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IMPACT OF THE COVID-19 PANDEMIC ON THE PERFORMANCE AND COSTS OF HOSPITAL HEALTH CARE IN SERBIA

Uticaj pandemije kovida 19 na učinak i troškove bolničke zdravstvene zaštite u Srbiji

Abstract

Since its appearance at the end of 2019, the disease of the COVID-19 virus has grown from the local level into a global pandemic that has not bypassed the Republic of Serbia. The COVID-19 pandemic has affected the health system, the economy and the general condition of the population. Depending on the available hospital and staff capacities, each of the countries affected by the COVID-19 pandemic has established measures to struggle and treat citizens affected by the pandemic. In the newly created conditions, state-owned health care institutions and the Republic of Serbia focused their capacities on treatment and rehabilitation of COVID-19 patients, which had an impact on the management, organization of work and efficiency of health care institutions as well as additional costs for the overall health care system in the period from March 2020 to January 2022. This study shows the effects of the pandemic on the performance and costs of state-owned health facilities with a special focus on acute inpatient facilities in the Republic of Serbia. Medical analysis consists of: differences in the total number of patients, outpatients, changes in the number of visits in the private sector, the value of the case-mix index, the number of operations in acute hospitals, day hospital procedures, and consumption of reserve antibiotics. The financial analysis consists of: allocations for health in the budget of the Republic of Serbia, investments in public health, additional allocations due to the COVID-19 pandemic, analysis of the budget of the Health Insurance Fund (HIF), expenditures on salaries, drugs and medical supplies, cost per day, and average cost per patient. The result of the COVID-19 pandemic is a decline in elective operations and the number of outpatient visits and, on the other hand, an increase in spending in the health sector, as a result of significant growth in investment in tertiary institutions and in new hospitals, wages and overall current spending.

Keywords: COVID-19, hospital care, non-COVID patients, performance, costs, Serbia

Sažetak

Od svog pojavljivanja krajem 2019. godine, bolest izazvana virusom kovid 19 je sa lokalnog nivoa prerasla u globalnu pandemiju koja nije zaobišla ni Republiku Srbiju. Pandemija kovida 19 uticala je na zdravstveni sistem, privredu i opšte stanje stanovništva. U zavisnosti od raspoloživih bolničkih kapaciteta i kapaciteta osoblja, svaka od zemalja pogođenih pandemijom kovida 19 uspostavila je mere za borbu i lečenje građana pogođenih pandemijom. U novonastalim uslovima, državne zdravstvene ustanove i Republika Srbija su svoje kapacitete usmerile na lečenje i rehabilitaciju obolelih od kovida 19, što je uticalo na upravljanje, organizaciju rada i efikasnost zdravstvenih ustanova, kao i na dodatne troškove za ukupan zdravstveni sistem u periodu od marta 2020. do januara 2022. godine. Ova studija pokazuje uticaje pandemije na rad i troškove zdravstvenih ustanova u državnom vlasništvu sa posebnim osvrtom na akutne stacionarne kapacitete ustanova u Republici Srbiji. Medicinsku analizu čine: razlike u ukupnom broju pacijenata, ambulantnih pacijenata, promene u broju poseta u privatnom sektoru, vrednosti *case-mix* indeksa, broj tretiranih hirurških kliničkih epizoda, broj procedura u dnevnoj bolnici i potrošnje rezervnih antibiotika. Finansijsku analizu čine: izdvajanja za zdravstvo u budžetu Republike Srbije, ulaganja u javno zdravstvo, dodatna izdvajanja zbog pandemije kovida 19, analiza budžeta Republičkog fonda za zdravstveno osiguranje (RFZO), rashodi po osnovu zarada, lekova i medicinskog materijala, cene po bolesničkom danu i prosečne cene po pacijentu. Posledica pandemije kovida 19 je pad elektivnih operacija i broja ambulantnih poseta, a sa druge strane povećanje potrošnje u zdravstvenom sektoru, kao rezultat značajnog rasta investicija u tercijarne ustanove i nove bolnice, plate i ukupnu tekuću potrošnju.

Ključne reči: kovid 19, bolnička nega, pacijenti koji nisu kovid, performanse, troškovi, Srbija

Introduction

From the appearance of the first case of COVID-19 in Serbia (March 6, 2020) until January 28, 2022, the total number of registered cases was 1,616,584, and 13,417 people died from this disease. The public health crisis reflected by these data posed two key challenges to the health system in Serbia: first, the ability of the public health system to identify, isolate and treat all COVID-19 cases and, second, the availability of health care capacities for non-COVID-19 health needs in the context of a general national crisis unseen since World War II. In response to these challenges of the COVID-19 pandemic crisis, all segments of the public health system came under immense pressure, putting in the spotlight its advantages and disadvantages. Stationary capacities, so-called state hospitals (founded by the Republic or the Autonomous Province) were under the greatest “blow” due to excessive and enormous needs for diagnosis, treatment and rehabilitation of patients with COVID-19. Therefore, it is necessary to analyze the impact and consequences that the pandemic crisis has had on hospital capacities in terms of crisis management, organization, efficiency and quality of health care provided, but also the consequent costs of this type of treatment. In our study, we will deal with the effects of the pandemic on certain aspects of work performance and costs of acute inpatient hospitals defined by the Healthcare Network Plan of health institutions of Serbia. The research objective of the paper is to identify and discuss the impact of the COVID-19 pandemic on the structure and accessibility of various health services in Serbian hospitals, and to shed light on a variance in work efficiency and costs of the hospitals in the COVID period compared to the pre-COVID period.

Data and methodology

Many recent studies all over the world focus their attention on the COVID-19 impact on general health care indicators [2], [6], [4], but also on performance indicators and costs of acute hospitals [1], [12]. General conclusion of these studies is that COVID-19 has put immense pressure on hospital capacities and deteriorated physical and human infrastructure for treatment of non-COVID patients. At

the same time, this imbalance between COVID and non-COVID health services has produced a negative impact on overall health outcomes and has increased the level of public health care costs, while deflecting a number of non-COVID patients toward private health care institutions.

Data from the e-invoice system of the Health Insurance Fund (HIF) for 2019, 2020 and the first quarter of 2021 were retrospectively analyzed, in relation to the model of payment by diagnosis related groups (DRG) for 57 acute inpatient hospitals defined by the Decree on the Healthcare Network Plan of health institutions of the Republic of Serbia. The analysis did not include the capacities of COVID hospitals (Batajnica, Novi Sad and Kruševac), nor military medical institutions and temporary hospitals.

Data from the matrix of cost centers of hospital institutions for 2019, 2020 and the first quarter of 2021, established on the basis of the Methodology of cost centers of healthcare institutions and the Rulebook on contracting health care of the HIF, were retrospectively analyzed.

For the statistical processing of data, the methodology of descriptive statistics was used.

Results and discussion

Despite the admission and treatment of a large number of COVID patients, the *total number of treated hospital cases* was on average 20,000 clinical episodes (diagnosis related groups - DRG) less in 2020 compared to 2019. We notice that the pandemic and the establishment of inpatient hospital capacities primarily for the purpose of treating COVID patients are in correlation with the decline in the total number of hospitalized episodes, in the peaks of pandemic waves during April, August and November 2020. The conversion of a number of hospital institutions into the so-called COVID hospitals has prevented hospital treatment of non-COVID patients and thus contributed to the reduction of the scope and content of health services in most of the hospital institutions we monitored (see Figure 1).

