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Geographic Distribution of Active Medical Specialists in Iran: A Three-Source Capture-Recapture Analysis

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Abstract

Background: Estimation of health workforce supply becomes problematic when there is no knowledge about the number of active specialists. The aim of this study is to estimate active specialists and their geographic accessibility in Iran.

Methods: We enrolled all medical specialists from the Iranian Ministry of Health database (14 151), national hospitals survey (28 898) and Continuing Medical Education registries (13 159) in 2015. Duplicate records across the three registries were identified based on the similarity of national ID codes and medical council codes. The number of active medical specialists was estimated by three-source capture-recapture method using Stata 12 software.

Results: A total of 33,416 specialists were identified from three sources. We estimated the number of specialists at 39 127 (95% CI: 38823.6-39448.4) in 2015. Of these, 45.4% pertained to the province of Tehran while only less than 1.8% of specialists were in the provinces of Ilam (0.50%), South Khorasan (0.56%) and Kohgiloye and Boyerahmad (0.59%). The estimated ratio for specialists was 4.9 per 10 000 population and ranged from 9.2 per 10 000 in Tehran to 1.5 per 10 000 population in Sistan and Balochestan. The overall completeness of data registries by three sources was 85.4%.

Conclusion: The current distribution of specialists appears to be imbalanced. It is suggested to adopt appropriate policies to improve the distribution and maintenance of medical specialists in different parts of Iran.

Keywords: Iran, Medical geography, Workforce

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Introduction

The supply of active physician implies the number of trained physicians who are employed by a health system.[1] The number of these physicians depends on the number of graduates from medical schools in the first place and then the number of individuals who continued their career by practicing medicine in the country of origin.[2] Regarding physician supply, the number of medical specialists is one aspect which indicates workforce availability; however, geographic distribution is another aspect which shows workforce accessibility and is one of the prominent indicators of equity in health systems performance/efficiency evaluation.[3]

This is an important point since even if the required number of physicians is achieved in national scope, their unbalanced geographic distribution leads to inappropriate accessibility to healthcare services in areas with physician shortage while in areas with physician surplus, there will be excessive health service delivery, increase in medical errors and side effects.[4] Therefore, it is essential to consider these aspects in review of specialists supply and their implications for supply-and-demand projections in coming years.

For specialist supply-and-demand studies in developed countries with up-to-date registries, it is only required to focus on relevant approaches and models. In fact, the up-to-date information system of specialists has resolved problematic calculations of workforce and has become a reliable source for estimating the future supply of specialists. Moreover, it paves the ground for moving

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towards acceptable accessibility of specialized services to people. On the other hand, in most countries especially the developing ones, lack of a centralized and up-to-date registry prevents the health workforce planning experts from estimating the supply-and-demand and thus limits the studies to simple theories and hypotheses. This matter has been one of the most prevalent and fundamental issues of health sector policy making regarding specialists in developing countries including Iran. It has evolved to a critical challenge in achieving equity of health services access.[5]

To estimate the number of specialists in most countries, the primary data source is the main national medical council database.[6] However, the master file data is prone to/suspected of overestimation of active physicians due to delay in master file updates. To avoid this issue, the American Medical Association master file is regularly updated through different surveys.[7] In the state of Florida, self-reporting methods are used to estimate the number of physicians who are active, for instance, among licensed physicians, or data is gathered from physicians' prescriptions in pharmacies indicating their active status. In another report, the active supply of physicians was determined through matching data sources such as medical council bank and telephone directories.[8] These studies are often costly and not feasible in most countries.

A method of obtaining an accurate estimate of health workforce supply-and-demand is known as the capture-recapture (CRC) method.[9] It has been shown to minimize the risk of over- or underestimation ever since its initial years of application in different animal population estimations to more sophisticated studies in recent epidemiologic research.[10,11] Noting that only few studies have applied the CRC method for the estimation of health workforces in developing countries, this study aims to estimate the density of medical specialists' active supply with a focus on Iran's case as a developing country using the novel method of three-source CRC in health workforce estimation.

