ОБЩЕСТВЕННОЕ ЗДОРОВЬЕ И ОРГАНИЗАЦИЯ ЗДРАВООХРАНЕНИЯ. СОЦИОЛОГИЯ И ИСТОРИЯ МЕДИЦИНЫ

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Shortage of doctors in remote and sparsely populated areas: Ways to improve the situation

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A shortage of physicians and a rural-urban imbalance in the distribution of health professionals are widespread problems nowadays. Medical graduates are considered as a next generation of doctors, but many of them do not choose medical career after graduation, particularly in the regions with low population density and severe climate. This study was conducted to find possible options to prevent further shortage of primary care physicians in remote areas based on the medical graduates' opinions, and search the factors that influence their decision to work in practical medicine positively. A cross-sectional study provided full coverage of 720 final year medical students using an anonymous questionnaire in Krasnoyarsk, Russia. Data were analyzed using SPSS Version 22 by the following methods: descriptive statistics, decision trees analysis, and $\chi 2$-test. Most of the graduates reported their intension to work in practical medicine after graduation. Less than half of the participants considered an opportunity to work in rural hospitals. The main motivating factors to work there were increase in salary, better working conditions and hospital equipment, and free housing. Students who more inclined to work in rural hospitals mostly came from rural areas, live in dormitory or rental housing, and have an employer-sponsored type of education. An appropriate comprehensive admission process to medical schools, including personality tests and adequate government support for medical university applicants, as well as offers of special conditions of work for young specialists in rural hospitals, could be significant steps to improve the shortage of doctors in remote areas.

Keywords: health planning, rural health, students, primary care.

Introduction

Shortage of doctors is a widespread problem nowadays [1]. There is also imbalance in the distribution of health professionals between rural and urban areas in almost all countries [2; 3] particularly in their remote parts [4]. Equitable ccess to qualified primary health care for urban and rural population is a key public health theme.

Previous studies show that the deficiency of primary care physicians is the largest compared to other healthcare workers [1; 4; 5]. Some of the authors argue that a demand for physicians is growing because the population is ageing [1; 6; 7]. Some of them note that many medical students prefer not to enter a career in primary care [5; 7]. The shortfall of primary care physicians causes an increase in medical costs, reduction of health care quality, rise in mortality, morbidity and hospitalization rates, and increase in patient and physician dissatisfaction [7].

Each country tries to prevent shortages of primary care physicians and reduce inequalities in access to health care across the country, i. e. for its remote parts. German authors mentioned a special program for qualified medical specialists changing to a career in general practice [8]. Some authors discuss strategies to deliver primary care services without increasing the number of primary care physicians such as formation of primary care team and usage of new modes of communication [9; 10]. Some strategies are aimed at the development of projection models to reach a balance between supply and demand for different health workers — health workforce planning [11; 12].

Generally, the proper changes in medical education policy may create an adequate balance in medical specialists [13]. Recognition of students' career priorities may help to attract young specialists to primary care [3]. Identifying the key factors influencing their choice to work in rural areas may help to reduce the shortage of doctors in rural hospitals [14; 15]. The establishment of scholarship programs for students who will practice medicine in rural hospitals during their education can strengthen their desire to work in a rural location after graduation [16]. Unfortunately, for many low- and middle-income countries the quality of medical education remains a painful point due to the various reasons [17; 18].

Shortage of doctors is also a recognized important issue in Russia [19; 20]. The last attempt to address this problem was a decision of the Ministry of Health of the Russian Federation to bring medical graduates to primary care. The decision has been extended to graduates since 2016 and was supposed to reduce the shortage of physicians across the country. However, there are students who decided not to work as primary care physicians after their graduation.

In this paper, we discuss the doctor shortage problem and possible steps to resolve it on the second largest region of the Russian Federation with a low population density and severe climate — the Krasnoyarsk Territory (also known as Krasnoyarsk Krai), investigating opinions of local final year medical students.

The only medical school located in the Krasnoyarsk Territory is the Krasnoyarsk State Medical University. Most of the doctors working in the region graduated from this university. But the shortage of doctors is widely pronounced especially in remote territories. For four years, we have studied the opinion of graduated students of the Krasnoyarsk State Medical University to understand the reasons behind the shortage of primary care physicians.