Simultaneously with the decrease in the total number of hospitalizations, there was a significant decrease in *outpatient visits to hospitals*. By comparing the total number of outpatient examinations in the first quarter of 2020

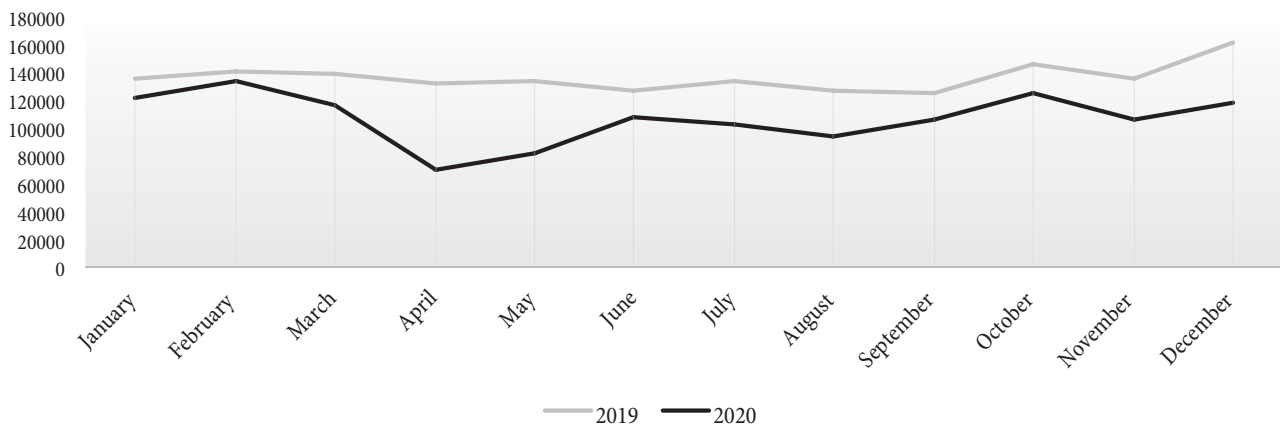
(before the beginning of the pandemic) and the second quarter of 2020, a reduction of these hospital services by as much as 57% was recorded (see Figure 2). Given the number of specialist-consultative examinations necessary for non-COVID patients, as well as the treatment and follow-up of patients with chronic diseases, the impact of the pandemic on reducing the availability of specialist examinations is evident. We can assume that this will result in the increase of existing and the formation of new waiting lists, as well as the provision of this type of health services within private health institutions that are paid “out of pocket”.

It is obvious that out-of-pocket health consumption in *private healthcare institutions* has grown since the beginning of the COVID-19 pandemic. People need prompt health

service, which could not be accessed in public hospitals during the infection peaks, especially when public hospitals are turned partly or fully into COVID hospitals. The three biggest private health services providers (Medigroup, Euromedik and BelMedic) recorded 14% growth in total turnover and number of employees in 2020 compared to 2019. Combined turnover increased from EUR 75 to 85 million and number of employees grew from 1,692 to 1,486 (206 new employees)¹. These numbers prove public-to-private spillover effect and show that the additional pressure is put on private hospitals infrastructure due to the COVID-19 pandemic, both in COVID and non-COVID health services.

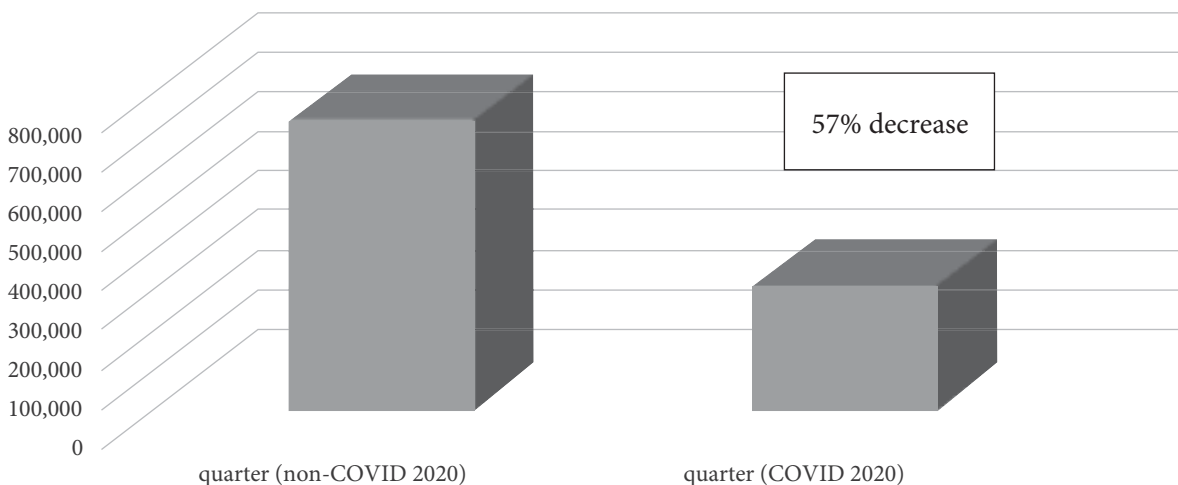
1 Serbian Business Registry, APR, accessed Jan 28th, 2022.

Figure 1: Total number of episodes of treatment - DRG in 2019 and 2020



Source: HIF – Health Insurance Fund/SSHP – Second Serbia Health Project

Figure 2: Comparative overview of the number of outpatient visits to hospitals in the first and second quarters of 2020



Source: HIF – Health Insurance Fund/SSHP – Second Serbia Health Project

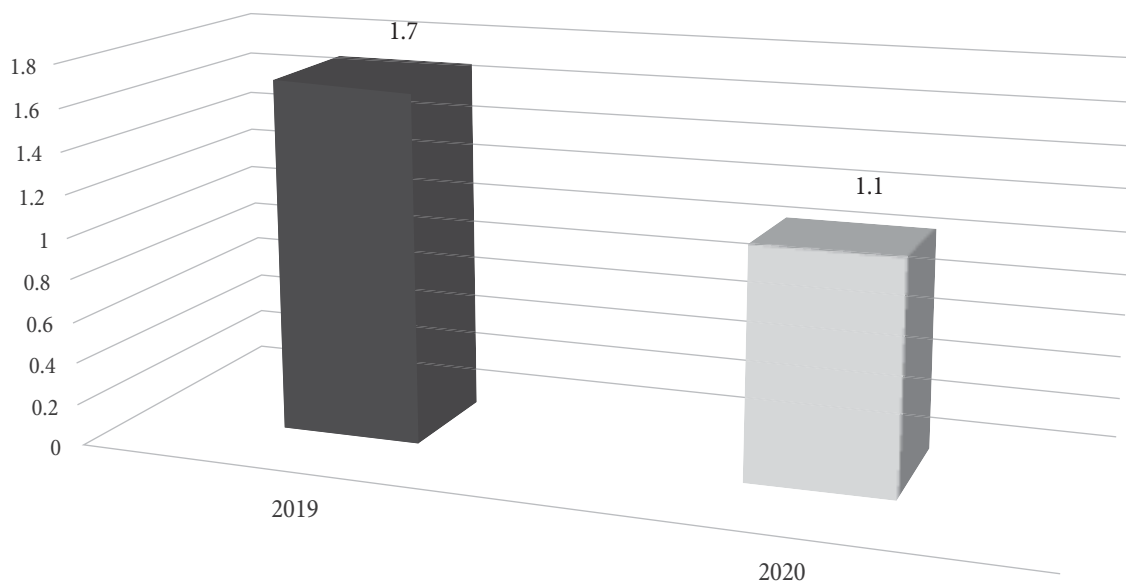
According to the Statistical Office of the Republic of Serbia, *mortality trends* in Serbia are discouraging in 2020 and 2021. Annual mortality figures in the period 2016-2019 were within the range from 100,834 to 103,722. In 2020, 114,954 people died, which was an increase of more than 13% from 2019 mortality level. In 2021, almost 136,000 people died, which is 18% growth compared to 2020. It means that Serbia has experienced 16% mortality compound annual growth rate in 2020-2021 compared to pre-COVID 2019. Since the first COVID-19 case appeared at the beginning of March 2019, about 13,000 people died from this disease, out of which 9,457 people died from COVID-19 in 2021. Lower accessibility of hospital healthcare for non-COVID patients, accompanied with the fear of those patients from infections if visiting hospitals, has had an indirect impact on deteriorated health status of those patients. For example, according to the SORS, the number of deaths from cardiac diseases in Serbia increased from 52,330 in 2019 to 55,305 in 2020 (6% growth).

