

INEQUALITY ASSESSMENT OF ORAL HEALTH WORKFORCE'S DISTRIBUTION IN IRAN'S NATIONAL ORAL HEALTH PROMOTION PROGRAM

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ABSTRACT

BACKGROUND

Oral health is a major factor in public health. Children aged 6-12 years are the most important target group for oral and dental hygiene programs due to the high prevalence of dental caries, development of permanent teeth, and formation of lifestyles in this period and schools are the easiest and most cost-effective way to reach them. The latest national oral health promotion (NOHP) program in Iran was implemented in 2016 - 2017 to provide preventive and treatment services such as fluoride varnish treatment (FVT) to 7-14-year-old children. The purpose of this study was to evaluate the status of oral health promotion services and inequality assessment of total inequality in oral health workforce distribution in Iran based on distribution indices.

METHODS

The data about the number of oral health related workforce and also primary students (6 - 12 years) in NOHP program was obtained from the report of oral health office in Iranian Ministry of health. The geographic unit of analysis was 50 medical universities in all provinces of Iran. The human resource per target population ratio was used as oral health workers accessibility. The Gini coefficient and Robin Hood index was used to assess inequality. Number of dentists, dental therapists and oral hygienists in medical universities per 100,000 primary students was calculated. FVT coverage reported by each medical university was considered as NOHP program outcome.

RESULTS

In terms of human resources to student's ratio, the results showed that North Khorasan and Tehran centers respectively had the highest (8.94) and lowest (0.03) ratio of health workers, and Ardabil had the highest ratio (0.79) of oral hygienists. Kerman had the highest (0.73) and Iranshahr had the lowest (0.07) ratio of dentists. The Gini coefficient was 0.28 for dentists and 0.76 for oral hygienists.

CONCLUSIONS

Although the coverage of programs for oral and dental health promotion among students in Iran seems adequate, unfair distribution of human resources and the lack of serious consideration for those involved in preventive care can negatively affect the quality of services. Fair distribution and adoption of corrective policies for redistribution of oral and dental care providers must be addressed more seriously by health policymakers in Iran.

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BACKGROUND

Oral health is an important public health factor.⁽¹⁾ Oral and dental diseases, oral cancer, certain congenital diseases such as cleft lip and palate, common risk factors for certain diseases and the incidence of early signs of certain cancers in this region are important oral and dental health issues.⁽²⁾

Dental caries is an important part of oral and dental diseases; 60-90% of children and nearly 100% of adults worldwide have dental cavities, and severe periodontal disease that often causes tooth loss is observed in 15 to 20 percent of people aged 35-44 years. Globally, about 30 percent of people aged 65-74 years have no natural teeth.⁽³⁾

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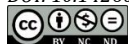
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Rapid increase in costs, inadequate coverage and access, and concerns about the efficiency of provided services are issues that challenge oral and dental health care systems.⁽⁴⁾ In 2015, \$356 billion was spent globally in oral and dental healthcare, constituting about 5 percent of total health expenditures. Accounting for indirect costs, this value reaches \$540 billion and causes catastrophic health expenditures for 35 percent of households that use dental care services in low- and middle-income countries.^(5,6)

In Iran, the cost of dental services accounts for a high percentage of out-of-pocket payments, with a 90 percent value recorded in 2011.⁽⁶⁾ According to the Iranian Statistical Center, dental and medical care are the second and third expenditure after hospital care, and approximately 25 percent of outpatient and medical care costs relate to dental care.⁽⁶⁾ Children aged 6 - 12 years are the most important target group for oral and dental hygiene programs due to the high prevalence of dental caries, the development of permanent teeth and the development of lifestyles during this period.⁽⁷⁾ Interventions that are carried out for 6-12 year-old children in schools are generally educational and preventive, and fluoride varnish treatment (FVT) and fissure sealants

(FS) are some of the interventions that are used to prevent caries and improve oral and dental health.⁽⁸⁾

Health in general and oral health in particular are affected by characteristics of health equity, such as access and distribution, and the disparities and access problems have forced many countries to improve their policies, especially the distribution of human resources.^(9,10) So in Iran the oral health office in ministry of health in 2014 decided to implement the national program to improve oral and dental health equality in 6-14 year-old students in all over the country.^(11,12) One of the objectives of this program was to ensure fairness in the provision of preventive services to students and the fair distribution of dental care providers throughout the programme. NOHP program was implemented throughout the country in partnership with the Ministry of Education and in collaboration with the Primary Health Care (PHC) network and use of oral health workforces.⁽¹²⁾