Methods

We examined the opinion of graduates on their preferred work model and future goals during the period from 2017 to 2020. Each year, all graduates of the Department of General Medicine were anonymously screened during the winter time (January — February).

The questionnaire used was designed to detect the graduates' preferences in future work, their reasons for study medicine, and the satisfaction from the obtained education and personal information. The questionnaire was based on 28 trial interviews with the graduates at 2016. The questionnaire final version was designed in 2017 under the control of sociologists.

The questionnaire response rate was 81.7 % [95 % CI: 78.4, 85.0]. Therefore, the responses of 720 graduates were included in the analysis. Statistical analysis was carried out with IBM SPSS Statistics 22 program (IBM, Armonk, New York, USA). The following methods were used: descriptive statistics, decision tree analysis, and $\chi 2$-test. Statistical significance was set at $p < 0.05$.

Ethical approval

No ethical approval was sought for this paper. The databases used in this study do not contain health data.

Results

Most of the graduates (82.6 % [95 % CI: 79.3, 85.9]) reported their intension to work in practical medicine right after graduation. Better conditions of work and higher salary were noted as conditions that could positively influence 46.1 % [95 % CI: 34.0, 58.2] of the students to work in medicine. These factors were not influential in the decisions of 53.8 % [95 % CI: 41.7, 65.9] of the students.

It was stated above that the shortage of doctors was more pronounced in the regions of the Krasnoyarsk Territory with the low population density and severe climate. Among the potential young doctors 42.9 % [95 % CI: 38.3, 47.5] considered an opportunity to work in rural andremote hospitals while 12.4 % [95 % CI: 9.4, 15.4] of students were not amenable to change their decisions not to work in rural and remote territories. It is possible to motivate the rest of the students to work in rural and remote areas. Main motivating factors for this change were increase in salary (34.9 %), better working conditions (22.2 %) and equipment of hospitals, and free housing (20.6 %).

Despite a large fraction of students who were planning to work in practical medicine after their graduation, the number of students satisfied with their decision to study medicine was rather low — only 55.0 % [95 % CI: 50.5, 59.5].

It should be noted that there is a significant difference between the graduates in dependence of medical career choice reasons. Using decision trees analysis, the choice reasons were separated into two groups: "conscious" choice and "unconscious" choice. "Conscious" choice means the will to help people, desire to be a doctor, interest in natural sciences, etc. "Unconscious" choice means parents authority, circumstances, someone's advice, etc. Nearly 75 % of the students indicated their "consciousness" when choosing a medical career, and about 38 % among them were unsatisfied with their decision to

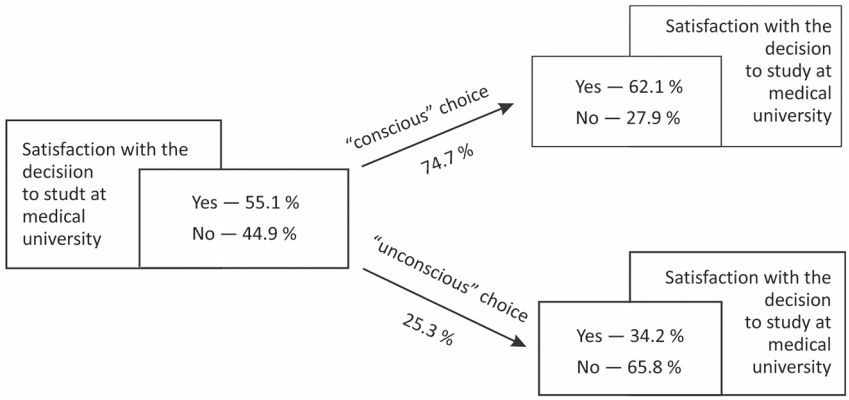

Figure. The differences in satisfaction with the decision to study medicine for students with "conscious" and "unconscious" choice of their future career

Table 1. **Distribution of students by their willingness to work in rural and remote hospitals, consciousness of choice, and their understanding of doctor's work, %**

Willingness to work in rural and remote areas	Conscious choice to study medicine		Proper understanding of doctor's work			In all
	Yes	No	Yes	No	Not sure	
Yes	47.4	33.6	47.3	38.3	53.8	42.9
No	45.7	60.0	49.6	50.0	46.2	50.5
Not sure	6.9	6.4	3.1	11.7	0	6.6
Total	*100*	*100*	*100*	*100*	*100*	*100*

study at the medical university. While among the students with 'unconscious' choice, almost 66 % of them were unsatisfied with their decision (see: Figure).

