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Estimates of human resources of dental specialists in Iran by 2025

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Review Article

Abstract

BACKGROUND AND AIM: Dental specialists have a fundamental role in the dental care system. In some countries, the number of dental specialists fulfills their workforce needs, whereas in developing countries, it does not. It is essential to plan for training professional workforce regarding the purpose of using specializations in developing programs of health sector. Although previous reports of Iran's dental human resources are accessible, there are no published data on the prediction of this important issue in the future. This study aimed to estimate the country's need for dental specialists by 2025 and provide the possibility of appropriate planning to complete and administrate the specialized human workforce for senior managers.

METHODS: This study was done based on an explanatory mixed-methods design at three steps. Supply analysis phase, collecting the status quo data and the process of variations in the admission and supply of dental residents, was done. Need assessment phase, the demand for dental specialties, in both treatment and educational sectors in Iran by 2025, was conducted. Gap analysis phase, the estimated gap between supply and demand of specialized workforce, was calculated by 2025, and the shortage or surplus was obtained.

RESULTS: In the fields of orthodontics, pediatrics, maxillofacial surgery, prosthetics, and restorative dentistry, we will need 279, 292, 335, 216, and 229 specialists, respectively, by 2025. In endodontics, periodontics, and oral diseases specialists, we will reach almost the desired situation. In oral pathology and radiology, we will have 87 and 59 specialists more than the defined standards, respectively.

CONCLUSION: Using the results of estimating the required number of dental specialists by 2025, and considering the admission capacity of the country's universities, the national division of labor concerning training of specialized dentists needed for the coming years can be done.

KEYWORDS: Human Resources; Specialists; Dentistry

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Oral health is the main part of a person's overall health. In fact, if individuals do not have good oral health, they are not considered healthy.[1] In order to improve people's oral health in each country, an informed and trained group of dentists and dental specialists is needed.[2]

Dental specialists have a fundamental role in providing special services to the patients, increasing the quality of dental care, using new procedures in patients' treatment, conducting clinical and academic research, and participating in continuing dental education of general practitioners.[3]

The human resources profile of dental

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specialists varies in different countries. The countries with the greatest number of dental specialists are the United States (US), Cuba, Canada, and France.[4] In some developed countries such as the US, Germany, Belgium, and the Bahamas, the dental specialty education system complies with their workforce needs, whereas in the developing countries such as Burundi, Burkina Faso, and Mozambique, it does not.[4] Some countries of the European Union such as the Netherlands, Belgium, Denmark, Austria, Spain, Italy, and Greece have few or no dental specialties at all. Others, such as the United Kingdom (UK), Sweden, Iceland, Slovenia, and Poland have many formally recognized specialties.[5] In Chile, 26.6% of dentists have accredited specialties.[6]

In Australia, there are 6.4 practicing specialists per 100000 population, and orthodontists are the largest group of specialists in this country.[3] Besides, in the UK, the dental specialist workforce is dominated in numbers by orthodontics.[7]

On the other hand, the unbalanced distribution of health care specialists is a long-standing and serious problem in many countries.

In Europe, with a population of more than 500 million people, there are about 300000 dentists, but the distribution of the dental human resources is unbalanced.[8] There is also an unfair distribution of specialists in Australia, so that the focus of dental specialists is in cities, and rural areas have little access to specialists.[3] In many parts of South Africa and Mexico, people have limited or no access to dental specialists.[9,10]

There are 36 public and 3 non-governmental schools of dentistry in Iran. Resident training is offered in 10 specialized fields in 15 public and 2 non-governmental dentistry schools. According to medical education policies in Iran, the annual resident admission has always had an ascending trend. The only exception has been a decline in the three fields of oral radiology, oral pathology, and oral diseases in recent years.[11] Based on the results of a study by Afsahi et al.,[11] there are 30811 general dentists and 4593 dental specialists in Iran. Most of them have graduated since 1980 and after the Iranian revolution. In Iran, the most numerous dental specialists are endodontists. Orthodontics is in the second place followed by restorative dentistry and prosthodontists. There are more specialists in the areas where there are more general dentists; the highest ratio of dental specialists to population is reported in Tehran and Ilam, Iran.[11]

It is essential that planners and policymakers ensure that sufficient human resources are well-distributed in terms of time and place to provide adequate access to health services. Comparison of the dental specialists' frequency in Iran with both developed and developing countries shows that they do not match in terms of ranking in number.[2,10] It seems that initial efforts to train more specialists in order to meet the standards, regardless of the type of specialty fields, have led to this situation. Moreover, the country's population is also growing, which leads to increasing applicants for specialized dental services. Therefore, it is essential to plan for training professional and trained human resources following the purpose of using specializations in health sector development programs, which will increase the health services efficiency and growth rate. Although there are previous reports on the Iranian dental human resource, focused on its current distribution profile,[11,12] there is no published document on the future prediction of this important sector. This study aimed to estimate the country's need for specialized human resources in various fields of dentistry by 2025 and to provide the possibility of appropriate planning in order to complete and administrate the specialized human workforce, for the health sector senior managers.

