DOI: https://doi.org/10.17816/DD568899

SWOT-Analysis: Remote Monitoring of Blood Pressure

Alexandra E. Demkina[1], Anna N. Korobeynikova[2], Anatoliy N. Rogoza[3], Anton V. Vladzymyrskyy[1]

[1] Research and Practical Clinical Center for Diagnostics and Telemedicine Technologies, Moscow, Russia;
[2] Center of Cardiology and Neurology, Kirov, Russia;
[3] National Medical Research Centre of Cardiology Named After Academician E.I. Chazov, Moscow, Russia

ABSTRACT

Global political and socioeconomic changes have caused a huge strain on the healthcare system. To transition into a new level of medical care, modern technological solutions are needed. Accelerated development of innovations in medicine and the formation of a personalized approach will improve the quality and accessibility of medical services. One of the directions of healthcare development is the use of digital technologies and remote monitoring in assessing the health indicators of citizens. Currently, the federal project of remote monitoring of patients with arterial hypertension, named, "Personal Medical Assistants," is being implemented in the Russian Federation. Similar to any new technology, remote monitoring has advantages and disadvantages. In this article, a strategic analysis (SWOT-analysis) was performed, considering medical, economic, social, and political aspects that may affect the results of the federal project. For effective implementation of remote monitoring technology in clinical practice, the strengths and weaknesses in the healthcare system and the state as a whole must be emphasized. SWOT-analysis can be used in formulating strategies for the widespread use of new digital technologies in clinical practice.

Keywords: SWOT-analysis; remote monitoring; blood pressure; federal projects; personal medical assistants; healthcare.

To cite this article:
Demkina AE, Korobeynikova AN, Rogoza AN, Vladzymyrskyy AV. SWOT-analysis: Remote monitoring of blood pressure. *Digital Diagnostics.* 2024;5(2):303–317. DOI: https://doi.org/10.17816/DD568899

Submitted: 28.08.2023 **Accepted:** 12.12.2024 **Published online:** 20.06.2024

DOI: https://doi.org/10.17816/DD568899

SWOT-анализ: дистанционный мониторинг артериального давления

А.Е. Демкина[1], А.Н. Коробейникова[2], А.Н. Рогоза[3], А.В. Владзимирский[1]

[1] Научно-практический клинический центр диагностики и телемедицинских технологий, Москва, Россия;
[2] Центр кардиологии и неврологии, Киров, Россия;
[3] Национальный медицинский исследовательский центр кардиологии имени академика Е.И. Чазова, Москва, Россия

АННОТАЦИЯ

В связи с глобальными политическими и социально-экономическими изменениями система здравоохранения испытывает огромную нагрузку. Переход на новый уровень оказания медицинской помощи требует внедрения современных технологических решений. Ускоренное развитие инноваций в медицине и формирование персонализированного подхода позволит повысить качество и доступность медицинских услуг.

Одним из направлений развития здравоохранения является использование цифровых технологий и применение дистанционного мониторирования для оценки показателей здоровья граждан. В настоящее время на территории Российской Федерации реализуется Федеральный проект дистанционного наблюдения за пациентами с артериальной гипертензией «Персональные медицинские помощники». Как и любая новая технология, дистанционное мониторирование имеет свои преимущества и недостатки. В данной статье проведён стратегический анализ (SWOT-анализ), а также рассмотрены медицинские, экономические, социальные и политические аспекты, которые могут оказать влияние конечный результат федерального проекта. Для эффективного внедрения в практику технологии дистанционного мониторирования требуется акцентуация сильных и проработка слабых сторон как в системе здравоохранения, так и в государстве в целом. Проведённый SWOT-анализ может быть использован для построения дальнейшей стратегии широкого использования в клинической практике новых цифровых технологий.

Ключевые слова: SWOT-анализ; дистанционное мониторирование; артериальное давление; федеральные проекты; персональные медицинские помощники; здравоохранение.

Как цитировать:
Демкина А.Е., Коробейникова А.Н., Рогоза А.Н., Владзимирский А.В. SWOT-анализ: дистанционный мониторинг артериального давления // Digital Diagnostics. 2024. Т. 5, № 2. С. 303–317. DOI: https://doi.org/10.17816/DD568899

Рукопись получена: 28.08.2023 **Рукопись одобрена:** 12.12.2024 **Опубликована online:** 20.06.2024

DOI: https://doi.org/10.17816/DD568899

SWOT 分析：远程血压监控

Alexandra E. Demkina[1], Anna N. Korobeynikova[2], Anatoliy N. Rogoza[3], Anton V. Vladzymyrskyy[1]

[1] Research and Practical Clinical Center for Diagnostics and Telemedicine Technologies, Moscow, Russia;
[2] Center of Cardiology and Neurology, Kirov, Russia;
[3] National Medical Research Centre of Cardiology Named After Academician E.I. Chazov, Moscow, Russia

摘要

由于全球政治和社会经济的变化，医疗保健系统面临着巨大的压力。向新的医疗水平过渡需要引入现代技术解决方案。医学创新的加速发展和个性化方法的形成将提高医疗服务的质量和可及性。

保健发展的一个领域是使用数字技术和应用远程监控来评估公民的健康指标。目前，俄罗斯联邦正在实施对动脉高血压患者进行远程监控的联邦项目《个人医疗助理》。与任何新技术一样，远程监控也有其优缺点。本文进行了战略分析（SWOT 分析），并考虑了可能影响联邦项目最终结果的医疗、经济、社会和政治方面。要有效实施远程监控技术，就必须强调医疗保健系统和整个国家的优势并克服其不足。所进行的 SWOT 分析可用于制定进一步的战略，以便在临床实践中广泛使用新的数字技术。

关键词： SWOT 分析；远程监控；血压；联邦项目；个人医疗助理；医疗保健。

引用本文：
Demkina AE, Korobeynikova AN, Rogoza AN, Vladzymyrskyy AV. SWOT 分析：远程血压监控. *Digital Diagnostics.* 2024;5(2):303–317.
DOI: https://doi.org/10.17816/DD568899

收到： 28.08.2023 **接受：** 12.12.2024 **发布日期：** 20.06.2024

INTRODUCTION

Healthcare systems are currently under great strain due to sociodemographic (e.g., decreasing working-age population, population aging, and increasing population with chronic noncommunicable disease risk factors) and economic (e.g., economic volatility and understaffing of healthcare facilities) factors [1–4].

Scientific and technological advancements in medicine and healthcare systems allows finding solutions to some existing problems. Digital transformation in healthcare requires innovative approaches for providing medical care [5]. Remote monitoring based on automatic reporting of the patient's health status is a key technology for personalized medicine [6]. The wide clinical use of innovative remote monitoring technologies is crucial in healthcare as it can determine the risk factors of chronic noncommunicable diseases [7–11].

Strengths, weaknesses, opportunities, and threats (SWOT) analysis is a universal tool for strategic analysis. It is applied in all sectors of the economy (commercial, nonprofit, and governmental organizations) to assess brands, products, and projects. A benefit of SWOT analysis is the ability to examine external and internal factors, determine the relationship between strengths and weaknesses, and evaluate external threats and opportunities [12].

Hypertension is a common health condition and significant modifiable cardiovascular risk factor [4]. According to research, in Russia, the prevalence of hypertension is constantly high, reaching 40%–45%. The current population aging in Russia can further increase the number of hypertension patients [3]. Epidemiological studies of hypertension performed in Russia between 2010 and 2020 revealed several unresolved challenges in providing medical care, including unwillingness of patients to take medicines, failure to reach the target blood pressure (BP) on antihypertensive therapy, and low motivation and BP control in rural areas [2].

Successful BP control is an effective preventive strategy in cardiovascular diseases[1]. A meta-analysis of 61 randomized clinical studies showed that a decrease in BP even by 2 mmHg resulted in a decreased mortality due to stroke and coronary heart disease; moreover, effective and timely hypertension therapy could be life-saving for approximately 30% of patients [13].

Suboptimal BP control by patients is a global concern [14]. In most countries, poor compliance and irregular or nonexistent physician visits for hypertension management are believed to be the main reasons for unsatisfactory control of the disease [15]. Low compliance with antihypertensive therapy prevents from reaching target BP levels and raises hospitalization rate and duration, thus increasing healthcare system expenses [8].

