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The comparison of the selected key performance indicators between the primary health care centers in Belgrade

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SUMMARY
Introduction/Objective The purpose of the article is to analyze the efficiency of primary health care centers (PHCCs) in the city of Belgrade, using key performance indicators (KPIs).
The main objective is to present the potentiality of the application of KPIs for improving primary health care services, in order to increase efficiency.
Methods As a tool for measuring the efficiency of PHCCs in Belgrade, this article defines a set of KPIs. Based on defined KPIs, a comparative analysis of PHCCs' efficiency is conducted.
Results According to the values of the overall average efficiency rating according to all observed KPIs, the best-rated, i.e., the most efficient PHCC in Belgrade is Rakovica, and the lowest, i.e., the least efficient is the PHCC Zvezdara. It was noticed that the PHCCs Novi Beograd and Vračar are among the least efficient.
Conclusion The efficiency of primary health care can be measured by applying KPIs, and the observed results can be used as a basis for increasing the efficiency of health care services in the PHCCs in Belgrade. Based on the results, recommendations to PHCCs to improve the efficiency of health care services are: appropriate distribution of patients to selected physicians, measuring patient satisfaction, improving internal processes by engaging professional managers, increasing the ability and opportunities to apply new technologies and new knowledge, increasing the accuracy of the data used for detailed analyzes, motivate physicians to raise the level of awareness of their patients about the importance of preventive examinations.
Keywords: efficiency; health care; primary level; key performance indicators; city of Belgrade

INTRODUCTION

The health care system presents one of the most important systems in every country. This system encompasses health care infrastructure that ensures a range of programs and services and provides health protection to individuals, families, and communities [1]. They are responsible for providing patient care and health care services to societies, families, and individuals [2].

The health care system in the Republic of Serbia is one of the largest systems in the Republic of Serbia, total of 115.670 health care workers in the health care system, where 105.955 have tenure and 9.715 have non-tenure contacts [3].

According to the Euro Health Consumer Index, the health care system of the Republic of Serbia is ranked 18th out of 35 countries in Europe and has the best health care system in the region [4].

According to the Ministry of Health of the Republic of Serbia, in 2020 Belgrade had 16 primary health care centers (PHCCs) [3], with 6.750 health care workers with tenure and 621 with non-tenure contracts. The total number of employees of PHCCs is 7.371 [3]. As of June 2020, there are a total of 1.661.695 persons covered by mandatory health insurance on the territory covered by the PHCs in Belgrade [5]. Departments in PHCCs are: general medicine, preschool children pediatrics, school children pediatrics, gynecology, pediatric dentistry, dentistry [6].

Today, patients expect free choice and preferential treatment in the health care system [7]. Providing these possibilities to all patients with health care insurance in PHCCs has led to an increase in the costs of health care services. Consequently, in recent years, significant attention has been dedicated to achieving, maintaining, measuring and improving the quality of health care services in primary health care institutions [8]. The World Health Organization point out that the quality health care services should be: effective, safe, people-centered, timely, equitable, integrated and efficient [9].

In order to achieve the institution's aims and desired results, it is necessary to manage their performances [10]. Therefore, for performance measurement is essential to define a certain number of performance indicators. Also, measurement methods and referent values for the comparison of measured values of performance indicators have to be determined. Performances

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identification comprises the identification of performance indicators, measurement methods, benchmarks for comparison of results, as well as, the source and reliability of the data used [11].

According to UNI 11097, the basic characteristics of indicators are: representativeness, simplicity and ease of interpretation, capability to indicate time trends, sensitivity to changes within or outside the institution, easy data collecting and processing, ease and quick to update [12].

Key Performance Indicators (KPIs) "focus on the aspects of institution's performances that are the most critical for the current and future success of the institution" [13]. The application of KPIs in a health care institution aim to more realistically and accurately evaluate the results and determine future strategies.

Performance represents the extent to which set objectives are accomplished [14]. The concept of performance in health care services represents an instrument for bringing quality, efficiency and efficacy together [14].

