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# ANALYSIS OF THE HEALTHCARE SYSTEM IN ROMANIA FROM THE PERSPECTIVE OF PREPARING THE HOSPITAL MEDICAL INFRASTRUCTURE AND HUMAN RESOURCES FOR THE COVID-19 CRISIS

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**Abstract**
*One of the most critical factors for the development and well-being of society is represented by the healthcare system, which has recently beFcome a huge sector. The budget allocated by each country for healthcare expenditure varies according to their level of development, it covers a significant part of the total budget. The health system and its infrastructure are under enormous pressure due to the rising costs of providing healthcare, increasing demand for health services, demographic changes and social inequalities, but healthcare is a vital public service. The main task of modern healthcare is to improve lifestyle and quality of life by providing current medical services at affordable prices. The objective of this paper is to analyze the healthcare system from the perspective of preparing the hospital medical infrastructure and human resources for the Covid-19 crisis based on specific external public audit methods. The Covid-19 crisis has dealt a shock to health systems, testing the adaptability and resilience of their key features. Detailed projections of resource and funding requirements can contribute to better long-term planning and sustainability of healthcare systems. Indicating that although destabilized, a health system can absorb the impact of shocks, recover, adapt and learn from this experience.*
**Keywords:** *public health; Covid-19 crisis; health infrastructure; economy.*
**JEL Classification:** I15, H5.

## 1. INTRODUCTION

The problems facing today's healthcare systems include an aging population, increased demand, new technology, rising healthcare expenditures, and an increase in the burden of chronic diseases (Džakula *et al.,* 2022). The effect of various health system variables on population health outcomes, based on prior work, is yet unknown. There is evidence that health finance affects health outcomes, according to earlier studies. Higher health expenditure may result in improved health outcomes since lower mortality and fewer years of life lost have been linked to higher overall healthcare spending (Vavken, 2012).

Due to the fact that it directly affects every individual, the evaluation of the effectiveness of the health systems is an area of intense debate among governments, international organizations, and the general public. Therefore, while creating growth goals and plans, the primary objective should be to increase efficiency in any area related to health. Technical efficiency, which involves creating more outputs than inputs, and allocative efficiency, which denotes the rational allocation of resources to produce the best results at the lowest costs, should both be taken into consideration when measuring health efficiency (OECD, 2016).

Studies that investigate the effectiveness of public health systems can be found in the literature, primarily at the microeconomic level, i.e., patients, hospitals, measures, and health programs (Hadad, Hadad and Simon-Tuval, 2013; Behr and Theune, 2017) as well as comparative research at the macro level, between states or regions (Cetin and Bahce, 2016; Ferraz *et al.,* 2021). However, the latter studies are much less common than the former. To determine the stimulants, or obstacles standing in the way of health systems, professionals must argue for efficiency in the healthcare industry. European nations differ in their health systems' effectiveness. The COVID-19 pandemic emergency has significantly altered a number of facets of life. The working environment has changed, and in addition to the old problems, there are now new ones. Countries must adapt to these conditions and devise (often unusual) answers to the issues they face. The effectiveness of the healthcare system in times of emergency directly affects people's lives, therefore the current crisis in some ways adds to that obligation (Lupu and Tiganasu, 2022). The COVID-19 outbreak has simply served as a further reminder of how fragile the health systems in Eastern European countries are (Lupu and Tiganasu, 2022).

The Romanian government implemented actions in a similar way to other nations that were impacted by the new coronavirus by adhering to WHO guidelines (CNSCBT, 2020). At various phases of epidemic containment, however, difficulties were encountered, including a significant number of people returning from abroad, a weak healthcare infrastructure, and sociocultural variables. In order to educate future tactics in the context of an ongoing pandemic, the study presents the accomplishments and pitfalls of the COVID-19 response in Romania. Parallels might be drawn to the chain of events that occurred in Romania in order to help handle future public health emergencies since there are significant lessons that can be gained from them.

The majority of medical services are offered in Romania through the public healthcare system, which still heavily depends on the antiquated infrastructure constructed during the previous communist dictatorship (Vladescu *et al.,* 2016). Romania also has the lowest health spending of any EU nation in terms of both per-capita spending (WHO, 2022) and the percentage of GDP.