In terms of the structure, regarding to complexity and cost of treated clinical episodes, *the value of the case-mix index* in the observed period was analyzed. The case-mix index represents the average value of the weighting factor of diagnostically related groups, which represents the numerical value of the cost or cost of treatment of a defined clinical episode. Also, the weighting coefficient,

and thus its average value for all treated clinical episodes in the observed period, can, as a rule, be considered as a measure of the clinical complexity of treatment. Higher values of the case-mix index are characteristic of tertiary, narrowly specialized hospitals or clinics that are capable of diagnosing and treating a larger volume of more complex clinical cases in terms of human resources and equipment, and vice versa, lower values reflect less treatment of complex clinical patients. A comparative analysis of the value of the case-mix index in 2019 and 2020 shows a significant decline from 1.7 to 1.1 (see Figure 3). In relation to the less common fluctuations of this value, we can assume that the temporary suspension of hospital admissions of non-COVID patients or their reduced volume of treatment in many hospitals during the pandemic crisis resulted in a reduction in the case-mix index. Also, having in mind the international clinical experience so far, that the majority of clinical cases related to COVID-19 do not belong to complex clinical episodes - DRG (treatment in intensive care units or the need for mechanical ventilatory support), it is clear that the weights of these groups could not affect the increase in the value of the case-mix index.

As a significant part of health services provided by acute inpatient institutions, we have comparatively analyzed the *number of treated surgical clinical episodes* in the period before and during the pandemic, which

Figure 3: Comparative presentation of the values of the case-mix index for 2019 and 2020



Source: HIF – Health Insurance Fund/SSHP – Second Serbia Health Project

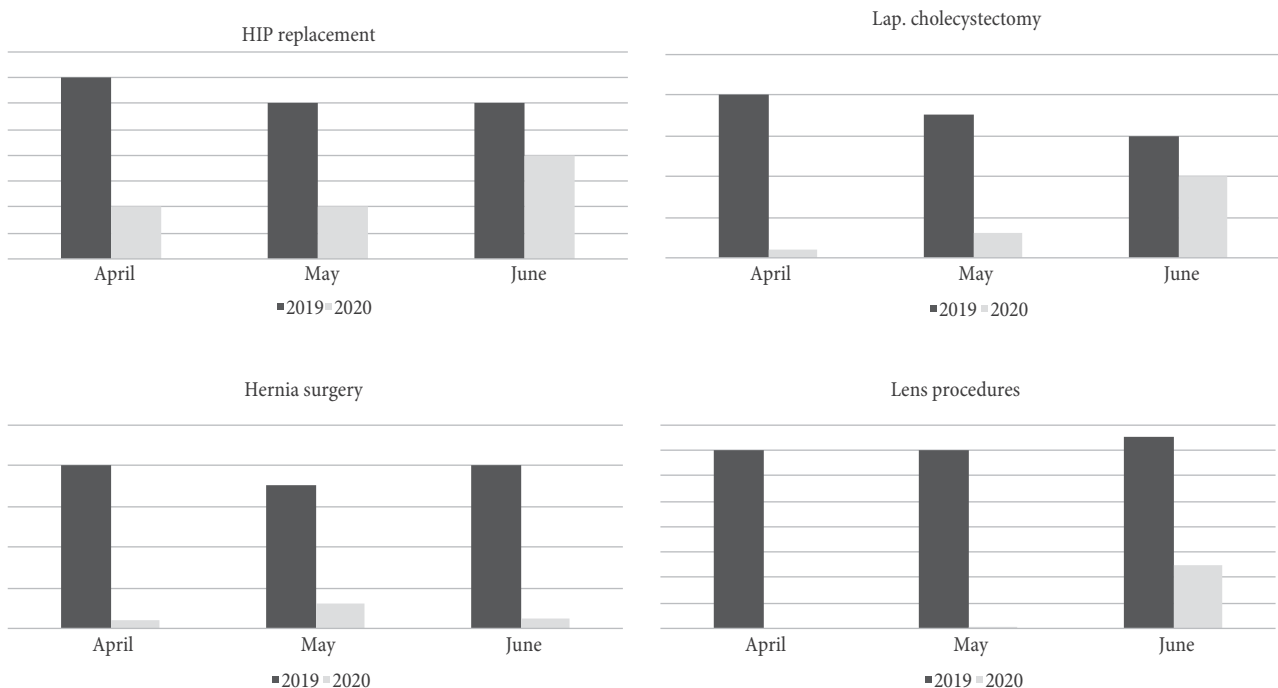
are the most common surgical operations in hospitals in Serbia. In addition, implantation of a hip endoprosthesis, implantation of a lens, laparoscopic gallbladder surgery and hernia surgery are, as a rule, pre-scheduled, so-called elective surgeries. Depending on the intensity of the COVID-19 pandemic, and thus the number of hospitalized cases, there is a drastic decline in the number of operations performed, from 30% of hip or gallbladder surgeries in June 2020, to almost negligible number of lens procedures and other surgeries at the peak of the pandemic waves during April 2020 (see Figure 4). Given the existing waiting lists for individual surgeries (e.g. the installation of a hip endoprosthesis at the Institute for Orthopedic and Surgical Diseases “Banjica”, more than 4,200 patients are waiting with an expected date of surgery for those at the bottom of the list at the end of 2025), an increase in the number of patients and waiting times is expected, but also the potential formation of new waiting lists for operations and procedures for which it has not been the case so far.

Within the existing model of payment of “acute hospitals” by the HIF, as an indicator of the performance and quality of work of the institution, the number of cases treated within the day hospital or “same day” (defined as the number of surgical or invasive non-surgical procedures)

is monitored. Comparing data on these indicators in 2019 and 2020, there is a decline in the number of day hospital services in tertiary health care institutions such as University Clinical Centers and Clinical Hospital Centers, Institutes for Oncology and Orthopedic Surgery ranging from 10 to 30% (see Figure 5). In addition to the previously described reduced volume of inpatients and outpatient examinations, there has been a decrease in the number of services provided in the day hospital during the pandemic, which in general indicates a reduction in the performance of hospitals.