Material and Methods

Data Gathering

This cross-sectional study was conducted in 2016 on all medical specialists in Iran. We used three independent national data sources including the national survey of specialists who are active in hospitals, the Iranian Ministry of Health database and the national registry of Continuing Medical Education (CME) to collect more complete data on active medical specialist in Iran. In the national hospital survey database, we included the data of active specialists from 925 hospitals in Iran in 2015 based on the hospitals' personnel registries. A total of 28 898 specialists were included from hospitals affiliated to ministry of health and medical education, military service hospitals, social insurance organization hospitals and private and charity hospitals. Moreover, 14 151 specialists were enrolled using the national registry system of the Human Resources Management (HRM) office in the Iranian ministry of health and medical education. This database was updated annually based on specialists who are active in the service delivery system. In the third national database, we enrolled 13 159 specialists from the continuing medical education system. More details of data collection process from the national data bank have been described previously.[12]

We used the transformation, extraction and loading method for data cleaning and assessing the accuracy of retrieved data. This method is known as a practical technique when we have various data registries through data linkage process.[13] Some criteria such as medical council code, name, surname and father's name and national ID code were used to identify the same records for a unique person. The SQL functions of Access software were used to perform data linkage.

Data Linkage

In the first step, we found and removed the duplicate records in each data source using Excel software. We used some variables such as name, surname and father's name, medical council code and personal national ID code to identify the common records across the three databases in Microsoft Office Access software version 2007.

Statistical Analysis

Three-source capture-recapture method using log-linear model was used to estimate the number of specialists who are active in Iran. We assessed the independency assumption between various data sources that should be considered when applying the capture-recapture method. Also, all specialists who are active had equal potential possibility to be registered in each data source. Also, we assessed all possible interactions between our three sources in log-linear models. Based on the eight possible interactions between the three sources of data registry in this study, we ran all eight possible combinations that consisted of a common parameter (the logarithm of the expected number in all data source lists), three 'main effects' parameters, three 'two-way interactions' and a 'three-way' interaction parameter.

Before we ran the CRC analysis, we assessed model fitting among eight possible log-linear models to find the model that had better fitting on our data using the goodness of fit criteria e.g. log likelihood-ratio (G^2 test), Bayesian information criteria (BIC) and the Akaike's information criterion (AIC).

The G^2 test was calculated as below:

$$G^2 = -2\sum Obs_j \ln[Obs_j/Exp_{ji}]$$

Where Obs_j is the observed number of subjects in each cell of j, and the expected number of subjects in each cell j under model i was shown as Exp_{ji}.

$BIC = G^2-[\ln N_{obs}][df]$

Where *df* is the degree of freedom and *N* is the total number of observed individuals.

We considered the log linear model with lower amount of AIC as the best fit model. STATA software, version 12 (StataCorp, Texas, USA), was used for all statistical analyses. We used the Arc GIS software to map the geographic distribution of specialists in Iran.

Results

A total of 838 (93%) hospitals in Iran enrolled in the survey. Of these, 42 hospitals (4.5%) did not respond and 45 hospitals (4.86%) withdrew from the study. A total of 33 416 specialists were included after removing the duplicate cases from each database. The hospital survey (A), and two data sources of MOHME human resource management office (B) and CME (C) yielded 28,898, 14 151 and 13 159 specialists, respectively. Male specialists accounted for 21 350 (63.89%) of the total 33 416 specialists. The male specialists had a mean age of 50.30 (± 11.44) years and the mean age of female specialists was 43.96 (± 8.49) years. The common specialists recorded across the three data registries are shown in a Venn diagram (Figure 1).

Current Supply

Table 1 represents the characteristics of specialists enrolled in this study. According to the data source A, B and C, 6727 (23%), 6185 (44%) and 5613 (43%) of specialists are working in the academic settings, respectively. In terms of recruitment relation, 39%, 39% and 33% of the specialists in data sources B, C and A were commonly employed on a permanent basis (Table 2). Moreover, our finding indicated that the majority of specialists were aged 35 to 55 years.

Figure 2 shows the specialists' ratio per population in Iran. Comparing the Tehran metropolitan area to the other provinces shows that there are 0.83 specialists per 100 000 populations in Tehran while in other cities, the ratio is 0.59-0.8.

