



## Knowledge production in Iranian cardiovascular research centers: A way to reduce the burden of disease

Asghar Ebadifar<sup>(1)</sup>, Monir Baradaran-Eftekhari<sup>(2)</sup>, Katayoun Falahat<sup>(2)</sup>, Masoumeh Eltemasi<sup>(2)</sup>, Zahra Sobhani<sup>(2)</sup>, Elham Ghalenoee<sup>(2)</sup>, Elham Habibi<sup>(2)</sup>, Nizal Sarrafzadegan<sup>(3)</sup>, Shahin Akhondzadeh<sup>(4)</sup>, Reza Malekzadeh<sup>(5)</sup>

### Original Article

#### Abstract

**BACKGROUND:** According to the World Health Organization (WHO), non-communicable diseases (NCDs) including cardiovascular diseases (CVDs) will be responsible for almost 70% of all deaths in 2020. Therefore, knowledge production to find suitable ways to prevent, diagnosis, and effectively cover this disease in research centers is mandatory. Therefore, the present study is carried out with the aim to examine the results of studies performed in three years in Iranian cardiovascular centers.

**METHODS:** Iranian cardiovascular research centers with more than three years of activity from 2015 to 2017 were evaluated. Research output, international collaboration, high quality publication, total citation, and average h-index (H) were evaluated and scored.

**RESULTS:** 23 cardiovascular diseases research centers (CVDRCs) related to 15 universities of Medical Sciences (UMSS) were evaluated. The mean and standard deviation (SD) of age of the research activities in CVDRCs was  $11.47 \pm 8.60$  years. Based on the research ranking, the first three centers were Isfahan Cardiovascular Research Center, Iran, Tehran Heart Center, and Shaheed Rajaei Cardiovascular Medical and Research Center, Iran, respectively, all of which have independent budget line. However, there is not any CVD research center in some provinces such as Zanjan, Kurdistan, Lorestan, and Arak, Iran.

**CONCLUSION:** Mission oriented research activities in Iranian cardiovascular research centers may be effective in reducing the burden of CVDs. Moreover, establishment of CVD research centers in high risk areas may be useful.

**Keywords:** Cardiovascular Diseases; Evaluation Program; Global Burden of Disease

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#### Introduction

According to the World Health Organization (WHO), non-communicable diseases (NCDs) including cardiovascular diseases (CVDs) will be responsible for almost 70% of all deaths in 2020.<sup>1,2</sup> Based on the third Sustainable Development Goal, among NCDs, CVDs are responsible for one-third of mortalities.<sup>3</sup> Additionally, it has been estimated that 30.5% of deaths in the world will be caused by CVDs by 2030.<sup>4</sup>

In Iran, based on a cohort study in Isfahan in 2013, CVD mortality rate was estimated to be 331 and 203 per 100000 person-years in men and women,

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1- Deputy for Research and Technology, Ministry of Health and Medical Education AND Dentofacial Deformities Research Center, Research Institute of Dental Sciences AND Department of Orthodontics, School of Dental, Shahid Beheshti University of Medical Sciences Tehran, Iran

2- Deputy for Research and Technology, Ministry of Health and Medical Education, Tehran, Iran

3- Isfahan Cardiovascular Research Center, Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran

4- Deputy for Research and Technology, Ministry of Health and Medical Education AND Psychiatric Research Center, Roozbeh Hospital, Tehran University of Medical Sciences, Tehran, Iran

5- Deputy for Research and Technology, Ministry of Health and Medical Education AND Digestive Disease Research Center, Tehran University of Medical Sciences, Tehran, Iran

Address for correspondence: Monir Baradaran-Eftekhari; Deputy for Research and Technology, Ministry of Health and Medical Education, Tehran, Iran; Email: mbeftekhari200@gmail.com

respectively.<sup>5</sup> Moreover, in 2016, years of potential life lost (YPLL) [95% confidence interval (CI)] for CVDs was 22.7 (19.8-25.6).<sup>6</sup>

Despite the numerous efforts made to control CVDs worldwide, these diseases continue to rise.<sup>7</sup> This is partly due to changing the pattern of the disease from communicable to non-communicable and injuries, especially in developing countries, besides, it may be due to the fact that secondary and tertiary prevention in CVDs are very expensive.<sup>8</sup> So, it is needed to find low-cost and effective methods based on research to control this problem and establish research centers that are important to conduct related projects.

