

Polupanov A.G.<sup>1,2</sup>, Arykova A.T.<sup>3</sup>, Tolebaeva A.A.<sup>3</sup>,  
Borubaev M.Ch.<sup>4</sup>, Altymysheva A.T.<sup>5</sup>, Dzhishambaev E.D.<sup>1</sup>,  
Dzhumagulova A. S.<sup>2</sup>, Abilova S. S.<sup>1,2</sup>, Sooronbayev T. M.<sup>1</sup>

<sup>1</sup> Mirrakhimov National Center of Cardiology and Therapy, Bishkek, Kyrgyz Republic

<sup>2</sup> Akhunbaev Kyrgyz State Medical Academy, Bishkek, Kyrgyz Republic

<sup>3</sup> Yeltsin Kyrgyz-Russian Slavic University, Bishkek, Kyrgyz Republic

<sup>4</sup> Center of Electronic Healthcare, Ministry of Health of the Kyrgyz Republic, Bishkek, Kyrgyz Republic

<sup>5</sup> World Health Organization Country Office in Kyrgyzstan, Bishkek, Kyrgyz Republic

## POSSIBILITIES OF USING THE NATIONAL ELECTRONIC DATA SYETSTEM IN ASSESSING THE CONTROL OF ARTERIAL HYPERTENSION AT THE PRIMARY HEALTH CARE LEVEL IN THE KYRGYZ REPUBLIC USING THE EXAMPLE OF A SINGLE FAMILY MEDICINE CENTER

<i>Aim</i>	To determine the capabilities of the National Electronic System for collecting quantitative data necessary to assess the quality of management and effectiveness of arterial hypertension (AH) control at the primary health care (PHC) level and to develop indicators and possibilities of their use for a standardized report on the quality of AH management and control at the PHC level in the Kyrgyz Republic.
<i>Material and methods</i>	Data from electronic outpatient records were processed for all registered patients of a pilot family medicine center (FMC) that was selected randomly. The registered patient group consisted of 91,226 people older than 18 years, including 37,740 men and 53,486 women. The data obtained during contact with a patient was entered by the family doctor into the electronic outpatient record and automatically forwarded to the center that collected and aggregated the data. To monitor AH control, 11 indicators were developed and evaluated. The indicators were divided into 3 groups: indicators for identifying AH, indicators for the quality of AH patient management, and indicators for the effectiveness of AH control.
<i>Results</i>	In total, 26,206 patients (7,933 men and 18,273 women) visited the FMC during a year, and blood pressure (BP) was measured in 71.4% of them. In 2022, 5,072 patients (5.6% of the registered group) visited the FMC for AH, including 1,539 men and 3,533 women (4.1 and 6.6% of the registered patient group, respectively; $p < 0.001$ ). The proportion of patients with AH who, according to the clinical protocol, had their BP measured 2 times a year or more, was 81.4% and was slightly higher for women than for men (82.3% and 79.1%, respectively; $p < 0.01$ ). 38.7% of AH patients received antihypertensive drugs. Lipid-lowering therapy was prescribed to 23.5% of AH patients. The proportion of AH patients taking acetylsalicylic acid was higher, 36.3% for the whole group, including 34.1% for men and 37.2% for women ( $p < 0.05$ ). The efficacy of AH treatment was 62.8%.
<i>Conclusion</i>	Any monitoring system has limitations for the amount of useful data that can be obtained ensuring their proper quality. Taking this into account, two major indicators are suggested to use for evaluating the effectiveness of AH control at the PHC level: 1) the number of AH patients who have achieved the BP goal; 2) the number of AH patients who visited a medical institution (health care facility) during a calendar year relative to the number of registered patients (AH detectability).
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<i>Corresponding author</i>	Arykova A.T. E-mail: arykova.aidana98@gmail.com