Methods

The present study used an explanatory mixed-methods design and was conducted at three steps:

Supply analysis phase: In this phase, the main focus was on collecting the status quo data and the variations in the admission and supply of dental residents.

Table 1. Description of the status of dental specialists in 2019 in Iran

Field	Dental specialists [n (%)]	Specialists per 100000 population
Orthodontics	593 (12.9)	0.72
Pediatrics	505 (11.0)	0.62
Surgery	380 (8.3)	0.34
Endodontics	635 (13.8)	0.77
Periodontics	508 (11.0)	0.62
Operative dentistry	544 (11.8)	0.66
Dental prosthesis	517 (11.3)	0.63
Oral medicine	374 (8.1)	0.46
Oral radiology	350 (7.6)	0.43
Oral pathology	193 (4.2)	0.24
Total	4593	5.49

In Iran, after completing the 6-year course of general dentistry, there are 10 specialized fields for continuing education. According to previous studies, in 2019, the total number of specialized dentists in Iran was 4593. Moreover, in a total of 36 public universities with 10 specialized fields studied, 1824 specialists are employed as faculty members.[11] In this way, the status of the existing specialized human resources and the ratio of each specialty to the country population were collected (Table 1).

Further, in this phase, the number and distribution of residency admission in specialized fields of dentistry in all Iranian universities of medical sciences were collected through correspondence with the Secretariat of the Dental and Specialized Education Council, which is in charge of admission and training specialized dental residents. The frequency of dentistry residency admission in universities of medical sciences, in the last three years, shows a stable situation; 1456 specialized residents are studying in different fields. According to the average annual residency admission in Iran, 3398 dental specialists are expected to be graduated by 2025 (Table 2).

Need assessment phase: The purpose of this phase was to determine the health system demand for specialized dental fields in both treatment and educational sectors in Iran by 2025. A method to measure the need for human resources is deploying the equal countries approach. The criteria such as population, geographical distribution index of the population, gross domestic product (GDP) per capita, and also, the population's age and gender are considered to select equal countries. Unfortunately, there are no accurate statistics on supply indicators for dental specialties in equal countries such as Malaysia, Poland, Argentina, Egypt, Mexico, and neighboring countries of Iran, as regionally and politically equal countries. Therefore, in this phase, supply indicators of the three developed countries, including Australia, the UK, and the US were considered as the criteria countries.

Table 2. Frequency of residents' admission in the last three years and estimation of graduates by 2025

Field	2019	2018	2017	Estimation of graduates by 2025
Orthodontics	35	38	38	259
Pediatric dentistry	35	35	38	252
Maxillofacial surgery	49	49	50	345
Endodontics	41	41	44	294
Periodontics	39	39	39	273
Operative dentistry	41	39	37	273
Dental prosthesis	45	40	44	301
Oral medicine	40	38	40	275
Oral radiology	25	25	28	182
Oral pathology	20	20	20	140

Since these countries have reached a stable position in the field of dental human resources, due to the free health economy based on supply and demand, paying attention to the dentist-population ratio in these countries and their arrangement of variant specializations could be a criterion for estimating our country's needs (Table 3).

By analyzing the specialist-population ratio in the selected criteria countries, considering the specific social, health, and economic conditions of Iran, and using the experts' assessments, these ratios were localized for Iran and the desired ratios for 2025 were presented. The criteria for selecting experts to participate in expert meetings were: 1) experience and managerial or policy work in medical sciences education, 2) history of similar researches and studies in the country, and 3) history of teaching or educational experience on similar topics. Since the provincial centers are mostly referred by people from the surrounding and have a higher population density, according to the experts' assessments, the specialist-population ratio was estimated for provincial centers and 92 cities with a population of over one hundred and fifty thousand (Table 4).

