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Assessment of the social effectiveness of providing medical care to patients with a cardiological profile using the method of remote monitoring of blood pressure

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ABSTRACT

BACKGROUND: Assessing social efficiency currently plays a key role in improving the organization of medical care to citizens. Satisfaction with medical care provided is an indicator of the availability of medical care and the effectiveness of healthcare in general.

AIM: To assess the social effectiveness of medical care using the method of remote monitoring of blood pressure in cardiac patients based on the results of remote monitoring.

MATERIALS AND METHODS: The study materials included data from an anonymous sociological survey of 200 patients who were under dispensary observation and had a history of periods of deterioration in the functional state of the cardiological profile. The questionnaire offered to patients contained six establishing questions, each of which was distributed on a scale balanced from extreme positive to extreme negative assessment.

RESULTS AND DISCUSSION: Before conducting remote monitoring, the level of awareness of patients about their own health status, preventive measures, and the use of devices for remote transmission of blood pressure data from the patient to the doctor was investigated. Subsequently, to increase patient awareness, additional information materials on the procedure for interaction between patients and medical workers, as well as about risk factors for the development of cardiovascular diseases and complications from them.

The sociological survey was conducted to summarize the results of remote monitoring of patients' blood pressure and was aimed at studying patients' opinions on changes in the organization of medical care provided in outpatient settings.

CONCLUSION: The data obtained showed that, in general, the degree of achievement of social results after remote blood pressure monitoring increased by 61.0%. Undoubtedly, such an increase in patient satisfaction was achieved as a result of the redistribution of responsibilities between doctors and nurses, as well as a result of well-established participatory interaction between medical workers and patients in terms of remote monitoring of dispensary groups of cardiac patients, instruction in the method of measuring blood pressure and monitoring its indicators in electronic form.

Keywords: health care; medical help; outpatient settings; patients with arterial hypertension; School of remote blood pressure monitoring; social efficiency; working age.

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Оценка социальной эффективности оказания медицинской помощи пациентам кардиологического профиля с применением метода дистанционного мониторинга артериального давления

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АННОТАЦИЯ

Актуальность. Оценка социальной эффективности в настоящее время играет ключевую роль в совершенствовании организации оказания медицинской помощи гражданам. Удовлетворенность оказанной медицинской помощью является показателем ее доступности и эффективности здравоохранения в целом.

Цель: оценка социальной эффективности медицинской помощи с применением метода дистанционного мониторинга артериального давления пациентам кардиологического профиля.

Материалы и методы. Использованы данные анонимного социологического опроса 200 пациентов, находившихся под диспансерным наблюдением и имевших в анамнезе периоды ухудшения функционального состояния кардиологического профиля. Предложенная пациентам анкета содержала шесть констатирующих вопросов, ответы на которые были распределены по шкале, сбалансированной от крайне позитивной к крайне негативной оценке.

Результаты. Перед проведением дистанционного мониторинга был исследован уровень информированности пациентов о состоянии собственного здоровья, профилактических мероприятиях, применении устройств дистанционной передачи данных артериального давления от пациента врачу. В дальнейшем для повышения информированности пациентов на сайтах двух городских поликлиник г. Санкт-Петербурга (№ 19 и 91) в рамках школы дистанционного мониторинга артериального давления были размещены дополнительные информационные материалы по порядку взаимодействия пациентов и медицинских работников, а также о факторах риска развития сердечно-сосудистых заболеваний и вызываемых ими осложнениях. Социологический опрос проводился для подведения итогов дистанционного мониторинга артериального давления пациентов и изучения их мнения об изменениях в организации медицинской помощи, оказываемой в амбулаторных условиях.

Заключение. Полученные данные показали, что в целом степень достижения социального результата после проведения дистанционного мониторинга артериального давления увеличилась на 61,0 %.

Несомненно, такого роста удовлетворенности пациентов удалось добиться перераспределением обязанностей между врачами и средним медицинским персоналом, а также в результате налаженного партисипативного взаимодействия между медиками и пациентами в части дистанционного наблюдения за диспансерными группами кардиологических пациентов, проведения инструктажа по методике измерения артериального давления и контроля за его показателями в электронном виде.

Ключевые слова: амбулаторные условия; здравоохранение; медицинская помощь; пациенты с артериальной гипертензией; социальная эффективность; трудоспособный возраст; школа дистанционного мониторинга артериального давления.

