoroughly screened for duplicate nodes, inconsistent naming conventions, contradictory tie directions, and missing attribute data.

Tab. I. Characteristics of participants in the qualitative interviews.

Participant Group	N	Position	Role(s)
Ministry of Health staff	6	Senior officials and health-sector experts	Policymaking, planning, and macro-level management of the health system
Presidents of medical universities	2	University president	Leadership and decision-making at the university/provincial health system level
Vice presidents of medical universities	4	Vice presidents for treatment, and for management and resource development	Prioritization, management, and distribution of treatment resources at the provincial level
Senior managers and experts at medical universities	8	Responsible managers and experts	Implementation of programs related to the distribution of treatment resources and bed capacity
Managers of public and private hospitals	6	Deputy director and hospital director	Management of operations, resources, beds, and hospital services
Faculty members and researchers	4	Faculty member / researcher	Research, analysis, and evaluation on health system issues and equity in bed distribution
Former members of parliament	2	Member of the Health, Treatment, Education and Research Commission	Legislation, oversight, and influence over the agenda and priorities of healthcare investment
Provincial officials of the Social Security Organization	2	Deputy for treatment, Social Security Organization	Oversight and management of treatment services provided by the Social Security Organization at the provincial level
Total	34		

Results

PARTICIPANTS AND SAMPLING

Data were obtained from 34 key informants with in-depth knowledge of the actors, dependencies, and decision pathways governing hospital bed allocation in Iran, drawn from the Ministry of Health, medical university leadership and management, hospital administration, academic and research institutions, parliament, and the Social Security Organization (Tab. I). Informants were selected for their first-hand insight into how bed-allocation decisions and stakeholder interactions actually unfold, rather than to reach a predetermined sample size. Saturation was effectively reached at the 32nd informant, with the final two interviews (informants 33 and 34) conducted to confirm saturation and rule out the emergence of any new actor category or interaction pattern.

