

ABSTRACT

on the dissertation work of Kaidaulov Muhtar on the topic «The scientific approach to the methodology of forecasting healthcare human resources (based on the example of general practitioners and nurses in a large city)», submitted for the degree of Doctor of Science (PhD) in the specialty 6D110200 – «Public Health»

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1. Relevance of the research topic

Healthcare human resources (HRH) are the totality of full-time medical workers who are the main driving force in healthcare [1]. There are a number of key problems in the management of health human resources over the world, such as: ineffective planning and forecasting of HRH [2], aging of health workers [3], staff turnover [4], internal migration of health workers, high workload, etc. [5,6].

Nowadays, one of the most important challenges facing the global community is to provide the healthcare system with an adequate number of health care workers, with the right skills, in the right place and at the right time for the population [7]. However, in many countries around the world, one of the problems in achieving the above policy is the uneven distribution of the healthcare workforce across regions and by personnel composition, which leads to a decrease in the availability of health care [8,9]. Efficient use and allocation of personnel is of firstly important to ensure effective service delivery in terms of cost and quality [10]. Uneven distribution of the healthcare workforce can lead to an oversupply or shortage of a certain type of health personnel. Accordingly, poor planning and forecasting of the health workforce can lead to inappropriate financial costs and unemployment for some health professionals [11], increased workload of health personnel and, as a result, a decrease in the quality of health care [12, 13]. In the domestic healthcare system, there is also a problem of uneven distribution of the healthcare workforce, possibly due to internal migration of specialists and inadequate forecasting [14].

Despite the importance and relevance of the problem, there is currently no generally accepted approach to forecasting the need for human resources in healthcare. Different countries use different methodologies and approaches to forecasting the need for human resources in healthcare [11,15,16].

In this regard, it becomes relevant to analyze international experience in forecasting the need for human resources in healthcare, to search for a forecasting approach suitable for the healthcare system of the Republic of Kazakhstan and determine the main structural elements necessary for the forecast.

2. The purpose of the dissertation research

Scientific substantiation of the approach to forecasting the need for medical personnel based on the study of world experience in forecasting and determining the need for human resources in healthcare (based on the example of general practitioners and general practice nurses in megapolis).

3. Research tasks

1. To analyze international and domestic experience in forecasting healthcare workforce needs using general practitioners (GPs) and general practice nurses as examples.

2. To conduct a content analysis of changes to regulatory legal acts governing the activities of GPs and general practice nurses.

3. To conduct a Delphi study to determine the best method for forecasting the needs of GPs and general practice nurses.

4. To conduct a sociological and time-based study to determine the workload of GPs and general practice nurses.

5. To assess the needs of an Almaty healthcare organization for GPs and nurses (using the Workload Indicators of Staffing Needs (WISN) method).

6. To forecast the needs of an Almaty healthcare organization for GPs and nurses and develop a proposal for forecasting healthcare workforce needs using GPs and nurses as examples.

4. Research methods and materials

The dissertation is based on the analysis of 99 scientific literature on methods of forecasting the need for human resources in healthcare, 26 regulatory documents governing the activities of general practitioners and nurses, the results of a survey of 219 general practitioners and 312 nurses, a chronometric study of general practitioners and nurses, analysis of expert opinions using the Delphi method, forecasting the need for general practitioners and nurses using the capabilities of artificial intelligence and WISN. Methods: Information and analytical, cross-sectional study, WISN method, chronometric method, Delphi method, modeling.

The dissertation research was approved at a meeting of the S. Asfendiyarov KazNMU's LEC (extract from minutes No. 10(61) dated October 25, 2017).

The study results were analyzed using nonparametric statistical methods, such as the Kruskal-Wallis and Mann-Whitney tests. Correlation analysis was used to determine relationships. Forecasting was performed using an ensemble of models, including ARIMA, LSTM, and Prophet forecasting models.

5. Object of study

Medical organizations, medical workers

6. Subject of research

Workload of general practitioners and nurses, demand for general practitioners and nurses, methods for forecasting demand for healthcare human resources.

7. Description of the main results of the study

1. The main trends in forecasting the human resources of health care have been identified. In developed countries, forecasting takes into account many factors that affect the need of practical health care for doctors and nurses. Such factors include the age and gender composition of the population, morbidity, patient visits to outpatient clinics, worker migration, aging of doctors, and changes in regulatory and legal acts. In recent years, an integrated forecasting method has been used, which requires a lot of reliable data. Some of the authors' research shows the importance of using artificial intelligence in planning and forecasting human resource needs.

2. Based on the analysis of regulatory documents, it was revealed that the functional responsibilities of general practitioners and nurses are expanding (increasing screening programs, medical examinations, and the inclusion of other diseases, such as tuberculosis, in the responsibilities of general practitioners). This may lead to an increase in the workload of general practitioners.

3. The reasons for the workload of doctors and nurses were identified. The main reason for the workload is paperwork. Also, the main reasons and frequency of unjustified calls were identified. It was established that the main reason for overtime work for 70% of general practitioners (GPs) is medical documentation maintenance (95% CI: 63.9–76.1%). The share of providing emergency care and other reasons amounted to 14% (95% CI: 9.4–18.6%) and 3% (95% CI: 0.7–5.3%), respectively. A high frequency of unjustified house calls was revealed - 84% of respondents ($p < 0.001$)

4. A Chronometric study showed that a general practitioner sees an average of 19 patients a day, with the average duration of one appointment being 11 minutes. The results show that general practitioners, on average, spend comparatively more time seeing patients with diseases of the musculoskeletal system (Md-840 sec; 25%-75%: 513-1113), genitourinary system (Md-819 sec; 25%-75%: 650-1173), endocrine system (Md-930 sec; 25%-75%: 555-1221), and oncology (Md-796.5 sec; 25%-75%: 640.25-1002). On the contrary, patients with complaints of respiratory diseases (Md-435 sec; 25%-75%: 260-720), medical examinations and screenings (Md-540 sec; 25%-75%: 385-720) spent comparatively less time.