Due to a lack of essential tools, substandard hospitals, and a shortage of resources, these flaws have previously created problems during prior epidemics and emergencies (Romanian Ministry of Internal Affairs, 2016; Dascalu, 2019). Due to the ongoing exodus of medical professionals, the Romanian healthcare sector also struggles with a lack of manpower. Since the nearest medical facilities are frequently located far away, many rural regions lack immediate access to healthcare facilities (Neagu, 2019). Together, these underlying problems made the challenges brought on by the COVID-19 outbreak worse.

According to the World Health Organization, the COVID-19 pandemic caused terrible social and economic disruption on a worldwide scale and was an unparalleled public health risk. An in-depth investigation of the causes of these variances is necessary since there have been significant discrepancies in the responses and performance of national healthcare systems in the face of the epidemic (Jakovljevic, 2022).

## 2. LITERATURE REVIEW

One of the most significant sectors of the economy has been health, and every government must prioritize life preservation. Growing concerns include the need to develop methods for managing both resources and people (Zamiela *et al.,* 2022).

The COVID-19 pandemic is the most significant worldwide health crisis since the influenza epidemic of 1918–1919. It brought with it previously unheard-of difficulties that put health systems' ability to withstand shocks to the test, eventually demonstrating that the world was not ready to handle such catastrophes. As a result, it becomes necessary to consider if, two and a half years after the COVID-19 pandemic's initial effects, there is anything new we should be considering in order to update our understanding of the idea of health system resilience, its phases, analytical framework, and implementation methods (Catussi Paschoalotto *et al.,* 2023).

As a result of the COVID-19 pandemic, health systems all around the world have experienced severe shocks; as a result, there is growing focus on the resilience of health systems and research into ways to survive shocks.

The health system, public health, and society are all under a great deal of stress as a result of COVID-19 (WHO, 2020). Four distinct challenges have resulted from the pandemic's shock: an increased burden of disease and mortality (CDC, 2021), a severe toll on mental health and wellbeing (Vindegaard and Benros, 2020), delays in necessary and urgent non-COVID-19 care (The Lancet Rheumatology, 2021), and acute economic losses (Evans and Over, 2020), not least because of widespread unemployment and other social health determinants (Abrams and Szefler, 2020). Such forces significantly destabilize supply and demand in the health system when brought on by abrupt and intense change or shock, which increases need while eroding capacity for treatment (Thomas *et al.,* 2020).

Health system resilience can be defined as a system's ability to withstand shocks over the course of its lifecycle in four phases: readiness, onset detection and quick response, impact management to maintain access and quality to the health system, and post-impact management of legacy issues (Thomas *et al.,* 2020). The term "health system resilience" has emerged as an adaptive approach to analyzing the impact of various types of crises, including economic recessions (Thomas *et al.,* 2013), Ebola epidemics (Kruk *et al.,* 2015; Ling *et al.,* 2017), refugee influxes (Ammar *et al.,* 2016; Alameddine *et al.,* 2019), and infectious disease outbreaks (Nuzzo *et al.,* 2019).

Health systems must be able to provide high-quality individual care while resolving broader social health issues. They must not only adjust to unexpected shocks and drastic shifts but also to expect, long-term challenges brought on by an aging population and rising multimorbidity (Corbaz-Kurth *et al.,* 2022).

According to Stephenson (2010), Barasa *et al.* (2017), and Nuzzo *et al.* (2019), resilient healthcare refers to the processes and capabilities that a complex healthcare system is able to manage to help it recover from common contingencies and rare but larger-scale hazards and provide quality care while addressing deeper issues.

Health systems all across the globe have been challenged by the coronavirus epidemic. Any government activity to comprehend, adapt, and react to the changes the epidemic has imposed depends on regional will, talents, and resources (Wiig and O'Hara, 2021). The effects of effective programs and initiatives started by a centralized government have been strongly related to decentralized activities taken by members of the public, leaders in the field of health, and healthcare professionals across the board. The idea of resilience in healthcare is consistent with the dual collaboration required from both centralized and decentralized systems (Hollnagel, 2018; Øyri and Wiig, 2022).

## 3. METHODOLOGY

Research on the health system's analysis from the perspective of preparing hospital medical infrastructure and human resources for the Covid-19 issue has been conducted.