Authors Smith et al. suggest that health care KPIs are a tool designed to improve health care and health system performance [15]. They can facilitate the achievement of health care policy by expressing a clear commitment to achieving specified results in a defined time period and facilitating the monitoring of progress towards achieving broader goals and objectives.

Many health care organizations have been developing KPIs for monitoring, measuring, and managing the performance of their health care systems to ensure effectiveness, efficiency, equity, and quality. Health care systems are expected to achieve and manage results in line with their established objectives and quality standards [16].

This article presents efficiency analyzes of health care services in PHCCs in Belgrade and a comparative analysis of their efficiency. The focus is on the efficiency analysis of health care services at PHCCs for three specializations: general medicine, preschool children pediatrics and gynecology. A set of defined KPIs are used to analyze the efficiency of health care services in PHCCs and their comparative analysis, according to the gathered data. The article has chosen five KPIs, based on available data, which are the most important for evaluating and measuring the efficiency of health care services in PHCCs. The criteria for choosing KPIs are [17]: feasibility (as the existence of necessary conditions and infrastructure for the KPIs measurement), relevance (as KPIs relevance for the main processes of PHCCs) and importance (importance of KPIs for the primary health care efficiency). Also, these KPIs were chosen, in order to conduct the most qualitative comparative analysis between PHCCs in Belgrade. The main objective of this article is to present the potentiality of KPIs application for improving health care services to increase the efficiency of PHCCs in Belgrade.

METHODS

The study was conducted at the end of 2021, based on official data published on the website of the Republic Fund of Health Insurance (RFHI). Data used in this study are from the first quarter of 2020, for the period from January 1st, 2020, to March 31st, 2020 [18]. In time that empirical research was done in Belgrade was 16 PHCCs. Five KPIs are defined as a tool for analyzing the efficiency are: Physician's work efficiency, Average number of first visits of registered users, Average number of issued diagnostic and therapeutic procedures, Percentage of children with three preventive examinations in the first year of life, and Percentage of obese children with status nourished. The research did not involve any human participants and the whole research was done in accordance with the ethical standards and principles of the RFHI institution.

Physician's work efficiency (PWE). The formula for the calculation of the KPI PWE is presented in (1).

$$PWE = \frac{NVP}{MAXP} \times 100 \ [\%] \qquad (1)$$

Where NVP is the number of visits per physician [1], and MAXP is the maximum number of patients per physician [1].

MAXP is calculated as a quotient of the physician's total number of working minutes and the average duration of examination per patient. The aimed value of this indicator is approximately 100%.

The average number of first visits of registered patients (ANF). The formula for the calculation of the KPI ANF is presented in (2).

$$ANF = \frac{TFV}{NR} \ [1] \qquad (2)$$

Where TFV is the total number of first visits to all physicians in the PHCC [1], and NR is the number of registered patients with health insurance in the PHCC [1].

The aimed value of this indicator is approximately 1 [1].

The average number of issued diagnostic and therapeutic procedures (ADTP). The physician in the PHCC can issue a diagnostic and therapeutic procedure for the primary, secondary, or tertiary level of health care. The formula for the calculation of the KPI ADTP is presented in (3).

$$ADTP = \frac{TDTP}{TNP} \ [1] \qquad (3)$$

Where TDTP is the total number of issued diagnostic and therapeutic procedures in the PHCC [1], and TNP is the total number of physicians in the PHCC [1].

The aimed value of this indicator is to be as high as possible.

Percentage of children with three preventive examinations in the first year of life (PCT). This indicator applies to physicians who specialized in pediatricians. The formula for the calculation of the KPI PCT is presented in (4).

$$PCT = \frac{NBC}{CTPE} \times 100 \ [\%] \qquad (4)$$

Where NBC is the number of born children in a period of one calendar year [1] and CTPE is the number of children with a minimum of three preventive examinations done in the first year of life in the observed calendar year [1].

The aimed value of this indicator is approximately 100%.