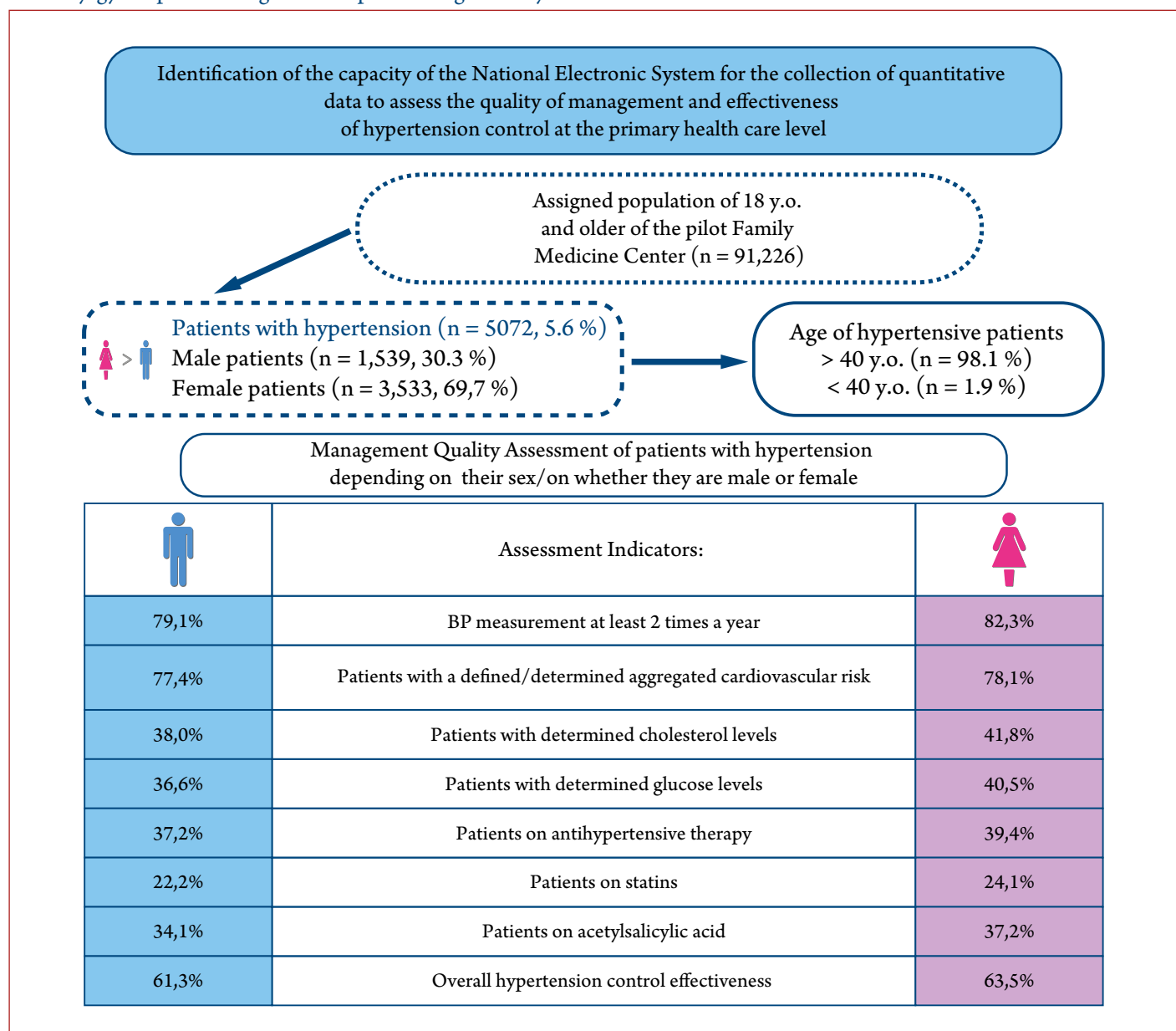
## Introduction

Noncommunicable diseases (NCDs) remain the leading cause of death worldwide. According to the World Health Organization (WHO), approximately 33.2 million people died from NCDs globally in 2019, an increase of 28% since 2000 [1]. At the same time, cardiovascular diseases (CVDs) represent the largest segment, accounting for 16% of all deaths internationally [2]. Populations in low- and middle-income countries are most at risk, accounting for approximately 80% of these deaths [3]. Preventing NCDs and achieving universal healthcare coverage by strengthening primary healthcare (PHC), as part of the integrated sustainable development goals, underlie the WHO European Region Programme of Work 2020–2025 [4].