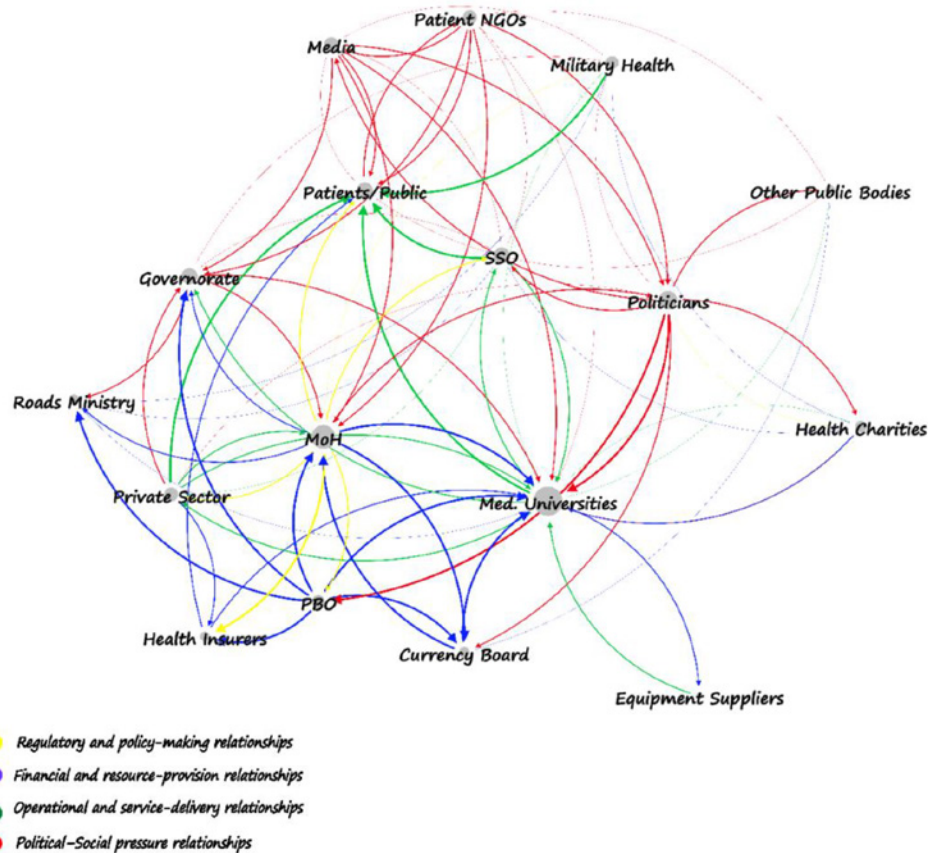
STAKEHOLDER NETWORK STRUCTURE

Drawing on the interview and document data, a stakeholder relationship network was constructed comprising 17 actors involved in hospital bed allocation governance, connected through 81 directed ties (network density=0.298), indicating a moderately dense system in which a substantial share of theoretically possible relationships are actually realized. These 81 ties corresponded to 79 unique directed actor dyads, with two actor pairs connected through more than one relationship type (*i.e.*, parallel ties representing distinct relational pathways). Collapsing these parallel channels into single directed dyads yields a simple directed density of 0.290. Because tie intensity scores affect only the coded strength of an observed relationship and not whether it was observed, this figure is unaffected by the intensity-based reweighting described in Tie Weighting.

Node size is proportional to each actor's weighted outdegree – the sum of intensity-weighted ties it directs toward other actors – reflecting the magnitude of its direct outward influence rather than its brokerage position (reported separately as betweenness centrality in Fig. 2). Edge color denotes relationship type: yellow – regulatory and policy-making relationships; blue – financial and resource-provision relationships; green – operational and service-delivery relationships; red – political-social pressure relationships. Edge thickness is proportional to tie intensity, based on the intensity-weighted relational data derived from interview and document analysis (see Tie Weighting).

As shown in Figure 1, Medical Universities and the Ministry of Health (MoH) occupy the most visually central positions in the network, connected through dense, high-intensity ties – particularly financial/resource and political-social pressure relationships – to actors such as the Plan and Budget Organization (PBO), the Currency Board, Health Insurers, and Politicians. Peripheral actors such as Patient Groups, the Military, Philanthropists, and Other Government Bodies are connected mainly through thinner, lower-intensity ties, suggesting a more marginal or indirect role in day-to-day allocation decisions.

To characterize this structure more precisely, three sets of network metrics were calculated for the 17 actors and 81 ties: brokerage position (betweenness centrality), directive influence (weighted outdegree), and the distribution of relationship types across all ties. These metrics are widely used in recent applications of social network analysis to stakeholder governance in the Iranian health system, where betweenness centrality identifies actors who broker information and resource flows between otherwise unconnected parties, and weighted outdegree captures the direct influence an actor exerts on others.