Gap analysis phase: In this phase, the estimated gap between specialized human resources' supply and demand by 2025 was anticipated, and thus, the shortage or surplus of specialized human resources in various fields was obtained. The number of specialists by 2025 includes the total number of dental specialists in the country[11] and specialized residents who will be graduated by the target year.

On the other hand, the required specialized human resources in the target year include two groups of treatment and education. The treatment group was assessed using the indicators of the criteria countries and the experts' assessments, and the required human resources in the education sector were estimated using the faculty members' educational needs assessment results announced by the Secretariat of Specialized Dental Education. Thus, the total number of the required treatment and educational human resources was considered as the total required human resources in the target year.

To obtain the population growth index, the data published by the Iranian Statistics Center for the 2017 census were used, which are available to the public on the website of the Statistics Center. In 2017, the country's population was announced as 79926000 people and with an annual population increase of 10.5% in 2019, the population was 82084000, and in 2025, the population is estimated to be 88432000 people. The average age of dental specializing graduates is low, and as a result, their mortality and retirement rates are low. On the other hand, foreign medical degrees are not acceptable in many developed countries, which reduces the labor migration rate for these graduates. However, according to the experts' opinions, a 2% annual reduction in human resources was considered for all fields.

Thus, considering the current process of admitting dental residents, the difference between the existing human resources by 2025 with human resources calculated in the demand phase was announced as a shortage or surplus of the dental specialized human resources.

Results

By 2019, there were 4593 dental specialists in Iran. The highest number of specialists was related to the fields of endodontics (13.8%), orthodontics (12.9%), and restorative dentistry (11.8%), respectively, and the lowest number was related to maxillofacial pathology (4.2%). Currently, 1456 dental residents are studying in various specialized fields of dentistry. Taking into account the average annual acceptance of residents in each field by 2025, it is estimated that 3398 specialists in different fields will be graduated from universities. Estimates of graduates in different specialized fields are presented in table 2.

In 2019, a total of 1824 specialists have been employed in the medical universities as faculty members in 10 dental specialized fields.[11]

Table 3. Frequency of different dentists in three criteria countries [Australia, the United Kingdom (UK), and the United States (US)]

Field	The US		The UK		Australia	
	Per 100000 population ratio	Specialists [n (%)]	Per 100000 population ratio	Specialists [n (%)]	Per 100000 population ratio	Specialists [n (%)]
Operative dentistry	-	-	0.48	308 (8.3)	-	-
Surgery	2.31	7546 (18.0)	1.14	728 (19.2)	1.00	206 (15.8)
Endodontics	1.74	5664 (13.5)	0.40	255 (7.0)	0.60	116 (9.0)
Orthodontics	3.27	10658 (25.5)	2.09	1338 (36.5)	2.50	518 (40.0)
Pediatric dentistry	2.39	7778 (18.7)	0.37	236 (6.5)	0.50	100 (7.7)
Periodontics	1.77	5790 (14.0)	0.52	334 (9.0)	0.70	146 (11.0)
Prosthodontics	1.14	3708 (9.0)	0.66	421 (11.5)	0.80	171 (13.0)
Oral pathology	0.13	426 (1.0)	0.05	31 (1.0)	0.10	23 (1.8)
Oral radiology	0.04	144 (0.3)	0.04	24 (1.0)	0.10	23 (1.8)
Total	12.79	41714	5.75	3675	6.30	1303

Table 4. Estimation indicators for 2025 in Iran

Field	For each city with a population over 150000 people	Per 100000 population in the provincial capitals
Operative dentistry	2	1.2
Surgery	2	1.5
Endodontics	2	1.2
Orthodontics	2	1.8
Pediatric dentistry	2	1.5
Periodontics	2	1.2
Prosthodontics	2	1.2
Oral pathology	1	0.1
Oral radiology	1	0.5
Oral medicine	1	0.5

The faculty members employed in 2019 are presented based on the information obtained from the Department of Human Resources of the Ministry of Health and Medical Education. In order to estimate the required human resources as faculty members by 2025, the report of the Secretariat of the Dental and Specialized Education Council was applied. In this report, the Iranian universities were divided into different groups based on the number of students and residency admissions (Table 5). Therefore, assuming that faculty members do not leave the universities and the number of faculty members in dental schools increases, we will achieve the favorable situation. There is a shortage of 1087 persons in 10 specialized fields in dental schools.

