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Original Article

Key Indicators for Monitoring the Efficiency of Iranian Health System: A Synthesized Design Study

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Abstract

Background: A significant share of medical care, primary health care, and health-related education and research in Iran is provided by the Ministry of Health and its affiliated universities of medical sciences. We aimed to identify a set of key metrics for monitoring their efficiency in the four areas of medical care, primary health care, education and research.

Methods: A combination of scoping review, expert panel and Delphi method was used. First, the relevant keywords were searched in the appropriate databases between 2000 and 2020. The final extracted indicators then reviewed, reduced and refined through the expert panel meetings. The last metrics were established following a three-stage Delphi study.

Results: Out of 2327 studies, 155 were selected following the different screening stages of scoping review. After summarizing and refining the indicators via several expert panel meetings and the Delphi method, a total of 36 key indicators were considered appropriate for measuring efficiency of the health system, 23 of which were for the sub-systems of public health (4 indicators), medical services (10 indicators), education (4 indicators) and research (5 indicators) and 13 indicators for the whole system efficiency.

Conclusion: The set of indicators presented representing both the technical and allocative efficiency, might be a reliable basis for designing information systems and management dashboards for periodic monitoring of health system efficiency at national, regional and local levels.

Keywords: Efficiency; Health system; Key indicators; Iran

Introduction

Inefficiencies, waste of resources, low-value care, and limited use of data and evidence to support reforms are among the main influential factors possibly threatening the future performance of health systems (1). Therefore, enhancing efficiency is of a high priority to improve health outcomes given slow economic growth and health budget constraints (2). To this end, efficiency

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should be firstly measured and its determinants are identified (3).

The goal of efficiency is to maximize benefit over the cost or minimize the cost to obtain a particular benefit (4). Efficiency assumes two different types of technical and allocative efficiency (TE & AE). TE is 'the difference between the actual ratio of inputs to outputs from its ideal rate' (5). AE 'occurs where the price is equal to the marginal cost of the resources used in production'. In practice, AE is defined as 'the selection of a combination of health care interventions that, in addition to minimizing the cost of producing each service, maximize cost-effectiveness' (5).

There are also different approaches to measure efficiency, including ratio analysis, ordinary least squares regression (OLS), total factor productivity (TFP), stochastic frontier Analysis (4), and data envelopment analysis (5, 6). The basis of using such methods is the selection of appropriate indicators. Many indicators have been introduced to evaluate the efficiency of health systems, ranging from activity to cost comparison indicators (7).

The choice of indicators is not only critical in assessing the performance of health systems, but also could reflect the areas in need of attention (8). Health systems are complex and multidimensional institutions (9), accordingly, different frameworks have been employed to measure their performance and efficiency (10-13), as it might be challenging to summarize their performance or efficiency in a single measure or method

Iran has had one of the highest growth rates of health expenditures as a percentage of GDP (14). The comparison of health care efficiency between countries also indicates the potential for more efficient use of health resources in Iran (15, 16). In recent years, many upstream policies (17, 18) have emphasized the need to measure the efficiency and efficacy of institutions in order to improve productivity. The health system is no exception to this principle (9).

Although the primary idea of efficiency is simple, measuring and interpreting efficiency metrics and identifying a set of measures to remedy the observed inefficiencies, in practice, is challenging (19). The multidimensionality of health systems also add to the complexity of measuring their efficiency (20).

Following the merger of health and medical faculties and educational institutions into the Ministry of Health (MoH) in 1985, in Iran, since then, the MoH and its affiliated universities of medical sciences are responsible for providing a wide range of education, public health, research and medical services (21). Various studies have shown some degree of inefficiency in the Iranian health system (IHS), e.g., the hospital services (22, 23), primary health care (9, 24), education and research (25, 26). For example, Kiadaliri et al (22) showed the average efficiency of hospitals in Iran around 0.8. Similarly, Jahanmehr et al (9) calculated the average performance score in the public health sector from 0.6 to 0.8. According to the Iranian National Institute for Health Research, the health system has been struggling with varying degrees of inefficiency, largely because of unnecessary/inappropriate use of highly advanced and expensive procedures and medications, less attention to the regionalization and health information systems (27).