NCDs are the most serious public health burden in the Kyrgyz Republic (KR): in 2021, NCDs accounted for more than 80% of all deaths, including 52.3% from CVDs [5], while the probability of premature death (between 30 and 70 years of age) from CVDs, diabetes mellitus, cancer, and chronic respiratory diseases was 28%, with a higher rate among male patients [6, 7]. In 2015, the Kyrgyz government spent 3.7 billion soms (approximately 3.7 billion rubles) on treating 4 major NCDs [8].

The burden of CVDs and other NCDs is due to the high prevalence of risk factors, both behavioral and biological, including hypertension. At the same time, hypertension holds a special position in the structure of CVDs, being the leading risk factor for death in cardiac patients [9–11]. It accounts for 62% of cerebrovascular disease cases and

**Central illustration.** Possibilities of Using the National Electronic Data Syetstem in Assessing the Control of Arterial Hypertension at The Primary Health Care Level in the Kyrgyz Republic Using the Example of a Single Family Medicine Center



49% of cases of coronary heart disease and chronic kidney disease, which makes a huge contribution to the overall morbidity structure and is the main cause of incapacitation of the population, including the working age population [12].

Despite significant progress made in recent years in the development of optimal approaches to the prevention and treatment of hypertension, this problem remains very topical/acute [13]. In particular, the prevalence of hypertension has increased by 40–50% in the Kyrgyz Republic in recent decades and has reached 44–46% according to the data of the INTEREPID and STEPS epidemiological studies [14, 15], while cardiovascular mortality (including due to hypertension) accounts for 51% of total mortality, according to the reports of the Center for eHealth Care under the Ministry of Health of the Kyrgyz Republic for 2019 [16]. This suggests an insufficient effectiveness of the previous programs for the health system strengthening [17–19] and confirms the relevance of actions taken to improve hypertension control at the PHC level.

Currently, the efficiency of hypertension control at the PHC level is assessed in the Kyrgyz Republic by the Compulsory Medical Insurance Fund through the indicators developed by the Ministry of Health of the Kyrgyz Republic, such as randomized audits of outpatient records, testing of medical staff, and a patient satisfaction survey questionnaire. These indicators allow assessing the quality of medical records and treatment of individual patients with hypertension in health care facilities, particularly in PHC [20], but do not provide a holistic/comprehensive view of the overall effectiveness of hypertension control in a district, region, or the country as a whole, i.e., at the subnational and national levels.

An alternative system for monitoring the effectiveness of hypertension control can be the National Electronic Database, which is administered in the Center for eHealth Care under the Ministry of Health of the Kyrgyz Republic. Established in 2012, the database covers the entire country. It includes information collected from PHC facilities on the basis of outpatient records – a clinical information form approved by the Ministry of Health of the Kyrgyz Republic [20], for the entire assigned population at the PHC level.

## Objective

The objective of the study was to determine the possibility of collecting quantitative data required to assess the quality of management and effectiveness of hypertension control on the basis of the clinical information form data, to develop indicators and assess the possibility of using them for a standardized report on the quality of management

and control of hypertension at the PHC level in the Kyrgyz Republic.

## Material and Methods

The study was conducted at the National Center of Cardiology and Therapy named after Academician M. Mirrakhimov and the Center for eHealth Care in collaboration with the WHO Regional Office for the Kyrgyz Republic. The study included processing of data from outpatient records, in their latest version approved by the Ministry of Health of the Kyrgyz Republic (outpatient clinical information form No. 039–5/u) [20] of all assigned patients of the pilot Family Medicine Center for 2022. Family Medicine Center No. 4 of Pervomaisky district of Bishkek was randomly selected as the pilot family medicine center. A total of 91,226 people over the age of 18 were assigned to/registered with Family Medicine Center No. 4, including 37,740 men and 53,486 women.