The fraction of the graduates who had a proper understanding of doctor's work early on was significantly higher for students with medical assisting or higher education (59.5 % [95 % CI: 43.7, 75.3]) than for students with secondary education or secondary specialized education (35.5 % [95 % CI: 31.0, 40.0]).

Analyzing the willingness of the students to work in rural hospitals and remote areas of the Krasnoyarsk Territory we found that most of the students with "unconscious" choice and misunderstanding of doctor's work reported that they are not ready to go work there. Where was the students with "conscious" choice and proper understanding of doctor's work are more willing to work in rural and remote areas (Table 1). Also, the students who came from rural and remote areas of the Krasnoyarsk Territory are more inclined to work there than those who came from the city of Krasnoyarsk or other Russian regions (Table 2). Budget students are the least inclined to work in rural hospitals, but those students who live in dormitory or those students who rent housing showed more willingness to work in rural and remote areas (Table 3).

Table 2. **Distribution of students by their willingness to work in rural and remote hospitals, and the type of their native place, %**

Willingness to work in rural and remote areas	Type of student's native place				In all
	The city of Krasnoyarsk	Urban area of the Krasnoyarsk Territory (apart from the city of Krasnoyarsk)	Rural area of the Krasnoyarsk Territory	Outside the Krasnoyarsk Territory	
Yes	31.0	55.0	57.7	32.6	42.9
No	66.7	40.0	38.5	62.8	50.5
Not sure	2.3	5.0	3.8	4.6	6.6
Total	*100*	*100*	*100*	*100*	*100*

Table 3. **Distribution of the students by their willingness to work in rural and remote hospitals, the type of education funding, and the type of accommodation, %**

Willingness to work in rural and remote areas	Type of education funding			Type of accommodation				In all
	State-funded	Employer-sponsored (sponsored by state-run hospital)	Un-funded	Dormitory	Rental housing	Privately-owned apartment	Housing with parents	
Yes	36.5	47.1	46.1	45.7	55.9	36.0	32.7	42.9
No	57.4	49.1	45.2	45.0	39.6	56.0	62.6	50.5
Not sure	6.1	3.8	8.7	9.3	4.5	8.0	4.7	6.6
Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Discussion

According to the government order of 2015 all medical graduates may work only as primary care physicians [20]. The main aim of this decision was to reduce the acute shortage of physicians in the country. It's required to obtain further special education to become a qualified medical specialist. But it's rather complicated to get such position just after graduation.

In this study, we analyzed all graduates of Krasnoyarsk State Medical University who finished their education after this order entered into force (2016–2020). Most of the final year medical students reported their willingness to work in practical medicine after their graduation. Despite that, the shortage of doctors is still pronounced. Many young doctors leave the profession. Only 55 % of the graduates are satisfied with their decision to study medicine. This means that the remaining 45 % is a "risk group" that could abandon a medical career.

We can add to the "risk group" the students who entered to medical school "unconsciously" — mostly somebody influenced on their decision about a future career. And also add those students who had improper understanding of doctor's work in the beginning. The fraction of the students who are unsatisfied with their decision to become doctors mainly consisted of the learners of high schools and colleges. They often have improper under-

standing of doctor's work and may feel disappointment at the final stage of education, leading someday to abandonment of a medical career. It should be noted that moreover graduates with medical background had better understanding of the rigors and needs of a medical career and, as we can see from the obtained results, the graduates with medical assisting or higher education and graduates with medical background are less dissatisfied with their medical career choice, and they are mostly willing to work in practical medicine.