The use of the so-called reserve antibiotics in the hospital treatment of patients was analyzed as another defined indicator of the performance and quality of work of the hospital institution. A comparative analysis of data for 2019 and 2020 showed a significant increase in the use of these antibiotics in most hospitals, with the exception of small hospitals, oncology institutes and gynecological and obstetric institutions (see Figure 6). Treatment of inpatients with “reserve antibiotics” certainly reflects an increased influx of more serious clinical cases during the COVID-19 pandemic, but further causes may be sought in the possible increase in hospital-acquired infections caused by resistant bacterial strains.

Figure 4: Comparative overview of performed elective surgical procedures in 2019 and 2020



Source: HIF – Health Insurance Fund/SSHP – Second Serbia Health Project

In parallel with the analysis of individual indicators of the scope and content of provided health services, and indicators of work performance and quality of work of acute inpatient hospitals, *the use of financial resources and their structure* in the observed period was analyzed.

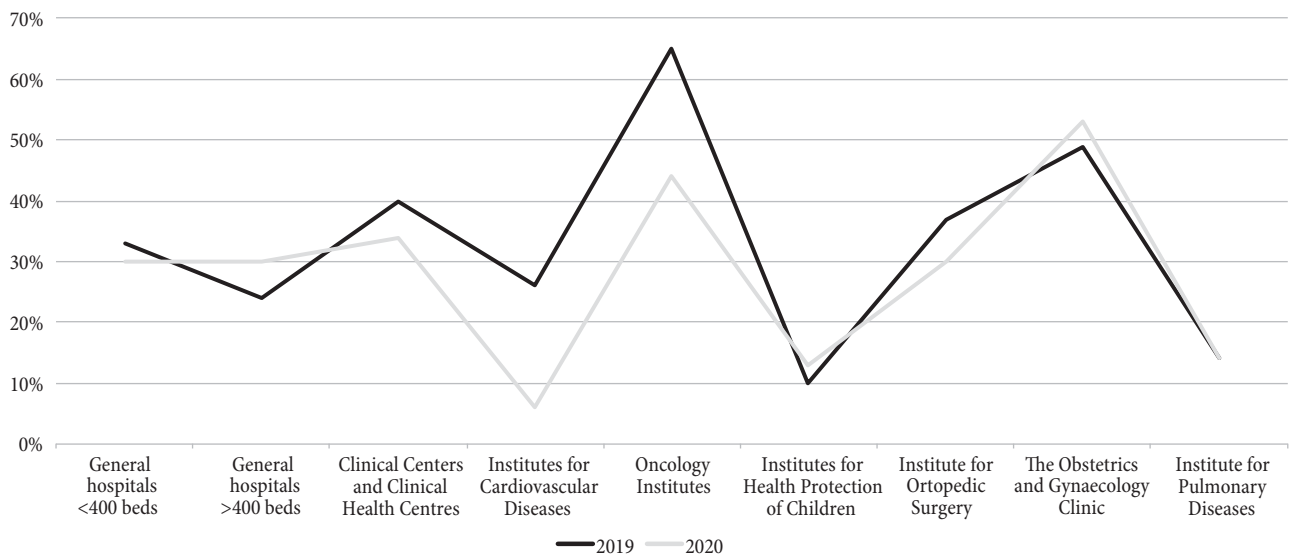
Within the total *budget expenditure*, the share of expenditures intended for health through the appropriation of the Ministry of Health has doubled in the period from 2019 (see Figure 7).

The mentioned increase of the budget for health in the budget can be explained by the increase of funds for certain program activities within the program budget

of the Ministry of Health. Thus, program activities, i.e. allocations for planned investments have been increased by more than four times. In 2020, the increase in budget funds for planned investments amounted to almost EUR 45 million, and in 2021 by a further EUR 124 million (see Figure 8).

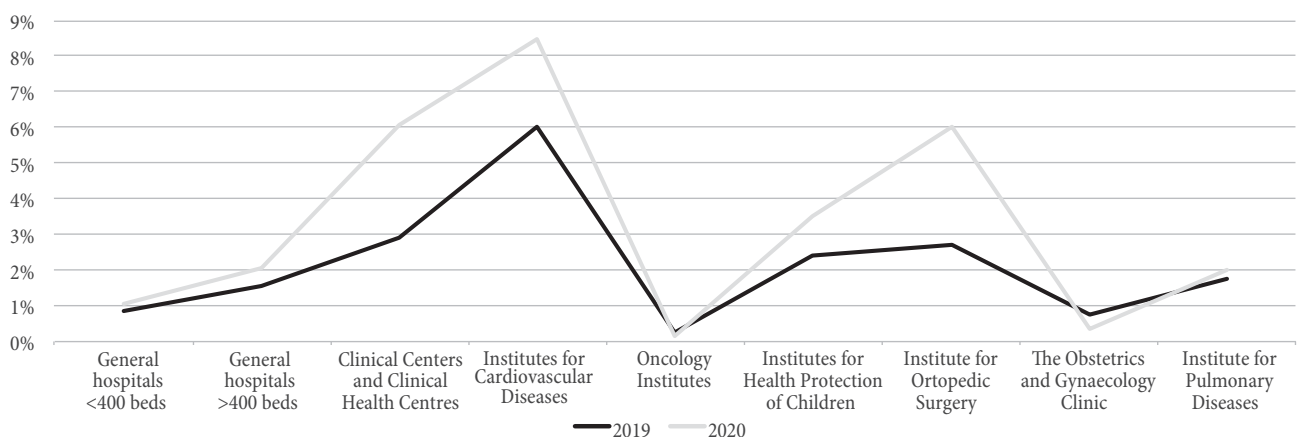
The reconstruction of the University Clinical Center of Serbia and other tertiary hospital institutions had the largest share in the allocations for planned investments, but the impact of the COVID-19 pandemic also caused expenditures for equipping the so-called COVID hospitals

Figure 5: Comparative overview of the number of cases treated within the day hospital for certain categories of hospital institutions in 2019 and 2020



Source: HIF – Health Insurance Fund/SSHP – Second Serbia Health Project

Figure 6: Comparative overview of the percentage of patients treated with so-called reserve antibiotics in 2019 and 2020



Note: Vancomycin, Tigecycline, Piperacillin, Tazabactam, Meropenem, Teicoplanin, Ganciclovir, Cilastatin, Amphotericin B, Colistimete sodium, Micafulgin sodium, Anidulafugin

Source: HIF – Health Insurance Fund/SSHP – Second Serbia Health Project

in 2020 and 2021 in the amount of more than EUR 40 million (see Table 1).

One of the most important reasons for the increase in health care allocations is the doubling of expenditures for the program of exercising rights from compulsory health insurance, which included a new program activity “Prevention and mitigation of the consequences caused by COVID-19 disease caused by SARS-CoV-2 virus” in the amount of EUR 76,990,956 (2020) and EUR 80,218,118

(2021) and has a significant share in the total planned expenditures for the health-related section of 26% in 2020 and 17.5% in 2021 (see Figure 9).