Currently, Russia is undertaking large-scale initiatives to implement remote BP monitoring. Therefore, a SWOT analysis of this strategic task is critical.

S: STRENGTHS

Remote monitoring of patients with cardiovascular diseases using wearable devices is regarded feasible, because these devices are efficient, readily available, small-sized, and user-friendly for prolonged use. Moreover, they enable remote monitoring of patients in a comfortable environment (at home) and provide prompt alerts on events that require emergency care or hospitalization [7]. Some wearable devices do not require hospital visits for maintenance. Their operation can be controlled remotely, which is critical for patients living far from large cities with a well-organized cardiovascular care service, including in rural areas [9]. Telemedicine solutions provide several benefits, including easy planning of monitoring and treatment [16] and easier communication between patients and physicians [17].

Patients who use remote technologies can better observe and understand the association between their daily behaviors, such as diet, sleeping habits, and adherence to medication, and health. Telemedicine technologies allow patients to monitor and record their health parameters. This raises awareness and encourages patients to take better care of their health [18, 19]. Patients benefit from telemedicine because it allows for long-term monitoring, long-term disease control by physicians, greater patient health literacy, and convenient communication without the need for hospital visits [20, 21].

Furthermore, remote monitoring increases access to healthcare in remote areas [22]. A healthcare professional (physician or physician assistant) can assess the patient's daily activities and behaviors, allowing for timely treatment plan adjustments [23]. Moreover, a study showed that BP levels measured at home are closer to actual levels, because stress caused by hospital visits and the white coat effect are avoided [24].

Healthcare facilities using remote technologies have various advantages, such as more patients enrolled in care, improved satisfaction with treatment, and more capacity in the facility owing to effective remote consultations. A direct short-term economic effect remains to be demonstrated; nevertheless, the long-term cost-effectiveness of these solutions is clear [19, 24, 25].

Several foreign studies have shown the cost-effectiveness of telemetric reporting of BP self-monitoring [26–29]. Russian studies have assessed the potential socioeconomic effect of

[1] WHO. Global report on hypertension. The race against a silent killer. Geneva, 2013. URL: http://apps.who.int/iris/bitstream/handle/10665/79059/WHO_DCO_WHD_2013.2_rus.pdf Last accessed: February 13, 2023

remote technologies in patients with elevated BP. According to mathematical estimates, in a region with a population of 1 million, with 30% involved in remote monitoring, over 600 patients could be spared over 5 years, and with 90% involved in remote monitoring, about 2,000 lives could be saved [30].

Additionally, economic benefits to patients have been confirmed. BP self-monitoring is more effective than standard therapy in both men and women (assuming the effect of lowered BP was maintained for at least 2 years in men and 5 years in women) [20]. Notably, long-term monitoring was not associated with reduced quality of life [31]. Furthermore, other studies demonstrated a varying economic effect of short-term use of remote technologies; however, this effect becomes apparent starting from 2 years of use [19, 20].

Thus, the advantages of remote monitoring in patients with hypertension include the possibility of BP control and improved access to healthcare in remote areas, providing long-term economic benefits both for patients and healthcare facilities.

W: WEAKNESSES

Despite the advantages of remote monitoring, several weaknesses have been discovered when using digital technologies for BP monitoring in clinical practice, which should be considered when upscaling ongoing and future projects.

Low technology literacy of patients is a limiting factor for remote monitoring. Many patients are unfamiliar with new possibilities and hence unable to integrate them in their everyday life [32]. This is especially true for older patients and requires training to extend the group of patients who comprehend and actively use remote monitoring systems [31].

Personal characteristics and emotional profile of patients considerably affect the efficacy of implementing innovative technologies [33]. A study conducted at the University of Pennsylvania investigated patient interaction phenotypes with a remote BP monitoring system. Three main patterns of engagement style were observed:

- The enthusiast, who tended to submit unprompted messages with high word counts (10.9%)
- The student, who inconsistently engaged with the remote monitoring system (22.6%)
- The minimalist, who engaged only when prompted (66.5%)

A significant association between the communication pattern and reaching the target BP was observed only in the group of patients demonstrating the minimalist communication style ($P < 0.001$) [34].

A study conducted in Belgium examined the effect of anxiety and depression on adherence to remote monitoring in women with pregnancy-induced hypertension using PHQ-9 and ECR-R questionnaires. The moderate adherence group showed significantly higher anxiety and depression levels, whereas no such association was observed in patients with good adherence and over-adherence [35].

Many patients are concerned about personal data safety; hence, some patients refuse to employ biometric data monitoring devices. Some of these patients, who finally consent to use monitoring devices, show high anxiety and depression levels [36].

According to some studies, the absence of interpersonal interaction could hinder the widespread use of remote monitoring [37]. A previous study found that patients valued such communication components as the ability to visit a hospital, meet a physician personally, and ask questions [38]. Moreover, the patient's passive role in remote monitoring is a risk factor, as evidenced by the absence of adequate and timely responses from physicians to suboptimal BP control [39].

The duration of remote monitoring has a significant effect on compliance. Short-term programs showed good adherence to monitoring in approximately 80% of 1,662 patients; 87% of patients found this monitoring option useful and convenient [40]. In long-term follow-up, the number of active patients decreased: an observational clinical trial using the Hello Heart software found that nearly half of patients ceased keeping the electronic diary between 3 months and 1 year [41]. Russian studies revealed similar tendencies: manual reporting of measurements is associated with low adherence to remote monitoring [42, 43]. More than 50% of patients in these studies discontinued monitoring, with most of these cases observed during the first 1.5–3 months of monitoring.

Research showed that patients require extensive support from healthcare professionals to use telemedicine technologies independently and regularly [16]. Moreover, some patients struggle to understand and follow the rules of remote monitoring [44] and resort to self-medication, which poses significant health risks [24].

In addition to the patient-related limitations of remote monitoring, weaknesses associated with the processes and staff management in healthcare systems were noted.

Russian studies revealed that outpatient physicians are hesitant about the widespread use of remote monitoring because of a lack of practical experience. For example, Kalinina et al. conducted a survey of 93 physicians from 6 outpatient clinics in Bryansk [45]. The survey found that respondents struggled the most with questions on the organizational structure of remote monitoring. More than 34.4% of physicians were unable to convey their opinions on the feasibility of establishing a separate system for follow-up remote monitoring, despite this topic being widely discussed presently. Thus, practitioners today cannot comprehend the functions of such an organizational structure. Further, the survey highlighted the ideas of physicians on potential barriers to the implementation of remote monitoring in follow-up care. The majority of respondents (80.6%) indicated insufficient time for monitoring as a barrier; economic

reasons (cost of equipment) were mentioned by 44.1%, technical issues by 45.2%, and challenges in patient training and uncertain reliability of data collection and reporting tools by 39.8%.

Additionally, several foreign countries have observed low digital literacy and reluctance among healthcare professionals. Shaw et al. highlighted the factors reducing technology acceptance by nurses, including additional workload, the need for integration into existing work processes, additional contacts with patients, and understaffing [25]. Moreover, physicians expect the use of telemedicine to increase the workload in the long term [19, 24, 46]. Practitioners are concerned that the cost of remote monitoring will exceed the insurance amount [46], leveling off the economic benefit [21]. Moreover, implementing this technology may make the professional roles in healthcare less clear [18].

In addition to staff-related limitations, economic factors significantly impede future development of information technology in follow-up care.

For example, when incorporating remote technologies into clinical practice, the high cost of devices and the need to train healthcare professionals in their use may become a barrier. Furthermore, the limitations of regulatory documents and the lack of general guidelines for the use of remote monitoring should be considered [10]. Another weakness is low engagement of insurance companies in the field of telemedicine for BP monitoring [39].

The development of remote monitoring technology demands attention to another poorly addressed issue, namely, the time and effort required for the physician to regularly assess the measurements obtained by patients at home and provide remote consultations during monitoring. Moreover, physician labor costs increase, because patients need to be trained on how to use applications. This issue requires adjustments in working time management and modifications in the compulsory/voluntary healthcare insurance system or the introduction of new sources of funding by a healthcare facility [22].