Estimated Number of Specialists by CRC Method

We used the model with twice two-way interactions between three registries (C & B, A & B) as the best fitted model based on lower amount of AIC (448.7) and BIC (448.4) in model selection process (Table 2). The total amount of estimated specialists in 2016 was 39,127.5 (95% CI: 38 823.6-36 448.2). Moreover, based on log-linear model estimation, it was estimated that 5711 of all medical specialist were not registered in any of the three

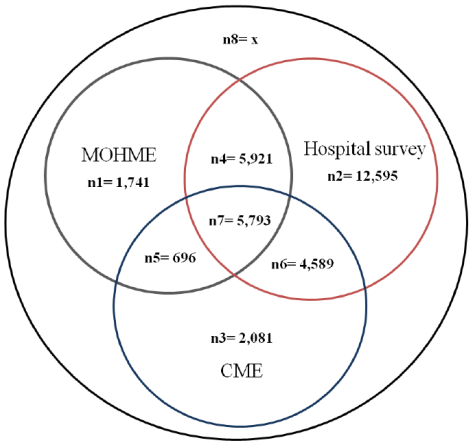

Figure 1. Venn Diagram Showing Common Records of Medical Specialists Across Three Sources; MOHME, Hospital Survey and CME.

Table 1. Descriptive Statistics of Specialists Registered in Three Sources in 2015.

Characteristics	Hospital Survey (A)		MOHME (B)		CME (C)	
	No.	%	No.	%	No.	%
Academic Situation						
Academic	6727	23%	6185	44%	5613	43%
Non-academic	22 171	77%	7966	56%	7546	57%
Sex						
Male	18 751	65%	8360	59%	9121	69%
Female	10 147	35%	5791	41%	4038	31%
Recruitment relation						
Payam avar[a]	21	0%	13	0%	8	0%
Zarib K[b]	5102	19%	3260	25%	982	9%
Peymani (semi-permanent)	2359	9%	2506	19%	1763	17%
Contractual	8725	33%	607	5%	2607	25%
Others	4182	16%	1531	12%	1343	13%
Permanent	5884	22%	5102	39%	3661	35%
Age						
Less than 35	1474	5%	1471	10%	285	2%
35-45	10 565	37%	6212	44%	4547	35%
46-55	10 996	38%	4945	35%	5618	43%
56-65	3513	12%	1274	9%	1786	14%
Over than 65	2277	8%	203	1%	904	7%

MOHME, Ministry of Health and Medical Education Database; CME, Continuing Medical Education.

[a] Recruitment contract in which graduates who are committed to do obligatory military service work in health related centers instead, mostly in deprived areas.

[b] Recruitment contract in which medical specialty graduates who are legally committed to certain obligations fulfil these obligations in a health-related center.

Figure 2. Geographic Distribution of Specialist's Ratio Per 100 000 Populations in Iran.

data registries (Tables 2 and 3). The completeness of registration for all three data sources was 85.4% (33 416 subjects) after removing duplicates; for hospital survey (A), MOHME HR (B) and CME (C), completeness was 73.85% (28 898 records), 36.16% (14 151 records) and 33.63% (13 159 records), respectively (Table 3).

In CRC analysis, the estimated number of specialist were 24,862.4 (95% CI: 24 639.5–25 100.5) and 14 357.4 (95% CI: 14 140.6–14 596.9) for male and female subgroups, respectively. Based on estimations, the majority of medical specialists were male and 14 375.3 (36.6%) were aged between 36 to 45 years. The estimated number of specialists by province showed that 45.4% belonged to the provinces of Tehran (30.1%), Khorasan Razavi (6.9%) and Isfahan (6.3%) (Table 3). Only fewer than 1.8% of the specialists were in the provinces of Ilam (0.50%), South Khorasan (0.56%) and Kohgiloye and Boyerahmad (0.59%) (Table 3). The estimated number of specialists by field of specialty is reported in Table 4. Among all fields of specialty, internal medicine (4603.7 [95% CI: 4535.5–4683.9]) and obstetrics and gynecology (4544.8 [95% CI: 4486.3–4614.8]) had highest number of active specialists while occupational medicine (191.5 [95% CI: 163.9–303.7]) and nuclear medicine (134.2 [95% CI: 127.9–145.6]) had the lowest number of active specialist in Iran. In some fields of specialty such as social medicine, sports medicine and geriatrics, there was not enough data in the three sources of registries to run the capture-recapture analysis.

Geographic Distribution of Active Medical Specialist

The distribution of specialists according to the estimated numbers among provinces indicated that the provinces of Tehran (9.2), Semnan (6.1), Qom (6.0), Yazd (5.6), Fars (5.0), and East Azarbaijan (5.0) had the most specialists per 10 000 population . On the other hand, the provinces of Hormozgan, Lorestan and Sistan & Baluchestan, with rates of 2.1, 2.0 and 2.5 specialists per 10 000 population, had the lowest share of specialists (Table 3). The geographic distribution of specialists per 10 000 populations in Iran is shown in Figure 2.