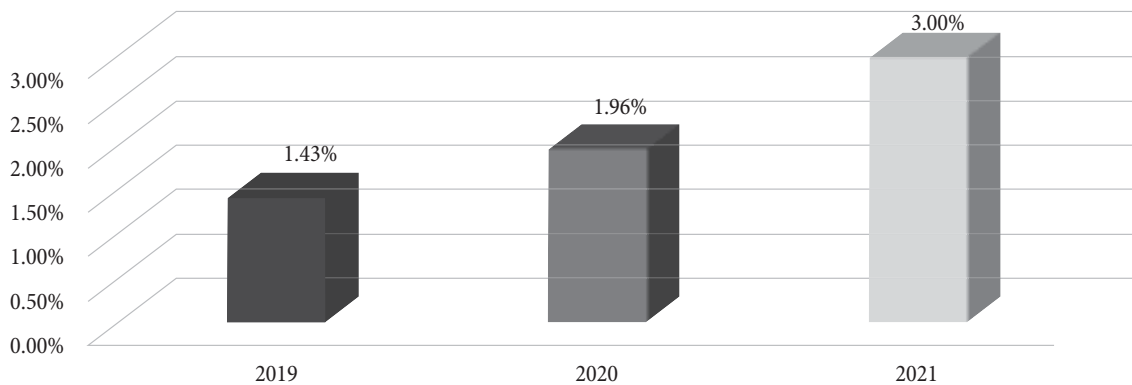
Based on the data from the financial plans of the HIF for 2019, 2020, and 2021, a significant increase in total funds is observed. Compared to the pre-pandemic 2019, in 2021 financial resources have increased by more than EUR 672 million or 28.8%. At the same time, the share of hospital financing (secondary and tertiary health care)

Table 1: The most significant infrastructure investments in the period 2019-2021

	2019	2020	2021
Reconstruction of the Clinical Center of Serbia, Belgrade	6,669,035 €	26,757,484 €	151,861,908 €
Reconstruction of the Clinical Center Kragujevac	0 €	305,853 €	841,312 €
Reconstruction of the Clinical Center Nis	3,486,371 €	3,980,492 €	641,105 €
Reconstruction of the Clinical Center of Vojvodina, Novi Sad	93,597 €	2,202,268 €	8,527,084 €
Construction and equipping of “COVID” hospital in Novi Sad	0 €	0 €	17,146,021 €
Equipping “COVID” hospitals	0 €	23,512,476 €	0 €
Total	10,249,003 €	56,758,573 €	179,017,429 €

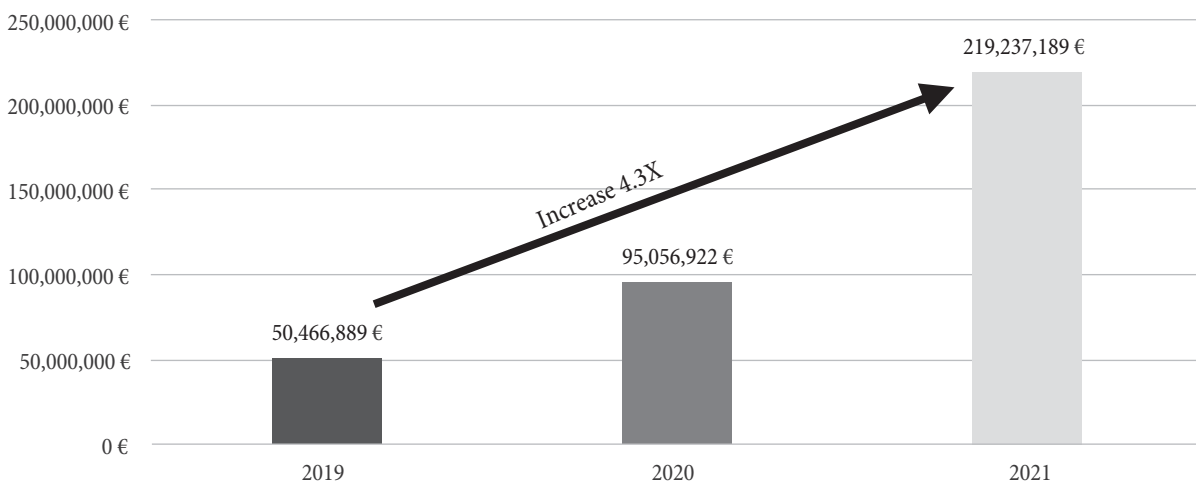
Source: Ministry of Finance of the Republic of Serbia

Figure 7: The share of the “health” sector in total planned expenditures, 2019-2021



Source: Ministry of Finance of the Republic of Serbia [16], [13], [18]

Figure 8: Planned investments and their growth in the period 2019-2021



Source: Ministry of Finance of the Republic of Serbia [16], [13], [18]

was maintained at a steady level of 51% of the total HIF budget (see Figure 10).

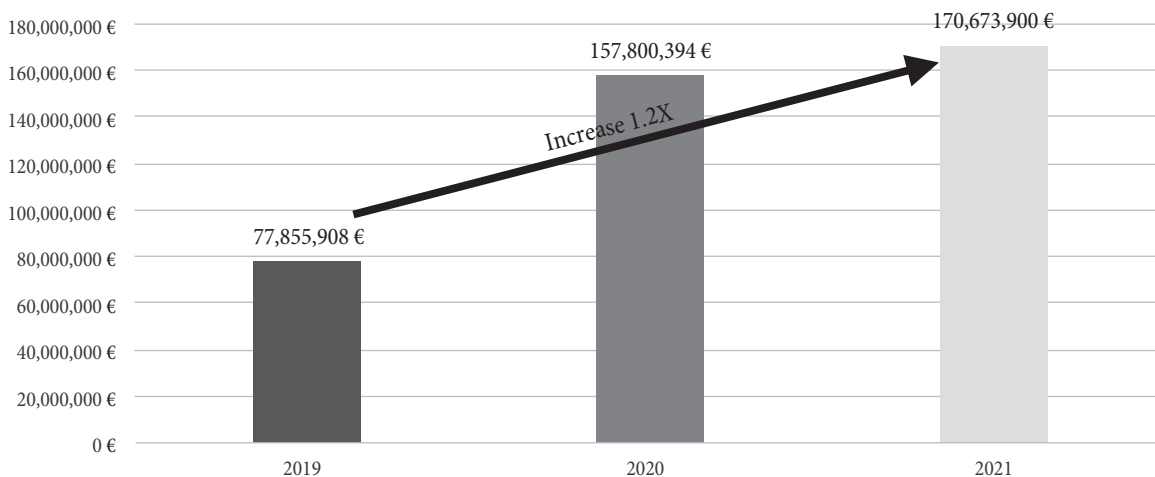
An insight into the program structure of the *HIF expenditures* shows a growth trend in most programs, especially in 2021. The increase in funding for hospital health care programs in 2021 compared to the period before the COVID-19 pandemic was 29% (see Figure 11).

The increase in expenditures for hospital health care by almost a third compared to 2019 was caused primarily by the increase in salaries of employees in secondary and tertiary health care institutions. Observing the share of costs by appropriate purposes, in Figure 12 we see that in contrast to the increase in the *share of costs* for salaries of 7%, costs by other purposes (drugs, consumables, blood

and blood products, etc.) were at the same or lower level in relation to 2019, i.e. before the advent of the COVID-19 pandemic. The previously shown reduction in the total volume of services provided in these institutions, especially when observing non-COVID patients, provides an explanation for the reduced consumption of drugs and medical supplies, while the indirect costs had a discrete reduction.