The third group of weaknesses of remote monitoring in hypertension includes methodology-related issues. The most significant unresolved difficulty is the diagnosis of white coat and masked hypertension based on office or home BP measurement. The PAMELA study found similar BP levels when measured at home and during ambulatory blood pressure monitoring [47]. Another study found variations in the diagnosis of white coat hypertension based on home BP measurement and ambulatory monitoring in 13% of participants [48]. Regarding masked hypertension, only 57% and 45% of patients with hypertension confirmed by elevated systolic and diastolic BP, respectively, had similar BP levels during home monitoring. However, the systolic and diastolic BP levels varied in 23% and 30% of patients, respectively [49]. Therefore, home BP monitoring confirms the diagnosis in the case of elevated office BP, whereas ambulatory monitoring is most effective in the diagnosis of masked or white coat hypertension [49]. The disparity in findings does not imply that one method is inferior to the other. Despite appearing similar, the methods address different aspects of the BP profile [50, 51]. According to Barochiner et al., the diagnosis of masked hypertension based on home monitoring can be rarely established owing to low reproducibility of office measurements (Cohen's kappa coefficient $\kappa = 0.19$; 95% confidence interval: 0.0002, 0.38; $P = 0.02$) [52].

Currently, no clear guidelines for addressing variations between office and home BP measurements have been established; thus, overtreatment and undertreatment are possible. This is not a limitation of telemedicine, but rather a methodological feature of hypertension detection. Home BP monitoring and reporting should be standardized to prevent bias in the assessment of findings and data misrepresentation [53].

When making therapeutic decisions, reliability of home BP measurements is critical. Technical errors or blood pressure monitor malfunction may result in inaccurate BP measurements. Hence, BP monitors should be validated and tested for accuracy. Furthermore, the data should be compared to measurements taken by a qualified healthcare professional. In addition to the technical serviceability of the BP monitor, a properly sized cuff is required. According to NHANES, 51% of adults in the USA, including 65% of patients aged 18–34 years and 84% of patients with obesity, required large or very large cuffs [54–56].

Thus, remote monitoring technology for hypertension is not free of weaknesses. Low digital literacy, distrust of innovative technologies, and the desire to maintain current patient–physician interaction style hinder the widespread use of this technique. Moreover, healthcare professionals show a certain degree of reluctance: a potential increase in time and labor input due to additional work results in a hesitation over the widespread use of remote monitoring. The methodological and technical challenges of remote monitoring in patients with hypertension result in a less than enthusiastic attitude toward this technology in the medical community.

O: OPPORTUNITIES

Despite its weaknesses, remote BP monitoring in patients with cardiovascular diseases has shown favorable outcomes, including a significant reduction in hospitalization rate and duration, a decrease in mortality, and improved BP control compared to standard therapy and follow-up. In the TEN-HMS study (UK, Germany, and the Netherlands), the 1-year mortality in the control, remote monitoring, and structured telephone support groups was 45%, 29%, and 27%, respectively [10]. A meta-analysis of 46 randomized clinical studies assessed the efficacy of remote BP monitoring compared to standard hypertension management. Remote monitoring was associated with a decrease in office systolic and diastolic BP by 3.99 mmHg ($P < 0.001$) [11]. The Home BP

study (UK) demonstrated improved systolic BP control when using a remote monitoring system. The mean difference in systolic BP was 3.4 mmHg (95% confidence interval: 6.1, 0.8; $P < 0.05$) [57].

Bubnova et al. conducted a study in 342 hypertension patients and found that remote monitoring provided significant benefits regarding the number of emergency calls, hospitalization rate, and time on sick leave. After 12 months, 92.2% of patients in the treatment group and 43.3% of patients in the control group achieved the target BP level [58].

Remote monitoring enables the collection of large amounts of patient data. Big data and intelligent computer systems have an increasing effect on conventional approaches in medicine [59, 60]. Data collection and integration and feedback to a physician will be automated. Big data collection from various devices, trend prediction via machine learning, and long-term analysis of vital and geographical characteristics will help improve our understanding of cardiovascular disease development on a population level [61].

Improvements to remote monitoring systems may make them more adaptive and flexible. For example, if a patient struggles to follow the remote monitoring protocol, a behavioral module will activate, adapting to the patient's needs to help overcome the challenges. Drug prescription algorithms can also be automated: large datasets allow for case-by-case analysis and real-time decision-making [62].

Remote monitoring has been widely used in healthcare systems of the USA and Europe, confirming its long-term economic and clinical efficacy. Telemedicine allows for more effective health management and efficient utilization of limited medical resources:

- Less time spent on follow-up visits and selecting effective antihypertensive therapy
- Improved BP control in hypertension and the resulting decrease in complication rates
- Shorter hospital stay for complications of hypertension
- Implementation of the technology in remote areas and consistently understaffed healthcare facilities
- Improved availability and quality of medical care for patients with disabilities [40]

T: THREATS

In the implementation of remote monitoring, several threats were identified that limit its wide clinical use.

The development of remote monitoring requires wide implementation of advanced solutions and modern technologies in healthcare systems. However, the current geopolitical environment has its own rules. Previously, most information technology (IT) products and their components were imported, which was significantly more convenient than developing domestic solutions with a long pay-off period. Thus, Russia became severely disadvantaged by sanctions due to weak domestic IT infrastructure. Major western IT companies, such as Microsoft, Oracle, Cisco, IBM, Adobe, SAP, Intel, and AMD[2], have limited their activities or stopped operating in Russia. According to Dmitry Pshichenko, lecturer of the IT Management School of the Russian Presidential Academy of National Economy and Public Administration, the main risks are currently associated with data security and server maintenance, because the majority of western software is cloud-based, and purchasing components for maintenance is difficult. This affects the development of digital technology in medicine[3].

In addition to software issues, the Russian IT industry faces a shortage of expertise. According to Vice Prime Minister Dmitry Chernyshenko, the deficit of IT specialists currently stands at 1 million people[4], with projections of 2 million by 2027. This impedes the rapid development of the IT industry, particularly in healthcare.

Furthermore, economic issues and resource shortages may cause delays in digitization. According to the HSE University, the healthcare industry spent 39.5 billion rubles on the development, distribution, and use of digital technologies and related products and services in 2019, which accounted for 1.6% of the total industry gross added value. When compared to total expenses, the share of expenses for digitization does not exceed 0.6%–0.7% [63].

In 2021, healthcare digitization expenses accounted for 2.6% of the total economic activity. When considering the expenses of Russian companies for digitization, the share of healthcare has increased insignificantly over the last 2 years: 1.6% in 2019 and 2.2% in 2020.

Cybersecurity concerns add to the doubts in the use of remote monitoring systems. Telemedicine involves the collection of large amounts of data, which should be stored in a specific manner to prevent them from being leaked into open sources. Fraudsters may gain access to patient data and use it for criminal purposes[5].

According to Kaspersky Lab, 54% of healthcare facilities use outdated software, because of the high cost of updates and issues with old and new system compatibility. A lack of updates makes a system more vulnerable to cyberattacks; attackers can break into the corporate system and use the databases for their own gain. According to statistics, owing

[2] Gone for good: IT companies that have exited Russia. URL: https://hightech.fm/2022/05/26/it-companies-went-away. Last accessed: March 1, 2023

[3] Major risks in IT stem from a shortage of expertise. URL: https://rg.ru/2023/02/17/vitaiut-v-oblakah.html. Last accessed: March 1, 2023

[4] This year, the number of certified IT companies in Russia has grown sevenfold. URL: https://www.ixbt.com/news/2022/10/24/v-jetom-godu-akkreditovannyh-itkompanij-v-rossii-stalo-v-sem-raz-bolshe.html. Last accessed: March 1, 2023

[5] The risks, threats, and lack of systemic approach in digitization. URL: https://www.infowatch.ru/resources/blog/tochka-zreniya-kasperskoy/o-riskakh-ugrozakh-i-otsutstvii-sistemnosti-v-tsifrovizatsii. Last accessed: March 1, 2023

to increased vulnerability of Russian medical systems, 32%, 32%, and 30% have experienced data leaks, DDoS attacks, and ransomware attacks, respectively[6]. A study by Buldakova et al. identified potential threats to information security: data leaks can occur at almost any point, from sensors and cloud-based medical information systems to healthcare professionals and patients [64]. Furthermore, the rapid development of mobile technologies and m-Health has resulted in numerous mobile applications and ready-made wireless devices. The majority of them have not been certified [65, 66] and thus cannot be used as medical devices, because of noncompliance with cybersecurity rules (such applications are only suitable for use by patients) [67].