The needs of the treatment sector were assessed based on the population index. Given that between 2019 and 2025, the rate of population increase is 10.5%, after achieving the demand in 2019 (Table 6) with an increase of 10% due to the increase in population demand in the target year, the need in the target year was estimated. Thus, using the indicators presented in table 4 and considering the population growth, the needs in the treatment sector were calculated based on the population index.

Regarding faculty members serving half of their time as human resources in treatment sector, half of the faculty members' number was applied to calculate the number of treatment sector human resources. Since the number of specialists in Iran is known, the total estimated demand by 2025 is equal to the sum of the number of dental specialists in 2019 and the shortage in the treatment and educational sectors. Considering the number of graduated residents between 2019 and 2025 with the current process of residency admission and the number of existing specialists in the country, the number of specialists in the country by 2025 can be calculated. The difference between this situation and the total need estimated by 2025 shows the shortage of specialists in each field by 2025. For all these fields, a 2% annual reduction in human resources due to migration, retirement, and mortality was added to the shortage estimate, and by applying this rate, the estimated need was calculated (Table 7 and Figure 1).

In short, as the current process of residency admission continues, in the fields of orthodontics, pediatrics, maxillofacial surgery, prosthetics, and restorative dentistry, 279, 292, 335, 216, and 229 specialists, respectively, will be needed by 2025.

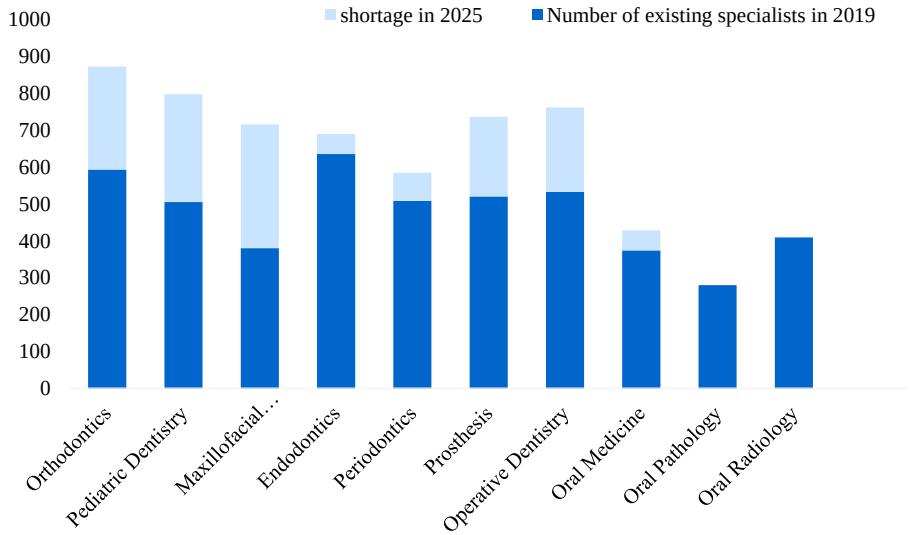

Figure 1. Estimates of human resources of dental specialists in Iran by 2025

Table 5. Current situation and estimated shortage of faculty members required in universities for 2025

Field	Orthodontics	Pediatric dentistry	Maxillofacial surgery	Endodontics	Operative dentistry	Periodontics	Prosthesis	Oral medicine	Radiology	Total	Pathology
Current situation	194	198	153	235	206	192	240	177	131	98	1824
Needed human resources	186	239	415	298	398	281	535	304	146	101	2903
Shortage/surplus	+8	-41	-262	-63	-192	-89	-295	-127	-15	-3	-1087

Table 6. Estimation of required dental specialists based on demographic index

Field	Population of provincial centers in 2017	Number of specialists in provincial centers in 2019	Specialists ratio per 100000 population in 2019	Ideal mode number of specialists per 100000 population in 2019	Shortage or surplus of specialists in provincial centers	Number of cities with a population of over 150000 in each province	Number of Specialists required for cities with a population of over 150000	Number of specialists available in the cities with a population of over 150000	Shortage or surplus of specialists in the cities with a population of over 150000	Total shortage or surplus in each province (center + cities)
Orthodontics	34482825	369	1.1	620.7	-251.7	92	184	66	-118	-369.7
Pediatric dentistry	34482825	253	0.7	517.2	-264.2	92	184	35	-149	-413.2
Maxillofacial surgery	34482825	227	0.7	517.2	-290.2	92	184	23	-161	-451.2
Endodontics	34482825	347	1.0	413.8	-66.8	92	184	44	-140	-206.8
Periodontics	34482825	337	1.0	612.0	-76.8	92	184	48	-136	-212.8
Prosthesis	34482825	299	0.9	413.8	-114.8	92	184	29	-155	-269.8
Restorative dentistry	34482825	282	0.8	413.8	-181.0	92	184	26	-158	-339.0
Oral medicine	34482825	56	0.2	172.4	-116.4	92	92	13	-79	-195.4
Oral pathology	34482825	58	0.2	34.5	23.5	92	92	9	-83	-59.5
Oral radiology	34482825	195	0.6	172.4	22.6	92	92	48	-44	-21.4