Therefore, we aimed to identify a set of key metrics for monitoring the IHS efficiency.

Methods

Various methods were used to determine the efficiency indicators of the health system as follow, adopting a qualitative approach in 2020.

Scoping review: In order to extract an inventory of efficiency indicators, scoping review was firstly conducted, as it has been used in several studies to identify indicators in health system (28, 29). The main keywords including "efficiency", "performance", "productivity" plus "Health system" and the various relevant sub-systems; Primary Health Care(PHC), medical & paramedical services such as hospital and etc., education and research) were searched in the databases of "PubMed", "Scopus", "Science direct" and "Web of Science" google scholar search engine, internal databases as "Magiran", "Medlib", "Irandoc",

"Iranmedex", " Scientific Information Database (SID)", and World Health Organization website between 2000 and 2020.

Besides, a separate google search was performed and related documents were extracted in order to identify the grey literatures. Inclusion criteria included mainly relevance, the possibility of accessing full-text of studies in English and Persian. All retrieved studies were entered into Endnote. They were first screened separately and checked, in case of possible inconsistency. A three-tier screening included reviewing papers' title, abstract and body, respectively, after removing duplications. No critical appraisal was applied here as we were looking for more indicator at first place. The extracted indicators were entered in a Microsoft Excel file and then evaluated by the members of the research team and duplicates were removed. The indicators were then rewritten in a fluent Persian and common health literatures language and the initial list of indicators was prepared.

Expert Panel: Separate meetings were held with the experts of education, research, public health and medical services, and finally a concluding meeting was held in the presence of a group of expert panels from all four fields to gather their opinions. Overall, 18 experts were consulted in the meetings; ranging from the university professors in health management, economics and policy-making, hospital administrators, to the authorities from the deputies of education, research and clinical services. In each session that lasted about two hours, the indicators were reviewed and those vague and unrelated items were removed. These meeting mostly were of a reductionist approach and served for discussion about the appropriateness of indicators and their compatibility with the given fields.

Delphi method: In this stage, the final indicators were prepared in the form of a questionnaire and sent to 15 health management and economics experts. They were asked to rate the indicators between 1 and 10, taking into account various criteria based on the RACER (relevant, acceptable, credible, easy to monitor and robust) (30), SMART (Specific, Measurable, Attainable, Relevant, Time-bounded) (31), CREAM (Clear, Realistic, Economic, Attainable, Measureable) and RAVES (Relevant, Achievable, Valid, Ethical, Simple) frameworks. Final indicators were regarded as those to which assigned a score higher than seven on average. Consensus was reached on the final indicators during the three-round Delphi.

Results

Following the retrieval process, 2297 articles, of which 1298, 837, and 37 were removed after reviewing their title, abstract, and body, respectively, were obtained. Around 30 documents were also identified and added to the list after reviewing the domestic databases and gray literature. Finally, 155 studies were included in the present study (Fig. 1). The specifications of these articles are presented in Table 1.

Table 1: Characteristics of the final studies

Frequency	*Category*	*Variable*
Language	Persian	18
	English	137
Setting	Iran	30
	Other countries	125
Document type	Article	134
	Reports & documents	21
Publication date	2000-2005	43
	2005-2010	36
	2010-2015	47
	2015-2020	29