Now, in Iran, there are more than 800 research centers in different fields, only 27 of which are active in the field of CVDs.<sup>9</sup> The first Iranian CVD research center was established in 1974 in Tehran.

Distribution of CVDs in Iranian provinces shows that in many provinces, CVDs increase by 13%, and heart diseases due to hypertension increase by 38%, which have been considered as the two major causes of early deaths.<sup>10</sup>

In 2007, hypertension was the third most common cause of deaths and disabilities in Iran, which has risen to 24% over the past 10 years and in 2017, it was ranked first.<sup>11</sup>

The key question is “what is the role of cardiovascular research centers in CVD prevention or hypertension control in Iran?” Based on a Global Burden of Disease (GBD) study in 2011, the prevalence of hypertension was more than 28% in 15 provinces in Iran.<sup>12</sup>

Meanwhile, numerous research projects have been designed and implemented to prevent CVDs, especially hypertension. Accordingly, the present study is conducted to evaluate knowledge production based on these studies in Iranian CVD research centers.

## Materials and Methods

The current study was implemented in Iran where there are 56 universities of medical sciences (UMSs) and more than 800 Medical Research Centers (MRCs) in clinical and biomedical fields. In clinical field, there are two main subgroups concluding communicable diseases (CDs) and NCDs. Based on another categorization, all of the approved MRCs are divided into two groups according to the budget line assigned (independent, dependent). All of MRCs are evaluated after at least one year of establishment by the Iranian Ministry of Health and Medical Education (MOHME).

This was a cross-sectional study in which the total number of cardiovascular disease research centers in Iran established from 2015 to 2017 was evaluated.

The study inclusion criteria were:

- a- Having a principled agreement from legal and competent authorities
- b- Having more than three years of research activity

The research indicators were designed based on peers' opinions in the expert panel. Representatives from research centers and UMSs, as well as three scientometric experts and research team were the members of this panel. It is worth noting that the indicators are revised and developed annually based on health policies considering the opinions of the stakeholders. Research indicators were classified to five main groups and their subgroups as follow:

- a- Research output:
  - The number of published articles indexed in International Scientific Indexing (ISI) during 2015-2017
  - The number of published articles indexed in PubMed database during 2015-2017
  - The number of published articles indexed in Scopus database during 2015-2017
  - The number of published books indexed in Scopus database during 2015-2017
  - The number of conference papers/meeting abstracts and proceedings indexed in ISI and Scopus databases during 2015-2017
- b- International cooperation(IC):
  - The number of articles published with international cooperation during 2015-2017
- c- High quality publication (Q1):
  - The number of articles published in the best quartile journals in each subject during 2015-2017
- d- Citation (C)
  - The total citations during 2015-2017 and articles published in the five past years in Scopus database
- e- Average H-index (H) in 2015-2017

The steps of evaluation process were: i) extracting the scientific documents of each research center based on its affiliation in ISI, PubMed, and Scopus databases; ii) designing the end note data base for each MRC; iii) eliminating data overlapping via Access software; and iv) scoring all research indicators.

The scoring system for data weighing was designed by peer review opinions through the expert panel. The scores for each published article indexed in ISI, PubMed, and Scopus were 2, 1.5, and 1, respectively. Each book had 2 points and the score of each conference paper was 0.5.

The weight of the main groups was determined based on their importance and that of the research output, collaboration, qualification, citation, and h-index were 250, 150, 200, 400, and 100, respectively, thus the maximum score was 1050 (Table 1).

