

Quantitative development scenario planning of health professional education in Iran: A mixed-method study

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Abstract

Background: The world surrounding human beings perpetually undergoes transformations and the universities are not an exception in this regard. The condition for survival amid this is to identify and control these transformations and the science that can assist human beings in this respect is "Futures Study" whose goal is to eliminate the ambiguity of the future, to establish the opportunities for certain future and, increase human control over the future. This issue is much more tangible than ever in medical universities dealing with the public health of the society and it is required to highly focus on their quantitative development.

Methods: The present study is a mixed-method study carried out in the medical universities of Iran in 2018-2019. First, in the qualitative approach, the components and indicators of the health professional education's quantitative development have been identified by the classical Delphi method according to targeted sampling from ten experts with content analysis that was identified and coded. In the quantitative approach, having analyzed the indicators using Scenario Wizard software, several scenarios have been designed for the quantitative development of education.

Results: The study findings suggest that at least 6 components and 32 indicators can be introduced in the quantitative development of medical science education, on which some robust scenarios can be considered for futures including the optimistic, intermediary, and pessimistic ones.

Conclusion: This study directs the researchers toward the quantitative development components and the indicators of medical science education in Iran and how they can be exploited to realize promising futures.

Introduction

Today changes occur at a faster rate. The governments, organizations, and nations have to perceive the changes and the future better and more since human beings all will live and work which differs from today.^{1,2} "Futures study" is a novel area of exploration and encompasses explicit and systematic thinking about alternative futures and it targets to eliminate the ambiguity of the future, to create a more clear-cut future, and increase human control over the future. The destination of Futures study is not forecasting future, rather it is analyzing and also designing serious changes in the future and the evidence denotes these changes will get wider and deeper in the future.³ Quantity in the development of education is related to the number and ratios in the components and indicators of education that attention to them will improve the level of education. These include the percentage of full-time and part-time faculty members, permanent and temporary faculty

members and retirees, their ratio to students, the number of hours of training courses, the number of course titles reviewed. The number of available fields, and the per capita educational space, were mentioned. Thus, the universities require "futures study" for their life and development.⁴ Futures studies are applied in universities by researchers all over the world. For instance, at Michigan University of Medical Sciences, a study was conducted on the supply and demand of physicians in different American disciplines with a "futures study" and scenario formulation approach in 2020. In formulating the future baseline scenario for the specialist human resources supply, they particularly considered four factors including the number and the composition of the medical specialists, the number of the new entrants, the number of exits (retirement and death, etc), and the migration rate. The report results indicate that through maintaining the current admission process for medical universities and specialized and post-specialized

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courses, the would-be specialists' growth process will be slower than the population growth and in the future, human beings will face the deficiency of medical specialist manpower.⁵ Foresighting and getting prepared are required for dealing with the risky would-be conditions, in the health and medical education system, due to the rapid changes in diverse areas of society.⁶ Because there is no complete consensus on the components of quantitative development and some of the components are discussed in the upstream documents, it is necessary to first examine the components of quantitative development and then conduct futures studies. Since few studies have been carried out about the issue known as "futures study" and Foresighting in Health professional area and only one study with this theme has been conducted by Tabatabai⁶ to qualitatively and quantitatively promote the specialized and post-specialized Health professional education at Shahid Beheshti University and also in Kerman University of Medical Sciences, there is a "futures study" center in which it is required that broad studies be done in this area. The goal behind the current study is to answer the following questions:

"What are the quantitative development components of health professional education in Iran? And how it is possible to present foresighting scenarios based on these components in pursuit of research goals, as reinforcing the quantitative dimensions of health professional education in Iran?"