Certain issues with remote monitoring are related to remote patient identification. Accurate and reliable identification of the patient being monitored is challenging. Hence, remote monitoring cannot be used in expert settings or in problematic situations, and the patient is solely accountable for the appropriate use of devices [68].

CONCLUSION

The widespread use of remote monitoring technologies in Russia requires large-scale threat analysis, which is not limited to healthcare. In our country, medicine advances at the same rate as IT. Digitization in medicine cannot be considered a standalone industry; it is linked to external and internal factors and political, economic, and social considerations. Certainly, healthcare-specific aspects (personal data and patient confidentiality) should be considered. However, the foundation for the development of IT solutions in Russia is consistent.

SWOT analysis involves developing a further strategy. To accomplish this, the Weihrich model is used to predict the interaction of factors from different squares:

- Strengths—opportunities
- Strengths—threats
- Weaknesses—opportunities
- Weaknesses—threats

A comprehensive approach enables seamless integration of remote monitoring technologies into healthcare systems, making the benefits of digital medicine available to all.

ADDITIONAL INFORMATION

Funding source. This article was prepared by a group of authors as a part of the research and development effort titled "Scientific evidence for using telemedicine-based models and methods for organization and delivery of medical care" (USIS No.: 123031400008-4) in accordance with the Order No. 1196 dated December 21, 2022 "On approval of state assignments funded by means of allocations from the budget of the city of Moscow to the state budgetary (autonomous) institutions subordinate to the Moscow Health Care Department, for 2023 and the planned period of 2024 and 2025" issued by the Moscow Health Care Department.

Competing interests. The authors declare that they have no competing interests.

Authors' contribution. All authors made a substantial contribution to the conception of the work, acquisition, analysis, interpretation of data for the work, drafting and revising the work, final approval of the version to be published and agree to be accountable for all aspects of the work. A.E. Demkina — the concept of the study, writing the text of the manuscript, manuscript's text editing; A.N. Korobeynikova — collection of materials, writing the text of the manuscript; A.N. Rogova — writing the text of the manuscript, manuscript's text editing; A.V. Vladzymyrskyy — manuscript's text editing.

REFERENCES

1. Zudin AB, Chepin VO. Global Challenges for Russian Healthcare. *Byulleten' Natsional'nogo nauchno-issledovatel'skogo instituta obshchestvennogo zdorov'ya imeni N.A. Semashko.* 2016;(5):41–45. (In Russ). EDN: XWOKVJ

2. Boytsov SA, Demkina AE, Oshchepkova EV, Dolgusheva YuA. Progress and Problems of Practical Cardiology in Russia at the Present Stage. *Kardiologiia.* 2019;59(3):53–59. EDN: CJGCQF doi: 10.18087/cardio.2019.3.10242

3. Boytsov SA, Pogosova NV, Bubnova MG, et al. Cardiovascular prevention 2017. National Guidelines. *Russian Journal of Cardiology.* 2018;23(6):7–122. EDN: XSLTTF doi: 10.15829/1560-4071-2018-6-7-122

4. Balanova YuA, Shalnova SA, Imaeva AE, et al. Prevalence, Awareness, Treatment and Control of Hypertension in Russian Federation (Data of Observational ESSERF-2 Study). *Rational Pharmacotherapy in Cardiology.* 2019;15(4):450–466. EDN: ZRWESV doi: 10.20996/1819-6446-2019-15-4-450-466

5. Lebedev GS, Vladzymyrskyy AV, Shaderkin IA, Dudareva VP. Remote monitoring complex for chronic noncommunicable diseases. *Russian Journal of Telemedicine and E-Health.* 2020;8(1):7–14. EDN: NMFKNG doi: 10.29188/2712-9217-2022-8-1-7-14

6. Nikolaev VA. Innovative technologies for personalized medicine. *Forcipe.* 2019;2(S3):40–41. EDN: UEPRRX

7. Bautista LE. Predictors of persistence with antihypertensive therapy: Results from the NHANES. *Am J Hypertens.* 2008;21(2):183–188. doi: 10.1038/ajh.2007.33

8. Paramore LC, Halpern MT, Lapuerta P, et al. Impact of poorly controlled hypertension on health care resource utilization and cost. *Am J Manag Care.* 2001;7(4):89–98.

9. Varma N, Epstein AE, Irimpen A, et al. TRUST investigators. Efficacy and safety of automatic remote monitoring for implantable cardioverter-defibrillator follow-up: the lumos-t safely reduces routine office device

[6] Every second healthcare facility in Russia uses equipment with an outdated operating system: A study. URL: https://tass.ru/ekonomika/13143911. Last accessed: March 1, 2023.

follow-up (TRUST) Trial. *Circulation.* 2010;122(4):325–332. doi: 10.1161/CIRCULATIONAHA.110.937409

10. Sana F, Isselbacher EM, Singh JP, et al. Wearable Devices for Ambulatory Cardiac Monitoring: JACC State-of-the-Art Review. *J Am CollCardiol.* 2020;75(13):1582–1592. doi: 10.1016/j.jacc.2020.01.046

11. Cleland JGF, Louis AA, Rigby AS, et al. Noninvasive home telemonitoring for patients with heart failure at high risk of recurrent admission and death: the Trans-European Network-Home-Care Management System (TEN-HMS) study. *Journal of the American College of Cardiology.* 2005;45(10):1654–1664. doi: 10.1016/j.jacc.2005.01.050

12. Pyzhlakov DS. Strengths and Opportunities. The concept of dynamic SWOT analysis. *Russian Journal of Entrepreneurship.* 2008;(6-1):133–138. (In Russ). EDN: JKONSZ

13. Lewington S, Clarke R, Qizilbash N, et al. Age-specific relevance of usual blood pressure to vascular mortality. *The Lancet.* 2003;361(9366):1391–1392. doi: 10.1016/S0140-6736(03)13061-9

14. Slimko ML, Mensah GA. The role of diets, food, and nutrients in the prevention and control of hypertension and prehypertension. *Clinical Cardiology.* 2010;4(28):665–674. doi: 10.1016/j.ccl.2010.08.001

15. Chazova IE, Oshchepkova EV. Results of the federal (national) project for prevention and treatment essential hypertension patients in Russia from 2002–2012 years. *Annals of the Russian academy of medical sciences.* 2013;68(2):4–11. EDN: PWEBNT doi: 10.15690/vramn.v68i2.542

16. McKoy J, Fitzner K, Margetts M, et al. Are telehealth technologies for hypertension care and self-management effective or simply risky and costly. *Popul Health Manag.* 2015;18(3):192–202. doi: 10.1089/pop.2014.0073

17. Fitzner K, Moss G. Telehealth-an effective delivery method for diabetes self-management education. *Popul Health Manag.* 2013;16(3):169–177. doi: 10.1089/pop.2012.0054

18. Flodgren G, Rachas A, Farmer AJ, Inzitari M, Shepperd S. Interactive telemedicine: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev.* 2015;2015(9):CD002098. doi: 10.1002/14651858.CD002098.pub2

19. Piette JD, Marinec N, Gallegos-Cabriales EC, et al. Spanish-speaking patients' engagement in interactive voice response (IVR) support calls for chronic disease self-management: data from three countries. *Telemed Telecare.* 2013;19(2):89–94. doi: 10.1177/1357633x13476234

20. Kaambwa B, Bryan S, Jowett S, et al. Telemonitoring and self-management in the control of hypertension (TASMINH2): a cost-effectiveness analysis. *Eur J Prev Cardiol.* 2014;21(12):1517–1530. doi: 10.1177/2047487313501886

21. Maciejewski ML, Bosworth HB, Olsen MK, et al. Do the benefits of participation in a hypertension self-management trial persist after patients resume usual care. *Circ Cardiovasc Qual Outcomes.* 2014;7(2):269–275. doi: 10.1161/CIRCOUTCOMES.113.000309