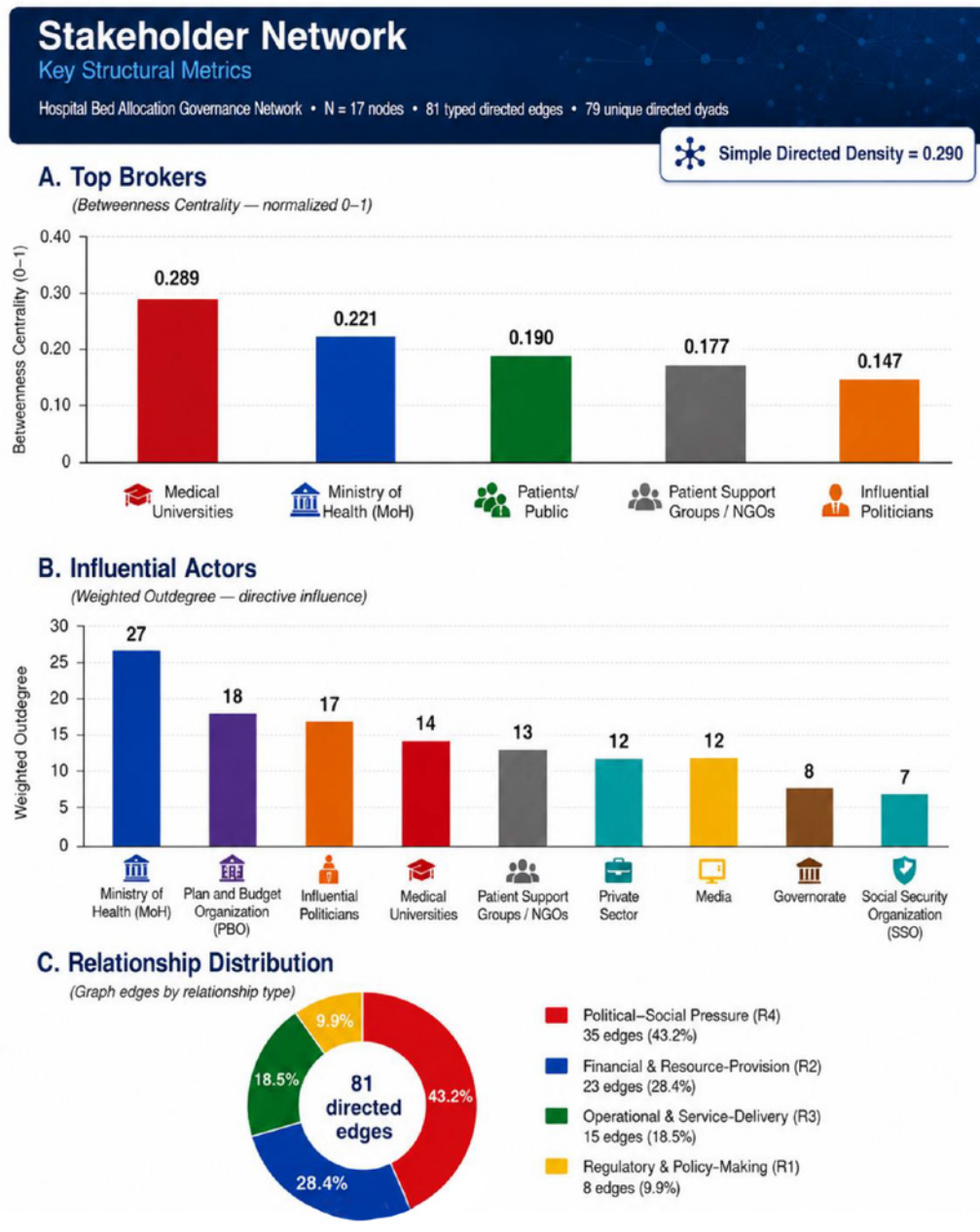
Fig. 1. Stakeholder Relationship Network in Hospital Bed Allocation Governance.

Panel A of Figure 2 shows the five actors with the highest betweenness centrality – the degree to which an actor sits along the shortest paths connecting other stakeholders, and thus acts as a broker within the network. Medical Universities recorded the highest betweenness centrality (0.289), followed by MoH (0.221), Patients/Public (0.190), Patient Support Groups/NGOs (0.177), and Influential Politicians (0.147); Media, by contrast, recorded a negligible betweenness score (0.003) despite its moderate outdegree, indicating that its outward ties rarely place it on the shortest path between other actors. This indicates that Medical Universities function as the principal intermediaries in the system: a large share of resource and information flows between other stakeholders passes through them rather than occurring via direct ties. Notably, Patients/Public and Patient Support Groups/NGOs together emerged as meaningful brokers despite their comparatively peripheral position in the visual layout of Figure 1, pointing to an indirect but structurally important role in connecting otherwise disconnected parts of the network.

