



# Changes in the Geographic Pattern of Iran's International Collaboration in Cardiovascular Research: A 15-Year Period

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## Abstract

**Background:** Cardiovascular Diseases (CVDs) which are considered as the major public health problems, result in substantial increases in economic and health care costs, and are the first leading cause of death worldwide. Clinical research are the backbone of attempts to build and conduct evidence-based policies to perform the best caring of CVDs. International collaborations, increase the quality of research. Therefore, the present study was conducted in order to assess the changes in the geographic pattern of Iran's international cardiovascular research collaborations.

**Methods:** This study was a systematic review with scientometrics approaches. Numbers and rates of international research collaborations were extracted from the "Web of Science" database. Results are reported as figures by Graph Pad v6 and Arc GIS v7 software.

**Results:** The results showed that, 18.3% of all Iran's cardiovascular research have been conducted with international collaborations. The increasing rates were 14.4%, 16.5%, and 21.3% in the time periods of 2004-2009, 2010-2014, and 2015-2019, respectively. The obtained results indicated that, the United States was the first research partner of Iran in the field of cardiovascular and the other partners were England, Australia, Italy and Poland; respectively.

**Conclusion:** This study provides a global description of a changing pattern of the international research collaboration behavior of Iran and also indicates that the international research collaboration follow a logical trend in the cardiovascular field. Building effective international research collaboration networks as well as encouraging researchers to work in these networks can be considered by policy makers in university levels in the future.

**Keywords:** Cardiovascular, International Collaboration, Changes in Geographic Patterns, Scientometric, Iran

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## Introduction

The rapid-changing demographic portrait in the developing countries has led to a development of Cardiovascular Diseases (CVDs).<sup>1</sup> The CVDs which are considered as major public health problems, result in substantial increases in economic and health care costs, and are known as the first leading cause of death worldwide. Based on the available statistics, CVDs have been the cause of 10% of all deaths in 1990, 50% in 2000 and approximately 75% of deaths in 2020 in the world. Compared to developed countries, developing countries account for greater lost years of life, therefore, the increasing burden of CVDs would be borne mostly by the developing countries in the next two decades.<sup>2</sup>

As CVDs are rapidly emerging as a major cause of mortality, conducting research with aim to provide the base of evidence to overcome this epidemic is crucially required. Therefore, the clinical research are the backbone of attempts to build and conduct evidence-based policies to perform the best caring of CVDs.<sup>3</sup>

In Iran, the changes in lifestyle has led to higher prevalence of CVDs risk factors among the community.<sup>4</sup>

Efforts to conduct clinical research has led to a rapid expansion of the literature related to cardiovascular.<sup>5</sup> However, many of these literature don't have novelty or high quality. The duplication of research<sup>6</sup> and methodological flaws<sup>7</sup> may reduce the credit of papers. This is while there is clear evidence that show the high quality of scientific

literature which are related to the collaboration between researchers.<sup>8</sup>

Generally, scientific collaboration plays an important role in medicine.<sup>9,10</sup> Especially International collaboration, as an important collaboration, increases the quality of research<sup>11,12</sup> and enables readers to decide which results are internally valid and bias-free.<sup>13</sup> Accordingly, papers with international collaboration had more citation and visibility compared to traditional ones.<sup>14</sup>

The effects of international collaboration may vary across countries.<sup>15</sup> Factors such as cost, the importance of interdisciplinary fields, geographical, economic or cultural interests, and also intra-scientific factors can affect the establishment of international collaborations.<sup>16-20</sup>

It seems that the survey of international productivity of developing countries especially Iran, as a West Asian country, is very important. Therefore, this study was conducted in order to assess the changes in the geographic pattern of Iran's international collaborations in the cardiovascular research field based on the "Web of Science" database in a 15-year time Period.

## Methods

The present study was a systematic review with a Scientometrics approach based on the "Web of Science" database.