It should be marked that training of students who will not stay in medicine for a long time is a great economic and workforce waste for the state.

An appropriate admission process for medical schools may lead to the reduction of this group. The process should evaluate applicants' educational background, experience in medical assistance, and "consciousness" when choosing a medical career. The proper understanding of medical work and initial medical background of the students could enhance the fraction of future work-motivated graduates. So, it's important to provide career guidance for scholars as well as to give preference to applicants with medical background.

Currently in Russia, enrolment into medical schools is based only on school (or college) final exams marks. This approach is not sufficiently correct, given that it does not take into account personal characteristics of the applicants. Some authors also remark that considering only an average grade of school or entrance exams is not sufficient [13].

In addition to entrance exams used in medical school admissions, it is important to assess personal qualities such as interpersonal communication, empathy, honesty, teamwork, etc. In some countries Situational Judgement Test (SJT) is used to evaluate such personal qualities for enrolment into medical school [21; 22]. France has its own system for selecting medical students: admission to the first year of medical school is open to all high-school graduates, and this first year is used to select the students [18; 23].

According to the annual Presidential Address to the Federal Assembly 2020, the shortage of primary care practitioners is supposed to be reduced by increasing the number of funded places for admission to the Faculty of Medicine and the Faculty of Pediatrics in medical schools across the country. Most of the places for admission should be employer-sponsored, i. e. sponsored by the state-run hospitals that the graduates will work for after their graduation. Taking into account the data we received, the students with employer-sponsored type of education more inclined to work in rural hospitals and remote areas than the students with state-funded type of education.

In Krasnoyarsk Territory the law on training and retraining of primary care practitioners is being developed this year in accordance with the Presidential Address to the Federal Assembly[1]. The effects of changes in admissions to medical schools can be evaluated 6 years later, when students will graduate from medical schools and will make a decision whether they want to continue their medical career or not.

Russia is a country with a widely extended territory. The population density greatly varies across the country, being high in the European part of the country (south and west) and very low on the north and in the central regions. It's much easier to provide medical care in the regions with a high population density than in the regions where it's low. Krasnoyarsk Territory is one of the major counties of the Russian Federation with a population of approximately three million people, equal to about 14% of the entire country. The average population density of the region is 1.2 people per square kilometer. One-third of the total

[1] List of instructions for the implementation of the Presidential Address to the Federal Assembly. 2020. Available at: http://www.kremlin.ru/acts/assignments/orders/62673 (accessed: 27.09.2021). (In Russian)

population in the region is concentrated in the city of Krasnoyarsk. Health care provision is an urgent problem for this territory. According to the laws of the Russian Federation, the amount of doctors, clinics' type, and clinic equipment depend on the population size [19]. Doctors typically want to work in a modern clinic with good equipment and strong colleagues. Working in severe climate or far away from the big cities is not desirable to most physicians. These factors are the usual reasons for doctors' shortage in different countries [3].

During our survey practically half of the medical graduates reported that they not excluded an opportunity to work in rural hospitals. Main motivating factors for their positive decisions were increase in salary, better working conditions and equipment of hospitals, and free housing.

Conclusions

The main idea of our survey was to find possible ways to overcome doctor shortage problem in the territory with low population density and severe climate (e. g. Krasnoyarsk Territory).

Practically, about half of the medical graduates in such territory in Russia doubt their choice to become a doctor. These students represent a "risk group": the possibility exists that someday they will discontinue their medical career. We can also add to the "risk group" those students who entered to medical school "unconsciously" — mostly somebody influenced on their decision about a future career. It should be noted that moreover graduates with medical background made their decision to study at medical university 'consciously" and possibility is rather high that they will stay in medicine for a long time in all types of territories.

This remark may indicate that the current medical school admission selection process is inadequate in selecting medical students who will go on to practice medicine for a long period. Therefore, improvements in this process could lead to an increase of medical practitioners all across the country in long-term outlook.