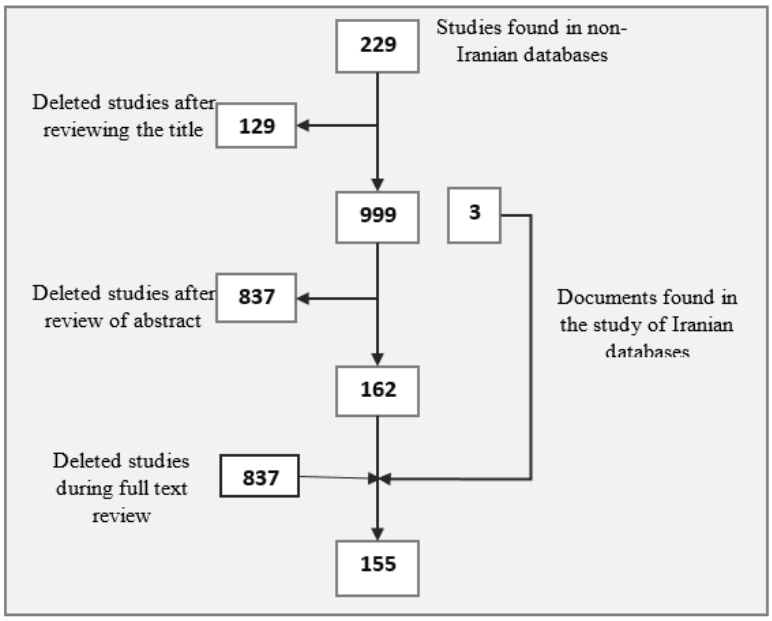

Fig. 1: Flow diagram of article selection

A number of 1262, 581, 230, 300 and 290 indicators were extracted for the areas of public health, medical services, education, research and the whole health system, respectively, at the review stage. After several steps of summarizing, polishing and refining at various expert panels and Delphi, the number of indicators reduced remarkably (Fig. 2).

	Sub systems				System
	PHC	Medical services	Education	Research	
Review Output indicators	1262	581	230	300	290
Preliminary refinement of indicators	810	112	176	260	54
Expert panel output indicators	27	101	37	21	31
Delphi method output indicators	4	10	4	4	13

Fig. 2: The process of determining the final indicators for measuring the efficiency of the Iranian health system (IHS)

Overall, 36 key indicators were introduced for designing a efficiency monitoring dashboard of Iran's health system, of which 23 are related to the sub-fields, i.e. public health (n=4), treatment

(n=10), education (n=4), and research (n=5). This dashboard also proposes 13 efficiency indicators for the health system (Fig. 3). The scientific and demographic characteristics of the members of the expert panel and Delphi method are presented in Table 2.