## Definition

Publications from different countries were classified as international collaboration. The international collaboration rate was calculated by including the percentage of papers with international collaborations.<sup>21</sup>

## Data Extraction

Information for numbers and rates of international collaboration was extracted from the "Web of Science"

database (<http://www.webofscience.com>). This database is supported by the Thomson Reuters Company. Scientometrics characteristics of indexed papers were reported by the database.

To access the cardiovascular papers, two steps searching method were conducted in the three time periods 2005-2009, 2010-2014, and 2015-2019 as 1) searching for the word "Iran" in the keyword box and 2) restricting the field of study to "cardiology and cardiovascular" in the subject area. Numbers and names of partner countries were extracted by "Region/Country" Category.

## Data Analysis

At first, data preprocessing was done, and secondly, data were entered into Microsoft Excel 2010 spread sheets, Graph Pad V6, and Arc GIS V7 soft wares, and after the priming data, data analysis was performed. Iran's international collaboration alterations and trends were reported as percentage, Bar chart, and GIS maps.

## Results

Until the 28<sup>th</sup> of April 2019, 2835 papers of Iran's cardiovascular research had been indexed in the web of science database, which about 479, 841, and 1354 were related to the 2005-2009, 2010-2014, and 2015-2019 time periods, respectively.

## International Collaboration Rate

As described in Figure 1, 18.3% (519/2835) of all Iranian cardiovascular research have been conducted with international collaborations. The increasing rate of Iran's international collaboration began during 2004-2009 from 14.4% (69/479), and continued to 16.5% (139/841) during 2010-2014, and finally reached 21.3% (289/1359) during 2015-2019.

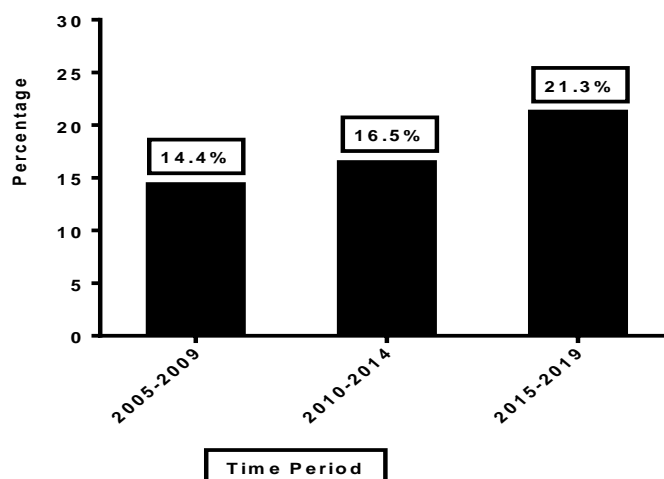


Figure 1. Iran's international collaboration rate in cardiovascular research

**Pattern Changes in International Collaborations**

According to the [Figures 1, 2 and 3](#), it's obvious that, within 15 years researching in cardiovascular field in Iran, some changes have been observed in the pattern of collaboration with the cooperating countries.

During 2005 to 2009, Iran had research collaborations in this field with the United States of America (39 articles). Although, collaboration with other countries such as Canada, Australia, Japan, some European countries, France, England, Denmark, Italy, and west Asian countries, Saudi Arabia and Azarbaijan were found however the number of research collaborations were less than 10 papers.

During 2010 to 2014, the research collaboration with America had an impressive increase to more than twice and reached to 76 papers. The collaboration with other countries such as England, Australia, Canada and Malaysia had an increase up to more than 10 papers. In the same time period, Iran began to collaborate with countries such as South America, Russia, China, India, South Africa, Turkey and some other European countries, although the collaboration wasn't impressive (up to less than 10 papers).

During 2015 to 2019, Iran's collaboration with America had another increase compared to the previous period, to 149 papers. In the same time period, in addition to increasing its collaboration with countries such as England, Australia, and Canada, the collaboration of Iran with some countries like Italy, Poland, Romania, Germany, and China reached to more than 20 papers. Moreover, in this period of time, Iran also began to collaborate with almost all countries except

some African and south American countries.