Learning motivational factors of the medical school graduates who are likely to remain in medicine and to work in rural hospitals, and then determining such factors among medical school applicants could be important to define the target students to enroll. Taking into account local features and differences, each medical school can develop its own questionnaire to learn what motivates their graduates to practice medicine and work in rural and remote areas. Approaches to select target applicants may be different: from the tests on the personal qualities (such as Situational Judgement Test) to new approaches to vocational counseling for schoolchildren, including workplace learning, volunteering in medical facilities and health centers, etc. The best option for Russian medical schools can be determined only empirically. In our study the characteristics of the students who were satisfied with their decision to study medicine and as a consequence likely to remain in medicine were medical background and consciousness of their choice, namely, the will to help people, desire to be a doctor, interest in natural sciences, etc. And the characteristics of the students who are more inclined to work in rural hospitals and remote areas were the following: the type of education funding (unfunded education and employer-sponsored education), the type of student's native place (students from the urban and rural areas of the Krasnoyarsk Territory apart from the city of Krasnoyarsk), and the type of accommodation (dormitory and rental housing).

In addition, it's possible to influence the provision of doctors in remote territories particularly. The government may attract young doctors to work in rural and remote

areas via better conditions of work, higher salary, free housing and good equipment of hospitals.

Finally, we can conclude that an appropriate comprehensive admission process to medical schools and adequate government support for medical university applicants as well as offers of special conditions of work for young specialists inrural and remote areas could be significant steps to improve the shortage of doctors in remote and sparsely populated territories.

Authorship

I. Arshukova (ORCID ID: 0000-0002-7347-574X; SPIN: 7166-5347) — contributed to the design of the research and development of the questionnaire, contributed to the implementation of the student survey, processing the questionnaires and analysis of the results, discussed the results and contributed to the final manuscript.

T. Dugina (ORCID ID:0000-0001-7155-7461; SPIN: 1964-1088) — contributed to the implementation of the student survey, processing the questionnaires and analysis of the results, contributed to the literature review, discussed the results and contributed to the final manuscript.

I. Akulin (ORCID ID:0000-0002-7618-4024; SPIN: 9115-1178) — contributed to the questionnaire development, verified the analytical methods and literature review, discussed the results and contributed to the final manuscript.

E. Dobretsova (ORCID ID:0000-0003-2552-3476; SPIN: 6294-7891) — contributed to the design of the research and development of the questionnaire, contributed to the implementation of the student survey and processing the questionnaires, contributed to the literature review, discussed the results and contributed to the final manuscript.

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Нехватка врачей в отдаленных и малонаселенных районах: пути улучшения ситуации

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Нехватка участковых врачей-терапевтов и дисбаланс в распределении медицинских работников между сельскими и городскими районами являются распространенными проблемами в настоящее время. Выпускники медицинских вузов представляют собой следующее поколение врачей, но многие из них не планируют работать в практическом здравоохранении после окончания обучения. Это особенно выражено в регионах с низкой плотностью населения и суровым климатом. Исследование с целью поиска возможных вариантов предотвращения дальнейшего дефицита врачей первичного звена в отдаленных районах проводилось на основе мнений выпускников медицинских вузов, а также поиска факторов, положительно влияющих на их решение работать в практической медицине. Проведено поперечное анонимное исследование 720 студентов-медиков последнего года обучения в городе Красноярске. Данные анализировали с помощью лицензионного программного пакета SPSS Version 22 методами описательной статистики, анализа деревьев решений и $\chi 2$-теста. Большинство выпускников заявили о своем намерении работать в практической медицине после окончания учебы. Менее половины участников рассматривали возможность работы в сельской местности. Основными мотивирующими факторами для работы в селе были повышение заработной платы, улучшение условий труда и оснащения больниц, бесплатное жилье. Студенты, более склонные к работе в сельских больницах, в основном приехали из сельской местности, во время обучения они проживают в общежитиях или арендуют жилье, обучаются за счет работодателя. Важными шагами для решения проблемы нехватки врачей в отдаленных районах могли бы стать изменение процессов набора студентов в медицинские вузы, включая проведение личностных тестов, адекватная государственная поддержка абитуриентов медицинских вузов, а также предложение особых условий работы для молодых специалистов в сельских больницах.

Ключевые слова: планирование здравоохранения, здравоохранение в сельской местности, студенты, организация здравоохранения.

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