Materials and Methods

In this research, a mixed qualitative and quantitative method accompanied by successive exploratory design has been applied. At first, the upstream documents of the health professional education including the quantitative development strategic document of the health professional education,⁷ the medical universities' educational ranking (RAD)⁸ and the comprehensive academic map of the country,⁹ have been investigated and the components available in such documents have been identified. Then, to further understand the problem with a qualitative approach, and using classical Delphi method (in two stages) - as one of the futures study methods - 10 health professional education and higher education experts working in the medical universities affiliated education research and development centers have been consulted with and the main quantitative development components of the health professional education have been surveyed from their perspective. Experts are working at Mazandaran, Tehran, Shahid Beheshti, Gilan, Golestan, Babol, Tabriz, and Kurdistan Universities of Medical Sciences. These experts included three PhDs in Higher Education, one Ph.D. in Medical Education, four MS in Medical Education, and two heads of medical education research centers. They answered questions to identify the main quantitative development components of the health professional education from their perspective.

In an email correspondence, the type of study method was outlined and they were asked to study documents while expressing their views on the components and key indicators of quantitative development. Then, the main components have been determined besides open-ended, axial, and selective encoding of the documents and the experts' views extracted material. In the continuation, the documents and Delphi study derived material have been sent to 5 authorities and after the views' saturation being approved, the final components have been specified, and based on this, we have taken measures to outline the Futures-based Scenarios. For this purpose, i.e., to formulate the scenarios, first off three experts have been asked to define 3 optimistic, intermediary, and pessimistic states for each of the specified components; following that, a checklist including a matrix of the probable situations and scenarios has been designed and brainstorming sessions have been held to analyze and respond to the crossover effects of the probable situations. The brainstorming sessions were made up of 3 sessions with 7 experts. The experts tried to complete the checklist by posing this question: "How will the occurrence or non-occurrence other situations be affected if each of the probable situations of the key factors takes place?" based on three features as promoting (empowering), ineffective, and restricting. In this checklist, the situations can also reveal that the negative influence and the checklist figures vary from +3 (from powerful restricting) to -3 powerful promoting) effect. Finally, the responses have been analyzed in Scenario Wizard software and the befitting scenarios have been extracted out of the probable ones. Since in this research, the components have been specified in the qualitative and quantitative parts, besides analyzing the crossover and paired effects, the components' different conditions have been examined, thus, the qualitative part's validation of the study also guarantees the validation of the quantitative part. Thus, in the present research, to address the reliability and validity and (the qualitative part's validation), "monitoring by the authorities" have been applied as follows:

- Review by Delphi group: Five of the interviewees have been assigned to, besides analyzing Delphi resulting final report, identify the components and also the probable situations of each of the components and their views and recommendations have been applied.
- Peer review: Through the assistance of four medical education officials and two experts of the futures study experts, paradigms and the probable situation of each of the components were addressed and their attitudes and perspectives were taken into account.
- Doing participatory research: Concurrently, the individuals informed about the futures study have been recruited as the assistants and fellows in the data analysis and interpretation.

Results

The study extracted information on upstream documents in health professional education and interview transcript with the medical education and higher education authorities working in medical education development centers of the country have been analyzed in terms of their content. Totally, via the qualitative data analysis, 60 open-ended codes and 17 axial codes, and 6 selective codes have been drawn. The 6 main codes as the very main components of the health professional quantitative development along with 32 relevant indicators have been picked up and listed in Table 1.

Scenario planning and employing Scenario Wizard software have been taken up in the quantitative part of the present research. To formulate the Scenario, based on 6 main previously stated components, and regarding three states as optimistic, intermediary and pessimistic have been put forth for the 18 diverse conditions from favorable

to unfavorable. After that to measure the judgments and different situations' effect on each other, an 18 * 18 cross matrix has been designed in the form of a checklist and seven experts have been polled in a face-to-face meeting and brainstorming has been performed to score the effect induced by each condition on the others out of -3 to +3. Through the checklist scoring, the ground has been paved to use the Scenario Wizard. The aim here is to provide possible scenarios out of 18 probable situations involving 6 key factors and, it is expected to come up with 324 probable mixed scenarios out of these potential situations encompassing all the subject upcoming future states. Each scenario is a combination of the probable situations related to the key factors besides taking the compatibility power among the conditions into account. Robust compatibility (in each state, it has the max score related to the key factors' effect balance), poor compatibility (in each state, it has one positive effect score or zero, leading to picking