Panel B shows weighted outdegree, which captures each actor's directive influence through its outgoing ties. Here a somewhat different pattern emerged: MoH showed by far the highest directive influence (weighted outdegree=27), consistent with its regulatory mandate, followed by the Plan and Budget Organization (18) and Influential Politicians (17), and then Medical Universities

(14), Patient Support Groups/NGOs (13), the Private Sector and Media (12 each), the Governorate (8), and the Social Security Organization (7); the remaining actors recorded weighted outdegrees of 6 or below (Fig. 2, Panel B), with the State Organization for the Construction of Governmental and Public Buildings and Installations recording no outgoing ties at all, consistent with its purely executive role in hospital construction rather than allocation governance. This divergence – Medical Universities leading on brokerage, MoH leading on directive influence – suggests a functional division of labor within the network: MoH acts as the primary source of top-down directives and financial allocation, while Medical Universities serve as the operational intermediary that channels and redistributes these directives toward hospitals and provincial-level actors, consistent with the dense cluster of ties converging on “Med. Universities” in Figure 1.

Panel C presents the distribution of the 81 edges across four relationship categories: regulatory and policy-making (R1), financial and resource-provision (R2), operational and service-delivery (R3), and political-social pressure (R4). Political-social pressure ties (R4) were the most frequent category, accounting for 43.2% of all edges (35 of 81), followed by financial and resource-provision ties (R2, 28.4%), operational and service-delivery ties (R3, 18.5%), and regulatory/policy-making ties (R1, only 9.9%). This pattern is visually corroborated in Figure 1,

Fig. 2. Structural Metrics of the Stakeholder Network.

where red (political-social pressure) and blue (financial) edges dominate the densest portions of the network – particularly around MoH, Politicians, PBO, and Medical Universities – while yellow (regulatory) ties are comparatively sparse and concentrated among a small subset of actors (*e.g.*, MoH, SSO, Health Insurers). The relative scarcity of formal regulatory ties compared to the prevalence of political-social pressure and financial relationships suggests that resource-allocation decisions in this system may be shaped as much, or more, by informal political influence and financial dependency as by formal regulatory mechanisms – a pattern consistent with recent stakeholder-network findings in other large-scale infrastructure and public-governance contexts, where information asymmetry and coordination power

have been shown to concentrate around a small number of high-centrality actors regardless of formal regulatory hierarchy [19].

Before drawing conclusions from these two positions, we checked how much they could be trusted. Medical Universities' lead in betweenness centrality held up at a moderate evidentiary threshold – ties corroborated by at least two independent sources – where it remained the top broker even as network density fell substantially. It did not hold, however, at the most extreme threshold, an 11-tie network retaining only the most strongly corroborated ties, where the Plan and Budget Organization moved to the top position on both measures; given how sparse this residual network is, we treat this reversal as a stress test of an unusually thin evidentiary base rather

than as a competing finding about the network's true structure. MoH's dominance in weighted out-degree was, if anything, even more solid: across 500 iterations of the edge-deletion perturbation analysis, its rank barely moved (mean Spearman $p=0.975$ for out-degree, 0.936 for betweenness), and it remained the top-ranked actor on out-degree in 98.8% of iterations. One comparison did turn out to be more fragile than it looks in the raw numbers – MoH edges out Patients/Public on betweenness in the main network, and this ordering held in only 68.4% of perturbation iterations, reversing under two of the three distance conversions tested, so we would not lean too hard on that particular gap. A few peripheral actors – the Currency Board, the Governorate, Health Charities, Medical Equipment Suppliers, Military Health Facilities, Other Governmental and Public Bodies and Patient Support Groups/NGOs – dropped out of the network altogether once we restricted ourselves to the most strongly corroborated ties, which tells us their marginal position rests more on evidence from a limited number of sources evidence than on a well-confirmed pattern.

Taken together, these findings indicate a governance structure in which formal regulatory authority (concentrated in MoH) and operational brokerage (concentrated in Medical Universities) are structurally separated but tightly interdependent, while civil-society and oversight actors – such as Media and Patient Support Groups/NGOs – occupy a limited but non-trivial position within an otherwise state- and institution-dominated allocation network.