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利用远程血压监测方法评估心脏病患者医疗护理的社会效益

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摘要

论证。目前，社会效益评估在改善公民医疗组织方面发挥着关键作用。对所提供的医疗服务的满意度是衡量医疗服务的可获得性和总体有效性的指标。

目的：利用远程监测心脏病患者血压的方法，评估医疗护理的社会效益。

材料和方法。本研究使用了一项匿名社会学调查的数据，调查对象是 200 名接受诊疗观察的患者，他们都曾有过头心脏功能状况恶化的经历。患者提供的问卷包含六个陈述性问题，这些问题的答案按从极度肯定到极度否定的评价比例进行分配。

结果。在进行远程监测之前，调查了患者对自身健康状况、预防措施以及使用远程血压数据传输设备从患者到医生的认识水平。为了提高患者的认识，作为远程血压监测学校的一部分，在圣彼得堡两家市立综合医院（第 19 和 91 号）的网站上发布了关于患者与医务工作者之间互动程序的补充信息资料。发布的材料还涉及心血管疾病及其并发症的风险因素。进行社会学调查是为了总结远程监测患者血压的结果，并研究他们对门诊医疗组织变化的看法。

结论。研究表明，总体而言，远程血压监测后的社会成果实现程度提高了 61.0%。毫无疑问，患者满意度的提高是通过医生和护理人员之间的责任重新分配实现的。此外，医生和患者之间建立了互动关系，对诊室的心脏病患者进行远程监测，并指导他们使用电子方式测量和监测血压。

关键词：门诊；保健；医疗护理；动脉高血压患者；社会效益；工作年龄；远程血压监测学校。

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BACKGROUND

Currently, the state policy in health care is aimed at developing patient-oriented elements of the organization of medical care according to the principles of 4P medicine [1–4]. The patients' opinions are a reference point for the improvement of the health care system [5]. Accessibility of medical care remains the indicator of social efficiency, with the satisfaction index as a common indicator [3].

Increasing patient satisfaction with the provided medical care is a priority of the Health Care Development Program. The study of patients' opinions is beneficial for identifying positive and negative trends and factors influencing the realization of patients' expectations when receiving medical services and taking prompt organizational and corrective measures.

Sociological surveys are the most informative method of studying the subjective opinions of patients regarding the organization of medical care. They are crucial because changes in the organization of health care, based on their results, are scientifically justified [5–7].

The need to ensure accessibility and improve the quality of medical care for individuals with cardiovascular diseases prompted the current study. This included the rational use of resources of medical organizations, especially human and technical resources, and the active use of information systems and elements of lean production [4, 8, 9].

The present study aimed to evaluate the social efficiency of medical care using remote blood pressure (BP) monitoring in cardiology patients.

MATERIALS AND METHODS

Data from a sociological survey conducted from 2018 to 2022 as part of a scientific study using remote BP monitoring of patients in the outpatient observation group were used. The work was initiated by the staff of the Department of Health Care Organization and Public Health according to the standards of good clinical practice and the principles of the Declaration of Helsinki and approved by the independent ethics committee of the Kirov Military Medical Academy.

The sample included questionnaire responses of the patients who participated in the remote BP monitoring programs of Polyclinics No. 19 and 91.

The study considered the increased demand of cardiology patients for medical services during the COVID-19 pandemic, and resulting increased burden on the district service to perform preventive measures, such as medical check-ups and examinations, against the general background of insufficient staffing of medical personnel.

The implementation of the study was facilitated by the redistribution of responsibilities between physicians and nurses regarding remote monitoring of outpatient

cardiology groups, training in BP measurement techniques, and electronic BP monitoring.

Anonymous questioning of patients was conducted at the beginning and end (as patients' BP values stabilized) of the study using a specially designed questionnaire to assess the results of changes in the organization of medical care in outpatient settings. Patients who provided voluntary informed consent were asked to answer several questions reflecting their level of satisfaction with various aspects of the medical care organization.

The subject of the study was the respondents' opinion on changes in the availability and quality of medical care provided in outpatient settings. The survey assessed the subjective judgments of patients with arterial hypertension on the treatment outcomes and preventive measures and their satisfaction with the results of remote BP monitoring as part of a high-risk strategy.

The results of the survey were processed using factor analysis, which allows for the identification of aggregate variables that affect the respondents' answers. The present study used a table with initial data for factor analysis, which included the respondents' answers. Subsequently, the relationship between the selected factors and additional variables was analyzed, which enabled us to ascertain which values of factor variables were most pronounced according to one or another criterion and test the hypothesis of independence of the signs.