Discussion

This study conducted a quite precise estimation of the present active number of medical specialists in different provinces of Iran. Utilizing the CRC technique, our results demonstrated that the assessed number of specialists in Iran has expanded significantly contrasting with existing information sources. The total number of medical specialists was 39 127.5 in 2016 while approximately 5711 specialists were not registered in any of the existing data banks. Realistically, this research shows the inaccuracy of the existing information systems due to inefficient data coverage and update.

Shortage or surplus of medical specialists has always been the main concern in health sectors workforce planning and it has been a controversial issue in most countries[14]. In our

Table 2. Goodness of Fit Criteria for Model Selection in Capture-Recapture Analysis

Model	X	*n*	95% CI for *n*	DF	G^2	BIC	AIC
C/A/B	2874.7	36290.7	(36190.6–36394.4)	4	1838.3	1915.8	1916.0
CA/B	2702.6	36118.6	(35981.4–36263.2)	5	1827.9	1907.3	1907.6
CB/A	3490.4	36906.4	(36778.6–37039.0)	5	867.5	947.0	947.3
AB/C	3805.2	37221.3	(37040–41216.9)	5	1613.9	1693.3	1693.6
CA/CB	3703.4	37119.4	(36916.9–37333.5)	6	860.1	941.5	941.8
CA/AB	5205.4	38621.4	(38136.3–39156.5)	6	1558.9	1640.6	1640.2
CB/AB	5711.5	39127.5	(38823.6–39448.4)	6	367.0	448.4	448.7
CA/CB/AB	13987.1	47394.1	(45942.3–49014.28)	7	0.01	83.35	83.73

AIC, Akaike's Information Criterion; BIC, Bayesian Information Criterion; G2, Goodness of fit; DF, Degree of freedom; X, The estimated number of medical specialist that were not recorded in any of three sources; n, The estimated total number of medical specialist in Iran in 2015; C, continuing medical education source; A, hospitals survey Source; B, MOHME HR bank; C/A/B, A model where all available resources are independent; CA/B, A model where sources C and A are dependent and independent of the source B; CB/A, A model where sources C and B are dependent and independent of the source A; AB/C, A model where sources A and B are dependent and independent of the source C; CA/CB, A model where two sources C and A and also two sources C and B are mutually interdependent and two sources A and B are independent; CA/AB, A model where two sources C and A and also two sources A and B are mutually interdependent and two sources C and B are independent; CB/AB, A model where two sources C and B and also two sources A and B are mutually interdependent and two sources C and A are independent; CA/CB/AB, A model where all two-way interaction between resources existed.

Table 3. Estimated Number of Active Medical Specialist by Capture-Recapture Analysis in 2016

Subgroups	Reported Number of Specialists*	Estimated Number of Specialists	95% CI for Estimated Number of Specialists	Estimated Number of Specialists Per 10 000 Population	Completeness of Registration** (%)
Gender					
Male	21350	24862.4	(24639.5–25100.5)	—	85.8
Female	12066	14357.4	(14140.6–14596.9)		84.0
Age groups					
≤35	2031	2443.5	(2310.2–2640.5)	—	83.1
36–45	12460	14375.3	(14567. –14200.8)	—	86.6
46–55	12366	14363.5	(14196.5–14545.6)	—	86.0
56–65	3868	4478.5	(4391.7–4579.7)	—	86.3
≥66	2599	3575.6	(3436. –3738.4)	—	72.6
Provinces					
Alborz	952	1152.9	(1100.8–1223.1)	4.3	82.5
Ardebil	373	443.9	(409.8–509.4)	3.4	84.1
Bushehr	308	337.3	(320.4–377.0)	2.9	91.3
Charmahal Bakhtiari	322	390.6	(358.7–450.3)	4.1	82.4
East Azarbaijan	1683	1937.6	(1871.3–2027.3)	5.0	86.8
Fars	2089	2433.3	(2356.8–2531.8)	5.0	85.8
Gilan	1083	1190.3	(1160.3–1231.9)	4.6	90.9
Golestan	590	659.2	(634.9–696.4)	3.4	89.5
Hamedan	562	670.6	(627.6–741.7)	3.7	83.8
Hormozgan	321	376.9	(352.2–421.3)	2.1	85.1
Ilam	199	227.5	(209.9–273.3)	3.8	87.4
Esfahan	2354	2491	(2473.6–2510.8)	4.8	94.5
Kerman	936	960	(953.1–969.6)	3.0	97.5
Kermanshah	519	541.0	(534.3–550.5)	2.7	96.0
Khorasan Razavi	2649	2738	(2724.2–2754.3)	4.2	96.7
Khozestan	1344	1385	(1375.6–1397.0)	2.8	97.0
Kohgiloye & Boyerahmad	227	232	(229.8–236.4)	3.2	98.1
Kordistan	388	397.0	(393.3–403.3)	2.5	97.7
Lorestan	367	376.0	(372.2–382.6)	2.0	97.6
Markazi	526	615.1	(583.4–664.3)	4.1	85.5
Mazandaran	1437	1573.1	(1539.5–1617.7)	4.9	91.3
Northern Khorasan	208	259.7	(234.6–308.2)	2.8	80.0
Qazvin	483	522.2	(505.6–550.7)	4.1	92.4
Qom	637	762.6	(720.4–826.1)	6.0	83.5
Semnan	384	422	(405.6–450.6)	6.1	90.9
Sistan and Balochestan	370	452.2	(414.5–521.9)	1.5	81.8
Southern Khorasan	201	221.4	(209.5–249.4)	2.4	90.7
Tehran	9652	11796.6	(11613.5–11996.7)	9.2	81.8
Western Azarbaijan	841	958.5	(911.8–1035.9)	2.9	87.7
Yazd	586	623.6	(608.8–647.9)	5.6	93.9
Zanjan	305	334.4	(334.4–417.6)	3.1	84.1
Total	33416	39127.5	(38823.6–39448.4)	4.9	85.4