The availability and accessibility of oral health professionals greatly influences the ideal results of oral health⁽¹³⁾ and evidence shows that increasing the number of health inputs, including dentists, does not inherently result in better health, but also the way in which they are distributed is so important.^(13,14) Although there have been many disparities in the dispersion of human resources in countries and among regions and cities.^(15,16) Though previous researches in Iran assessed the association between social determinants with the oral health status of the population^(9,17-19) and the use of dental services,^(20,21) little attention was actually paid to the distribution of oral health human resources such as dental therapists, oral hygienists and dentists, especially in NOHP programs. In order to cover this knowledge gap, this study assessed the availability of oral health team in public sector of Iran using different inequity indices to assess oral and dental human resource disparity within school-based Iran's NOHP Program. In the other words, the aim of this study was to measure the total disparity indices (Gini coefficient and Robin Hood index) of oral health human resources (Dentists, dental therapists and oral hygienists) employed in NOHP Program along with the coverage assessment of fluoride varnish treatment coverage.

METHODS

Data Sources and Variables

Data on the distribution of oral health workers such as dentists, dental therapists and oral hygienists at the PHC network of 50 medical universities in all provinces were obtained from the national school-based oral health promotion report that was published by oral health bureau of the Iranian Ministry of Health.⁽¹¹⁾ The data on the primary student population and number of covered schools and FVT coverage were also obtained from the mentioned report.⁽¹¹⁾ In the current study, the number of dentists, dental therapists and oral hygienists per 100,000 students in 50 PHC network of medical university and faculty of medicine was calculated and used as an indicator of the availability of oral health human resources for the primary student population within NOHP program.

Inequality Measures

In the current study, we assessed total disparities. We evaluated availability of dentists, dental therapists and oral hygienists and distribution across the regional executive centers of National oral health promotion (NOHP) program. Then we calculated the FVT coverage as one of the program outputs. To evaluate the total inequality, Gini coefficient Robin Hood index based on Lorenz curve was used.

Lorenz Curve, Gini Coefficient and Robin Hood Index

The Gini coefficient is one of the most commonly used indices of inequality⁽²²⁾ and is based on the Lorenz curve. Lorenz curve is used to compare perfect equality between the dispersion of specific health factors (Diagonal line). This curve traces the cumulative proportion of the population classified by variable health. It can range from 0 to 1, with 0 indicating complete equality and 1 indicating complete inequality. Gini coefficient values less than 0.2 indicate complete equality in distribution; values between 0.2 and 0.3 indicates that distribution is largely equal; values between 0.3 and 0.4 indicate inequality and values between 0.4 and 0.6 indicate a high degree of inequality in distribution; and finally, values greater than 0.6 indicate complete inequality.⁽²³⁾ There are many ways of calculating the Gini coefficient, one of which is the formula proposed by Brown⁽²⁴⁾:

$$G = 1 - \sum_{i=0}^{k-1} (Y_{i+1} + Y_i)(X_{i+1} - X_i)$$

Where G is the coefficient of Gini; Y_i is the cumulative share of dentists, dental therapists and oral hygienists in the medical universities; X_i is the cumulative share of the student population in the executive centers; and k is the total number of executive centers.

The Robin Hood index was used to examine the redistribution. It is represented as the longest vertical distance between the Lorenz curve and the 45 degree line representing perfect equality.⁽²⁵⁾ The Robin Hood index is the portion of the total community income that would have to be redistributed from the richer half of the population and given to the poorer half for there to be income uniformity.⁽²⁶⁾

Data Analysis

In this study, the geographic unit of analysis was 50 medical university in all provinces of Iran. Each medical university cover the regional population and provide preventive and treatment services. The human resource per population ratio was used as oral health workers accessibility. So primary school (7-14 years old) population was selected as target population and the number of dentists, dental therapists and oral hygienists per 100,000 primary students was calculated. This ratio was used in further analysis. FVT coverage reported by each medical science university was considered as NOHP program outcome.