We used an electronic data collection system implemented in the Center for eHealth Care to analyze data from outpatient records. The data obtained during the contact with a patient (BP, presence of cardiovascular risk factors, laboratory data, medications) were entered by a family physician into the electronic clinical information form and automatically sent to the Center for eHealth Care, which collected and aggregated data from Family Medicine Center No. 4 of Pervomaisky district of Bishkek. This system allows keeping track of all individual parameters of patients entered in the outpatient records and affords the possibility of regular automatic data extraction for aggregated reporting [21].

We developed and evaluated 11 indicators to monitor hypertension control. The indicators were divided into 3 groups: indicators of hypertension detection, indicators of hypertensive patient management quality, and indicators of hypertension control effectiveness (Table 1).

The above indicators were analyzed using the SPSS Syntax program adapted for eHealth. Differences between male and female patients were evaluated using a Z-test. We used logistic regression with calculation of odds ratio (OR) and 95% confidence interval (CI) to assess the prognostic significance of sex-related factor in adherence to visiting PHC facilities. The threshold for statistical significance was  $p < 0.05$ .

## Results

### *Demographic characteristics of patients with hypertension who visited the pilot PHC facility in 2022*

Characteristics of the patients with hypertension, who sought care in the pilot family medicine center in Bishkek for 2022, are presented in Table 2. During the calendar year, 5,072 patients with hypertension (30.3% male and 69.7% female) visited the Family Medicine Center. The age distribution was similar in the male and female patients, with

**Table 1. Study indicators and calculation formulas**

Detection rate	Screening for hypertension	Percentage of population aged 18 and older who had their BP measured during a visit to the PHC facility
	Patients with confirmed diagnosis	Percentage of hypertensive patients in the assigned population under regular outpatient monitoring
Quality indicators	Regular BP measurement	Percentage of patients with two documented BP measurements
	Cholesterol measurement	Percentage of hypertensive patients with total cholesterol documented
	Glucose testing	Percentage of hypertensive patients with glucose levels determined
	Cardiovascular risk assessment using the WHO nomogram	Percentage of hypertensive patients with total CVD risk assessed
	CVD risk $\geq 30\%$ according to the WHO nomogram	Percentage of hypertensive patients with total CVD risk $\geq 30\%$
	Prescribed antihypertensive therapy	Proportion of hypertensive patients prescribed antihypertensive therapy
	Prescribed statins	Proportion of hypertensive patients using statins
	Prescribed ASA	Proportion of hypertensive patients taking ASA
	Achievement of target BP $< 140/90$ mm Hg	Proportion of hypertensive patients with BP $< 140/90$ mm Hg at the last measurement

PHC, primary health care; ASA – acetylsalicylic acid.

the most frequent visits to PHC facilities made by persons over 60 years of age (72.3% of cases).

Among all patients with hypertension, diabetes mellitus was diagnosed in 18.3% (17% male and 18.9% female patients), various forms of coronary artery disease (CAD) in 46.4% (46.9% male and 46.2% female), and cerebrovascular disease in 0.6% (1% male and 0.4% female). Very high cardiovascular risk ( $\geq 30\%$ ) was observed in 13.8% of the patients with hypertension, including 17% of the male patients and 12.5% of the female patients (Table 3).

**Table 2. Demographic characteristics of patients with hypertension who visited Family Medicine Center No. 4 in Bishkek in 2022**

Parameter		%	n	N	Assigned population aged 18 and older
Sex	Male	30.3	1539	5072	91 226
	Female	69.7	3533		
Age, years	18–39	1.9	96	5072	
	40–49	7.0	353		
	50–59	18.9	958		
	60–69	34.2	1733		
	70+	38.1	1931		
Male	< 40 years	3.4	53	1539	37 740
	> 40 years	96.6	1486		
Female	< 40 years	1.2	44	3533	53 486
	> 40 years	98.8	3489		

N, total number of patients with a symptom/indicator assessed; n, number of patients who have the symptom.