**Table 1.** Scoring system in Cardiovascular Diseases Research Centers (CVDRCs) evaluation

Main Indicators	SGI	Score per SGI	Weight	Calculation method
RO	a- published article indexed in ISI	2.0	250	$\sum\{a \times 2, (b \times 1.5), (c \times 1), (d \times 2), \times (e \times 0.5)\}$ $= T(RO)$ <i>Max T(RO) in n*RC = Max weight = 250</i> <i>&amp; For (n-1): Adjusted T(RO)</i>
	b- published article indexed in PubMed	1.5		
	c- published article indexed in Scopus	1.0		
	d- published books indexed in Scopus	2.0		
	e- conference paper/meeting abstract	0.5		
IC	f- published article with international cooperation	1.0	150	$\sum f = T(IC)$ <i>Max T(IC) in n*RC = Max weight = 150</i> <i>&amp; For (n-1): Adjusted T(IC)</i>
Q1	g- published articles in the best quartile journals		200	$\sum g = T(Q1)$ <i>Max T(Q1) in n*RC = Max weight = 200</i> <i>&amp; For (n-1): Adjusted T(Q1)</i>
C	h- total citation to five past years published articles		400	$h = T(C)$ <i>Max T(C) in n*RC = Max weight = 400</i> <i>&amp; For (n-1): Adjusted T(C)</i>
H	i- Average H-index		100	$i = T(H)$ <i>Max T(H) in n*RC = Max weight = 100</i> <i>&amp; For (n-1): Adjusted T(H)</i>
Total Score		$\sum\{(TRO), T(IC), T(Q1), T(C), T(H)\}$		

SGI: Subgroup indicators; RO: Research output; IC: International cooperation; Q1: High quality publication; C: Citation; H: H-index; TRO: Total research output

\* Number of cardiovascular research centers

The data obtained were analyzed using SPSS software (version 19.0, SPSS Inc., Chicago, IL, USA) and the P values < 0.050 were considered statistically significant. Descriptive analysis and some tests such as independent t-test were used for data reporting.

In this study, all of ethical considerations were met.

### Results

In this study, out of the total 27 cardiovascular diseases research centers (CVDRCs) in Iran, 23 ones with more than three years of activity related to 15 UMSs were included. Table 2 demonstrates the name, number, and budget line of the research centers related to UMSs.

**Table 2.** Frequency and distribution of Cardiovascular Diseases Research Centers (CVDRCs) in Iran

Name of UMS	Name of CVDRC	Budget line
Ahvaz Jundishapur	Atherosclerosis	Lack of independent budget line
Baqiyatallah	Atherosclerosis	Lack of independent budget line
Shahid Beheshti	Cardiovascular Diseases	Lack of independent budget line
Birjand	Cardiovascular Diseases	Lack of independent budget line
Golestan	Ischemic Disorders	Lack of independent budget line
Iran	Cardiac Electrophysiology, Cardiovascular Intervention, Echocardiography, Heart Valve Disease, Prevention of Cardiovascular Disease, Cardiovascular Diseases	Lack of independent budget line except Shaheed Rajaei Cardiovascular Medical and Research Center
Isfahan	Cardiac Rehabilitation, Interventional Cardiology, Cardiovascular, Hypertension, Heart Failure	Lack of independent budget line except Cardiovascular Diseases Research Center
Kerman	Cardiovascular Diseases	Lack of independent budget line
Hormozgan	Cardiovascular Diseases	Lack of independent budget line
Mazandaran	Cardiovascular Diseases	Lack of independent budget line
Shiraz	Cardiovascular Diseases	Lack of independent budget line
Tabriz	Cardiovascular Diseases	Lack of independent budget line
Shahid Sadoughi Yazd	Cardiovascular Diseases	Lack of independent budget line
Tehran	Tehran Heart Center	With independent budget line

UMS: University of Medical Sciences; CVDRC: Cardiovascular disease research center

Based on the statistical analysis, there was a significant correlation between the independent budget line and the score obtained ( $P < 0.050$ ).

The mean and standard deviation (SD) of age of the research activities in CVDRCs was  $11.47 \pm 8.60$  years, with minimum and maximum ages of 5 and 45 years, respectively.

Based on the results, there was a significant difference between the year of activity and total research score ( $P < 0.050$ ).

The number of published articles indexed in ISI, PubMed, and Scopus by CVDRCs during 2014 to 2017 was estimated to be 1851, about 50% of which being published in research centers affiliated to UMSs with domestic cooperation. Almost 12% of the articles published in the best quartile journals in each subject and in more than 16% of cases, the articles had at least one foreign counterpart. The highest international cooperation was related to cardiovascular research centers in Tabriz and Isfahan. Tehran Heart Center with 46 high quality publications was the first center among CVDRCs. Moreover, cardiovascular research center in Isfahan had the highest number of citations and h-index. After scoring and weighing, the first three centers were Isfahan Cardiovascular Research Center, Tehran Heart Center, and Shaheed Rajaei Cardiovascular Medical and Research Center, respectively (Table 3).