Percentage of obese children with status nourished (POC). This indicator applies to physicians who specialized in pediatricians. The formula for the calculation of the KPI POC is presented in (5).

$$POC = \frac{NCSN}{NCE66} \times 100 \ [\%] \qquad (5)$$

Where NCSN is the number of children with status nourished in the PHCC [1], and NCE66 is the number of children with diagnosis code E66 (general obesity in children) in the PHCC [1].

The aimed value of this indicator is approximately 100%.

KPIs presented in this article aim to improve the quality of health care. KPI PWE - Physician's work efficiency shows the level of occupancy of the physicians and the effectiveness of their work. This KPI allows quantification and maximization of the number of patients that will be examined by physicians [19, 20, 21]. KPI ANF - the average number of first visits of registered patients shows the increase or decrease of the number of new patients examined for the first time, in the observed health care center. If the value is high or increasing, the health care center receives higher popularity among new patients, as well as higher capacity occupancy [22, 23]. KPI ADTP - the average number of issued diagnostic and therapeutic procedures shows the possible work overload or lack of work of physicians in the PHCCs. However, the more issued diagnostic and therapeutic procedures, the higher the level of competency of the health care center [24]. Measuring KPI PCT - the percentage of children with three preventive examinations in the first year of life and KPI POC - the percentage of obese children with status nourished indicates the number of children treated in the observed health care center, with an aim of preventive effect on the occurrence of children's illness and further health problems in the phases of growth and development. Also, these KPIs show the level of awareness of health care center of current children's health problems and the importance of monitoring their health, since recent studies show that the children's obesity epidemic is still in progress [25, 26].

The efficiency of health care services in PHCCs is presented in [%] and [1], depending on the KPIs (Table 1), while for the comparative analysis, values for observed KPIs have been converted in the point, using the 5-point Likert scale (Table 2).

RESULTS

Table 1 shows calculated values of KPIs defined in the previous chapter, according to the type of specialization of physicians (for general medicine, preschool children pediatrics and gynecology) in PHCCs in Belgrade. The first two defined KPIs (PWE and ANF) are applied to physicians of all three specializations. The third defined KPI (ADTP) is applied to physicians specialized in gynecology. The fourth and fifth KPIs (PCT and POC), are applied to physicians specialized in pediatrics.

Minimum and maximum values for PHCCs per observed KPIs are marked grey in Table 1. As shown in Table 1 the values of individual KPIs for some PHCCs exceed 100%. The reason is that citizens who live in Belgrade have the opportunity to choose a physician.

Based on the data shown in Table 1, i.e., obtained values for observed and defined KPIs, a comparative analysis of the efficiency of health care services in PHCCs in Belgrade is done for each KPI per each PHCC, as shown in Table 2. The values for different KPIs are not presented in the same units, and their values are in various value ranges. Therefore, values for every observed KPIs have been converted to the point using the 5-point Likert scale.

DISCUSSION

Based on data shown in Tables 1 and 2, the efficiency analysis of PHCCs was done. According to the values of KPI PWE, the analyzed efficiency of physicians in general medicine in PHCCs in Belgrade shows that PHCC Barajevo has the highest efficiency with only seven physicians in general medicine. The lowest efficiency has PHCC Zvezdara, with 52 physicians in general medicine. According to obtained data, the average efficiency of all PHCCs in Belgrade for KPI PWE for physicians in general medicine is 2.9.

According to obtained data for gynecologists, the PHCC with the highest value of KPI PWE, i.e. efficiency, is PHCC Stari Grad, while the lowest efficiency is PHCC Lazarevac. PHCC Stari Grad has three physicians, while in PHCC Lazarevac there is four physicians. PHCC Barajevo, as the most efficient in the previous analysis, by this indicator is among the PHCCs with the lowest efficiency. The average efficiency of all PHCCs in Belgrade for KPI PWE for gynecologist is 3.2.

Observing values for KPI PWE for the efficiency of pediatricians in PHCCs in Belgrade show that the least efficient is the PHCC Stari Grad, while the most efficient is PHCC Sopot. According to obtained data, the average efficiency of all PHCCs in Belgrade for KPI PWE for pediatricians is 2.8. The research done in 2022 has shown that the optimizing, professional, technological and economic environment will affect the growth of pediatric health care services efficiency [27].