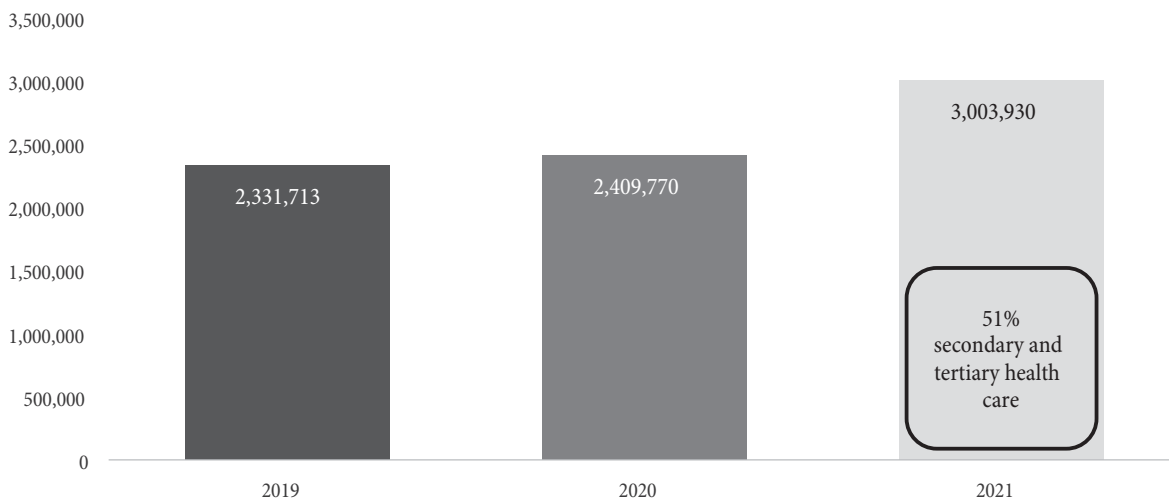
Considering that the *increase in salaries* mostly participated in the increase of HIF expenditures for health care in health institutions, we analyzed the trend of this increase in relation to the level of health care for 2019, 2020 and 2021. The total increase in salaries in primary, secondary and tertiary health care institutions was 30%

Figure 9: Support for the realization of the rights from the obligatory health insurance in the period 2019-2021



Source: Ministry of Finance of the Republic of Serbia

Figure 10: Comparative overview of the total “budget” of the HIF based on the financial plan for 2019, 2020 and 2021 (thousand EUR)

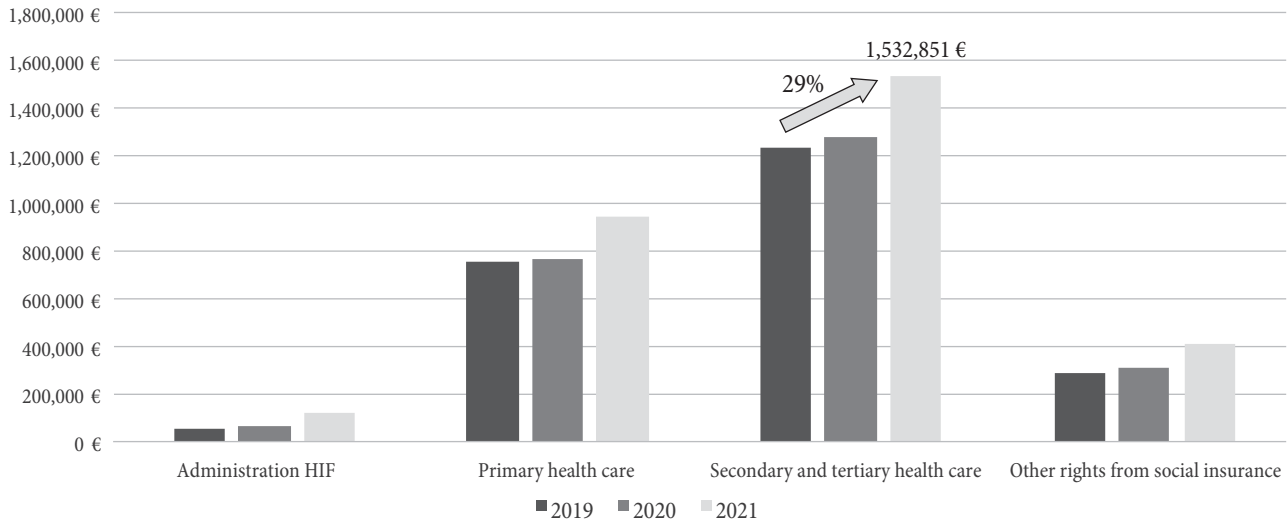


Source: HIF – Health Insurance Fund

compared to the period before the COVID-19 pandemic (2019). Of that, the increase in salaries for hospital

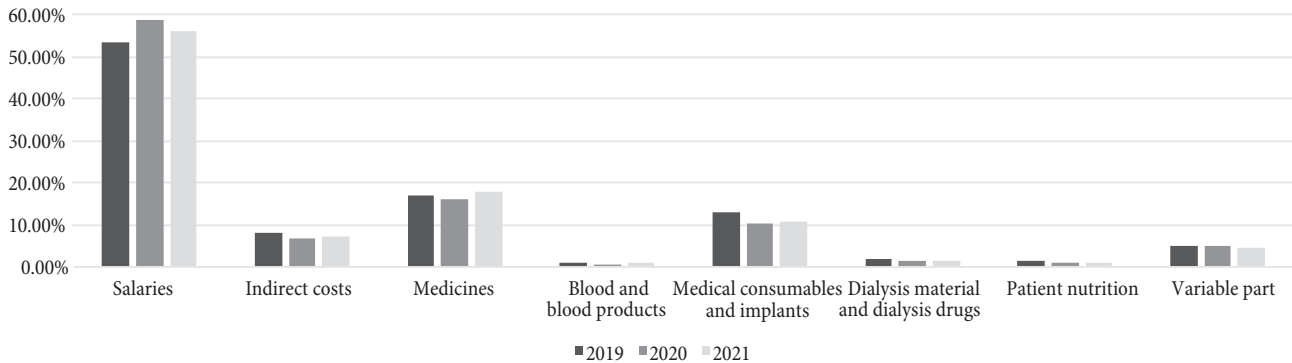
institutions in 2021 was nominally higher by EUR 195.8 million (see Figure 13).

Figure 11: Comparative overview of financial resources by individual programs in the “budget” of the HIF for 2019 and 2020 (thousand EUR)