RESULTS

Oral Health System in Iran

Dental services in Iran are provided by both the public and the private sector. The private sector provides 80 percent of dental services in urban areas and 70 percent of dental

services in rural areas.^(6,27) These services are largely financed through out-of-pocket payments (Up to 85%).⁽⁶⁾

Level	Trained Professionals	Tasks
Special treatment	Dental specialist	Special treatment
Treatment	Dental therapist, Dentist	Pulpotomy, filling, infected root extraction, fluoride therapy, scaling and root planning
Secondary prevention	Oral hygienist	Providing fluoride varnish treatment, Oral health education, referrals to higher levels
Primary prevention	Behvarz (rural), Health care provider (urban)	Oral health education, periodic dental examination, referrals to higher levels

Table 1. An Overview of the Public Dental and Oral Care Services Provided in Iran's Oral Health Service Delivery

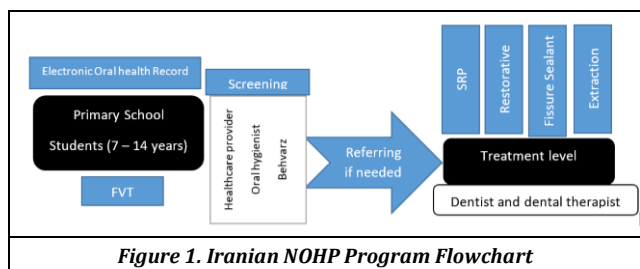


Figure 1. Iranian NOHP Program Flowchart

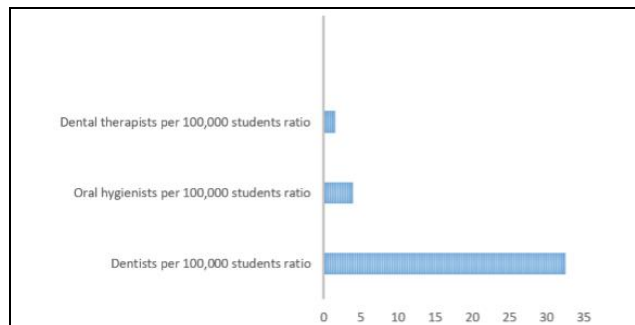


Figure 2. The Ratio of Oral Health Workforce in NOHP Program

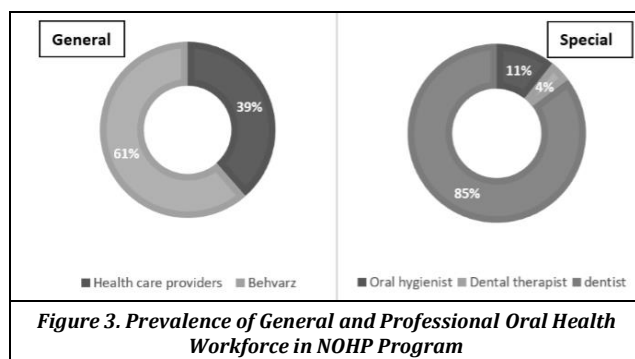


Figure 3. Prevalence of General and Professional Oral Health Workforce in NOHP Program

Medical University	HRPR for Oral Hygienist	HRPR for Dental Therapist	HRPR for Dentist	Medical University	HRPR for Oral Hygienist	HRPR for Dental Therapist	HRPR for Dentist
Zanjan	0	0	58	Khuzestan	2	2	13
Abadan	1	1	12	Shahid Beheshti	3	1	17
Ardebil	79	1	33	Iranshahr	0	5	7
Chahrmahal O Bakhtiary	5	1	59	Larestan	16	0	12.5
Yazd	7	2	52	Isfahan	2	1	51
Esfarayan	16	0	41	Bam	0	0	43
Bushehr	7	2	56	Tehran	0	0	25
Kermanshah	3	2	45	Maragheh	0	4	22
Gerash	0	0	43	Shushtar	0	5	29
Alborz	4	0	12	Gonabad	0	0	62
Kashan	5	3	60	Babol	2	2	63
Kurdistan	5	0	38	Mashhad	0	0	19
Fasa	0	6	63	Torbat e heidarieh	0	3	31
Sabzevar	0	4	49	Yasuj	12	12	57
Dezful	6	0	15	Gilan	0	3	62
Tabriz	1	1	37	Arak	1	2	41
Jiroft	1	1	39	Rafsanjan	0	3	73
Zahedan	2	3	20	Shahroud	0	0	42
Lorestan	9	1	24	Torbat e jam	0	3	41
Zabol	7	4	26	Saveh	0	0	58
Iran	0	0	11	Jahrom	5	5	68
Neyshabour	0	2	23	Hamedan	0	0	46
Kerman	4	3	55	Semnan	3	0	52
Ghazvin	0	3	32	Golestan	6	1	32
Birjand	19	13		Qom	0	1	12