The average efficiency of each PHCC is determined based on values KPI PWE according to the work efficiency of all observed physician's specializations (Table 2, column 5). Based on observed data, the conclusion is that the most efficient are PHCCs Palilula and Rakovica, while the least efficient are PHCCs Vračar and Zvezdara.

According to the observed data of KPI ANF, the lowest average number of first visits to physicians in general medicine, i.e. the lowest efficiency has PHCC Vračar, while the highest efficiency has PHCC Lazarevac. According to observed data, the average efficiency of all PHCCs for KPI ANF for the efficiency of physicians in general medicine 2.8.

Regular preventive gynecological examinations are of inestimable importance for the timely diagnosis of various diseases and sexually transmitted diseases and infections.

Table 1. The efficiency of health care services in primary health care centers (PHCCs) in Belgrade by application of key performance indicators

PHCCs	General medicine		Gynecology			Pediatrics			
	PWE [%]	ANF [1]	PWE [%]	ANF [1]	ADTP [1]	PWE [%]	ANF [1]	PCT [%]	POC [%]
PHCC- Lazarevac (with maternity ward)	82.31	1.73	69.25	0.30	255	127.28	2.31	64.16	0.00
PHCC– Barajevo	115.07	1.64	117.86	0.48	397	130.76	2.41	82.93	13.33
PHCC– Palilula	81.12	1.25	139.68	0.30	206	141.17	1.96	56.65	0.69
PHCC– Čukarica	82.18	1.16	135.93	0.37	483	114.94	1.85	72.42	0.73
PHCC– Grocka	91.72	1.25	136.51	0.50	384	109.04	1.70	64.74	6.57
PHCC– Mladenovac	101.24	1.42	121.24	0.32	529	103.87	1.56	51.21	1.37
PHCC– Novi Beograd	71.50	0.94	132.16	0.42	277	96.34	1.30	64.82	2.42
PHCC– Obrenovac	89.74	1.16	117.07	0.28	297	103.25	1.57	74.96	0.88
PHCC– Rakovica	81.24	1.08	153.13	0.48	577	121.40	1.81	70.59	43.73
PHCC- Savski Venac	95.05	1.01	161.41	0.28	426	110.94	1.28	50.68	3.70
PHCC– Sopot	88.05	1.14	91.74	0.43	448	142.52	3.02	78.91	22.22
PHCC– Stari Grad	83.39	0.90	176.31	0.37	384	89.25	1.23	65.56	1.71
PHCC– Voždovac	74.60	1.13	119.68	0.42	276	124.59	1.92	73.14	34.54
PHCC– Vračar	66.03	0.75	135.85	0.41	199	96.89	1.55	64.24	33.78
PHCC– Zemun	80.55	1.05	148.09	0.40	386	117.24	1.45	41.79	1.91
PHCC- Zvezdara	63.67	1.03	124.78	0.36	484	93.48	1.40	54.55	15.84

PWE – physician's work efficacy; ANF – average number of first visits of registered patients; ADTP – average number of issued diagnostic and therapeutic procedures; PCT – percentage of children with three preventive examinations in the first year of life; POC – percentage of obese children with status nourished

Table 2. Comparative analysis of efficiency of health care services in primary health care centers (PHCCs)in Belgrade by application of key performance indicators