### Indicators of hypertension detection at the PHC level (process indicator)

A total of 26,206 patients (7,933 male and 18,273 female) visited the pilot PHC facility during the year for various reasons (not only hypertension). BP was measured in 71.4% of the hypertension group, including 66.8% of the male patients and 73.4% of the female patients ( $p < 0.001$ ). In 2022, 5,072 patients visited the Family Medicine Center for hypertension, representing 5.6% of the assigned population, including 1,539 men (4.1% of the assigned population) and 3,533 women (6.6% of the assigned population;  $p < 0.001$ ).

Notably, the male patients with hypertension were significantly less likely to visit primary care facilities than the female patients. At the same time, the statistical analysis suggests that male sex/being a male is a factor of low adherence to seeking medical care among patients with hypertension (OR 0.60; 95% CI 0.57–0.64;  $p < 0.001$ ) and may be one of the reasons for higher mortality in working-age men.

### Indicators of quality of care for patients with hypertension at the PHC level (process indicator)

The percentage of the hypertensive patients, whose BP was measured at least twice or more in the previous calendar year,

**Table 3. Documented diseases and cardiovascular risk of patients with hypertension in the study cohort**

Diseases and cardiovascular risk	Total			Male			Female		
	%	n	N	%	n	N	%	n	N
Diabetes mellitus	18.3	929	5072	17.0	261	1539	18.9	668	3533
CAD	46.4	2353	5072	46.9	722	1539	46.2	1631	3533
Cerebrovascular diseases	0.6	30	5072	1.0	15	1539	0.4	15	3533
Cardiovascular risk $> 30\%$	13.8	546	3951	17.0	202	1191	12.5	344	2760

N, total number of patients with a symptom assessed; n, number of patients who have the symptom/indicator.



**Table 4.** Indicators of detection, quality of management and control of hypertension in the pilot PHC facility in the Kyrgyz Republic

Parameter	Total			Male			Female			P
	%	n	N	%	n	N	%	n	N	
Indicators of detection										
Patients with measured BP among visitors	71.4	18 707	26 206	66.8	530 2	7933	73.4	13 405	18 273	0.001
Patients with hypertension under outpatient monitoring	5.6	5072	91 226	4.1	1539	37 740	6.6	3533	53 486	0.0001
Quality indicators										
Patients with hypertension who had BP measured twice or more a year	81.4	4127	5072	79.1	1218	1539	82.3	2909	3533	0.012
Patients with hypertension with plasma total cholesterol documented	40.7	2063	5072	38.0	585	1539	41.8	1478	3533	0.050
Patients with hypertension with plasma glucose determined	39.3	1993	5072	36.6	563	1539	40.5	1430	3533	0.012
Percentage of hypertensive patients with total cardiovascular risk assessed	77.9	3951	5072	77.4	1191	1539	78.1	2760	3533	0.584
Patients with hypertension receiving antihypertensive treatment	38.7	1965	5072	37.2	573	1539	39.4	1392	3533	0.139
Patients with hypertension using statins	23.5	1192	5072	22.2	342	1539	24.1	850	3533	0.142
Patients with hypertension taking ASA	36.3	1840	5072	34.1	525	1539	37.2	1315	3533	0.050
Control indicators										
Patients with hypertension who archived target BP during antihypertensive therapy	67.7	1320	1965	68.6	391	573	66.7	929	1392	0.414
Overall effectiveness of hypertension control	62.8	3186	5072	61.3	943	1539	63.5	2243	3533	0.136

N, total number of patients with a symptom/indicator assessed; n, number of patients who have the symptom/indicator. PHC, primary health care.

was 81.4% and was slightly higher in the female patients than in the male patients (82.3% and 79.1%, respectively,  $p < 0.012$ ), which can be considered a good result for this indicator.

The percentage of the hypertensive patients, who had their cumulative cardiovascular risk assessed, was 77.9%, 77.4% for males and 78.1% for females ( $p = 0.584$ ).