Table 1. Quantitative development components & indicators of health professional education in Iran

MSE's quantitative development components	MSE's quantitative development indicators
Amount of funding allocated, facilitating and increasing investment	<ul style="list-style-type: none"> Existence of accreditation and quality assurance agencies in health field The amount of funding allocated to educational service units
Knowledge production level (doing medical education research and innovations)	<ul style="list-style-type: none"> Number of medical research centers in terms of governmental and non-governmental Number of the higher hubs and centers of research and education of health system Number of health system articles (national and international) Number of industry consulting contracts with health system-related research centers Number of research rankings and honors from national and international scientific and research festivals
Quantitative development of human workforce	<ul style="list-style-type: none"> Number of medical science researchers by gender and by governmental and non-governmental ones Number of medical students and related majors by degree, gender, governmental and non-governmental ones Number of graduates of specialized medical PhD courses and the related majors by degree, gender, governmental and non-governmental Number of educational hospitals and beds Number of active medical personnel in the country Number and composition of faculty members in the governmental and non-governmental medical universities countrywide Number of students to faculty ratio Number of educated manpower employed in research centers Number of allocated scholarships by majors
Quantitative development of dissemination and sharing of produced knowledge	<ul style="list-style-type: none"> Cost ratio of purchasing and transferring health information technology from overseas out of total import -related costs Number of databases and informing networks Number of hospitals and health centers with computerized medical records of patients in terms of the outpatient and inpatient basis Number of scientific associations of health system Number of medical articles indexed in reputable domestic and foreign databases Total effect factor of medical articles published in international authentic journals Number of specialized medical books compiled and issued by universities, research centers and scientific publishers
Increasing medical education goods and services' production capacity	<ul style="list-style-type: none"> Medical service export revenue to total export revenue ratio Proceeds from diagnostic and medical services provided to foreign patients by Iranian hospitals and institutions % of foreign medical students of Iranian postgraduate medical schools out of total medical postgraduate courses student community Number of completed research projects whose results have been applied Number of patents and discoveries
Quantitative development of academic majors available at universities	<ul style="list-style-type: none"> Number of new majors or degrees established at the university for the first time in the last three years Number of newly established educational majors by distance learning method Number of newly established majors leading to the establishment of new college Number of known invalid majors by permanent or temporary deletion

up a larger set of selected scenario with lower intensity) and incompatible (there is no probable situation with a distance larger than that between its effect score and the max effect score relative to the permissible eigenvalues). From the output of the Wizard Scenario software, 3 scenarios with robust compatibility, 60 ones with poor compatibility, and 4 incompatible scenarios have been extracted and the scenarios with robust compatibility have been dealt with.

First scenario: optimistic state and spring of medical education's quantitative development

The quantitative spring scenario getting realized as the optimal scenario of the health professional education's quantitative development results from increased allocated budget to the educational service provision centers, increasing the research centers and hubs, raising the number of countrywide and global health system articles compared with the previous years, increasing the active students, graduates and workforce, raising the inventions and medical research and service export yielded revenue and increasing the number of the majors or the novel courses or the newly established faculty in the universities.

Second scenario: intermediary state and welcoming spring of quantitative development of medical education

The scenario known as "Welcoming the spring" has been termed as the intermediary scenario of the quantitative development of health professional education. The scenario is the result of approving the last year allocated budget in the present year without increasing the investments, or changing the research centers and activities in medical sciences education area, the number of the active students, graduates and workforce, medical sciences research and education remaining fixed in the health area, or changing the number of the databases, information networks and health system scientific associations, or changing the number of the inventions, or changing the number of the majors –the new courses or the newly established faculty in the universities.

Third scenario: unfavorable state and fall of the quantitative development of medical education

The scenario "fall of quantitative development" has been taken as the unfavorable scenario of the quantitative development of health professional education. This scenario develops from reducing the budget allocated to the educational service departments, decreasing the health professional education-related research activities, lowering the health professional education, and research and health area related active students, graduates and workforce, reducing or lack of the information databases, the information networks and scientific associations of the health system, reducing the number of the inventions and medical service export and research yielded revenue and permanently or temporarily omitting invalid majors

in the universities.