Table 2. Distribution of Oral Health Workforces in NOHP Program

HRPR: Human Resource per Population Ration

	Oral Hygienist	Dental Therapist	Dentist
Gini coefficient	0.76	0.59	0.28
Robin Hood index	57.55 %	44.1%	20.33%
Number of transferable workers per 10 health workforces	5.8	4.4	2

Table 3. Inequality Distribution Indices in School-Based Iran's National Oral and Dental Health Promotion Program

In Iran, oral and dental health services are integrated to primary health care (PHC) network and are provided within a rationing system. This integration was implemented in 1997 with the goal of promoting oral and dental health by

providing preventive and treatment services in three tiers of PHC service provision. It includes various groups of oral and dental care providers that operate at four levels.⁽²⁸⁾

Health houses are the first service providers in the PHC network in rural areas and cover one or more villages with a population of less than 1,500. Behvarz and oral hygienists as general oral health workers are responsible for providing primary oral health care at health houses and rural health centers.

In urban areas, health care providers have preventive and screening tasks like Behvarzes. These two health workers are

generally selected from indigenous and local youth in the region and after two years of education they provide general primary health services such as oral health and are guided by a professional health worker such as oral hygienist, dental therapist or dentist.⁽²⁸⁾ Dental therapists are responsible for providing the second level of services, i.e. preventive care and treatment, with the latter including simple procedures such as scaling and root planning, simple dental extractions, and conservative restorations. Dentist is the head of oral health team and responsible for preventive and therapeutic services. An overview of providing oral health care services in PHC network is shown in the table 1:⁽²⁸⁾

NOHP Program Content

In this program the elementary students aged 6 -14 years are visited regularly in school, health house or health centers by the oral hygienist, health care providers or Behvarz (based on rural or urban areas). Students receive oral health education and then fluoride varnish would be applied (twice per year) in school or rural/urban health center based on Iranian FVT guideline.⁽¹²⁾ Electronic record of oral health is generated and all services are recording. If decayed teeth, Infectious root or calculus identified in screening visits, the students refer to the treatment level and dentist or dental therapist would deliver therapeutic services. These service are as follows: restorative filling teeth, scaling and root planning (SRP), extraction and vital pulp therapy (VPT). These services are provided without any costs. The summary of NOHP program is shown in Figure 1.

Distribution of Human Resources in NOHP Program

On average, there were 32.5 dentists (range 7 - 73), 1.5 dental therapists (range 0 - 13), 4 oral hygienists (range 0 - 79) per 100,000 primary students in NOHP program in Iran (Figure 2). The data showed that 1,980 dentists were employed in NOHP program. Table 2 shows the distribution of oral health related workforces in NOHP program in 2017. In order to the ratio of human resources to 100,000 students, Kerman had the highest (73.0) and Iranshahr had the lowest (7.0) ratio for dentists. The number of dental therapists was zero in many regions, and the highest ratio of dental therapists to was reported in Birjand (13.0).. Ardabil had the highest (79.0) ratio of oral hygienists, while this ratio was close to zero in many other medical universities. Prevalence of general and special oral health workers in NOHP program is shown in Figure 2.

The Gini coefficient and Robin Hood index are shown in Table 2. The highest Gini coefficient belonged to the oral hygienist group and the lowest Gini coefficient belonged to the dentist group.

Based on these results, it can be argued that the distribution of dentists was almost equal, the distribution of dental therapists was vastly unequal, and the distribution of oral hygienists was completely unequal. The number of transferable health workforces was more than 1 person per 10 health workforces (Table 4). The highest number was related to oral hygienists and the lowest was about dentists.

Fluoride Varnish Treatment Coverage

In this program, a total of 6,089,312 elementary students throughout the country were covered by NOHP program. On average, 88.71 percent of these students were received FVT. FVT coverage in Saveh, Jahrom, Semnan, Hamedan, Arak, Yasuj, Gonabad, Bam, Birjand, North Khorasan, Zahedan, Kashan, and Chaharmahal O Bakhtiari was 100 percent. The lowest FVT coverage was observed in Gerash (10 percent).