Table 7. Estimation of dental specialized human resources in Iran for 2025

	Orthodontics	Pediatric dentistry	Maxillofacial surgery	Endodontics	Periodontics	Prosthesis	Restorative dentistry	Oral medicine	Oral pathology	Oral radiology
Shortage based on the population index in 2019	-369	-413	-451	-206	-212	-269	-339	-195	-60	-22
Shortage based on the population index in 2025	-405	-454	-496	-226	-233	-296	-373	-214	-66	-24
Educational shortage in 2025	+8	-41	-262	-63	-89	-295	-192	-127	-3	-15
Total shortage of treatment and half of educational sector in 2025	-401	-474	-627	-258	-278	-444	-469	-277	-68	-32
Specialists available in 2019	593	505	380	635	508	520	532	374	193	350
Total demand estimated at 2025	994	979	1007	893	786	964	1001	651	261	382
Graduated residents from 2019-2025	259	252	345	294	273	301	273	275	182	140
Status of specialists by 2025	798	757	725	929	781	821	805	649	375	490
Specialist shortage by 2025	-196	-222	-282	36	-5	-143	-154	-2	114	108
Mortality/migration rate (2% per year) by 2025	-83	-70	-53	-90	-71	-73	-75	-52	-27	-49
Shortage considering the reduction rate of 2% per year	-279	-292	-335	-54	-76	-216	-229	-54	87	59

In the fields of endodontics, periodontics, and oral diseases, we will reach almost the desired situation (-54, -76, and -54 specialists, respectively). In the fields of oral pathology and radiology, we will have 87 and 59 specialists more than the defined standards, respectively.

Discussion

Achieving health-related goals in a population depends to a large extent on providing effective, efficient, accessible, and high-quality services nationwide by an adequate number of personnel in various specialized fields. In fact, human resources are the foundation of health systems and an important factor in people's access to high-quality health services.[10] The World Health Organization (WHO) expresses its concern in this regard: "We are currently facing a severe global crisis in the health system human resources. The major shortages, imbalanced skill mix, and unequal geographical distribution of health professionals have kept millions from accessing health services".[13] Studies have also shown a positive relationship between the number of available physicians and community health.[14]

In Iran, the ratio of dental specialists per 100000 population is 5.5 on average, and also, 6.3, 5.7, and 12.7 in Australia, the UK, and the US, respectively. As shown, it seems that the number of specialists in Iran is similar to some developed countries, but the existing specialists' distribution ratios do not fit together, which is probably due to the lack of attention to standards in various fields when admitting specialized residents. On the other hand, there is inequality in the geographical distribution of dental specialists in Iran. The skilled human resources are still concentrated in cities and there is little or no access to specialists in towns.[11] This unequal distribution is also a health system problem in some other countries.[3,8-10] It appears that increasing the number of dental schools in Iran was not effective in solving this old problem. In Iran, the fields of endodontics, orthodontics, restorative dentistry, and dental prosthesis have the highest number of specialists, respectively, and maxillofacial surgeons are the least common dental specialists, while in Australia and the UK, orthodontics, maxillofacial surgery, and dental prosthesis have the highest percentage of dental specialties. In the US, pediatric dentistry is also among the top three fields in terms of number.[11] One of the reasons for this difference in the ranking of dental specialties in Iran and developed countries may be the treatment-based dental system in Iran, which has led to giving less importance to preventive dentistry.[11]