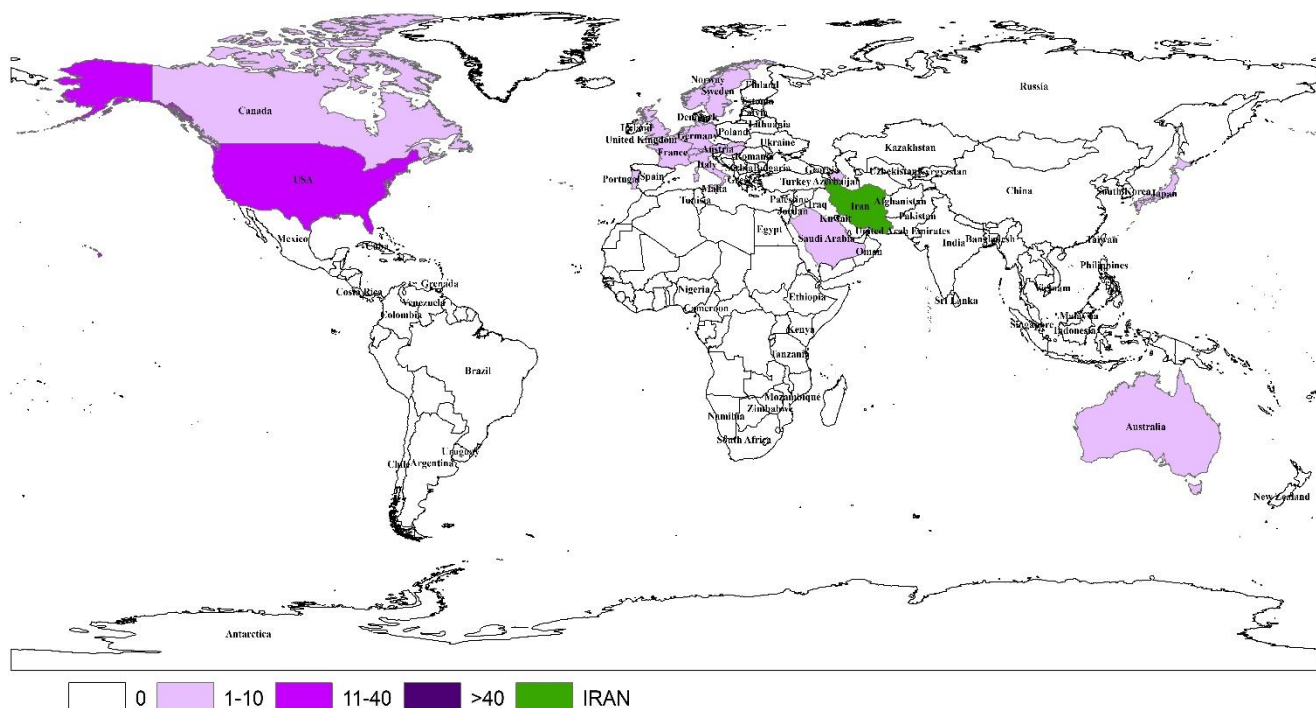
**Discussion**

This study was conducted to assess the changes in the geographic patterns of Iran's international collaboration rate in the field of cardiovascular research. The results showed that, the trend of international research collaboration rate has a good slope. This growth implicates that the quality of research has increased in this field.<sup>11,12</sup> Moreover, it is expected that the number of citations to the published cardiovascular papers to have increased in the mentioned period.<sup>14</sup>

The most similar study to this research was the study conducted by Farahani et al. that indicated that based on the Web of Science database from the year 2002 to 2011 the international research collaboration in Iranian Cardiovascular papers was 17%.<sup>22</sup>

Comparing the findings of this study with other studies such as the results of Qi et al., it can be stated that the international research collaboration rate of Iran in the field of cardiovascular has not been of great difference compared to the average of world. They showed that, international publications have steadily increased from 2% in 1981 to 19% in 2010.<sup>23</sup>

Furthermore, the results of the present study showed that the United States of America was the first research partner of Iran in the field of cardiovascular studies and the next partners were England, Australia, Italy and Poland, respectively.