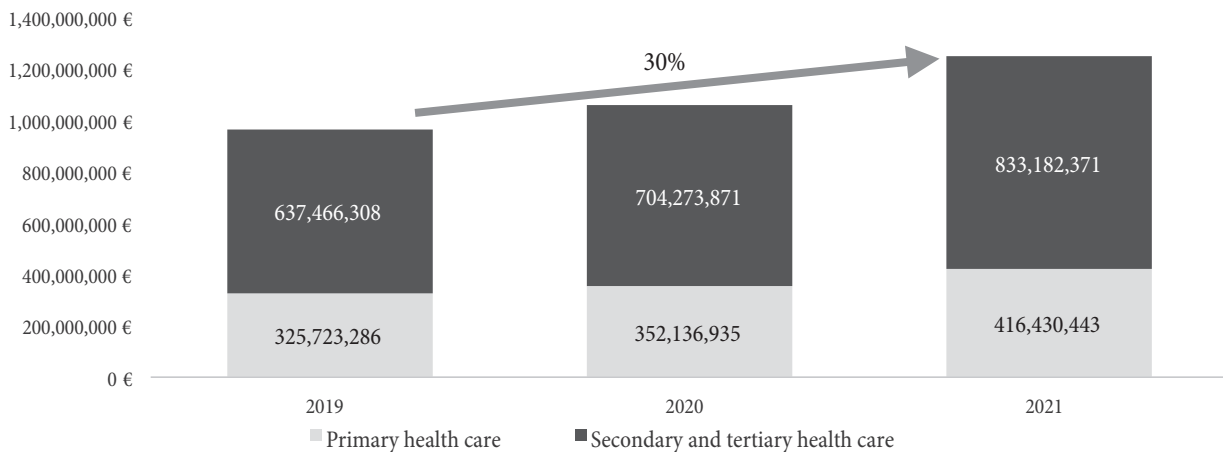
Source: HIF – Health Insurance Fund

Figure 12: Comparative presentation of the share of costs in the total budget of acute hospitals by individual purposes in 2019, 2020 and 2021



Source: HIF – Health Insurance Fund/SSHP – Second Serbia Health Project

Figure 13: Comparative overview of expenditures for salaries in relation to the level of health care in 2019, 2020 and 2021



Source: HIF – Health Insurance Fund/SSHP – Second Serbia Health Project

While the previously presented share of costs for medicines and consumables had a slight decrease, the total *expenditures for medicines and consumables* in 2021 were higher by 11% compared to 2019. Comparing the costs of medicines and consumables in relation to institutions of different levels of health care, we see that this increase is caused by increased spending in hospitals, while in primary health care institutions there was a decline in these costs (see Figure 14).

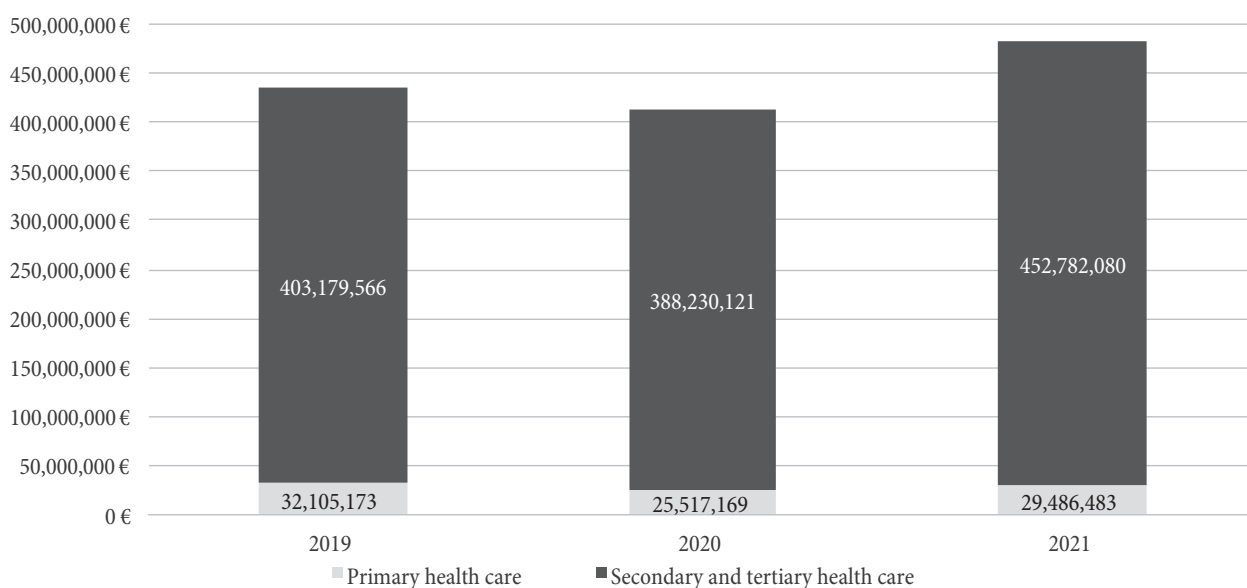
By analyzing the costs reported by hospitals that we observed in the period 2019 and 2020, we come to the result which shows that the average *cost of a bed-day* was increased in each month of 2020 compared to the period before the pandemic. This was especially pronounced in the peaks of the pandemic waves during April, May,

August and September of 2020. The explanation for this lies in the fact that hospital health care institutions are still predominantly paid on the basis of inputs, i.e. capacities (expenditures for salaries, energy, etc.) and that the total number of patients for the same or similar invoiced value gives a relatively higher cost per bed-day (see Figure 15).

Also, the average cost per patient was higher in the observed period. A total of a smaller number of hospitalized patients, for the same or higher amount of hospital budgets, resulted in an increase in the mentioned cost (see Figure 16).

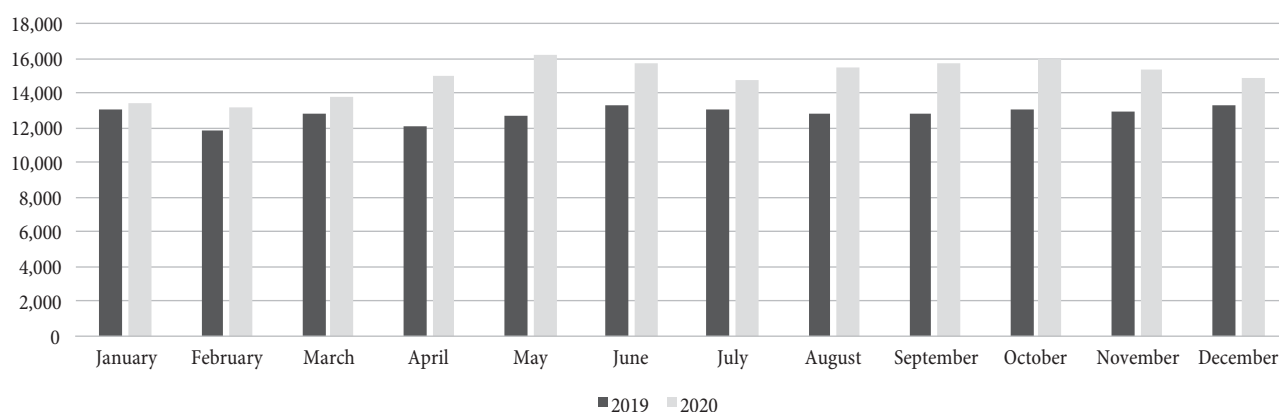
In the context of the COVID-19 pandemic, special attention is paid to the *cost structure for the treatment of*

Figure 14: Comparative overview of expenditures for medicines and consumables in relation to the level of health care in 2019, 2020 and 2021



Source: HIF – Health Insurance Fund/SSHP – Second Serbia Health Project

Figure 15: Comparative presentation of the average cost per day of hospitalization by months in 2019 and 2020



Source: HIF – Health Insurance Fund / SSHP – Second Serbia Health Project

complex clinical episodes in intensive care units, which is expected to be the most expensive form of hospital treatment. Compared to the previously shown decrease in the total number of hospitalizations, the number of sick days in intensive care units decreased by 10 to 30%, depending on the month of 2021 compared to 2019 (see Figure 17). Since this research does not cover the capacities of COVID hospitals, which also have the capacities of intensive care units, it is not possible to see the overall picture of this form of treatment and the consequent costs.