The results were statistically processed using a personal computer running the Microsoft Windows 7 operating system and the Microsoft Excel 2013 software and standard StatSoft Statistica 10 application program package.

Methodology for remote transmission of self-reported BP measurements: The decision to participate in the study was made by the patients and their physician after a joint discussion. During the study, the participants used personal smart medical devices or electronic automatic tonometers of the same model (UA 911BT-(C), A&D, Japan), which were provided during the observation period, with the possibility of remote transmission of measurement results via a contactless Bluetooth connection and mobile application for patients on Android and IOS. BP values were transmitted in the usual way by pressing a button on the device, which is extremely advantageous for elderly people and patients with cognitive impairment.

The MedM RPM platform and personal health monitoring diary applications were utilized. The mobile application was a form with three fields for entering systolic BP, diastolic BP, and heart rate.

The patient used an automated tonometer to transmit BP data via the Internet to the remote monitoring center, which was stored in an encrypted format in a cloud database on the doctor's computer.

The measurement method was oscillometric, classified as accuracy class A/A. The program is recommended

for clarifying the presence or absence of arterial hypertension, verifying the diagnosis, and determining treatment.

The frequency of measurements was identified by remote monitoring 2 times a day, on average, with patients in the resting state. Intermediate monitoring of BP was performed by medical personnel. The patient received reminders about the need to measure BP and take medication and recommendations for therapy correction (phone call) via SMS messages.

The patient's mobile application was mainly for interacting with the tonometer or watch sensors. After measuring BP, the results were displayed to the user and sent to the server.

The doctor's application is designed to display patients' data and their measurement results in graphs and statistical diagrams, which allows for the analysis of the dynamics of the patient's condition for a given sample.

RESULTS

The organization of medical care with the use of remote BP monitoring was tested at the population level.

At the outset of the study, a retrospective analysis of primary medical records and patient follow-up revealed drawbacks in the organization of dispensary dynamic monitoring. These manifested as inadequate control over the health status of patients in health groups II and IIIa and a decline in functional status in 60% of observed patients (i.e., cases of acute myocardial infarction and acute cerebral circulatory failure).

The most common causes of complications were low motivation among patients to prevent disease risk factors, insufficient information about preventive measures, and inadequate procedures for monitoring cardiology patients in dispensaries, including the use of devices for remote transmission of BP data from the patient to the doctor.

Considering these circumstances, a decision was made to implement changes in the organization of medical care for cardiology patients. The focus was placed on remote BP monitoring as a pivotal component in cardiovascular disease prevention and regulator of patients' adherence to therapy.

Such changes in work with cardiology patients were based on participative interaction of all participants of the treatment and prevention process and on making organizational decisions on redistribution of functional responsibilities of medical workers. This helps increase the social effectiveness of medical care. Patients' satisfaction with provided medical services and quality of medical care in outpatient settings increased.

The main work with the patients was assigned to the nursing staff (i.e., issuing a registration card; filling out the patient's personal account, if necessary; educating

the patient; filling out the necessary paper documentation; entering information into the electronic system on the patient's placement for monitoring and equipment receipt/transfer; conducting a telephone survey; checking the remote monitoring indicators; filling in the necessary documentation for outpatient monitoring programs (depending on the program); reacting in case of destabilization of the patient's condition: calling the patient, close relatives, or other legal representatives; recording the patient for a medical consultation using telemedicine technologies; calling an ambulance in case of a situation requiring emergency intervention).

The functions of physicians providing medical care with the use of remote BP monitoring were minimized to its prescription, medical consultation using telemedicine technologies, filling out the necessary documentation, and timely response in case of destabilization of the patient's condition.

To assess patient satisfaction with the organization of follow-up dynamic care, an online survey of patients selected for participation in the study was conducted.

The sociological study included 200 patients of working age and older who were under follow-up care and had a history of functional decline. They were later enrolled in the remote BP monitoring school (Figure).

The largest proportion of respondents were aged 31–50 years (45.9%), followed by those aged 18–30 years (25.2%). The mean age of respondents was 42.9 ± 12.8 years for men and 40 ± 21 years for women.