Discussion

In the present study, the researchers have strived to tackle the scenario planning of the quantitative development of health professional education through diverse research techniques. Since no integrated and uniform components in the existing documents were introduced for quantitative development of health professional education, it was necessary to first specify the quantitative development components and to address the health professional education's quantitative scenario planning using these key components. As perceived from the present research findings, the amount of financial allocation, facilities and increasing investment is considered a significant component in health professional education's quantitative development, in this regard, based on "Employer-Agent" theory, Shariati et al conducted a qualitative study on the design and application of allocation indicators for education funding in the Universities of Medical Sciences. In this study, it has been stated that the allocation of credits to each faculty has been more focused on prior years incurred expenses and the bargaining power of the authorities of the faculties and the performance yielded output is less commonly used as an indicator. They have considered the most appropriate indicator for allocating education funding among different faculties of a university, based on the number of the students and the cost per major and degree.¹⁰ The next component contributing to the quantitative development of the health professional education refers to the level of knowledge production (research and innovation in health professional education). Fakhari et al conducted a research on the qualitative analysis of Persian version articles published in the health professional education, the results of which suggested that addressing the research cases published in the health professional education will help determine the direction of future research cases in this field. The study researchers stated that there are few specific studies in health professionals and it is a necessity to develop specific research cases in health professionals.¹¹ Another effective component in the health professional quantitative development is the quantitative development of workforce. Ehsani Chimeh et al investigated the countrywide health professional and health department affiliated human workforce number and distribution process during 2009-2015. They stated that recognizing the status of the existing human workforce is the first step in accurate planning for the quantitative and qualitative growth consistent with health requirements. Their study results implied that in terms of gender, women have the highest workforce share.¹² In terms of employment status, most of the workforce consists of those working formally and based on contracts. Analyzing education status indicated that the growth coefficient of below the professional Ph.D. degree has been negative and most of the Ministry of

Health affiliated work force had a bachelor's degree. As declared by the researchers, this research merely addressed the quantity of human workforce and it is imperative to focus on the quality of human workforce, too. Another component of quantitative development is to disseminate and share the produced knowledge. In their study as knowledge sharing status at the Ministry of Health Decision-making Center, Azari et al¹³ announced that the managers must run a knowledge management department and subsequently, to apply knowledge sharing in this format and by this department, to follow the programs, strategies, policies, and to receive incentives in exchange for knowledge sharing. They announced that considering financial and non-financial incentives in exchange for voluntary knowledge sharing at the deputy level can be effective. Also another research by Salajeghe et al surveyed satisfying the public medical students' information demands of Kerman based University of Medical Sciences. They stated PubMed as the most widely used database, saying that students' knowledge level and use of databases is below average, the reason behind which can be attributed unfamiliarity with their subject content, being unaware of such resources, and unfamiliarity with search manner in such databases.¹⁴ In another study, Hosseini et al¹⁵ examined the knowledge translation in Qazvin University of Medical Sciences from the faculty members' perspective, declaring that the gap between knowledge and practice is the challenge knowledge translation can overcome. They identified the audience's needs and their transformation into research projects, producing evidence used in decision-making, and employing the end-users' research results, which was less than expected in all cases. The knowledge translation status in Qazvin University of Medical Sciences is far from the desirable condition from the faculty members' viewpoint and the studies extracted findings have not been much translated into the audiences' language. Thus, to follow up on the incentives and policies for researchers to transfer the research findings to the users can bridge the gap between knowledge and practice.¹⁵ Another influencing component in health professional education's quantitative development is to raise the medical education product and service production capacity. The research by Zarei and Parsamehr to identify the factors influencing the medical equipment's export development announced that the export development reflects the international trade and results in enhancing the foreign balances and it is one of the tools for the country economic development and the companies active in the medical equipment industry are required to pay attention to the introduced indicators in the structural, economic, organizational, political-legal and marketing factors for export development in their planning.¹⁶ Another study conducted by Amini Mashhadi and Mohammadzadeh on promoting the attraction of international students in Iran via focusing on Canadian policies and experiences, which declared that higher

