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Knowledge Production and Transfer in the Iranian Oral Health Research Centers: Based on Research Evaluation from 2019 to 2021

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A B S T R A C T

Due to the global burden of oral diseases, knowledge production and transfer are essential for clinical practice and policy. This descriptive study assessed 28 Iranian Oral Health Research Centers (OHRCs) from 13 medical universities (2019–2021), using indicators like research output, high-quality publications, international collaboration, citations, and H-index for production, and Altmetrics for transfer. Over three years, these centers published 4,428 articles in indexed databases, with approximately 20% (883 articles) appearing in first-quartile (Q1) journals. More than 16% of publications involved international co-authorship. In knowledge production, the Dental Research Center of Tehran University of Medical Sciences ranked first, followed by the Dental and Periodontal Research Center of Tabriz and the Dental Research Center of Shahid Beheshti University. For knowledge transfer, the Dental Materials Research Center of Babol ranked first, followed by Mashhad's center. The findings demonstrate substantial scientific productivity among Iranian OHRCs, with notable variation in research performance across institutions.

Keywords: Iran; Knowledge; Oral Health; Translational Research, Biomedical

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INTRODUCTION

According to the World Health Organization, oral diseases stand as the fourth most expensive chronic diseases, and approximately 3.5 billion people (50% of the world's population) suffer from at least one oral disease. Also, oral diseases are responsible for major global health burdens of diseases (with an annual expenditure of about US$710 billion in direct and indirect costs) with common risk factors with other non-communicable diseases [1]. As a matter of fact, the global burden of oral diseases exceeds the combined global burden of the next five most common non-communicable diseases (mental disorders, cardiovascular diseases, diabetes mellitus, chronic respiratory diseases, and cancers) [2]. Statistics indicate that the rate of global caseload of oral diseases (which not only affect general health but also increase the probability of diabetes mellitus and cardiovascular diseases) exceeded the population growth rate between 1990 and 2019, indicating the explicit failure of the applied policies and efforts to reduce the spread of oral diseases [3]. The World Health Organization explores three main causes in this regard. First, like other non-communicable diseases, social determinants of health exclusively determine individuals' behaviors in their lives as in sociogenic,

familial, and historical circumstances, inequitable wealth and manpower distribution, and marginalization in the society. Second, the commercial determinants of health are the corporate activities that affect people's oral health, promoting detrimental habits such as smoking and alcohol consumption in one hand and fluoridation/use of fluoridated products on the other hand which need urgent education and different implementation. Third, the neglected attitude of insurance companies toward the coverage of oral health expenditures, and lack of funding in oral health research that remain major problems [4]. But despite this, many research projects have been carried out to control the disease burden.

Over the past decade, more than 110,000 articles related to dental science have been published in journals indexed in ISI database by researchers around the world [5]. Of these, 424 articles have been highly cited. The most common topic in these articles was oral medicine (n=54781 papers). The highest number of these articles have been published by the Universities of London (2.27%), Sao Paulo (2.2%), California (1.39%) and Harvard (1.3%). In Iran, Tehran University of Medical Sciences (UMSc), Shahid Beheshti UMSc, and Islamic Azad University have published a total of 1.24% of dental science articles [6].

In Iran, there is a powerful national health research system to support the health system. There are more than 70 UMScs, 65 research institutes, and 840 medical research centers (MRCs) that are active in different research fields. in this regard, 3 research institutes and 29 MRCs are specifically active in dental science and different aspects of oral health.

Considering the existing challenges in the oral health domain in Iran, like many other countries, and the strategic role of oral health research centers (OHRCs) in order to produce new knowledge and collect new evidence, this study aimed to assess the knowledge production and transfer in the Iranian OHRCs during 2019 to 2021 based on annual research evaluations. The results of this study can be used by policymakers and researchers to enhance interventions on the oral health domain in health-related or non-health-related sectors.