22. Shaderkin IA, Shaderkina VA. Remote health monitoring: motivating patients. *Journal of Telemedicine and E-Health.* 2020;6(3):37–43. EDN: PBHHKX doi: 10.29188/2542-2413-2020-6-3-37-43

23. Wise J. Activity trackers, even with cash incentives, do not improve health. *BMJ.* 2016;355:i5392. doi: 10.1136/bmj.i5392

24. Jones MI, Greenfield SM, Bray EP, et al. Patients' experiences of self-monitoring blood pressure and self-titration of medication: the TASMINH2 trial qualitative study. *Br J Gen Pract.* 2012;65(595):e135–e142. doi: 10.3399/bjgp12X625201

25. Shaw RJ, Kaufman MA, Bosworth HB, et al. Organizational factors associated with readiness to implement and translate a primary care-based telemedicine behavioral program to improve blood pressure control: the HTN-IMPROVE study. *Implement Sci.* 2013;8. doi: 10.1186/1748-5908-8-106

26. AbuDagga A, Resnick HE, Alwan M. Impact of Blood Pressure Telemonitoring on Hypertension Outcomes: A Literature Review. *Telemedicine and eHealth.* 2010;16(7):830–838. doi: 10.1089/tmj.2010.0015

27. Chandak A, Joshi A. Self-management of hypertension using technology enabled interventions in primary care settings. *Technology and Health Care.* 2015;23(2):119–128. doi: 10.3233/thc-140886

28. McKinstry B, Hanley J, Lewis S. Telemonitoring in the management of high blood pressure. *Curr Pharm Des.* 2015;21(6):823–827. doi: 10.2174/1381612820666141024154232

29. Sivakumaran D, Earle K. Telemonitoring: use in the management of hypertension. *Vascular Health and Risk Management.* 2014;10:217–224. doi: 10.2147/vhrm.s36749

30. Kontsevaya AV, Komkov DS, Boytsov SA. The modeling as a technique of evaluation of expediency of remote monitoring of arterial tension at the regional level. *Health Care of the Russian Federation.* 2017;61(1):10–16. EDN: YFOKVP doi: 10.18821/0044-197X-2017-61-1-10-16

31. Ho K. Health-e-Apps: A project to encourage effective use of mobile health applications. *BCMJ.* 2013;55(10):458–460.

32. Isaeva AV, Krasnova KS, Tagoev YuSh, et al. A study of the digital readiness of patients with chronic heart failure. *Russian Journal of Preventive Medicine and Public Health.* 2023;26(3):101–108. EDN: DGKTAU doi: 10.17116/profmed202326031101

33. Baysangurov AF, Arutyunova NN, Baysangurova MM. Analysis of the demotivation factors that reduce the efficiency of employees. *Digital Diagnostics.* 2021;2(2S):10–11. EDN: VGEGJF doi: 10.17816/DD83175

34. Davoudi A, Lee NS, Chivers C, et al. Patient interaction phenotypes with an automated remote hypertension monitoring program and their association with blood pressure control: observational study. *J Med Internet Res.* 2020;22(12):e22493. doi: 10.2196/22493

35. Vandenberk T, Lanssens D, Storms V, et al. Relationship Between Adherence to Remote Monitoring and Patient Characteristics: observational study in women with pregnancy-induced hypertension. *JMIR mHealth and uHealth.* 2019;7(8):e12574. doi: 10.2196/12574

36. Case MA, Burwick HA, Volpp KG, et al. Accuracy of smartphone applications and wearable devices for tracking physical activity data. *JAMA.* 2015;313(6):625–626. doi: 10.1001/jama.2014.17841

37. O'Kane MJ. Efficacy of self-monitoring of blood glucose in patients with newly diagnosed type 2 diabetes (ESMON study): randomised controlled trial. *BMJ.* 2008;336(7654):1174–1180. doi: 10.1136/bmj.39534.571644.BE

38. Walker RC, Tong A, Howard K, et al. Patient expectations and experiences of remote monitoring for chronic diseases: Systematic review and thematic synthesis of qualitative studies. *Int J Med Inform.* 2019;124:78–85. doi: 10.1016/j.ijmedinf.2019.01.013

39. Mareev YuV, Zinchenko AO, Myasnikov RP, et al. Telemonitoring in patients with chronic heart failure. *Kardiologiia.* 2019;59(S9):4–15. EDN: ISWIAY doi: 10.18087/cardio.n530

40. Omboni S, Ferrari R. The role of telemedicine in hypertension management: focus on blood pressure telemonitoring. *Curr Hypertens Rep.* 2015;17. doi: 10.1007/s11906-015-0535-3

41. Gazit T, Gutman M, Beatty AL. Assessment of hypertension control among adults participating in a mobile technology blood pressure self-management program. *JAMA Netw Open.* 2021;4(10):e2127008. doi: 10.1001/jamanetworkopen.2021.27008

42. Komkov DS, Baturin DI, Kulikov AA, et al. The role of SMS-informing in the dispensary monitoring of patients with arterial hypertension. *Arterial'naya Gipertenziya.* 2015;21(S1):91. (In Russ). EDN: WEPXLT

43. Komkov DS, Goryachkin EA, Korsunsky DV, et al. Clinical effectiveness of various models of telemedicine technologies in patients with arterial hypertension. *Russian Journal of Preventive Medicine and Public Health.* 2020;23(4):27–35. EDN: PMROKX doi: 10.17116/profmed20202304127

44. Melnyk SD, Zullig LL, McCant F, et al. Telemedicine cardiovascular risk reduction in veterans. *Am Heart J.* 2013;165(4):501–508. doi: 10.1016/j.ahj.2012.08.005

45. Kalinina AM, Gornyy BE, Dubovoy II, et al. The attitude of primary care physicians to the use of telemedicine technologies in dispensary observation of patients with chronic diseases (medical and sociological research). *Russian Journal of Preventive Medicine and Public Health.* 2020;23(6):8–13. EDN: TIADWK doi: 10.17116/profmed2020230628

46. Wang V, Smith VA, Bosworth HB, et al. Economic evaluation of telephone self-management interventions for blood pressure control. *Am Heart J.* 2012;163(6):980–986. doi: 10.1016/j.ahj.2012.03.016

47. Cuspidi C, Facchetti R, Dell'Oro R, et al. Office and out-of-office blood pressure changes over a quarter of century: findings from the PAMELA Study. *Hypertension.* 2020;76(3):759–765. doi: 10.1161/HYPERTENSIONAHA.120.15434

48. Mancia G, Facchetti R, Bombelli M, et al. Long-term risk of mortality associated with selective and combined elevation in office, home, and ambulatory blood pressure. *Hypertension.* 2006;47(5):846–853. doi: 10.1161/01.HYP.0000215363.69793.bb

49. Stergiou GS, Salgami EV, Tzamouranis DG, Roussias LG. Masked hypertension assessed by ambulatory blood pressure versus home blood pressure monitoring: is it the same phenomenon. *Am J Hypertens.* 2005;18(6):772–778. doi: 10.1016/j.amjhyper.2005.01.003

50. Pickering TG. Self-monitoring of blood pressure. In: *Ambulatory Monitoring and Blood Pressure Variability (Part 1)*. London: Science Press; 1990.