*Number of registered medical specialists by national hospital survey, MOHME HR bank and continuing medical education bank after removing duplicates.
**Number of registered specialists divided by the estimated number of specialists.

study, the national ratio of medical specialists was 4.9 per 10 000 populations based on a population of 79 686 000 in 2015 while in the United States, this ratio is about 26 per 10 000 populations.[15] In Canada, it is 10, and in Denmark, Finland and Norway, it is 23.2, 21.8 and 23.4, respectively.[16,17] Therefore, the physician to population ratio in Iran is much lower than developed countries and it is expected that this shortage will be intensified in the coming years due to the aging population, changing disease pattern, lifestyle changes and growth in demand and expectations of health care. However, according to the results of our study, there are a significant percentage of physicians in retirement age, which will further sharpen the shortage of specialists. All these calculations were based on the number of specialists; however, if they were based on productivity or full-time equivalency, the actual supply of medical specialist would be much smaller. In 2003, the Canadian health full-time (equivalent) model showed that the average FTE for specialist physician is 0.86 per physician i.e. 15 797 FTE against 13 594 headcount.[18]

Table 4. Estimated Number of Active Medical Specialists by Field of Specialty in Iran

Field of Specialty	Reported Number of Specialists *	Estimated Number of Specialists	95% CI for Estimated Number of Specialists	Completeness of Registration (%)**
Nose and Throat and Head and Neck Surgery	1152	1347.1	(1293.8–1420.1)	85.5
Obstetrics and Gynecology	4194	4544.8	(4486.3–4614.8)	92.3
Ophthalmology	1442	1694.6	(1633.9–1774.3)	85.1
Neurosurgery	622	650.8	(638.3–673.1)	95.6
Urology	926	983.8	(966.1–1009.3)	94.1
General Surgery	2929	3243.4	(3182.9–3318.2)	90.3
Orthopedics	1601	1709.8	(1679.1–1752.9)	93.6
Psychiatry	1349	1699.7	(1624.9–1494.7)	79.3
Neurology	838	945.9	(914.3–990.7)	88.5
Pediatric	3379	3920.1	(3839.5–4016.5)	86.2
Infectious disease	731	801.5	(780.6–829.7)	91.2
Internal medicine	4152	4603.7	(4535.5–4683.9)	90.1
Dermatology	627	948.7	(853.2–1083.6)	66.8
Cardiology	1940	2054.4	(2024.2–2095.5)	94.4
Radiology	1657	2361	(2211.9–2552.3)	70.2
Anesthesiology	2959	3327.5	(3245.4–3433.5)	88.8
Emergency Medicine	690	891.5	(777.8–1152.3)	77.4
Pathology	971	1361.7	(1274.4–1472.4)	71.6
Radiotherapy	211	238.4	(226.5–258.1)	88.6
Nuclear medicine	120	134.2	(127.9–145.6)	89.4
Occupational Medicine	155	191.5	(163.9–303.7)	80.9
Forensic Medicine	219	268.3	(248.1–302.7)	81.6
Physical medicine and rehabilitation	270	358.4	(324.6–413.2)	75.6
Sports Medicine	62	—	—	—
Social Medicine	211	—	—	—
Geriatrics	4	—	—	—

*Number of registered medical specialists by national hospital survey, MOHME HR bank and continuing med-ical education bank after removing duplicates.
**Number of registered specialists divided by the estimated number of specialists.