MATERIALS AND METHODS

Study setting:

This study was carried out in Iran with 70 national public UMScs, 65 research institutes, and 840 MRCs active in biomedical, clinical, and health promotion research fields that have been approved by the Council for Expansion, Supervision, and Evaluation of Medical Universities, have at least five researchers, and operate within a specific research field to address the needs of the health research system. In the clinical field, there are three main specified subgroups of internal medicine, surgery, and dentistry. Also, based on the budget line, the approved MRCs were assigned to dependent and independent groups. In independent centers, the budget is deposited from the program and budget organization and through a special budget line. Dependent research centers do not have a budget line and receive a budget from the university research credits.

All MRCs with more than one-year activity are involved in the evaluation process. The UMSs are also divided into three types of one, two and three in descending order based on their size. In other words, Type 1 universities have the highest input in terms of human resources, budget, facilities and equipment while Type 3 universities have the least. The research and technology activities of UMSs and MRCs are evaluated by the Undersecretary for Research and Technology of Ministry of Health and Medical Education (MoHME) annually. This evaluation is done quantitatively and based on international scientific indicators in research output. In this study, all dental research centers in Iran were evaluated from 2019 to 2021.

Study design:

This was a descriptive study conducted in 2022 based on the evaluation results of knowledge production in MRCs of Iran. The research population included all OHRCs approved by the Development Council of Universities of Medical Sciences in the MoHME. The inclusion criterion was being active of OHRCs during 2019 to 2021.

Research steps:

For annual evaluation of research centers, the following steps were carried out:

-Establishing a scientific committee consisting of scientometric, research evaluation, and bibliometric experts familiar with the research and technological activities of UMSs and MRCs.

-Formation of an executive committee consisting of representatives from UMSs (two members from each type) and MRCs (two members from each field).

-Compilation of evaluation indicators, preparing and sending evaluation instructions to universities and research centers.

-Holding capacity building workshops to familiarize universities and research centers with the evaluation indicators.

-Designing a suitable platform for collecting and extracting data.

-Designing a scoring system by the scientific committee based on importance, measurability and feasibility.

-Implementing the evaluation process with the cooperation of executive committee members.

Research indicators:

The two main topics of knowledge production and knowledge transfer with 20 research indicators were used for the evaluation process.

Knowledge production: It included 8 indicators as shown in Table 1.

Table 1. Knowledge production indicators for evaluation of Iranian oral health research centers (OHRCs)

Indicators	Description	Weight	Score calculation method
Research output (RO)	Number of published articles during 2019-2021 indexed in WOS (w), PubMed (p), Scopus (s), Number of published books indexed in Scopus during 2019-2021(b), Number of conference presentation index in Scopus and WOS during 2019-2021 (cp)	250	(w*2)+(p*1.5)+(s)+(b*2)+(cp*0.5)=Total score RO
			Max Total score RO in OHRCs =Max weight =250 & For (n-1): Adjusted Total score (RO)
International cooperation (IC)	Number of published articles with international cooperation indexed in Scopus during 2019-2021	150	Σ IC=Total score IC
			Max total score (IC) in OHRCs= Max weight=150 & For (n-1): Adjusted total score (IC)
High quality publication (Q1)	Number of published articles in the best quartile journals in each subject during 2019-2021	200	Σ Q1=Total score Q1
			Max total score (Q1) in OHRCs = Max weight=200 & For (n-1): Adjusted total score (Q1)
Citation (C)	Total citations during 2019-2021 to published articles in the past 5 years based on Scopus database	400	Σ C=Total score C
			Max total score(C) in OHRCs = Max weight=400, & For (n-1): Adjusted T(C)
H index (H)	Average 5-year H-index during 2019-2021	100	Mean h index=Total score H
			Max. total score (H) in OHRCs = Max weight=100 & For (n-1): Adjusted T(H)
AAS	Mean of AAS based on Altmetric Explorer in June 2023	200	Mean AAS=Total score
			Max Total score (AAS) in OHRCs = Max weight=200 & For (n-1): Adjusted T(AAs)
Total score	Σ total score {(RO), (IC), (Q1), (C), (H), (AAS)}		