Prior to remote monitoring, patients' awareness of their own health status (e.g., knowledge of optimal BP values, health group, and body mass index), preventive measures (e.g., follow-up care, health centers, etc.), and the use of devices for remote transmission of BP data from the patient to the doctor were evaluated.

The respondents demonstrated a high level of awareness regarding their own health status. However, they exhibited lesser knowledge about the organization of cardiovascular disease prevention through remote BP data transmission devices. Among the middle-aged (31–50 years old) and older respondents (predominantly women), a notable presence of awareness about their health and preventive measures (i. e., follow-up care, health centers) was determined. This contrasts with the findings observed among the respondents aged 18–30 years who demonstrated a lesser level of awareness about these topics.

Conversely, young respondents (18–30 years old) were most likely aware of the use of devices for remote transmission of BP data from patient to the doctor, and older respondents were least likely to be aware of this information. Knowledge of the use of such devices differed between men and women (65.0% and 45.2%, respectively).

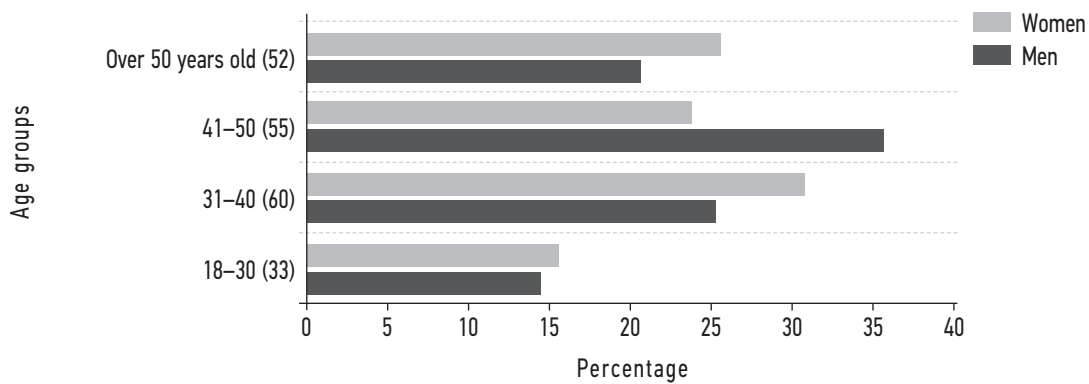


Figure. Gender and age characteristics of respondents of working age who applied to the School of remote monitoring of blood pressure, %
Рисунок. Половозрастная характеристика респондентов трудоспособного возраста, обратившихся в Школу дистанционного мониторинга артериального давления, %

Data analysis revealed that 10%–15% of respondents to the above questions had no information about common risk factors of the disease.

Additional information regarding the interaction between patients and medical professionals and risk factors for cardiovascular diseases and associated complications has been made available on the websites of Polyclinics No. 19 and 91. This is part of a wider initiative to raise awareness of remote BP monitoring and ensure its effectiveness.

The survey was conducted via the Internet using Google Forms. The questionnaire presented to the patients included a series of statements, the responses to which were distributed on a scale ranging from extremely positive to extremely negative assessments. A list of answer options were provided, from which patients could select one: satisfied, satisfied rather than dissatisfied, somewhat dissatisfied, not satisfied, and difficult to answer.

At the end of the study, patient satisfaction with the modifications to the medical care organization resulting from the implementation of remote BP monitoring, in comparison to traditional outpatient care, was evaluated (Table 1).

A comparative analysis demonstrated a positive trend in patient satisfaction/dissatisfaction indicators across all criteria as a consequence of remote BP monitoring.

The level of patient satisfaction was determined for each criterion listed in Table 1 using the following formula:

$$\text{satisfaction} = \frac{\text{number of satisfaction cases}}{\text{number of assessed cases}} \times 100$$

The level of satisfaction with the organization of outpatient monitoring following the implementation of remote BP monitoring increased by 91.0%, and the level of dissatisfaction decreased by 22.0% (to 1.5% of the

number of respondents). This increase was due to a reduction in the number of patients who found the question difficult to answer.

The proportion of respondents who expressed satisfaction with the availability of health information increased by 49.0%, whereas the proportion who expressed dissatisfaction decreased by 21.5% (to 1.0% of respondents). The level of satisfaction with the availability of information on risk factors increased by 40%, and the level of dissatisfaction decreased to 0% (i.e., by 52.5%).