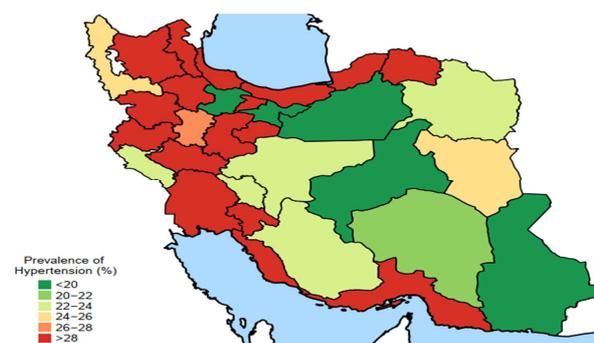
## Discussion

Based on the review results, there were 23 CVD research centers with more than three years of activity affiliated to 15 UMSs in 10 provinces consisting of Tehran, Golestan, Kerman, Isfahan, Mazandaran, Shiraz, Tabriz, Ahvaz, Birjand, and Hormozgan.

The total number of published articles indexed in ISI, PubMed, and Scopus was estimated 1851. Almost 12% of articles were published in the best quartile journals. 50% and 16% of cases were performed with domestic and foreign cooperation, respectively.

Comparing the results of evaluation of research activities in CVDRCs shows that there are more knowledge production and research scores in research centers with independent budget line, which may be due to attracting more scholars, other resources, equipment, and so on.<sup>13</sup> The maximum research score in this evaluation was related to Isfahan Cardiovascular Research Center. This center not only has more qualified published papers and citations, but also many valuable projects such as Isfahan Healthy Heart Programme (IHHP) were designed and implemented by its researchers.<sup>14</sup>

The geographical distribution of cardiovascular research centers indicates that the establishment of these centers has not completely been based on the burden of CVDs. For example, based on Iranian surveys on NCD risk factors in 2004 and 2011, the prevalence of hypertension in 17 provinces was more than 28%, while there was a CVDRC in only five of them, including Golestan, Mazandaran, Tabriz, Ahvaz, and Hormozgan (Figure 1).<sup>9,15</sup>



**Figure 1.** Illustrates the prevalence of hypertension in different provinces in Iran.<sup>15</sup>

Additionally, in some provinces such as Zanjan, Kurdistan, Lorestan, Arak, and Hormozgan, Iran, despite many efforts, treatment coverage has not been effective. It seems that in the research field, it is necessary for cardiovascular researchers to identify barriers to effective control and therapies through scientific methods.<sup>15</sup>

Based on a study by Adedapo, in areas with high prevalence of CVDs, the number of related studies and publications is less compared to other cases.<sup>16</sup>

Considering that CVDRC in Hormozgan Province had the fewest score in research evaluation, it is necessary to make much more effort in community heart health promotion. Moreover, establishing mission oriented cardiovascular research centers in Zanjan, Kurdistan, Lorestan, and Arak, Iran, with implementing applied research in heart health promotion can be useful.<sup>17</sup>

In Tehran, the capital of Iran, there are nine CVDRCs with more than three years of activity. These RCs are affiliated to Tehran, Iran, Baqiyatallah, and Shahid Beheshti UMSs. Tehran is one of the largest metropolises in Iran with a high air pollution level, so it is an alarm of the increased CVD incidence rate, and consequently the high mortality rate.<sup>18</sup>

Based on the lipid and glucose study in Tehran, the prevalence of coronary heart diseases (CHDs) and its associated risk factors in adult residents of Tehran is high and the age-adjusted prevalence of CHD is 21.8% (22.3% and 18.8% in women and men, respectively).<sup>19</sup>