AAS: Altmetric Attention Score

Knowledge transfer: Based on the Altmetrics indicators, total mentions in 19 social media (Mentions of News, Blog, Policy, Patent, Twitter, Peer review, weibo, Facebook, Wikipedia, Google +, LinkedIn, Reddit, Pinterest, F1000, Q&A, Video, Syllabi, Mendeley readers, Number of Dimensions citations) in five categories of social media, policy and patents, news and blogs, other sources, and academic sources were assessed. Overall, three main factors are used to calculate the Altmetric score: volume (how many times the article is mentioned), sources (where the mentions come from), and authors (of each mention). Table 1 shows how the Altmetric Attention Score (AAS) was calculated in this study.

Data collection:

Regarding knowledge production, according to the instructions, the data were extracted from ISI, PubMed, and Scopus databases and all scores were automatically calculated by the system.

Regarding knowledge transfer, the records of each research center were retrieved in three ways; first, their profiles in the Universities' Scientific Metrics System were retrieved; then, the specific profiles of the centers in the Scopus database were retrieved, and finally, for the centers that did not have a specific profile, their records were retrieved by searching for their organizational affiliation.

Based on the comma-separated value output of the Scopus citation database, only the data of articles that had a digital object identifier and PubMed IDs were searched from the Altmetric Institute database. These two identifiers were combined in Altmetric Explorer with the OR operator in the retrieval. Finally, the mean AAS was calculated separately for each center.

Data analysis:

The data analysis was done using SPSS version 19.0 (SPSS Inc., Chicago, IL, USA). Independent t-test was used for data comparison. $P<0.050$ was considered statistically significant. To evaluate the reliability of the checklist, the split off method was considered.

RESULTS

This study evaluated 28 OHRCs related to 13 UMSs (Table 2).

Table 2. Name of Iranian University of Medical Sciences (UMSs) and oral health research centers (OHRCs) and their research lines

Name of UMS	Type of UMS	Name of centers	Research line
Isfahan	one	Dental implants RC, Dental RC, Dental materials RC	Nanomaterials, Biomaterials and tissue engineering Novel treatment methods in dentistry including laser, stem cell and so on. Screening and treatment of oral cancer Preventive dentistry (Social dentistry) Dental implant
Babol	two	Oral Health RC, Dental Materials RC	
Baqiyatallah	two	RC for Prevention of Oral and Dental Diseases	
Tabriz	one	Dental and Periodontal RC	
Tehran	one	Dental Implant RC, Craniomaxillofacial RC, RC for Caries Prevention, Dental RC, Laser RC of Dentistry	
Zahedan	two	Oral and Dental Disease RC	
Shaheed Beheshti	one	Iranian Center for Endodontic Research, Dental RC, Dentofacial Deformities RC	
Shiraz	one	Orthodontic RC, Oral and Dental Diseases RC	
Qazvin	two	Dental Caries Prevention RC	
Kerman	one	Endodontology RC, Oral and Dental Diseases RC, Social Determinants on Oral Health RC	
Gilan	two	Dental Sciences RC	
Mashhad	one	Oral and Maxillofacial Diseases RC, Dental RC, Dental Materials RC,	
Hamedan	two	Dental Implants RC, Dental RC	

RC: Research Center

The mean duration of activity of these OHRCs was 10.9±4.39 years (range 5 to 24 years). There was a significant association between the duration of activity and total research score (P=0.000). Of all, 80% of research centers were active in the clinical field, 14% in prevention and health promotion, and only 7% in biomedical field. The mean number of researchers working in each center was 14.1 (range 2 to 56). There was no significant association between the number of researchers and the total research score (P>0.050). Only Dental Research Centers affiliated to Shahid Beheshti and Tehran UMSs had an independent budget line. The total number of articles published during 2019 to 2021 by OHRCs in journals indexed in ISI/Web of Science (WOS), PubMed, and Scopus databases was 4428, and almost 20% (n=883) of them had been published in Q1 journals in each subject. In more than 16% (n=383) of the cases, the published articles had at least one foreign counterpart. Based on the results, Dental Research Center of Tehran UMS with 79 high-quality publications and 1970 citations to articles within 5 years ranked first among the Iranian OHRCs. The highest number of international collaborations (n=45) and H index (22) were related to Dental Research Center of Shahid Beheshti UMS and Dental and Periodontal Research Center of Tabriz UMS, respectively.