### 3.1. Study area

Romania is represented in the research region by its 42 counties as can be seen in Figure 1 (Bacău, Botoșani, Iași, Neamț, Suceava and Vaslui part of North-East Development Region; Brăila, Buzău, Constanța, Galați, Vrancea and Tulcea part of South-East Development Region; Argeș, Călărași, Dâmbovița, Giurgiu, Ialomița, Prahova and Teleorman part of South-Muntenia Development Region; Dolj, Gorj, Mehedinți, Olt and Valcea part of South-West Oltenia Development

Region; Arad, Caraș-Severin, Hunedoara and Timiș part of West Development Region; Bihor, Bistrița-Nasăud, Cluj, Sălaj, Satu Mare and Maramureș part of North-West Development Region; Alba, Brașov, Covasna, Harghita, Mureș and Sibiu part of Center Development Region and Municipality of Bucharest and Ilfov part of Bucharest-Ilfov Development Region).


Source: https://www.naturalearthdata.com/

**Figure 1. Localization of the research area: Romania**

### 3.2. Statistical analysis

Data description and correlation matrix are presented in Tables 1 and 2.

**Table 1. Descriptive statistics**

| Variable | Obs. | Mean | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|
| ***County*** | | | | 1 | 42 |
| ***year*** | 336 | | | 2014 | 2021 |
| ***complaints*** | 336 | 16.494 | 25.267 | 0 | 210 |
| ***logEXP*** | 336 | 12.6776 | 0.854 | 10.9698 | 15.9128 |
| ***nosocomial*** | 336 | 0.5647 | 1.9077 | 0 | 32.6053 |
| ***beds*** | 336 | 2938.723 | 2967.61 | 695 | 20198 |
| ***medics*** | 336 | 345.5 | 479.2345 | 61 | 3412 |
| ***nurses*** | 336 | 1129.321 | 1239.875 | 186 | 8900 |
| ***revenue*** | 336 | 526954.3 | 903861.9 | 61743 | 8193665 |
| ***expenditures*** | 336 | 523325.6 | 906063.1 | 58093 | 8144052 |

Source: computed by the author

The data has 336 observations, from 42 units. The dependent variable *complaints* have a mean of 16, and a standard deviation of 25, while the dependent variable of interest *expenditures* has a mean of 523325. Due to the high difference in values, it was decided to use logarithmic values, also to normalize the series. In this case,

The correlation matrix is presented in Table 2.

**Table 2. Correlation matrix**

| | **complaints** | **nosocomial** | **medics** | **nurses** | **beds** | **logEXP** |
|---|---|---|---|---|---|---|
| **complaints** | 1.0000 | | | | | |
| **nosocomial** | 0.6966 | 1.0000 | | | | |
| **medics** | 0.5941 | 0.1883 | 1.0000 | | | |
| **nurses** | 0.6151 | 0.1965 | 0.9872 | 1.0000 | | |
| **beds** | 0.5830 | 0.1711 | 0.9856 | 0.9881 | 1.0000 | |
| **logEXP** | 0.4394 | 0.1243 | 0.1372 | 0.1725 | 0.1619 | 1.0000 |

Source: computed by author using database of the National Institute of Statistics (2023)

The correlation matrix suggests a high correspondence between *complaints* and *nosocomial*, and also between *complaints, number of medics, nurses and beds*. There is also relatively high correlation between complaints and expenditures (in logarithmic value), a fact that can be explained as follows: the number of complaints depending directly on the medical act, which is regarded as a single variable depends on financing/expenditures. On the other hand, there is no direct implication of financing on diagnostics, or the nursing activity. In this case, the expenditures become an important variable of interest along with *nosocomial, between the number of medics, nurses or beds*. Due to the high correlation between the number of medics, nurses and beds, the variables will be used as control and will be interchangeable.

The choice of the methodology (Tables 3-9) is related to the fact that there are particularities in hospitals, and changes between years, so the fixed and random effects on panel data will be used. After performing these models, a Hausman test will be used to disguise between fixed and random effects.