DISCUSSION

The results of this study indicated the favourable distribution of dentists, vastly unequal distribution of dental therapist, and completely unequal distribution of oral hygienists. Based on the Robin Hood index more than half of oral hygienists must be redistributed to achieve fairness in the distribution. Oral and dental care in Iran is integrated into primary health care and is divided into three tiers, i.e. preventive services, treatment, and specialized services; however, the results showed that the first level of oral and dental care services requires serious consideration. Oral hygienists, who are the main providers of oral and dental health and education services, faced the highest level of unequal distribution.

We gathered our data from medical universities that are responsible for PHC network and providing 3 tire level services. Though our data was not provincially, but it can present a good picture of human resource distribution. Because each medical university is responsible for allocating resources and so the reported data is more accurate. Medical schools in Iran has the leadership responsibility in education and providing services.⁽²⁹⁾

In our study by considering trained health care providers and Behvarz, more than 90 percent of oral health related workforces involved in NOHP Program were related to preventive level. But if we consider special oral health workforces (Dentists, dental therapists and oral hygienists), the results would be changed. The ratio about the number of special oral health workers per 100,000 elementary students has the highest amount in dentists that is 8 times greater than oral hygienists' ratio. In the United States, more than 60 percent of services in school-based programs are carried out by oral hygienists^(30,31) that is in contrary with our results.

In the report of American Association of State and Territorial Dental Directors (ASTDD), oral hygienists had the highest level of involvement in oral health services that revealed the importance of preventive-related oral health workforces. The importance of preventive oral health workforce usage was also reflected in Shah et al. that emphasized the necessity of using oral hygienists in provision of preventive services and promotion of oral and dental health.⁽³²⁾ Furthermore, in oral health policy making Simmer et al., highlighted policies for the use of dental hygienists to promote dental health and expand their capacity to deliver essential oral health services.⁽³³⁾ Given that one of the mail NOHP program objectives was providing preventive services, the composition of oral health workers in this program seems to be moving to a therapeutic approach.

Dental therapists are able to provide certain simple treatments in addition to preventive services and their education and employment was started in 1981 in Iran and made them a less costly choice for provision of health and hygiene services in deprived regions.⁽³⁴⁾ In most countries, dental therapists are used well to promote oral and dental

health and hygiene.^(35,36) Our study showed that there are vast inequalities in the distribution of dental therapists in Iran, which may be due to the termination of the Dental Therapist Training Program in 1991.⁽²⁷⁾

In the present research, it was revealed that dentists are the majority of human resources in the dental sector of Iran healthcare system. As Teusner et al. revealed, dentists were also the largest group of human resources in the area of oral and dental health in Australia,⁽³⁷⁾ Although dentists are regarded as therapists in most countries, there are intermediate human resources in the area of oral and dental health that, as a team, can be effective in provision of health services.^(38,39) This issue must be taken into consideration by health policymakers in Iran.

The Gini coefficient for the distribution of dentists was 0.28 in the present research, which is consistent with the results of Rezaei et al.⁽⁴⁰⁾ This study reported a 0.27 Gini coefficient for the distribution of dentists in the country in 2011. In addition, Okawa reported a 0.26 Gini coefficient for geographic distribution of dentists in Japan, which again supports the present findings.⁽⁴¹⁾

In this study, the coverage of FVT services for primary school students around the country was 87.1 percent. Turner et al. reported that coverage of the Student Oral Health Promotion Package which included FVT was 100 percent in Scotland,⁽⁴²⁾ however, given the inequality observed in the distribution of human resources in the present research, the FVT coverage in Iran seems acceptable. In Douglass et al., increasing the coverage of FVT in younger ages was highlighted as a strategy to prevent early dental caries in children.⁽⁴³⁾ Given the results of measuring inequality in distribution of oral and dental workforce in the present research, it can be argued that improving the distribution of dentists among the provinces of Iran can yield a better output.

In this study we couldn't obtain the sociodemographic characteristics of elementary students that was one of our limitations. Another limitation in our study was not reporting inequality indices for health care providers and Behvarzes. Because there was no data about rural and urban student population.

CONCLUSIONS

Even though the coverage of oral and dental care services seems appropriate in Iran's national oral and dental health promotion program, unequal distribution of service providers and the lack of serious attention to human resources providing preventive care can have a negative impact on the quality of services. Equal distribution and adoption of corrective policies for redistribution of oral and dental care providers must be addressed more seriously by health policymakers in Iran.

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