PHCCs	PWE				ANF				ADTP	PCT	POC	Total average
	General medicine	Gynecology	Pediatrics	Average	General medicine	Gynecology	Pediatrics	Average	Gynecology	Pediatrics	Pediatrics	
PHCC– Lazarevac (with maternity ward)	3	1	4	2.67	5	1	5	3.67	2	2	1	2.67
PHCC– Barajevo	5	2	4	3.67	5	5	5	5	3	4	2	3.89
PHCC– Palilula	3	5	5	4	3	1	4	2.67	2	1	1	2.78
PHCC– Čukarica	3	3	3	3	3	2	4	3	4	3	1	2.89
PHCC– Grocka	4	4	2	3.33	3	5	3	3.67	3	2	1	3
PHCC– Mladenovac	5	3	2	3.33	4	2	2	2.67	5	1	1	2.78
PHCC– Novi Beograd	2	3	1	2	2	4	1	2.33	2	2	1	2
PHCC– Obrenovac	3	2	2	2.33	3	1	2	2	2	3	1	2.11
PHCC– Rakovica	3	5	4	4	2	5	4	3.67	5	3	5	4
PHCC- Savski Venac	4	5	2	3.67	2	2	1	1.67	4	1	1	2.44
PHCC– Sopot	3	1	5	3	3	4	5	4	4	3	3	3.4
PHCC– Stari Grad	3	5	1	3	1	2	1	1.33	3	2	1	2.11
PHCC– Voždovac	2	2	4	2.67	3	4	4	3.67	2	3	4	3.11
PHCC– Vračar	1	3	1	1.67	1	4	2	2.33	1	2	4	2
PHCC– Zemun	2	4	3	3	2	3	2	2.33	3	1	1	2.33
PHCC– Zvezdara	1	3	1	1.67	2	2	1	1.67	4	1	2	1.89
Mean value	**2.9**	**3.2**	**2.8**	**2.94**	**2.8**	**2.9**	**2.9**	**2.86**	**3.1**	**2.1**	**1.9**	**2.71**

PWE – physician's work efficacy; ANF – average number of first visits of registered patients; ADTP – average number of issued diagnostic and therapeutic procedures; PCT – percentage of children with three preventive examinations in the first year of life; POC – percentage of obese children with status nourished

Data from the health care survey of the population of Serbia show that preventive examinations for early detection of these diseases (Papanikolau test) are efficient 57.1%. Of all performed preventive examinations, 72.5% are done in Belgrade, while among the inhabitants of Šumadija and Western Serbia, it is 48.9% [28].

Based on the analyzes conducted in this study and based on the observed values of KPI ANF, it can be concluded that gynecology is the most visited in PHCC Grocka, i.e., this PHCC is the most efficient by this indicator. PHCCs Obrenovac and Savski Venac have the lowest efficiency. Based on observed data, the average efficiency of all PHCCs for KPI ANF for gynecologist is 2.9.

The average number of first visits to the pediatricians is higher than the average number of first visits to the physicians of other specializations. Based on observed data and performed an analysis of values of KPI ANF, it can be concluded that in the analyzed period, the highest number of

visits to pediatricians, i.e., the highest efficiency has PHCC Sopot, while the lowest efficiency has PHCC Stari Grad. According to observed data, the average efficiency of all PHCCs for KPI ANF for pediatricians is 2.9.

For every PHCC is calculated average values based on KPI ANF, based on the work efficiency of all observed specializations (Table 2, column 9). According to that indicator, the highest efficiency has PHCC Barajevo, while the lowest has PHCC Stari Grad.

Efficiency is analyzed based on the observed values of KPI ADTP for gynecologists for all PHCCs in Belgrade. PHCC Rakovica has the highest number of issued diagnostic and therapeutic procedures, i.e., it is the most efficient, while PHCC Vračar has the lowest efficiency. According to observed data, the average efficiency of all PHCCs for KPI ADTP for gynecologists is 3.1.

PHCCs' efficiency is further analyzed by the percentage of children with three preventive examinations in the first year of life – KPI PCT. Preventive examinations, during the first year of life, are of significant importance. Position of the spine and hips, vaccines, weight and others, indicate the development of the child in its first year of life. Observed data show that the values of this KPI did not exceed 83% in any PHCC. In preventive health care examinations of children up to one year of age, the most efficient is PHCC Barajevo, while the least efficient is PHCC Zemun. According to observed data, the average efficiency of all PHCCs for KPI PCT for pediatricians is 2.1.

In the last three decades, obesity in children has been on the rise, which has numerous health consequences [29]. Data from population health research of the Republic of Serbia conducted in the year 2013 show that 28.2% of children and adolescents aged from 7 to 14 years were overweight and obese, of which 14.5% of children were overweight and 13.7% were obese [30]. The same research shows that during the last 13 years, the prevalence of obesity has increased from 4.4% to 13.7%, and of overweight from 8.2% to 14.5%) [29]. Another research shows that obesity is also associated with flat feet. Children with flat feet had a significantly higher body mass index (BMI) than children without flat feet [30].