Gender is another factor that must be considered when examining the shortage or surplus of specialist doctors due to the different working patterns of women and men. Some studies in the United States show that male doctors were less dynamic than their female peers in the ending period of their profession (55 to 64 years) while female doctors are less dynamic in the early phases (25 to 34 years). In addition, specialists' sex has a determining role in their retirement age as studies show that men work longer years than women.[6] According to the results of this study, 63% of active medical specialists in Iran are male, meaning that women account for only one third of total specialists. Compared to 2012, the number of female doctors has increased significantly (31% female specialist ratio)[19]; however, this increase does not necessarily mean an increase in the active supply of specialists due to the lower female participation rate in service delivery.[20] Different preferences of female doctors in choosing specialized disciplines, such as less willingness to practice surgery and more willingness to work in urban areas,[21] are important issues to be considered in analyzing the increase in the proportion of female specialist doctors and their impact on planning and distribution of specialist doctors.

Findings on geographical distribution of medical specialists show that about 50% of doctors are located in three provinces of Tehran, Khorasan Razavi and Isfahan. Comparison of provinces showed that the ratio of specialist to population in central provinces was significantly higher than the total national average (more than 5.5 to 10 000 population) while in deprived provinces, this ratio was much lower than the average, nearly 2 to 10 000 populations. Compared to previous studies in Iran, the current distribution of doctors appears to be better than earlier findings.[22] However, mal-distribution of specialists in different parts of the country is still evident and seems to be a serious issue faced by most countries. The negative impacts of this phenomenon have been more obvious in middle- and low-income countries. The World Health Organization has reported that half of the world's population lives in rural areas, while fewer than a quarter of physicians serve in these areas.[23] Japan, China, Britain, Australia, America, Turkey, Africa, especially sub-Saharan Africa, Indonesia, and Thailand have reported this problem.[24-32] For example, in Indonesia, 20% of physicians serve 70% of the rural population31 and in South Africa, 25% of specialized physicians cover 46% of

rural residents.[30,31] Most studies show that inappropriate distribution of specialist doctors has occurred due to the attractiveness of large cities in terms of economic and social factors, health facilities and financial incentives.[33]

Given the negative impacts of this problem on health outcomes, interventions by governments and formulation of appropriate policies are necessary. The World Health Organization has proposed to apply a comprehensive package of measures such as legal and educational policies, financial incentives and professional supports.[34]

This study has potential limitation. Although we tried to run a comprehensive national hospital survey (as one of our data sources in three-source capture-recapture method), some military hospitals did not share the complete list of specialists. However, considering the limited number of military hospitals that did not have sufficient cooperation compared with the total number of hospitals in Iran, this issue could not have had a major impact on our findings. Nevertheless, we tried to minimize the potential impact on our findings by using two additional sources of registry e.g. CME and MOHME database.

This study showed that the geographic distribution of specialists is not appropriate in Iran. The current distribution appears to be imbalanced and the specialists are mainly concentrated in advantaged areas where there is comparatively more and better healthcare facilities while the underserved areas need more medical services, particularly specialized. Moreover, the number of specialists is a health system performance indicator which shows equality in health care services accessibility, and therefore appropriate measures should be taken for its improvement. It is suggested to develop an optimum process for the distribution of specialists and adopt appropriate policies in terms of improved distribution and maintenance of medical specialists in different parts of the country.

Authors' Contribution

Conception or design of the work: MB, MK, AS, GSZ and EM. Data collection: AS, EM, RK, FGS and SRK. Data analysis and interpretation: MK and AS. Drafting the article: MB, MK, AS, GSZ, RK, EM, FGS and HF. Critical revision of the article: MB, MK, AS, EM, GSZ and SRK.

Conflict of Interest Disclosures

The authors declare that they have no competing interests.

Ethical Statement

Not applicable.

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