51. Pickering T. Recommendations for the use of home (self) and ambulatory blood pressure monitoring. American Society of Hypertension Ad Hoc Panel. *Am J Hypertens.* 1996;9(1):1–11. doi: 10.1016/0895-7061(95)00341-x

52. Barochiner J, Posadas Martínez ML, Martínez R. Reproducibility of masked uncontrolled hypertension detected through home blood pressure monitoring. *J Clin Hypertens (Greenwich).* 2019;21(7):877–883. doi: 10.1111/jch.13596

53. Myers MG. Reporting bias in self-measurement of blood pressure. *Blood Press Monit.* 2001;(6):181–183.

54. Miao H, Liu Y, Tsai TC, Schwartz J, Ji JS. Association between blood lead level and uncontrolled hypertension in the US population (NHANES 1999-2016). *J Am Heart Assoc.* 2020;9(13):e015533. doi: 10.1161/JAHA.119.015533

55. Jackson SL, Gillespie C, Shimbo D, Rakotz M, Wall HK. Blood Pressure Cuff Sizes for Adults in the United States: National Health and Nutrition Examination Survey, 2015–2020. *Am J Hypertens.* 2022;35(11):923–928. doi: 10.1093/ajh/hpac104

56. Cepeda M, Pham P, Shimbo D. Status of ambulatory blood pressure monitoring and home blood pressure monitoring for the diagnosis and management of hypertension in the US: an up-to-date review. *Hypertens Res.* 2023;46:620–629. doi: 10.1038/s41440-022-01137-2

57. Duan Y, Xie Z, Dong F, et al. Effectiveness of home blood pressure telemonitoring: a systematic review and meta-analysis of randomised controlled studies. *Journal of Human Hypertension.* 2017;31:427–437. doi: 10.1038/jhh.2016.99

58. Bubnova MG, Tribuntseva LV, Ostroushko NI, et al. Impact of remote follow-up on the course of hypertension. *The Russian Journal of Preventive Medicine.* 2018;21(5):77–82. EDN: YPHTZJ doi: 10.17116/profmed20182105177

59. Schoenhagen P, Mehta N. Big data, smart computer systems, and doctor-patient relationship. *European Heart Journal.* 2017;38(7):508–510. doi: 10.1093/eurheartj/ehw217

60. Sharova DE, Zinchenko VV, Akhmad ES, et al. On the issue of ethical aspects of the artificial intelligence systems implementation in healthcare. *Digital Diagnostics.* 2021;2(3):356–368. EDN: TGZGZZ doi: 10.17816/DD77446

61. Kario K, Tomitani N, Kanegae H, et al. The further development of out-of-office BP monitoring: Japan's ImPACT Program Project's achievements, impact, and direction. *J Clin Hypertens (Greenwich).* 2019;21(3):344–349. doi: 10.1111/jch.13495

62. Starodubtseva IA, Sharapova YuA. The Distance Monitoring of Blood Pressure as a Tool for Improving of the Quality of Follow-Up Observation of Patients with Arterial Hypertension. *The Russian Archives of Internal Medicine.* 2021;11(4):255–263. EDN: FTKKTE doi: 10.20514/2226-6704-2021-11-4-255-263

63. Karpov OE, Khramov AE. *Information Technology, Computing and Artificial Intelligence in Medicine*. Moscow: DPK Press; 2022. (In Russ).

64. Buldakova TI, Mikov DA, Sokolova AV. Data Security at Remote Monitoring of Human State. *Herald of the Bauman Moscow state technical university. Series Instrument engineering.* 2020;(4):42–57. EDN: QHBUUF doi: 10.18698/0236-3933-2020-4-42-57

65. Alessa T, Hawley MS, Hock ES, de Witte L. Smartphone apps to support self-management of hypertension: review and content analysis. *JMIR mHealth and uHealth.* 2019;7(5):e13645. doi: 10.2196/13645

66. Picone DS, Deshpande RA, Schultz MG, et al. Nonvalidated home blood pressure devices dominate the online marketplace in Australia. *Hypertension.* 2020;75(6):1593–1599. doi: 10.1161/HYPERTENSIONAHA.120.14719

67. Jalali MS, Russell B, Razak S, et al. EARS to cyber incidents in health care. *J Am Med Inform Assoc.* 2019;26(1):81–90. doi: 10.1093/jamia/ocy148

68. Vladzymyrskyy AV. Systematic review: the messengers «WhatsApp®» and «Viber®» in a clinical routine. *Zhurnal telemeditsiny i elektronnogo zdravookhraneniya.* 2017;(1):30–41. EDN: YPTUYR

СПИСОК ЛИТЕРАТУРЫ

1. Зудин А.Б., Щепин В.О. Глобальные вызовы для российского здравоохранения // Бюллетень Национального научно-исследовательского института общественного здоровья имени Н.А. Семашко. 2016. № 5. С. 41–45. EDN: XWOKVJ

2. Бойцов С.А., Демкина А.Е., Ощепкова Е.В., Долгушева Ю.А. Достижения и проблемы практической кардиологии в России на современном этапе // Кардиология. 2019. Т. 59, № 3. С. 53–59. EDN: CJGCQF doi: 10.18087/cardio.2019.3.10242

3. Бойцов С.А., Погосова Н.В., Бубнова М.Г., и др. Кардиоваскулярная профилактика 2017. Российские национальные рекомендации // Российский кардиологический журнал. 2018. Т. 23, № 6. С. 7–122. EDN: XSLTTF doi: 10.15829/1560-4071-2018-6-7-122

4. Баланова Ю.А., Шальнова С.А., Имаева А.Э., и др. Распространенность артериальной гипертонии, охват лечением и его эффективность в Российской Федерации (данные наблюдательного исследования ЭССЕ-РФ-2) // Рациональная фармакотерапия в кардиологии. 2019. Т. 15, № 4. С. 450–466. EDN: ZRWESV doi: 10.20996/1819-6446-2019-15-4-450-466

5. Лебедев Г.С., Владзимирский А.В., Шадеркин И.А., Дударева В.П. Комплекс дистанционного мониторинга при хронических неинфекционных заболеваниях // Российский журнал телемедицины и электронного здравоохранения. 2020. Т. 8, № 1. С. 7–14. EDN: NMFKNG doi: 10.29188/2712-9217-2022-8-1-7-14

6. Николаев В.А. Инновационные технологии персонализированной медицины // Forcipe. 2019. Т. 2, № S3. С. 40–41. EDN: UEPRRX

7. Bautista L.E. Predictors of persistence with antihypertensive therapy: Results from the NHANES // Am J Hypertens. 2008. Vol. 21, N 2. P. 183–188. doi: 10.1038/ajh.2007.33

8. Paramore L.C., Halpern M.T., Lapuerta P., et al. Impact of poorly controlled hypertension on health care resource utilization and cost // Am J Manag Care. 2001. Vol. 7, N 4. P. 89–98.

9. Varma N., Epstein A.E., Irimpen A., et al. TRUST investigators. Efficacy and safety of automatic remote monitoring for implantable cardioverter-defibrillator follow-up: the lumos-t safely reduces routine office device follow-up (TRUST) Trial // Circulation. 2010. Vol. 122, N 4. P. 325–332. doi: 10.1161/CIRCULATIONAHA.110.937409

10. Sana F., Isselbacher E.M., Singh J.P., et al. Wearable Devices for Ambulatory Cardiac Monitoring: JACC State-of-the-Art Review // J Am CollCardiol. 2020. Vol. 75, N 13. P. 1582–1592. doi: 10.1016/j.jacc.2020.01.046

11. Cleland J.G.F., Louis A.A., Rigby A.S., et al. Noninvasive home telemonitoring for patients with heart failure at high risk of recurrent admission and death: the Trans-European Network-Home-Care Management System (TEN-HMS) study // Journal of the American College of Cardiology. 2005. Vol. 45, N 10. P. 1654–1664. doi: 10.1016/j.jacc.2005.01.050

12. Пыжлаков Д.С. Сила и возможности. Концепция динамического SWOT-анализа // Российское предпринимательство. 2008. № 6-1. С. 133–138. EDN: JKONSZ

13. Lewington S., Clarke R., Qizilbash N., et al. Age-specific relevance of usual blood pressure to vascular mortality // The Lancet. 2003. Vol. 361, N 9366. P. 1391–1392. doi: 10.1016/S0140-6736(03)13061-9

14. Slimko M.L., Mensah G.A. The role of diets, food, and nutrients in the prevention and control of hypertension and prehypertension // Clinical Cardiology. 2010. Vol. 4, N 28. P. 665–674. doi: 10.1016/j.ccl.2010.08.001

15. Чазова И.Е., Ощепкова Е.В. Итоги реализации Федеральной целевой программы по профилактике и лечению артериальной гипертензии в России в 2002–2012 гг. // Вестник Российской академии медицинских наук. 2013. Т. 68, № 2. С. 4–11. EDN: PWEBNT doi: 10.15690/vramn.v68i2.542