**Figure 2.** Number of Iran's International Collaborations rate in Cardiovascular researches (2005-2009 years)

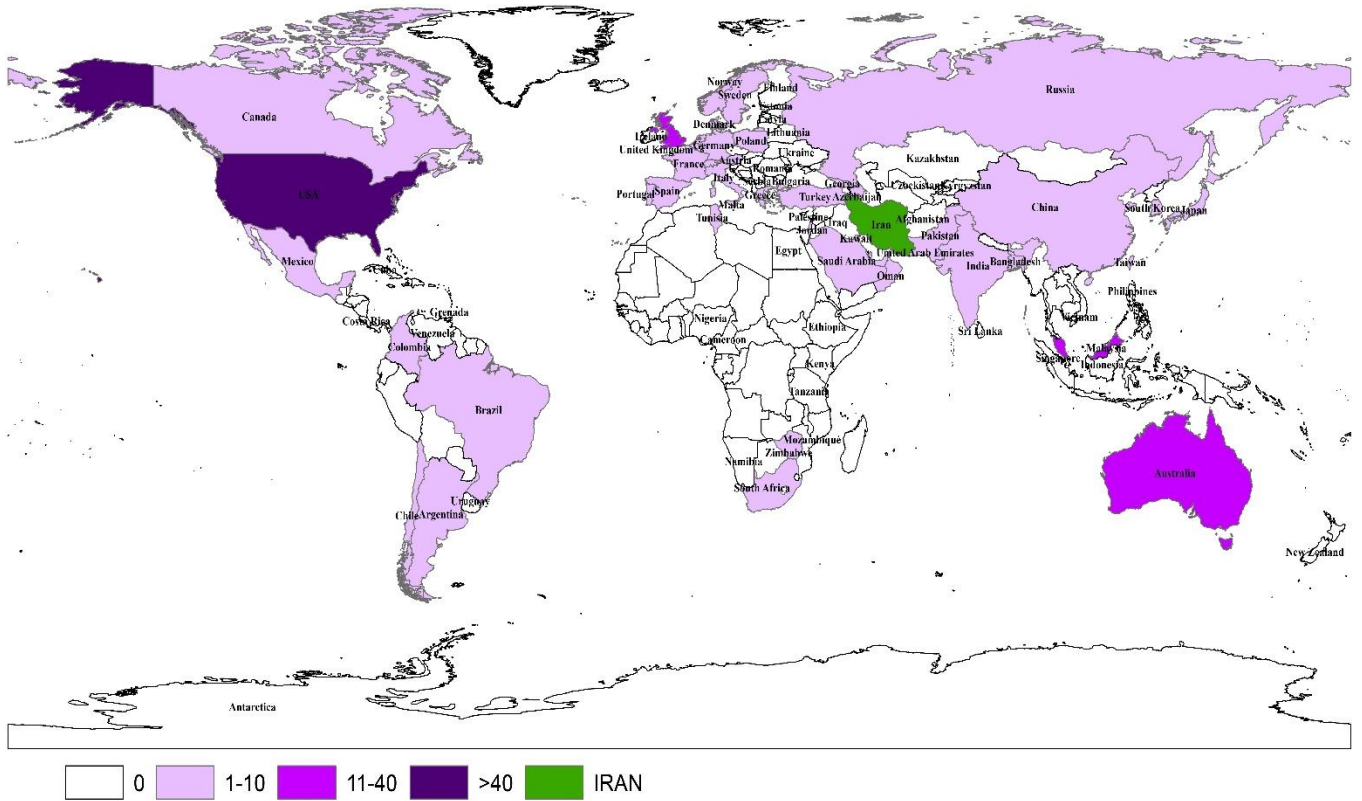


Figure 3. Number of Iran's international collaboration rate in cardiovascular research (2010-2014 years)