In Family Medicine Center No.4, the percentage of the hypertensive patients, whose blood glucose was measured in the current calendar year, was 39.3% overall, 36.6% among males and 40.5% among females ( $p < 0.012$ ). The percentage of the hypertensive patients, whose total cholesterol was measured and reported in the outpatient clinical information forms in the current calendar year, was 40.7% (including 38% of the male patients and 41.8% of the female patients;  $p < 0.050$ ). The percentage of the hypertensive patients receiving antihypertensive therapy was 38.7%, including 37.2% of the male patients and 39.4% of the female patients ( $p = 0.139$ ).

The percentage of the hypertensive patients, who received statin therapy, was 23.5%, including 22.2% of the male patients and 24.1% of the female patients ( $p = 0.142$ ).

The percentage of the hypertensive patients receiving acetylsalicylic acid was higher and amounted to 36.3% in the whole group, including 34.1% in the male patients and 37.2% in the female patients ( $p < 0.050$ ).

#### Indicators of effectiveness of hypertension control at the PHC level (quality indicator)

In Family Medicine Center No.4, the percentage of the patients with hypertension, who achieved target BP levels

during antihypertensive therapy, was 67.7%, including 68.6% in the male patients and 66.7% in the female patients ( $p = 0.414$ ).

The overall effectiveness of hypertension control, specifically the percentage of the patients with hypertension with BP  $< 140/90$  mm Hg relative to all patients with hypertension, who visited the health facilities during the analyzed/analysis period, was 62.8% at the PHC level, and the treatment effectiveness was comparable in both male and female patients (61.3% and 63.5%, respectively;  $p = 0.136$ ).

#### Discussion

Monitoring is a key element of any successful program and includes continuous collection, management, and use of information to assess a particular activity or a program to be carried out as planned. A monitoring system starts by identifying the indicators needed to address the most important monitoring issues. It is very important that indicators are standardized and can be used for comparisons over time, and between facilities and populations.

Collecting and analyzing data to calculate indicators require time and resources. Any system will have limitations on the amount of useful data that can be obtained in a timely manner with adequate quality. A few carefully selected indicators that can be easily collected and integrated into an existing national health management information system is preferable to numerous indicators that

may be inconsistent, low-quality, or not used [22]. The CVD monitoring system, as currently conceived, should be implemented at three levels: the facility level, the subnational level (district, city, region), and the national level (country).

At the medical facility level, patient monitoring involves monitoring of changes of health status and management of an individual patient using an individual outpatient record of a cardiovascular patient. Depending on local circumstances, elements of the outpatient record of the cardiovascular patient can be used to monitor the quality of services, such as assessing the quality of hypertension treatment, patient adherence to medicine therapy, and achievement of target BP levels among all patients assigned to a given health facility.

Aggregated data from health facilities can help evaluate the results of a program or intervention at the subnational level. Moreover, subnational assessments can also evaluate certain aspects of the quality of care provided, such as medicine therapy coverage or the percentage of individuals who achieve target BP levels.

Population-level monitoring involves conducting both the national and subnational surveys. Population-level monitoring typically involves disease prevalence studies, such as STEPS [15], and related parameters, such as the percentage of the population receiving medicine therapy or the percentage of the population with adequate BP control, and so on. Such indicators can reflect all interventions and programs in place and can constitute a general indicator of intervention efficacy and to monitor changes.

A study on the use of the National electronic database for NCD monitoring has already been conducted in the Kyrgyz Republic [21]. The authors of the study note that the information obtained from the database of the Center for eHealth Care allowed identifying different patient groups and analysis of some indicators of process and NCD control [21]. Patient-level analysis was possible with the database, and its structured nature allowed for easy data extraction and variable generation. However, the system has several shortcomings, including inaccurate data entry, discrepancies in coding methods, and a lack of clear indicators to track services provided by PHC facilities and monitor their key performance indicators [21].

In 2021, an expert group of the National Center of Cardiology and Therapy named after Academician M. Mirrakhimov, the Center for eHealth Care, the Ministry of Health of the Kyrgyz Republic in collaboration with the WHO experts improved the electronic clinical information form: new parameters for analysis were added, intervals for indicators were introduced to reduce input errors, and mandatory fields for filling in were set. Additionally, they provided training to specialists working

with the monitoring system. As its strongest point, the National Electronic Database of PHC in the Kyrgyz Republic has nationally standardized content, which allows for comparable analysis of data from different facilities. Additionally, the unique patient identification code makes it possible to track an individual patient across multiple facilities.