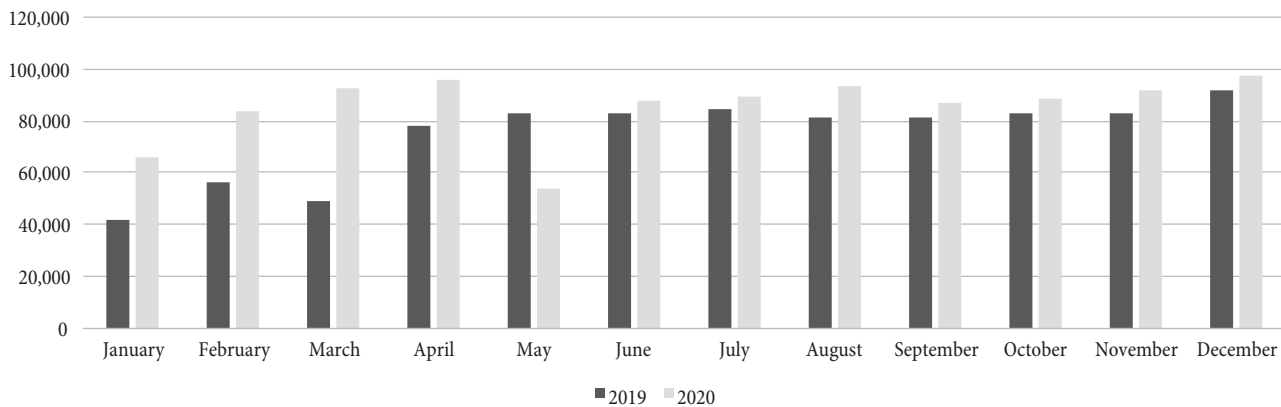
However, observing the *share of bed-days* realized in intensive care units in relation to the total number of bed-days, the pressure on these capacities is noticeable in the period since the beginning of the pandemic. Compared to 2019, in 2020 the share of the so-called bed-days was higher by 5 to 15%. This has certainly contributed to the increase in the cost of hospital treatment, especially during

the periods of the largest influx of COVID patients during the pandemic waves in April, August and December 2021 (see Figure 18).

Conclusion

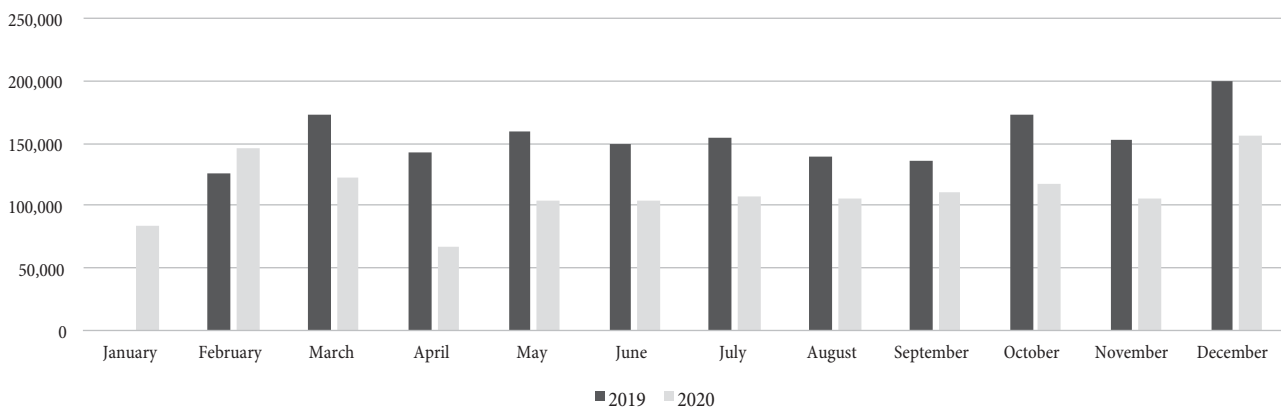
The COVID-19 pandemic, despite an excessive increase in the number of COVID patients and pressure on the hospital system, has contributed to a reduction in the scope and content of hospital services provided. The system of so-called state hospitals, playing a key role in the organized response to the COVID-19 pandemic, was forced to significantly reduce the number of services provided to non-COVID patients, which further complicates the inherited burden with waiting lists and reduces the availability of certain health care services. Despite the decrease in the volume and content of hospital health

Figure 16: Comparative overview of the average cost per patient in hospital treatment by months in 2019 and 2020



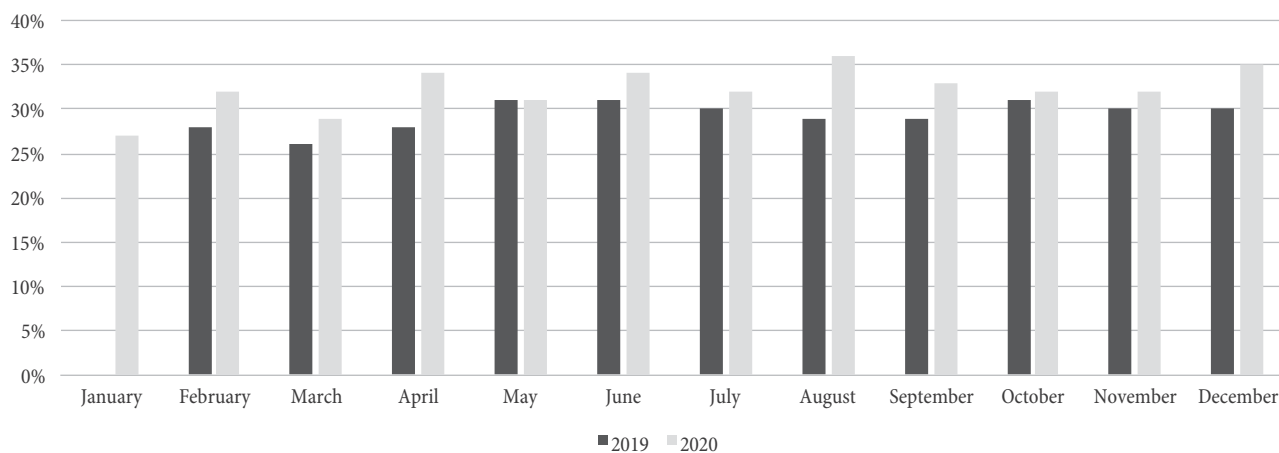
Source: HIF – Health Insurance Fund/SSHP – Second Serbia Health Project

Figure 17: Comparative overview of the total number of bed-days in intensive care units by months in 2019 and 2020



Source: HIF – Health Insurance Fund/SSHP – Second Serbia Health Project

Figure 18: Comparative overview of the share of sick days in intensive care units in relation to the total number of sick days by months in 2019 and 2020



Source: HIF – Health Insurance Fund/SSHP – Second Serbia Health Project

services provided during the COVID-19 pandemic, the costs of hospital health care increased significantly, primarily in the part related to the increase of employees' salaries. The very significant increase in the HIF budget during the COVID-19 pandemic was primarily caused by the increase in expenditures for hospital health care (29%), due to the increase in expenditures for salaries and medicines in hospitals. The inherited, so-called historical model of payment for hospital services based on the payment of input costs (inputs), i.e. payments by capacity and not by performance, due to the COVID-19 pandemic resulted in a significant increase in hospital costs and reduced productivity of hospital capacity.

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