**Table 3.** Results of Heart Research Center (HRC) ranking in Iran

Name of UMS	Name of CVDRC	Number of three years*				Average H*	Total score	Rank
		Output	Q1	IC	C			
Golestan	Ischemic Disorders	27 (21.57)	8 (34.78)	7 (18.42)	120 (16.74)	6.7 (15.87)	107.39	11
Iran	Cardiovascular Intervention	74 (54.36)	4 (17.39)	3 (7.89)	38 (5.30)	3.7 (8.73)	93.67	13
	Echocardiography	42 (32.36)	3 (13.04)	3 (7.89)	47 (6.56)	5.7 (13.49)	73.35	16
	Cardiac Electrophysiology	19 (13.75)	2 (8.70)	5 (13.16)	54 (7.53)	4.7 (11.11)	54.24	17
	Heart Valve Disease	39 (29.82)	9 (39.13)	7 (18.42)	37 (5.16)	3.3 (7.94)	100.47	12
	Prevention of Cardiovascular Disease	15 (11.21)	2 (8.70)	5 (13.16)	7 (0.98)	1.3 (3.17)	37.21	21
	Cardiovascular Diseases-Shahid Rajaei	339 (250.00)	25 (108.70)	29 (76.32)	370 (51.60)	9.3 (22.22)	508.84	3
Kerman	Cardiovascular Diseases	52 (39.55)	7 (30.43)	2 (5.26)	53 (7.39)	4.3 (10.32)	92.96	14
Tehran	Tehran Heart Center	249 (186.34)	46 (200.00)	29 (76.32)	1841 (256.76)	24 (57.14)	776.56	2
Isfahan	Cardiovascular	240 (180.20)	41 (178.26)	55 (144.74)	2868 (400.00)	42 (100.00)	1003.20	1
	Cardiac Rehabilitation	124 (93.06)	12 (52.17)	24 (63.16)	762 (106.28)	14 (33.33)	348.00	5
	Interventional Cardiology	27 (19.67)	2 (8.70)	5 (13.16)	23 (3.21)	2.3 (5.56)	50.29	19
	Hypertension	67 (50.76)	12 (52.17)	14 (36.84)	368 (51.32)	10 (23.81)	214.91	7
	Heart Failure	27 (19.25)	2 (8.70)	2 (5.26)	45 (6.28)	4.7 (11.11)	50.59	18
Mazandaran	Cardiovascular Diseases	14 (8.88)	0 (0.00)	0 (0.00)	24 (3.35)	2.3 (5.56)	17.79	22
Shiraz	Cardiovascular Diseases	77 (60.70)	9 (39.13)	3 (7.89)	183 (25.52)	7.7 (18.25)	151.50	8
Tabriz	Cardiovascular Diseases	183 (139.59)	17 (73.91)	57 (150.00)	624 (87.03)	13.7 (32.54)	483.08	4
Yazd	Cardiovascular Diseases	104 (73.82)	9 (39.13)	24 (63.16)	297 (41.42)	9 (21.43)	238.96	6
Ahvaz	Atherosclerosis	34 (23.27)	1 (4.35)	3 (7.89)	35 (4.88)	3.7 (8.73)	49.12	20
Baqiyatallah	Atherosclerosis	30 (23.90)	4 (17.39)	6 (15.79)	51 (7.11)	4 (9.52)	73.72	15
Shahid Beheshti	Cardiovascular Diseases	61 (45.90)	3 (13.04)	10 (26.32)	154 (21.48)	7 (16.67)	123.40	9
Birjand	Cardiovascular Diseases	82 (60.07)	6 (26.09)	4 (10.53)	53 (7.39)	4 (9.52)	113.60	10
Hormozgan	Cardiovascular Diseases	3 (2.33)	0 (0.00)	0 (0.00)	32 (4.46)	3.7 (8.73)	15.52	23

UMS: University of Medical Sciences; CVDRC: Cardiovascular Disease Research Center; Q1: High quality publication; IC: International cooperation; C: Citation; H: H-index  
\* Adjusted T

Due to the higher prevalence of hypertension in the north, west, and south of Iran, it is mandatory to provide the license necessary for the establishment of cardiovascular research centers in these areas. It is obvious that designing the strategic planning and determining main missions for the prevention, diagnosis, effective treatment, and rehabilitation of patients with CVDs through research projects by the CVDRCs can decrease the burden of the disease.

This study has two strengths. First, it evaluates knowledge production in the field of CVDs in order to make appropriate policies to reduce one of the most important disease burden in Iran. Second, based on geographic distribution of CVDRCs, it specified the provinces needing the establishment of such centers in them.

Failure to address the outcomes and impacts in this evaluation process is one of the limitations of the present study. A peer-based evaluation of research activities in these centers seems to lead us to more equitable judgments.

### Conclusion

Mission oriented research activities in Iranian cardiovascular research centers may be effective to reduce the burden of CVDs. Furthermore, it is necessary to carry out a quantitative and qualitative evaluation for an accurate and comprehensive assessment.

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### Conflict of Interests

Authors have no conflict of interests.

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