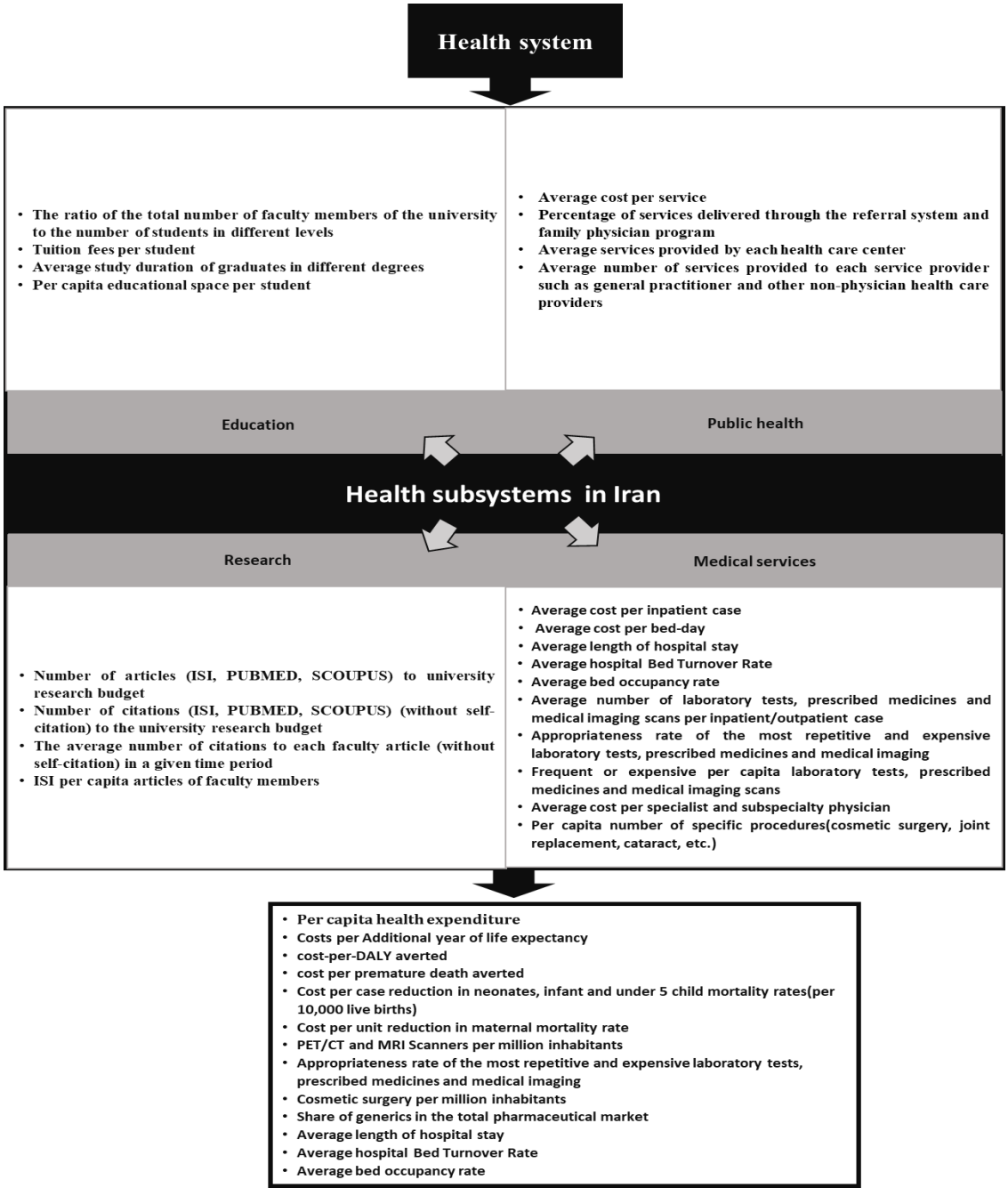

Fig. 3: Key indicators for measuring the efficiency of the Iranian health system

Table 2: The scientific and demographic characteristics of the members of the expert panel and Delphi method

Variable	*Groups*	*Expert panel*		*Delphi method*	
		Number	**%**	**Number**	**%**
Job position	Faculty member	5	27.78	15	100.00
	Hospital administrators	2	11.11	0	0.00
	The authorities from the deputies of education, research and clinical services	11	61.11	0	0.00
Gender	Male	12	66.67	11	73.33
	Female	6	33.33	14	93.33
Age group(yr)	20-40	4	22.22	4	26.67
	40-60	7	38.89	8	53.33
	>60	7	38.89	4	26.67

Discussion

This study aimed to provide a list of indicators for measuring the IHS efficiency. A number of 36 indicators were ultimately introduced, of which 13 indicators could be applicable at health system level. These indicators can be used both to measure efficiency and benchmark at national and subnational levels as well as to compare the efficiency of Iran's health system with other countries. Cross-country comparisons could provide an opportunity to contemplate and evaluate the performance of national health systems; create an empirical context for designing reform programs, and serve as a pathway to enhance the accountability (32). Numerous studies have been conducted to compare the performance and efficiency of health systems and their ranking (33, 34). Most international comparisons seek to recognize health systems with the best outcomes or the highest value for money. Although these concepts may seem simple at first glance, they could be very difficult to put into practice. There could be at least three challenges: conceiving the boundaries for health systems, managing data limitations, and finding the proper techniques to address the inherent characteristics of national health systems. Without understanding and addressing such challenges, the comparisons between countries might fail to feed effectively into health policies and might lead to misinterpretation (32).

These indicators could monitor the improvement made in each country in comparison with international trends. Some also examine the progress in improving the general population health indicators, i.e. healthy life expectancy, premature mortality, infant and child mortality, maternal mortality, and burden of diseases relative to costs. Multiple studies have been conducted using these indicators to compare the efficiency of health systems. For instance, child mortality rates and life expectancy (34), healthy life expectancy (35), infant mortality and life expectancy (36) and healthy life expectancy and disability-adjusted life years by González (37). Three indicators i.e., the average length of hospital stay (ALOS), average bed occupancy rate (BOR) and average bed turnover rate (BTR) can measure the efficiency of hospitals, especially in low and middle-income countries (38). Data on these indicators are not routinely reported for all countries (39). As developed countries are ranked high in most studies comparing the efficiency of health systems (15, 16), they can be an appropriate reference for benchmarking.