16. McKoy J., Fitzner K., Margetts M., et al. Are telehealth technologies for hypertension care and self-management effective or simply risky and costly? // Popul Health Manag. 2015. Vol. 18, N 3. P. 192–202. doi: 10.1089/pop.2014.0073

17. Fitzner K., Moss G. Telehealth-an effective delivery method for diabetes self-management education? // Popul Health Manag. 2013. Vol. 16, N 3. P. 169–177. doi: 10.1089/pop.2012.0054

18. Flodgren G., Rachas A., Farmer A.J., Inzitari M., Shepperd S. Interactive telemedicine: effects on professional practice and health care outcomes // Cochrane Database Syst Rev. 2015. Vol. 2015, N 9. P. CD002098. doi: 10.1002/14651858.CD002098.pub2

19. Piette J.D., Marinec N., Gallegos-Cabriales E.C., et al. Spanish-speaking patients' engagement in interactive voice response (IVR) support calls for chronic disease self-management: data from three countries // Telemed Telecare. 2013. Vol. 19, N 2. P. 89–94. doi: 10.1177/1357633x13476234

20. Kaambwa B., Bryan S., Jowett S., et al. Telemonitoring and self-management in the control of hypertension (TASMINH2): a cost-effectiveness analysis // Eur J Prev Cardiol. 2014. Vol. 21, N 12. P. 1517–1530. doi: 10.1177/2047487313501886

21. Maciejewski M.L., Bosworth H.B., Olsen M.K., et al. Do the benefits of participation in a hypertension self-management trial persist after patients resume usual care? // Circ Cardiovasc Qual Outcomes. 2014. Vol. 7, N 2. P. 269–275. doi: 10.1161/CIRCOUTCOMES.113.000309

22. Шадеркин И.А., Шадеркина В.А. Удаленный мониторинг здоровья: мотивация пациентов // Журнал телемедицины и электронного здравоохранения. 2020. Т. 6, № 3. С. 37–43. EDN: PBHHKX doi: 10.29188/2542-2413-2020-6-3-37-43

23. Wise J. Activity trackers, even with cash incentives, do not improve health // BMJ. 2016. Vol. 355. P. i5392. doi: 10.1136/bmj.i5392

24. Jones M.I., Greenfield S.M., Bray E.P., et al. Patients' experiences of self-monitoring blood pressure and self-titration of medication: the TASMINH2 trial qualitative study // Br J Gen Pract. 2012. Vol. 65, N 595. P. e135–e142. doi: 10.3399/bjgp12X625201

25. Shaw R.J., Kaufman M.A., Bosworth H.B., et al. Organizational factors associated with readiness to implement and translate a primary care-based telemedicine behavioral program to improve blood pressure control: the HTN-IMPROVE study // Implement Sci. 2013. Vol. 8. doi: 10.1186/1748-5908-8-106

26. AbuDagga A., Resnick H.E., Alwan M. Impact of Blood Pressure Telemonitoring on Hypertension Outcomes: A Literature Review // Telemedicine and eHealth. 2010. Vol. 16, N 7. P. 830–838. doi: 10.1089/tmj.2010.0015

27. Chandak A., Joshi A. Self-management of hypertension using technology enabled interventions in primary care

settings // Technology and Health Care. 2015. Vol. 23, N 2. P. 119–128. doi: 10.3233/thc-140886

28. McKinstry B., Hanley J., Lewis S. Telemonitoring in the management of high blood pressure // Curr Pharm Des. 2015. Vol. 21, N 6. P. 823–827. doi: 10.2174/1381612820666141024154232

29. Sivakumaran D., Earle K. Telemonitoring: use in the management of hypertension // Vascular Health and Risk Management. 2014. Vol. 10. P. 217–224. doi: 10.2147/vhrm.s36749

30. Концевая А.В., Комков Д.С., Бойцов С.А. Моделирование как метод оценки экономической целесообразности дистанционного мониторинга артериального давления на региональном уровне // Здравоохранение Российской Федерации. 2017. Т. 61, № 1. С. 10–16. EDN: YFOKVP doi: 10.18821/0044-197X-2017-61-1-10-16

31. Ho K. Health-e-Apps: A project to encourage effective use of mobile health applications // BCMJ. 2013. Vol. 55, N 10. P. 458–460.

32. Исаева А.В., Краснова К.С., Тагоев Ю.Ш., и др. Изучение цифровой готовности пациентов с хронической сердечной недостаточностью // Профилактическая медицина. 2023. Т. 26, № 3. С. 101–108. EDN: DGKTAU doi: 10.17116/profmed202326031101

33. Байсангуров А.Ф., Арутюнова Н.Н., Байсангурова М.М. Анализ факторов демотивации, снижающих эффективность работы сотрудников // Digital Diagnostics. 2021. Т. 2, № 2S. С. 10–11. EDN: VGEGJF doi: 10.17816/DD83175

34. Davoudi A., Lee N.S., Chivers C., et al. Patient interaction phenotypes with an automated remote hypertension monitoring program and their association with blood pressure control: observational study // J Med Internet Res. 2020. Vol. 22, N 12. P. e22493. doi: 10.2196/22493

35. Vandenberk T., Lanssens D., Storms V., et al. Relationship Between Adherence to Remote Monitoring and Patient Characteristics: observational study in women with pregnancy-induced hypertension // JMIR MhealthUhealth. 2019. Vol. 7, N 8. P. e12574. doi: 10.2196/12574

36. Case M.A., Burwick H.A., Volpp K.G., et al. Accuracy of smartphone applications and wearable devices for tracking physical activity data // JAMA. 2015. Vol. 313, N 6. P. 625–626. doi: 10.1001/jama.2014.17841

37. O'Kane M.J. Efficacy of self-monitoring of blood glucose in patients with newly diagnosed type 2 diabetes (ESMON study): randomised controlled trial // BMJ. 2008. Vol. 336, N 7654. P. 1174–1180. doi: 10.1136/bmj.39534.571644.BE

38. Walker R.C., Tong A., Howard K., et al. Patient expectations and experiences of remote monitoring for chronic diseases: Systematic review and thematic synthesis of qualitative studies // Int J Med Inform. 2019. Vol. 124. P. 78–85. doi: 10.1016/j.ijmedinf.2019.01.013

39. Мареев Ю.В., Зинченко А.О., Мясников Р.П., и др. Применение телеметрии у больных с хронической сердечной недостаточностью // Кардиология. 2019. Т. 59, № S9. С. 4–15. EDN: ISWIAY doi: 10.18087/cardio.n530

40. Omboni S., Ferrari R. The role of telemedicine in hypertension management: focus on blood pressure telemonitoring // Curr Hypertens Rep. 2015. Vol. 17. doi: 10.1007/s11906-015-0535-3

41. Gazit T., Gutman M., Beatty A.L. Assessment of hypertension control among adults participating in a mobile technology blood pressure self-management program // JAMA Netw Open. 2021. Vol. 4, N 10. P. e2127008. doi: 10.1001/jamanetworkopen.2021.27008

42. Комков Д.С., Батурин Д.И., Куликов А.А., и др. Роль SMS-информирования в диспансерном наблюдении пациентов с артериальной гипертензией // Артериальная Гипертензия. 2015. Т. 21, № S1. С. 91. EDN: WEPXLT

43. Комков Д.С., Горячкин Е.А., Корсунский Д.В., и др. Клиническая эффективность различных моделей телемедицинских технологий у больных с артериальной гипертензией // Профилактическая медицина. 2020. Т. 23, № 4. С. 27–35. EDN: PMROKX doi: 10.17116/profmed20202304127

44. Melnyk S.D., Zullig L.L., McCant F., et al. Telemedicine cardiovascular risk reduction in veterans // Am Heart J. 2013. Vol. 165, N 4. P. 501–508. doi: 10.1016/j.ahj.2012.08.005

45. Калинина А.М., Горный Б.Э., Дубовой И.И., и др. Отношение врачей первичного звена к применению телемедицинских технологий при диспансерном наблюдении больных с хроническими заболеваниями (медико-социологическое исследование) // Профилактическая медицина. 2020. Т. 23, № 6. С. 8–13. EDN: TIADWK doi: 10.17116/profmed2020230628