If the dental specialists-100000-person ratio is considered, in the fields of orthodontics (0.72) and maxillofacial surgery (0.34), this ratio is very low in Iran compared to the three criteria countries. For orthodontics, this number is 2.5, 2, and 3.2 in Australia, UK, and the US, respectively, and for maxillofacial surgery, it is 1, 1.1, and 2.3, respectively. In the field of dental prosthesis, there is a ratio of 0.63 per 100000 persons in Iran, which is similar to that in the UK (0.66) and Australia (0.80) and lower than the ratio reported in the US (1.14). Among the criteria countries, only in the UK, like in Iran, restorative dentistry is defined as a separate specialty, and the ratio of specialists in this field in Iran (0.66) is slightly higher than that in the UK (0.48). In the field of pediatric dentistry, the ratio of specialists to 100000 persons in Iran (0.62) is slightly higher than that in the UK (0.37) and similar to that in Australia (0.50), while it is lower than that in the US (2.39). In the mentioned fields, considering the situation of the criteria countries, the rate of population increase, and the current trend of resident admission in Iran, we will not reach the desired number of required specialists.

In the field of endodontics, this ratio in Iran is 0.77 per 100000 persons, which is similar to Australia (0.60), higher than that in the UK (0.40), and lower than that in the US (1.74). The ratio mentioned in the field of periodontics in Iran is 0.62, which is similar to Australia (0.70)

and the UK (0.52), and lower than the US (1.77). In these two specialized fields and considering the current residency admission trend, we will reach the desired number of required specialists.

Among the specialized fields of basic dental sciences, oral medicine is not defined as a separate specialty in many countries. For example, in Australia, this field is defined as "oral pathology and oral medicine". In the UK, it is designated as "oral surgery and oral medicine". However, in Iran, it is defined as an independent specialized field since 1984, and currently, 16 dental schools are training specialized residents in this field. For maxillofacial radiology, the ratio of specialists to 100000 population in Iran is 0.43, while this ratio is 0.1 in Australia, and even below 0.1 in the UK and the US. For maxillofacial pathology, the mentioned ratio is 0.2 in Iran, which is almost similar to that in Australia and the US (0.1). In the UK, this number is below 0.1. In these two specialized fields and considering the current trend of admitting residents, Iran will have more specialists than the defined standard in 2025.

Achieving the right proportion of specialists to the population is a common challenge in the healthcare system around the world. In general, both developed and developing countries report some regions where the number of general dentists is higher than the desired level. There is a similar scenario for dental specialists, which is more prominent in developing countries. In fact, the numbers in both groups of countries clearly show that training the correct number of oral health human resources and having a uniform distribution of these human resources nationwide is still a major problem for many countries.[4] It seems that migration to smaller cities and even rural areas is a new trend that has been recently seen in developed countries, and may be due to the increased competition in large cities, as well as incentives to provide services in small towns and villages.[15] Creating such incentives in Iranian young dental human resources should also be on the policymakers' agenda.

In recent years, the WHO has recognized inter-professional collaboration in education and practice as an innovative strategy that plays an important role in mitigating the global health human resources crisis.[16] A trend that seems to be similar in recent years for both developing and developed countries is the preference for dental clinics over individual offices. The dentists and specialists prefer to work in groups with other dentists or specialists instead of working alone.[4] This trend, which is more common in terms of general dental services than specialized services in Iran, can be considered in line with the WHO strategy.

Human resources planning is to ensure that "the right people with the right skills are in the right place at the right time". The appropriate government policies are needed to expand specialized dental services alongside the primary oral care in order to diminish inequality in availability of oral health services by strengthening oral hygiene and oral diseases' treatment. But it should also be emphasized that in case of improper distribution, increasing the number of specialists not only does not help meet oral health needs but also leads to the lack of specialized dental care services in some regions. Although planning to balance the admission capacity of dental assistants for addressing the shortage of dental specialists in the country should be a priority, it is also necessary to consider policies to define mechanisms for monitoring the dental professionals' distribution and the specialized services provision. In this regard, compiling clinical guidelines and designing a service-level program can also help make optimal use of existing capacities. On the other hand, in Iran, with the integration of medical science education with the health service delivery system, a suitable platform has been provided to facilitate intra-sectoral coordination between the Education Deputy and the Treatment Deputy of the Ministry of Health and Medical Education.[17] Utilizing the

capacities of this integration is an effective measure in coordinating the supply of trained specialists following the medical needs of different regions of the country.

Conclusion

Obtaining the current status of dental specialists and estimating the required number by 2025 is the first step in planning reforms in the current process, which results in planning for the admission and training of specialists in the Iranian medical education system. With this view and the foresight of medical education, and considering the Iranian universities' admission capacity, the national division of labor to train specialized dentists required for the coming years can be done.

Conflict of Interests

Authors have no conflict of interests.

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