**Table 3. Panel Data statistics**

| **Variable** | | **Mean** | **Std. Dev.** | **Min.** | **Max.** | **Obs.** |
|---|---|---|---|---|---|---|
| ***year*** | overall | 2017.5 | 2.29471 | 2014 | 2021 | N = 336 |
| | between | | 0 | 2017.5 | 2017.5 | n = 42 |
| | within | | 2.29471 | 2014 | 2021 | T = 8 |
| ***beds*** | overall | 2938.723 | 2967.61 | 695 | 20198 | N = 336 |
| | between | | 2996.595 | 701.375 | 19898.63 | n = 42 |
| | within | | 121.4957 | 1763.098 | 4086.723 | T = 8 |
| ***medics*** | overall | 345.5 | 479.2345 | 61 | 3412 | N = 336 |
| | between | | 482.8019 | 69.625 | 3136.375 | n = 42 |

| Variable | | Mean | Std. Dev. | Min. | Max. | Obs. |
|---|---|---|---|---|---|---|
| | within | | 37.93032 | 54.125 | 621.125 | T = 8 |
| ***nurses*** | overall | 1129.321 | 1239.875 | 186 | 8900 | N = 336 |
| | between | | 1247.396 | 222.25 | 8129 | n = 42 |
| | within | | 117.5095 | 458.3214 | 1900.321 | T = 8 |
| ***nosocomial*** | overall | 0.56477 | 1.90779 | 0 | 32.6053 | N = 336 |
| | between | | 0.76616 | 0.00839 | 4.32635 | n = 42 |
| | within | | 1.75069 | -3.66948 | 28.84372 | T = 8 |
| ***complaints*** | overall | 16.49405 | 25.26705 | 0 | 210 | N = 336 |
| | between | | 22.60893 | 0 | 109 | n = 42 |
| | within | | 11.74483 | -36.50595 | 117.494 | T = 8 |
| ***revenue*** | overall | 526954.3 | 903861.9 | 61743 | 8193665 | N = 336 |
| | between | | 851378.7 | 114319.5 | 5520782 | n = 42 |
| | within | | 327516 | -1612206 | 3199837 | T = 8 |
| ***expenditures*** | overall | 523325.6 | 906063.1 | 58093 | 8144052 | N = 336 |
| | between | | 855418.6 | 113214.6 | 5561922 | n = 42 |
| | within | | 323263.8 | -1731343 | 3105455 | T = 8 |
| ***County*** | overall | 21.5 | 12.139 | 1 | 42 | N = 336 |
| | between | | 12.26784 | 1 | 42 | n = 42 |
| | within | | 0 | 21.5 | 21.5 | T = 8 |
| ***logEXP*** | overall | 12.67761 | 0.85401 | 10.9698 | 15.9128 | N = 336 |
| | between | | 0.76577 | 11.53822 | 15.48165 | n = 42 |
| | within | | 0.39392 | 12.01986 | 13.3738 | T = 8 |
| ***logREV*** | overall | 12.68827 | 0.85269 | 11.03074 | 15.91887 | N = 336 |
| | between | | 0.76652 | 11.55242 | 15.47374 | n = 42 |
| | within | | 0.38961 | 11.97214 | 13.37683 | T = 8 |

Source: computed by the author using database of the National Institute of Statistics (2023)

**Table 4. Variance inflation factor for: "complaints", "nosocomial", "medics", "nurses", "beds" and "logEXP"**

| Variable | VIF | 1/VIF |
|---|---|---|
| ***nurses*** | 64.62 | 0.01548 |
| ***beds*** | 52.73 | 0.01896 |
| ***medics*** | 50.94 | 0.01963 |
| ***logEXP*** | 2.68 | 0.37354 |
| ***nosocomial*** | 1.07 | 0.93653 |
| ***Mean VIF*** | 34.41 | |

Source: computed by the author

**Table 5. Variance inflation factor for: "complaints", "nosocomial", "beds" and "logEXP"**

| Variable | VIF | 1/VIF |
|---|---|---|
| ***logEXP*** | 4.85 | 0.20626 |
| ***nosocomial*** | 1.07 | 0.9338 |
| ***beds*** | 3.91 | 0.25554 |
| ***year*** | | |
| ***2015*** | 1.77 | 0.56492 |
| ***2016*** | 1.79 | 0.55777 |
| ***2017*** | 1.91 | 0.52326 |
| ***2018*** | 2.11 | 0.47289 |
| ***2019*** | 2.3 | 0.43393 |
| ***2020*** | 2.44 | 0.40944 |
| ***2021*** | 2.57 | 0.38836 |
| ***Mean VIF*** | 2.47 | |