Furthermore, no patients expressed dissatisfaction with their interactions with physicians following remote BP monitoring. The number of respondents indicating dissatisfaction with this indicator decreased by 70%, whereas satisfaction with the indicator increased by 66.5%.

Following the study, patients expressed satisfaction with the organization of dispensary dynamic monitoring through the use of remote BP monitoring and indicated willingness to recommend the school of remote BP monitoring. This is evidenced by the observed increase in satisfaction rates by 51.0% and 65.0% according to these criteria, accompanied by a decrease in dissatisfaction by 36.0% and 45.0%, respectively.

No significant differences were found in patient satisfaction/dissatisfaction between the age groups of patients.

The social effectiveness index was calculated as the sum of the mean scores. The maximum level of social effectiveness should be 100%.

Data analysis before and after the study showed that the degree of social outcome achievement increased significantly (from 26.0% to 87.8%) (Table 2).

The data obtained revealed that the degree of social outcome achievement after remote BP monitoring increased by 61.0%. Additionally, the number of patients who were confident in their answers increased significantly at the end of the study. This is evidenced by the data in the “difficult to answer” column.

Table 1. Results of patient satisfaction before and after remote monitoring of blood pressure, %**Таблица 1.** Результаты удовлетворенности пациентов до и после проведения дистанционного мониторинга АД, %

Criteria	Satisfied			Not satisfied			Difficult to answer
	rather yes	yes	total	rather yes	yes	total	
Before remote BP monitoring							
Organization of follow-up care	1.0	8.0	9.0	0.4	19.5	23.5	67.5
Availability of health information	35.5	7.0	42.5	08.5	14.0	22.5	35.0
Availability of information on risk factors	32.5	07.5	40.0	30.0	22.5	52.5	07.5
Doctor-patient interaction	04.5	19.0	23.5	31.5	39.0	70.5	6.0
Willingness to recommend a school for remote BP monitoring	1.5	6.0	7.5	37.5	40.0	67.5	25.0
Remote BP monitoring	7.0	27.0	34.0	31.5	14.5	46.0	20.0
After remote BP monitoring							
Organization of follow-up care	39.5	55.5	95.0	6.0	0.00	1.5	3.5
Availability of health information	16.5	75.0	91.5	1.0	0.0	1.0	7.5
Availability of information on risk factors	5.0	87.5	92.5	0.0	0.0	0.0	7.5
Doctor-patient interaction	10.0	80.0	90.0	0.0	0.0	0.0	10.0
Willingness to recommend a school for remote BP monitoring	1.0	71.5	72.5	22.5	0.0	22.5	5.0
Remote BP monitoring	2.0	83.0	85.0	10.0	0.0	10.0	5.0

Table 2. Changes in the level of patient satisfaction before and after remote monitoring of blood pressure, %**Таблица 2.** Изменение уровня удовлетворенности пациентов до и после проведения дистанционного мониторинга АД, %

Period	Answer options		
	Satisfied	Not satisfied	Difficult to answer
Beginning	26.0	47.0	26.8
Ending	87.8	5.8	6.4
Value difference	61.8	41.2	20.4

Moreover, such an increase in patient satisfaction was achieved in specially created conditions of the ongoing study with the use of telemedicine technologies and established participatory interaction between medical staff and patients and because of the redistribution of responsibilities between doctors and nurses regarding remote monitoring of outpatient groups of cardiology patients.

CONCLUSIONS

The sociological survey was a summary of the results of the conducted remote monitoring of patients' BP and was aimed at studying their opinions about changes in the organization of medical care provided in outpatient settings.

At the beginning of the study, the level of patients' awareness of their own health status (knowledge of optimal BP values, health group, and body mass index), preventive measures (follow-up care, health centers, etc.), and the use of devices for remote transmission of BP data from the patient to the doctor were determined.

The results of the survey before and after remote BP monitoring showed an increase in the degree of achievement of social outcomes to 61.0%. This increase in patient satisfaction was due to the redistribution of responsibilities between doctors and nurses and the established participatory interaction between medical staff and patients.

Based on the results of the scientific study, recommendations for the use of remote BP monitoring in ambulatory patients are indicated in several areas, including

a set of measures to improve the organization of follow-up care of cardiology patients.

The organization of remote BP monitoring schools and regular remote information events with patients on their platform will strengthen the prevention of socially significant diseases and increase the adherence to treatment of outpatients. Redistribution of functional responsibilities between doctors and nurses improves the quality and efficiency of follow-up care.

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