Discussion

The puzzle we set out with in the introduction was a simple one to state and a hard one to explain: why does hospital bed allocation in Iran look reasonably equitable at the national level while remaining so uneven underneath it, at the level of provinces and cities? The six Iran-focused studies reviewed there could describe that pattern in impressive detail but had little to say about who was actually producing it. Looking at the stakeholder network itself turns out to help close that gap, and in a fairly direct way: the unevenness is not just a statistical artifact of how the data happen to be aggregated, it is built into the structure of who talks to whom, who controls what, and who answers to no one in particular.

Start with the network's overall density. Using the typed-edge representation of the multigraph, the network density was 0.298 (simple directed density=0.290 after collapsing parallel ties), indicating a moderately interconnected governance network, consistent with the moderate range reported for other policy and health-governance networks [20, 21]. However, this density value on its own is not a dramatic finding. But it is worth pausing on what “moderate density” actually means here rather than treating it as a neutral descriptive statistic. A very sparse network would point to something

close to institutional anarchy – nobody coordinating with anybody. A very dense one would suggest the opposite, a tightly integrated system where information and authority move freely in every direction. What we have instead is neither: roughly three out of every ten possible relationships among the seventeen stakeholders are actually realized, and those realized relationships cluster heavily around a handful of actors – the Ministry of Health, medical universities, the Plan and Budget Organization – while thinning out considerably around others. That clustering is, we think, the more interesting fact than the density figure itself. It offers a plausible mechanism for exactly the paradox the introduction raised: national indicators can look tidy precisely because the actors who generate and report those indicators are well-connected to each other, while the actors closer to where a bed shortage is actually felt are not.

The most striking single finding to come out of the tie-type breakdown is how lopsided the network is toward sociopolitical relationships (43.2% of all ties) and away from regulatory ones (just 9.9%). It would be easy to read that gap as a distinctly Iranian pathology, but the broader literature on hospital governance suggests some caution is warranted. Hospitals have been described as complex adaptive systems in which outcomes depend as much on relational “software” – negotiation, informal norms, who owes whom a favor – as on the formal “hardware” of budgets and regulations [5]. Scarce resources allocated under competing claims tend to migrate toward exactly this kind of informal bargaining almost everywhere, because regulatory instruments are generally built to check compliance with a rule, not to adjudicate between two legitimate but conflicting demands [22]. So the general shape of the finding is not unique to Iran.

What does look more specific to this setting is the scale of the gap, and three features of the network help explain it. One is that the Ministry of Health combines the highest weighted out-degree in the entire network (27) with the second-highest betweenness centrality (0.221) – meaning the institution that sets policy and controls resources is, to a substantial extent, also the institution checking on itself. That kind of role concentration tends to crowd out exactly the sort of independent oversight channel a healthier system would need, a tension documented in other health systems where the ministry of health simultaneously directs resources and is expected to oversee their use [23]. A second feature is the weight carried by the Plan and Budget Organization (out-degree=18) and by individual politicians (out-degree=17) – both nearly on par with the Ministry of Health, and higher than medical universities, the actors who actually deliver the service. That is consistent with earlier evidence that Iranian health-resource decisions tend to cluster around a small set of central actors, often at the cost of weaker connections further out in the system [21, 24]. And a third is simply the thinness of the regulatory layer itself: with only 8 of the network's 81 ties coded as regulatory, there does not appear to be an actor positioned to monitor the process independently of the two bodies that already control it. Put those three

things together and the dominance of political and social channels over regulatory ones starts to look less like an anomaly and more like a fairly predictable consequence of how authority is currently distributed.