Source: computed by the author

**Table 6. Full results for fixed and random effects models (including time effects)**

| | (1) Model: Fixed Effects Dependent variable: complaints | (2) Model: Fixed Effects Dependent variable: complaints | (3) Model: Fixed Effects Dependent variable: complaints | (4) Model: Random Effects Dependent variable: complaints | (5) Model: Random Effects Dependent variable: complaints | (6) Model: Random Effects Dependent variable: complaints |
|---|---|---|---|---|---|---|
| ***VARIABLES*** | | | | | | |
| ***logEXP*** | -40.44* | -47.18* | -40.66** | -7.066 | -13.20 | -21.01* |
| | (23.08) | (24.79) | (19.93) | (6.874) | (9.884) | (12.64) |
| ***nosocomial*** | 0.434* | 0.443* | 0.187* | 0.755* | 0.614* | 0.386* |
| | (0.710) | (0.765) | (0.459) | (1.047) | (0.871) | (0.637) |
| ***beds*** | -0.0268 | | | 0.00552*** | | |
| | (0.0174) | | | (0.00131) | | |
| ***medics*** | | 0.0709* | | | 0.0492*** | |
| | | (0.0462) | | | (0.0130) | |
| ***nurses*** | | | 0.0382* | | | 0.0247*** |
| | | | (0.0216) | | | (0.00639) |
| ***2015.year*** | 3.649** | 5.517** | 3.155* | 2.463* | 3.238* | 2.379* |
| | (1.652) | (2.666) | (1.678) | (1.368) | (1.711) | (1.443) |
| ***2016.year*** | 9.792** | 12.18** | 8.463** | 3.853** | 5.150** | 5.178** |
| | (4.369) | (5.532) | (3.896) | (1.672) | (2.569) | (2.195) |
| ***2017.year*** | 19.41* | 23.19** | 16.96** | 5.326* | 7.815 | 9.243* |
| | (9.631) | (11.29) | (7.797) | (3.020) | (5.216) | (5.186) |
| ***2018.year*** | 33.74** | 38.18** | 30.35** | 11.12*** | 14.61** | 18.03** |
| | (16.20) | (17.67) | (13.52) | (4.049) | (7.126) | (7.700) |
| ***2019.year*** | 39.83* | 44.66** | 35.86** | 11.74** | 15.69* | 20.52* |
| | (20.04) | (21.55) | (16.16) | (5.813) | (9.502) | (10.86) |
| ***2020.year*** | 42.35* | 47.43** | 37.01** | 11.34* | 15.38 | 20.37* |
| | (21.97) | (23.44) | (17.65) | (6.134) | (10.07) | (11.35) |
| ***2021.year*** | 50.47** | 55.90** | 44.67** | 16.91** | 21.05* | 26.59* |
| | (24.73) | (27.04) | (20.22) | (7.840) | (12.62) | (14.14) |
| ***Constant*** | 582.8* | 561.5* | 466.7* | 81.58 | 156.1 | 242.0 |

| | (1) Model: Fixed Effects Dependent variable: complaints | (2) Model: Fixed Effects Dependent variable: complaints | (3) Model: Fixed Effects Dependent variable: complaints | (4) Model: Random Effects Dependent variable: complaints | (5) Model: Random Effects Dependent variable: complaints | (6) Model: Random Effects Dependent variable: complaints |
|---|---|---|---|---|---|---|
| | (310.9) | (294.7) | (239.5) | (82.34) | (115.7) | (147.1) |
| ***Obs.*** | 336 | 336 | 336 | 336 | 336 | 336 |
| ***R-squared*** | 0.186 | 0.151 | 0.21 | | | |
| ***Counties*** | 42 | 42 | 42 | 42 | 42 | 42 |
| ***Unit effects*** | YES | YES | YES | YES | YES | YES |
| ***Time effects*** | YES | YES | YES | YES | YES | YES |
| ***Robust*** | YES | YES | YES | YES | YES | YES |