Based on this evaluation, the first ranked OHRC was Dental Research Center of Tehran UMS followed by Dental and Periodontal Research Center of Tabriz UMS and then Dental Research Center of Shahid Beheshti UMS. There were eight research lines, and 60% of the knowledge production of OHRCs was related to their research line (Table 2).

In Altmetric evaluation, Dental Materials Research Center of Babol UMS ranked first followed by Dental Materials Research Center of Mashhad UMS. Ranking of OHRCs during 2019-2021 is shown in Supplementary Table 1.

DISCUSSION

There are 28 OHRCs in Iran with more than three years of activity affiliated to 3 UMSs in 11 provinces of Tehran, Mashhad, Gilan, Kerman, Isfahan, Mazandaran, Fars, East Azarbaijan, Sistan and Baluchestan, Qazvin, and Hamedan. The geographical distribution of OHRCs in Iran is not consistent with the burden of oral and dental diseases, and the results showed that some provinces, such as Kurdistan or Yasuj lacked OHRCs [7].

The total number of articles published by the Iranian OHRCs in journals indexed in ISI/WOS, PubMed, and Scopus was estimated to be 4428. One-fifth of them were published in Q1 journals. There was 16% and 50% of foreign and domestic research cooperation in knowledge production, respectively. The highest evaluation score was related to Dental Research Center of Tehran UMS. This center had more qualified articles and higher number of citations.

Studies show that there is a significant relationship between low socioeconomic status and decayed, missing, and filled teeth (DMFT) index [8]. Therefore, presence of centers providing oral and dental services as well as related research centers in deprived provinces can reduce the burden of this health problem [9]. The largest number of research centers was located in Tehran (capital city of Iran), and also, the number of dentists in this city is 6 times the national average [9, 10].

Community-based programs are suitable for oral and dental health promotion through public participation and needs assessment [11]. OHRCs can play an important and fundamental role in oral health promotion. It is obvious that assigning appropriate missions to research centers is one of the main tasks of health decision-makers [12].

Every Iranian has at least 6 decayed teeth, and people aged 30-40 years, who are at the peak of social activity, usually have 12-13 missing teeth [13]. According to a meta-analysis conducted in 2020 in Iran, the mean pooled DMFT index score in the age group over 65 years was 26.84 (26.41-27.28). The majority (92%) of the DMFT score was related to missing teeth [14].

Due to the high prevalence of dental problems in the community, knowledge production and transfer especially in the media can reduce the ascending trend of such problems [15]. Reviewing the Altmetric results of OHRCs shows the low visibility of the knowledge generated by research in the social media such as Twitter, Blog, Facebook, and so on. In Dental

Materials Research of Babol UMS, the article entitled "Effect of popping chocolate and candy on enamel microhardness of primary and permanent teeth" [16] has had the highest number of views in the cyberspace based on alternative attention score. The Altmetric index of this article was 633 and it was reported 80 times in the news format.

This study had two strength points. First, it evaluated knowledge production and transfer in the field of oral and dental health in order to make appropriate policies to reduce this widespread health problem. Second, based on distribution of research centers, it identified provinces in need.

Failure to address the impact dimension in this evaluation process is one of the weak points of this study. In addition, in this study, indicators for measuring input such as the quantity and quality of human resources/budget and process monitoring were not defined.

CONCLUSION

Iranian OHRCs have demonstrated significant scientific productivity within a 3-year period. The identified leading centers in knowledge production and transfer reflect diverse research performance across institutions.

CONFLICT OF INTEREST STATEMENT

None declared.

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