The indicator KPI POC was used in the analysis of pediatricians work efficiency. Based on the observed data, it can be concluded that the highest enrollment status of obesity, i.e., the highest efficiency has PHCC Rakovica, while the lowest efficiency has PHCC Lazarevac, with 0%.

According to observed data, the average efficiency of all PHCCs for KPI POC for pediatricians is 1.9.

CONCLUSION

Previously analysis presents that it is recommend to do the overall average efficiency rating of all PHCCs in Belgrade by observing all five defined KPIs. Based on values of the total average efficiency for all observed KPIs, PHCC Rakovica is the most efficient PHCC in Belgrade, while the least efficient is PHCC Zvezdara. PHCCs Novi Beograd and Vračar are among the least efficient. Even, PHCC Rakovica has half fewer employees than other PHCCs, the percentage of selected physicians differs only by 5%. All observed KPIs present that the average efficiency of all PHCCs in Belgrade is 2.71. Since the observed scale is from one (minimum) to five (maximum), it can be concluded that the efficiency level of PHCCs in the capital of the Republic of Serbia is not at a satisfactory level.

Based on all previously shown data and analyses done in this article, the conclusion is that PHCCs in Belgrade have to improve and increase health care efficiency. The recommendations for improvement are:

– Appropriate distribution of patients to the selected physicians. Patients of health care services in PHCCs could choose their physicians. Managers of PHCCs could better organize the appropriate distribution of patients to the selected physicians;

– Improvement of internal processes by engaging professional managers, applying modern knowledge and innovative technologies to improve treatments approaches;

– Increase of data accuracy and data analysis continuation used for efficiency of health care services. By continuing analysis of the data, PHCCs could improve their efficiency;

– Physicians' motivation to raise patients' awareness of the importance of preventive examinations. Increasing the population's awareness of the importance of preventive examinations can improve the efficiency of PHCCs and the population's health.

By applying defined KPIs, presented efficiency analyses can be used for all health care institutions in the Republic of Serbia.

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Поређење одабраних кључних индикатора перформанси примарне здравствене заштите у домовима здравља у Београду

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САЖЕТАК

Увод/Циљ Сврха рада је упоредна анализа ефикасности примарне здравствене заштите у домовима здравља на територији града Београда применом кључних индикатора перформанси.

Циљ рада је да се прикаже могућност унапређења здравствених услуга и повећања њихове ефикасности применом кључних индикатора перформанси.

Методе Као алат за мерење ефикасности примарне здравствене заштите у домовима здравља на територији града Београда у раду је дефинисан скуп кључних индикатора перформанси. Затим, на основу вредности дефинисаних помоћу њих, извршена је упоредна анализа ефикасности посматраних домова здравља.

Резултати На основу добијене укупне просечне оцене ефикасности по свим посматраним кључним индикаторима перформанси, најбоље оцењени, односно најефикаснији Дом здравља на територији града Београда је „Раковица", док је најлошије оцењен, односно најмање ефикасан Дом здра-
вља „Звездара". Закључено је да су домови здравља „Нови Београд" и „Врачар" међу најмање ефикасним.

Закључак Ефикасност примарне здравствене заштите се може мерити применом кључних индикатора перформанси, а добијени резултати се могу користити као основа за повећање ефикасности пружања услуга здравствене заштите домова здравља града Београда. На основу добијених резултата, препоруке домовима здравља за унапређење ефикасности здравствених услуга су равномерна расподела пацијената према одабраним лекарима, мерење задовољства пацијената, унапређење интерних процеса ангажовањем професионалних менаџера, повећање могућности и прилика за примену нових технологија и нових знања, повећање тачности података који се користе за детаљне анализе, мотивисаност лекара да унапређују ниво свести код својих болесника о значају превентивних прегледа.

Кључне речи: ефикасност; здравство; примарни ниво; кључни индикатори перформанси; Београд