46. Wang V., Smith V.A., Bosworth H.B., et al. Economic evaluation of telephone self-management interventions for blood pressure control // Am Heart J. 2012. Vol. 163, N 6. P. 980–986. doi: 10.1016/j.ahj.2012.03.016

47. Cuspidi C., Facchetti R., Dell'Oro R., et al. Office and out-of-office blood pressure changes over a quarter of century: findings from the PAMELA Study // Hypertension. 2020. Vol. 76, N 3. P. 759–765. doi: 10.1161/HYPERTENSIONAHA.120.15434

48. Mancia G., Facchetti R., Bombelli M., et al. Long-term risk of mortality associated with selective and combined elevation in office, home, and ambulatory blood pressure // Hypertension. 2006. Vol. 47, N 5. P. 846–853. doi: 10.1161/01.HYP.0000215363.69793.bb

49. Stergiou G.S., Salgami E.V., Tzamouranis D.G., Roussias L.G. Masked hypertension assessed by ambulatory blood pressure versus home blood pressure monitoring: is it the same phenomenon? // Am J Hypertens. 2005. Vol. 18, N 6. P. 772–778. doi: 10.1016/j.amjhyper.2005.01.003

50. Pickering T.G. Self-monitoring of blood pressure. In: Ambulatory Monitoring and Blood Pressure Variability (Part 1). London : Science Press, 1990.

51. Pickering T. Recommendations for the use of home (self) and ambulatory blood pressure monitoring. American Society of Hypertension Ad Hoc Panel // Am J Hypertens. 1996. Vol. 9, N 1. P. 1–11. doi: 10.1016/0895-7061(95)00341-x

52. Barochiner J., Posadas Martínez M.L., Martínez R. Reproducibility of masked uncontrolled hypertension detected through home blood pressure monitoring // J Clin Hypertens (Greenwich). 2019. Vol. 21, N 7. P. 877–883. doi: 10.1111/jch.13596

53. Myers M.G. Reporting bias in self-measurement of blood pressure // Blood Press Monit. 2001. № 6. P. 181–183.

54. Miao H., Liu Y., Tsai T.C., Schwartz J., Ji J.S. Association between blood lead level and uncontrolled hypertension in the US population (NHANES 1999-2016) // J Am Heart Assoc. 2020. Vol. 9, N 13. P. e015533. doi: 10.1161/JAHA.119.015533

55. Jackson S.L., Gillespie C., Shimbo D., Rakotz M., Wall H.K. Blood Pressure Cuff Sizes for Adults in the United States: National Health and Nutrition Examination Survey, 2015–2020 // Am J Hypertens. 2022. Vol. 35, N 11. P. 923–928. doi: 10.1093/ajh/hpac104

56. Cepeda M., Pham P., Shimbo D. Status of ambulatory blood pressure monitoring and home blood pressure monitoring for the diagnosis and management of hypertension in the US: an up-to-date review // Hypertens Res. 2023. Vol. 46. P. 620–629. doi: 10.1038/s41440-022-01137-2

57. Duan Y., Xie Z., Dong F., et al. Effectiveness of home blood pressure telemonitoring: a systematic review and meta-analysis of randomised controlled studies // Journal of Human Hypertension. 2017. Vol. 31. P. 427–437. doi: 10.1038/jhh.2016.99

58. Бубнова М.Г., Трибунцева Л.В., Остроушко Н.И., и др. Влияние дистанционного диспансерного наблюдения на течение артериальной гипертензии // Профилактическая медицина. 2018. Т. 21, № 5. С. 77–82. EDN: YPHTZJ doi: 10.17116/profmed20182105177

59. Schoenhagen P., Mehta N. Big data, smart computer systems, and doctor-patient relationship // European Heart Journal. 2017. Vol. 38, N 7. P. 508–510. doi: 10.1093/eurheartj/ehw217

60. Шарова Д.Е., Зинченко В.В., Ахмад Е.С., и др. К вопросу об этических аспектах внедрения систем искусственного интеллекта в здравоохранении // Digital Diagnostics. 2021. Т. 2, № 3. С. 356–368. EDN: TGZGZZ doi: 10.17816/DD77446

61. Kario K., Tomitani N., Kanegae H., et al. The further development of out-of-office BP monitoring: Japan's ImPACT Program Project's achievements, impact, and direction // J Clin Hypertens (Greenwich). 2019. Vol. 21, N 3. P. 344–349. doi: 10.1111/jch.13495

62. Стародубцева И.А., Шарапова Ю.А. Дистанционный мониторинг артериального давления как инструмент повышения качества диспансерного наблюдения пациентов с артериальной гипертензий // Архивъ внутренней медицины. 2021. Т. 11, № 4. С. 255–263. EDN: FTKKTE doi: 10.20514/2226-6704-2021-11-4-255-263

63. Карпов О.Э., Храмов А.Е. Информационные технологии, вычислительные системы и искусственный интеллект в медицине. Москва : ДПК Пресс, 2022.

64. Булдакова Т.И., Миков Д.А., Соколова А.В. Защита данных при дистанционном мониторинге состояния человека // Вестник МГТУ им. Н.Э. Баумана. Серия «Приборостроение». 2020. № 4. С. 42–57. EDN: QHBUUF doi: 10.18698/0236-3933-2020-4-42-57

65. Alessa T., Hawley M.S., Hock E.S., de Witte L. Smartphone apps to support self-management of hypertension: review and content analysis // JMIR MhealthUhealth. 2019. Vol. 7, N 5. P. e13645. doi: 10.2196/13645

66. Picone D.S., Deshpande R.A., Schultz M.G., et al. Nonvalidated home blood pressure devices dominate the online marketplace in Australia // Hypertension. 2020. Vol. 75, N 6. P. 1593–1599. doi: 10.1161/HYPERTENSIONAHA.120.14719

67. Jalali M.S., Russell B., Razak S., et al. EARS to cyber incidents in health care // J Am Med Inform Assoc. 2019. Vol. 26, N 1. P. 81–90. doi: 10.1093/jamia/ocy148

68. Владзимирский А.В. Систематический обзор применения мессенджеров «Whatsapp» и «Viber» в клинической медицине // Журнал телемедицины и электронного здравоохранения. 2017. № 1. С. 30–41. EDN: YPTUYR

AUTHORS' INFO

*** Anna N. Korobeynikova,** MD, Cand. Sci. (Medicine);
address: 93 Sovetskaya street, 610008, Kirov, Russia;
ORCID: 0000-0002-8934-7021;
eLibrary SPIN: 9728-9583;
e-mail: anna_best2004@mail.ru

Alexandra E. Demkina, MD, Cand. Sci (Medicine);
ORCID: 0000-0001-8004-9725;
eLibrary SPIN: 4657-5501;
e-mail: ademkina@bk.ru

Anatoliy N. Rogoza, Dr. Sci. (Biology), Professor;
ORCID: 0000-0002-4829-0954;
eLibrary SPIN: 9362-3496;
e-mail anrogoza@gmail.com

Anton V. Vladzymyrskyy, MD, Dr. Sci. (Medicine);
ORCID: 0000-0002-2990-7736;
eLibrary SPIN: 3602-7120;
e-mail: a.vladzimirskiy@npcmr.ru

ОБ АВТОРАХ

*** Коробейникова Анна Николаевна,** канд. мед. наук;
адрес: Россия, 610008, г. Киров, ул. Советская, 93;
ORCID: 0000-0002-8934-7021;
eLibrary SPIN: 9728-9583;
e-mail: anna_best2004@mail.ru

Демкина Александра Евгеньевна, канд. мед. наук;
ORCID: 0000-0001-8004-9725;
eLibrary SPIN: 4657-5501;
e-mail: ademkina@bk.ru

Рогоза Анатолий Николаевич, д-р биол. наук, профессор;
ORCID: 0000-0002-4829-0954;
eLibrary SPIN: 9362-3496;
e-mail anrogoza@gmail.com

Владзимирский Антон Вячеславович, д-р мед. наук;
ORCID: 0000-0002-2990-7736;
eLibrary SPIN: 3602-7120;
e-mail: a.vladzimirskiy@npcmr.ru

* Corresponding author / Автор, ответственный за переписку