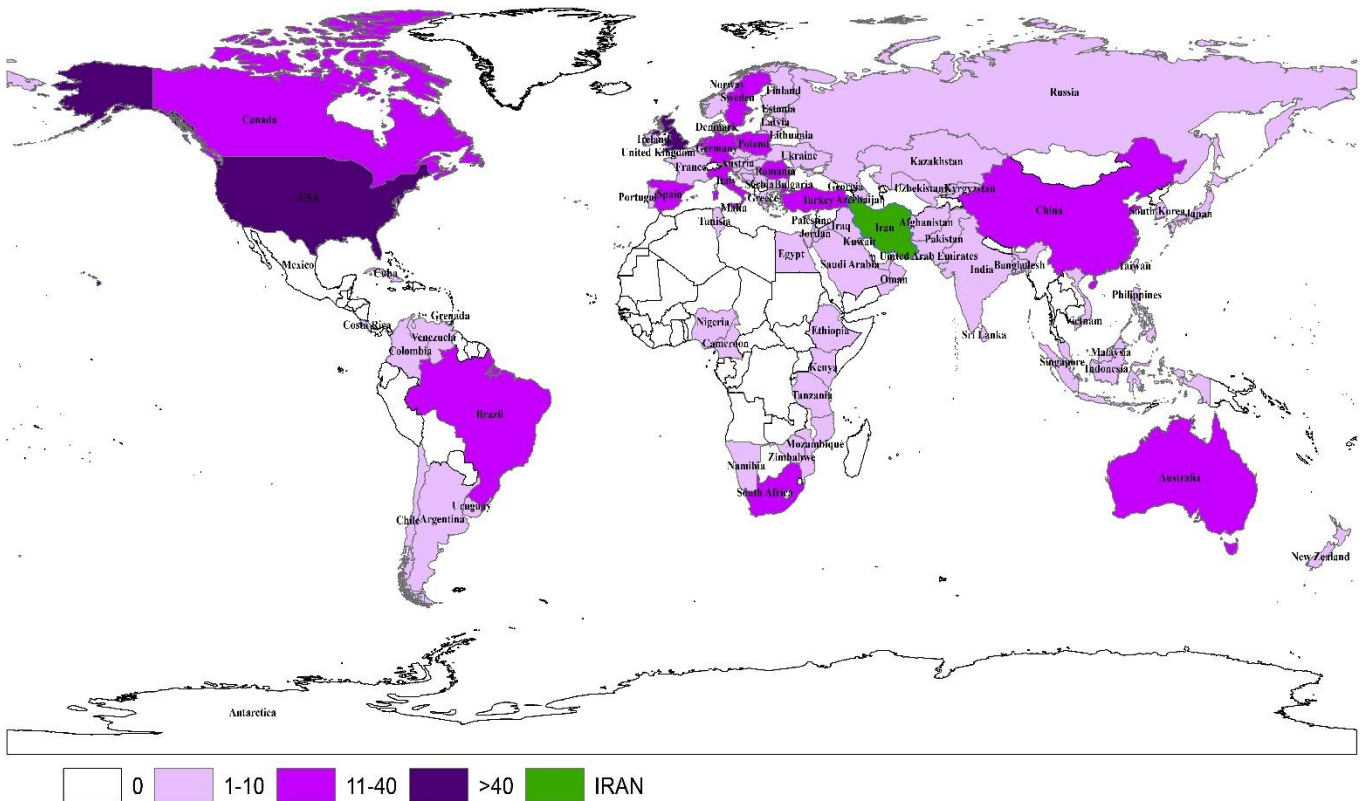


Figure 4. Number of Iran's international collaboration rate in cardiovascular research (2015-2019 years)



In addition, although the level of international research collaboration of Iran could have been severely affected by sanctions in recent years; findings have demonstrated that, Iran has been able to overcome the barriers of the sanctions.

### Conclusion

The present study provides a global description of the changing pattern of international research collaboration behavior of Iran and also indicates that the international research collaboration follows a logical trend in the cardiovascular field. Building effective international research collaboration networks as well as encouraging researchers to work in these networks can be considered by policy makers in university levels.

### Conflict of Interest Disclosures

The authors declare they have no conflicts of interest.

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