To measure the effectiveness of hypertension control at the subnational level, we suggest using the hypertension detection rate, which is the percentage of people with hypertension who visited a health center during the current calendar year in proportion to the number of people in the assigned population (expressed in percentages). In Family Medicine Center No. 4, this rate was 5.6%. However, according to the INTEREPID and STEPS studies, the prevalence of hypertension at the national level is 44–46% [14, 15].

Thus, on average, only one in ten patients with hypertension is registered with PHC facilities, and hypertension is detected in health care facilities due to patients' seeking medical care rather than active screening of the assigned population. This undoubtedly affects the quality of prevention and treatment. It should be noted that the young patients with hypertension (about 2% in the facility under review) represent a group of patients without severe complications (angina pectoris, myocardial infarction, stroke), and the effectiveness of preventive measures is the greatest in this group. The percentage of the male patients of the Family Medicine Center was 30.3%, i.e., less than a third of all outpatients with hypertension.

The 2019 clinical protocol «Hypertension» [23] recommends that patients with hypertension should have their BP measured at least twice a year or more often if necessary. This indicator was 81.4% in the pilot Family Medicine Center, which can be considered a very good result.

The assessment of the general cardiovascular risk, in addition to BP, is a key indicator for decision-making on the commencement and intensity of antihypertensive therapy, and the prescription of additional therapy (statins, antithrombotic drugs), which is why physicians must register it in medical records (including the clinical information form). General cardiovascular risk was assessed at the PHC facility, and the results were registered in the clinical information form for 77.9% of the hypertensive patients, which can be considered a satisfactory result.

The quality of patient management in terms of ordering laboratory tests such as cholesterol and serum glucose were highly unsatisfactory. For example, total cholesterol and glucose levels were checked during the calendar year only in 40.7% and 39.3% of the patients with hypertension, respectively.

The low coverage of patients with medicine therapy was observed in the Family Medicine Center – only 38.7% of the patients received regular antihypertensive therapy. At the same time, the majority of the patients had the indications for its use. Similarly, the frequency of prescription of lipid-lowering therapy (23.5%) and antithrombotic therapy (36.3%) was low, although more than 50% of the patients had the indications for them.

According to the epidemiological studies conducted in the Kyrgyz Republic after 2010 [14, 15], the efficacy of antihypertensive therapy was 20–25%, and the overall efficacy of treatment of hypertensive patients was 9.1%. Moreover, the effectiveness of treatment of hypertension rarely exceeds 50% even in the European Union and the United States [24]. In Family Medicine Center No. 4, the effectiveness of hypertension control in the patients receiving antihypertensive therapy was 67.7%, and the overall treatment efficacy was 62.8%. It seems that such treatment efficacy is definitely overestimated, which requires stricter control over the quality and objectivity of filling in medical records by doctors of the Family Medicine Center.

## Conclusions

1. The detection rate of hypertension is extremely low (5.6% of the assigned population). The prevalence of hypertension in the country is 44–45% [10, 11]. This means that only slightly more than 10% of the patients/population with hypertension are registered, while the remaining patients/population are not examined or treated by health professionals.
2. The male patients with hypertension visit primary health care facilities less frequently than the female patients. At

the same time, the statistical analysis suggests that male sex/being a male is a factor of low adherence/likelihood of/to seeking medical care among the patients with hypertension and may be one of the reasons for higher mortality in working-age men.

3. There is insufficient quality of hypertensive patient management/patient tracking at the primary health care level, which is assessed by indicators such as the frequency of measurements of blood glucose and total cholesterol, and prescribed medicine therapy.
4. The effectiveness indicator of hypertension control, estimated by the number of hypertensive patients, who achieved target blood pressure levels relative to all patients with hypertension who visited a health care facility in the current calendar year (quality indicator), is about 60% and seems to be somewhat overestimated, which requires increased control of the quality of filling in the electronic clinical information form.

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