Medical universities present a genuinely puzzling case within this picture. They occupy the single highest betweenness score in the network (0.289), which fits the broader pattern of high-betweenness actors bridging policy and frontline levels of a health system [25]. Nearly everything that moves between the national level and the provincial or hospital level seems to pass through them. And yet their weighted out-degree (14) trails well behind the Ministry of Health, the Plan and Budget Organization, and influential politicians. In practice, this means medical universities are usually the first to see a local bed shortage and the last to have the authority to fix it on their own – they carry the operational weight of decisions made elsewhere without a matching share of the power to shape those decisions. That mismatch between informational centrality and financial authority is exactly the kind of position resource-dependence accounts of organizations would flag as unstable over time [26], and it offers one plausible thread connecting this network structure to the persistent provincial and city-level disparities documented in earlier Iranian studies [13, 27].

It's worth pausing here on how much weight this particular finding can bear. The gap we're describing – universities see the problem but don't hold the purse strings – survived every robustness check we threw at it, so we feel comfortable treating it as a real feature of how this system works, not just a quirk of which interviews happened to mention which relationship. The same confidence doesn't extend to every corner of the network. Patient Support Groups/NGOs, in particular, moved around a lot across our perturbation iterations – some runs placed them well outside the top handful of brokers – and several of the more peripheral actors lost their footing in the network entirely once we demanded stronger evidence for every tie. We don't think this is a flaw unique to our data so much as a fairly predictable feature of studying stakeholder networks this way: the actors everyone talks to leave an obvious trail across interviews and documents, while the quieter, more peripheral ones are inherently harder to pin down with the same confidence [28]. So when we talk about who sits at the center of this network, we mean it fairly strongly; when we talk about who sits at the edges, that should be read as more of a tentative sketch than a settled fact.

The other end of the network tells a related story. Patients and the public sit at a moderate betweenness position (0.190) – closely followed by patient advocacy groups/NGOs (0.177), while the media's brokerage role is comparatively negligible (0.003) by comparison – and still well behind medical universities or the Ministry of Health – and they connect to the system almost entirely through sociopolitical and civil-society channels rather than through any formal seat at the policy or financing table [20]. What that suggests, practically, is that patient need tends to enter the decision-making process only

once it has become visible enough to generate media attention or public pressure, rather than being built into planning from the outset. It is not hard to see how that pattern connects back to something already documented in the introduction: a city like Shiraz can carry a Gini coefficient as high as 0.68-0.70 [13], and disparities of that size are the kind that typically become policy problems only after they have already become public ones. Meanwhile, actors with genuine service capacity but limited network reach – military health facilities, the Social Security Organization – remain on the periphery of directive influence despite the real resources they control, which is broadly consistent with the idea that structural gaps in a health network often mark the limits of formal integration rather than an absence of actual capacity [21].

Conclusion

Taken as a whole, this analysis suggests that inequity in hospital bed allocation in Iran is not simply a matter of too few beds or an imperfect population-based formula – it is, in real part, a governance problem. Directive authority sits with a small cluster of policy, budget, and political actors; the institutions best placed to see local need, medical universities chief among them, lack the authority to act on what they see; the regulatory channel meant to hold the system accountable is thin to the point of being almost notional; and the people the system is ultimately meant to serve enter the conversation mainly once their situation has already become a public one. None of this shows up in a bed-to-population ratio or a Gini coefficient, which is precisely why those measures, however carefully constructed, have not been able to explain why national equity and local inequity can sit side by side for as long as they have in Iran. If there is a practical takeaway, it is that closing this gap will likely require less emphasis on the number of beds and more attention to how authority, oversight, and participation are actually distributed among the people making these decisions – a question the existing literature on Iran's hospital system has, until now, largely left unasked.

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Ethical Considerations

Ethical approval was obtained prior to data collection, and written informed consent was secured from all

participants. Identifying information was removed from transcripts and reports, and findings are reported at the institutional rather than individual level to protect participant confidentiality. Participation was entirely voluntary, and all data were used solely for research purposes.

Conflict of interest statement

The authors declare that they have no conflict of interest.

Authors' contributions

All authors contributed to the conception and design of the study, data collection and analysis, interpretation of results, drafting and revising the manuscript, and approved the final version of the manuscript.

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