The MoH provides a wide range of primary and secondary care in the country, along with being responsible for research activities and education and training of human resources for health sector. The number of indicators for medical services is more than other fields. According to the National Health Accounts, the share of public health, medical services, education, research from total health expenditures was 5.4%, 86.2%, 3.1%

and 0.04%, and 4.9%, respectively, in 2017 (40). In most countries, medical expenditures represent the major share of health expenditures (41). Therefore, the management of medical costs is a proper avenue to increase health system efficiency globally.

Some indicators such as ALOS, BTR, and BOR are though used as hospital performance indicators, they were also considered to compare the efficiency of international health systems and hospitals sub-nationally. For example, on comparing the performance of 139 hospitals in Iran, BTR ranged from 64.5 to 114.8, LOS from 1.82 to 3.27 d, and BOR from 31/4 to 64.5 (42).

The indicators identified reflect both TE and AE. An organization is technically efficient if it is not possible to obtain more output from its production process that keeps all inputs constant (13). The indicators here were *de facto* meant to reflect the TE. For example, the amount of cost spent per unit increase in impact indicators such as healthy life expectancy, the average cost per hospitalized patient, the number of articles over to the university research budget and the average educational cost per student.

AE demonstrates the use of the appropriate combination of outputs that could maximize community preferences, e.g., the most cost-effective services, and can be considered at both micro and macro levels for health systems (7, 43). Some indicators proposed, such as the frequent or expensive per capita laboratory tests, prescribed medicines and medical imaging scans, attempt to represent a depiction of allocation efficiency. Whilst the relationship of such indicators with performance is not initially clear, but it should be noted that these indicators could be a manifestation of possible wasted resources in the health system. Hence, if their level at the national level is significantly higher than the global average, whether or not it is significantly different from the national average in an area, it might be an indication of improper prescribing and the imposition of an unnecessary burden on the health system and society.

In recent years, several studies have been conducted to evaluate the efficiency and performance in public health at both micro (44, 45) and macro (9, 46). levels. Some studies have only focused on the development of the efficiency/performance evaluation framework (47) and in their other studies, they have used for ranking and evaluating performance (9, 46). Some of the suggested indicators in recent studies have been based on national surveys such as Demographic and Health Survey, so their information will not always be available. Four indicators have been proposed to evaluate the efficiency in PHC sector. To calculate these indicators, the data related to the number of services provided by each health center and each provider can be obtained from the Integrated Health System (SIB system in Persian) (48). Four indicators have been proposed to evaluate the efficiency in each of the education and research sectors. These indicators were extracted from among the total indicators used in different university ranking methods at the international level; News Week, URAP (University Ranking by Academic Performance), SIR (Scimago Institutions Rankings), QS, Times Higher Education etc. and the set of identified published studies. In education, three indicators assess the cost, the number of faculty members, and the physical space against the number of students. These indicators are the main ones that are used in most studies (49, 50).

Although measuring efficiency over time is vital for improving the performance of health systems, MoHs do not generally have access to the data needed, including the use of physicians, health technologies, health centers, and medications, to properly assess efficiency among their operational units (12). Therefore, development of information and management systems could be a prominent step towards improving efficiency (51). The indicators introduced can be a reliable basis for designing information systems and management dashboards to monitor periodically the efficiency of various health sub-systems, identify their strengths and weaknesses, and propose a number of corrective initiatives to improve their efficiency under an operational guide for ultimate correction of inefficiencies in health systems.

Conclusion

We proposed a list of key indicators for monitoring efficiency of the IHS as the chief steward for nation health. The indicators are divided into two general groups; some for comparing the overall performance of the whole system with other countries, and others for comparing sub-systems, including the MoH and its affiliated medical sciences universities in the areas of public health, medical services, education and research. They could pave the way towards developing an optimal information system, the results of which can be accessed periodically in the form of management dashboards for policy and decision makers. Besides, the possibility of ranking DMUs and uncovering their weaknesses as well as national and international comparisons and annual evaluation of the DMUS are highly likely.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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