education's advancement to attract international students relies on paying special attention to the higher education system in other countries. Some points can be mentioned about how to increase the attraction of foreign students. Therefore, by pursuing the model of the Canadian higher education system as a country successful in attracting international students, we can find out the points to raise drawing foreign students. It has to be noticed that along with efforts for revising the higher education system and teaching methods, promoting the scientific and educational capacity through employing new technologies and launching training workshops, the necessity behind focusing on inter-university research, international collaborations, and the requirement to communicate with Iranian professionals abroad, paying attention to the higher education system to attract international students, will exert a profound impact on the countrywide scientific development and the achievement of the goals of twenty-year vision document of the country.¹⁷ Another component is the quantitative development of the existing academic majors in the country. Taleb and Hadjati studied the 40-year achievements of the postgraduate health professional education development in Iran, the results of which indicate the meaningful growth in terms of the number of the majors in postgraduate and specialist Ph.D. degrees and the universities with admission capacity where seriously focusing on the existing country needs' consistent majors and also paying more serious attention to the quality of education seems necessary.¹⁸ With the subject as to determine the extent of expanding medical sciences majors of postgraduate degrees in the country, Razavi et al examined the academic majors based on the input, process, output, and outcome indicators. They suggested developing a university major if not based on the present and future needs of the community, would not only remove the burden of mass community problems but also it is a waste of national costs and capital, dependency, the prevalence of degree-orientation, the prevalence of economic jobbery, the prevalence of specialized errors, the increase of educated unemployed in society, the waste of energy and frustration. They also indicated that in most cases, there is no right criterion for providing an academic major in a given region and that regional competition overcomes the rational needs of society.¹⁹

Conclusion

As mentioned in the Results section, by the key elements being specified, the probable scenarios and possible conditions have been formed, and by brainstorming, the experts have been asked about the influence of each situation on each other to identify the strong, poor, and incompatible scenarios employing the resulting Scenario Wizard software.

Scenario planning has also been set forth in the futures study of other researchers. Each dealt with developing the scenarios based on their extracted components; for

example, Blass et al, who outlined the future outlook for higher education in the UK by 2035, considering their five main scenarios including leading knowledge, responsive knowledge, local mixes, non-governmental financing, and government financing.²⁰ As perceived in the current study, these cases have been stressed in the components and in the extracted scenarios.

It is the nature of the studies to get constrained by some limitations. According to the researchers' attitude in this study, accessing the study sample from the medical education and higher education experts and practitioners working in the medical education's development center is another limitation the present research suffered from since most of the practitioners of the educational development centers as the experts in their job possess non-educational degrees and are of a clinical group. Another present study related critical limitation is the deficiency of futures study research centers in the country based Universities of Medical Sciences that only Kerman University of Medical Sciences has futures study research centers in health, the issue which has led to lack of sufficient information and knowledge of the authorities about the studies on futures study and the study goals.

And ultimately, drawing on the present research findings and the significance of performing "futures study" studies ahead of making macro-decisions and also the importance of the country health professional education that the graduates of which deal with people's life and health issues, it is proposed to present the current study yielded beneficial scenarios to the Health and Medical Sciences Ministry affiliated Research and Development Center so that they could be employed in their macro-decisions, for revising the Universities of Medical Sciences' educational development centers' job description, modifying upstream documents and paying more attention to "futures study".

Ethical approval

Authorities were allowed to begin the investigation. Expert specifications were preserved. The nature of the project provided no ethical obstacles to the study.

Competing interests

The authors declare that there is no conflict of interest.

Authors' contributions

Designing concept by ESO. Collecting information by NG. Data analysis and interpretation by SM. Manuscript consulting research by SI. Preparing research by NG.

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