5. According to the opinion of experts, the following were chosen as the most optimal forecasting methods for use in the healthcare system: 1 – needs-based forecasting (90.9% CV – 20.8); 2 – forecasting based on an integrated model (81.8% CV – 23.4). 81.8% (CV – 25) of experts indicated 20-30 minutes as the optimal time for receiving patients.

6. Forecasting the need for general practitioners in Almaty shows that all three forecasting approaches show a shortage of general practitioners: forecasting using the population ratio method showed a shortage of 833 individuals by 2030; demand-based forecasting showed a shortage of 599 individuals among general practitioners; forecasting using the method based on the population's need for medical services showed a shortage of 1 735 individuals among general practitioners.

8. Justification of scientific novelty

1. Based on a study of international practices for forecasting healthcare workforce needs and on results of expert opinions, key trends and best practices for forecasting healthcare workforce needs were identified.

2. The workload of general practitioners was studied through questionnaires and time-based studies. The average time spent per patient consultation was determined, as well as determined differences in time spent by GPs depending on the reason for visiting the clinic.

3. The functional responsibilities of GPs and nurses were studied through a time-time-based study to identify any unrelated tasks.

4. An assessment and short-term forecast were conducted based on workload determination using the WISN method recommended by the World Health Organization, utilizing artificial intelligence capabilities.

9. The main provisions submitted for defense

1. Currently, to improve forecasting quality, the following forecasting approaches are recommended: 1. Needs-based forecasting for strategic goal setting; 2. Integrated forecasting using the WISN program and opportunities of artificial intelligence.

2. The study results showed that general practitioners spend an average of 11 minutes per patient appointment, which is lower than the approved national standard (15 minutes per patient), indicating a high workload for general practitioners.

3. Optimal appointment times for general practitioners should be differentiated between initial, follow-up, and preventive appointments.

10. Practical significance of the obtained results

1. The identified trends and best practices for forecasting the healthcare workforce enable us to determine a course for developing a national healthcare workforce forecasting system.

2. The identified patterns in the time spent by general practitioners per patient, depending on the types and reasons for patient visits, enable us to improve the quality and accuracy of forecasting the need for general practitioners and nurses.

3. The identified results on the functional responsibilities of general practitioners and nurses enable us to assess the level of delegation of functional responsibilities for the further development of the organization of general practitioners and nurses.

4. The assessment conducted using the WISN methodology allows us to determine the need not only in terms of established standards but also in terms of the workload of general practitioners and nurses.

5. Practical recommendations have been developed to improve the process of forecasting and assessing the need for general practitioners and nurses, based on a study of the workload of healthcare workers.

11. Personal contribution of a PhD student

The PhD student made a significant contribution to the implementation of the doctoral dissertation, through the analysis of international forecasting practices and the analysis of the results of scientific research.

12. Conclusions

1. International experience demonstrates the need for a comprehensive consideration of demographic, epidemiological, personnel, and organizational factors when forecasting the need for healthcare human resources, while noting the relevance of the use of artificial intelligence technologies.

2. The trend towards expanding the functions of general practitioners and nurses indicates the need for reforms in the healthcare system aimed at reducing the workload of general practitioners by delegating the functions of general practitioners to nurses, revising the structure of general practitioners' working hours, and introducing multidisciplinary teams and mobile groups.

3. The workload of general practitioners and nurses is confirmed by the results of a sociological and chronometric study. The main factors contributing to the high workload of general practitioners are medical record-keeping (95% (CI: 63.9–76.1%)) and unnecessary house calls (84%). Differences in general practitioner time spent

depending on the reasons for patient visits demonstrate the importance of collecting high-quality data on population morbidity in order to forecast healthcare workforce needs using a demand-based approach.

4. According to the results of the Delphi study, the most valid approaches to forecasting healthcare human resources are models based on needs and the integration of supply and demand. The optimal duration of an outpatient appointment with patients should be 20–30 minutes.

5. Regardless of the forecasting method used, a significant shortage of general practitioners is expected in Almaty by 2030. This highlights the need to develop and implement long-term measures to secure and retain general practitioners and nurses in the health system.

13. Approbation of the dissertation results

The main results of the dissertation research were presented at the following conferences:

- XIV International Youth Scientific and Practical Conference "Topical Issues of Economic Development and Professional Education in Modern Society" (March 29, 2017, Yekaterinburg);

- XV International Youth Scientific and Practical Conference "Topical Issues of Economic Development and Professional Education in Modern Society" (March 28, 2018, Yekaterinburg);

- International Scientific and Practical Conference of Young Scientists "Akanov Readings: Topical Issues of Medicine and Healthcare" (Almaty, April 19-20, 2018);

- 16th Asia-Pacific International Conference "Regenerating Localities in a Global World" (December 1-2, 2018, Beppu, Japan)

14. Publications

On the topic of the dissertation, 11 works have been published, including 1 article in the peer-reviewed journal *Polski Merkuriusz Lekarski* included in the Scopus database (2nd quartile), 3 articles in journals recommended by the Committee for Control in the Sphere of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan, 6 publications in collections of international conferences, 1 publication in collections of a foreign conference.

15. Volume and structure of the dissertation

The dissertation is presented on 119 pages, consists of an introduction, 4 sections, conclusions and findings, practical recommendations and appendices. The work is illustrated with 32 tables and 20 figures. The list of references contains 45 domestic and 54 foreign sources.

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