Source: computed by author

**Table 7. Full Results for Fixed and Random Effects Models with Lag Instrumented dependent variable (including time effects)**

| | (1) Model: Fixed Effects with Instrumented variables Dependent variable: complaints | (2) Model: Fixed Effects with Instrumented variables Dependent variable: complaints | (3) Model: Fixed Effects with Instrumented variables Dependent variable: complaints | (4) Model: Random Effects with Instrumented variables Dependent variable: complaints | (5) Model: Random Effects with Instrumented variables Dependent variable: complaints | (6) Model: Random Effects with Instrumented variables Dependent variable: complaints |
|---|---|---|---|---|---|---|
| ***VARIABLES*** | | | | | | |
| ***L.complaints*** | 0.0665 | 1.623 | 6.589 | 0.318 | 0.338* | 0.309 |
| | (0.607) | (2.743) | (23.25) | (0.207) | (0.205) | (0.208) |
| ***L2.complaints*** | 0.256** | 0.561 | 0.996 | 0.584*** | 0.571*** | 0.579*** |
| | (0.0995) | (0.350) | (2.282) | (0.165) | (0.164) | (0.164) |
| ***logEXP*** | -23.12* | -37.15* | -30.8* | -6.139*** | -4.002** | -5.893*** |
| | (27.73) | (114.4) | (948.9) | (2.115) | (1.811) | (2.030) |
| ***nosocomial*** | 3.414 | 10.01 | 26.81 | 2.121 | 2.270 | 1.693 |
| | (2.982) | (11.05) | (83.64) | (1.381) | (1.402) | (1.398) |
| ***beds*** | -0.0234*** | | | 0.00319*** | | |
| | (0.00903) | | | (0.000740) | | |
| ***2018.year*** | 9.467 | 25.06 | 69.21 | 5.215** | 4.510* | 5.072** |
| | (6.879) | (25.19) | (205.1) | (2.504) | (2.498) | (2.492) |
| ***2019.year*** | 12.44 | 46.50 | 143.5 | 4.498 | 3.160 | 4.217 |
| | (13.20) | (53.51) | (449.8) | (2.754) | (2.653) | (2.713) |
| ***2020.year*** | 10.69 | 45.38 | 141.6 | 0.961 | -0.795 | 0.500 |
| | (14.38) | (55.26) | (450.2) | (2.891) | (2.796) | (2.832) |
| ***2021.year*** | 17.65 | 57.72 | 167.0 | 7.031** | 4.943* | 6.334** |
| | (16.49) | (63.21) | (512.7) | (2.956) | (2.830) | (2.872) |
| ***medics*** | | 0.0803 | | | 0.0160*** | |
| | | (0.127) | | | (0.00385) | |
| ***nurses*** | | | 0.145 | | | 0.00754*** |
| | | | (0.458) | | | (0.00170) |
| ***Constant*** | 368.5 | 1,224 | 3,728 | 68.73*** | 45.68** | 66.88*** |
| | (370.8) | (1,437) | (11,730) | (25.23) | (22.08) | (24.43) |
| ***Observations*** | 210 | 210 | 210 | 210 | 210 | 210 |

| | (1) Model: Fixed Effects with Instrumented variables Dependent variable: complaints | (2) Model: Fixed Effects with Instrumented variables Dependent variable: complaints | (3) Model: Fixed Effects with Instrumented variables Dependent variable: complaints | (4) Model: Random Effects with Instrumented variables Dependent variable: complaints | (5) Model: Random Effects with Instrumented variables Dependent variable: complaints | (6) Model: Random Effects with Instrumented variables Dependent variable: complaints |
|---|---|---|---|---|---|---|
| ***Number of County*** | 42 | 42 | 42 | 42 | 42 | 42 |
| ***Unit effects Country*** | YES | YES | YES | YES | YES | YES |
| ***Time effects Year*** | YES | YES | YES | YES | YES | YES |
| ***Robust*** | YES | YES | YES | YES | YES | YES |
| ***Instrumented*** | YES | YES | YES | YES | YES | YES |

Source: computed by the author

The objective is the estimation in (1) the main content of $\boldsymbol{\beta}$ (estimates, coefficient vector), considering the existence of a unit-specific error-term $\nu_i$, that differs between units, but is constant for any particular one, $y_{it}$ is the dependent variable, $\mathbf{x}_{it}$ is the dependent variables matrix, and $\epsilon_{it}$ is the error term.

$$y_{it} = \alpha + \boldsymbol{x}_{it}\boldsymbol{\beta} + \nu_i + \epsilon_{it} \quad (1)$$

The previous equation can be rewritten as in (2):

$$\bar{y}_i = \alpha + \bar{\boldsymbol{x}}_i\boldsymbol{\beta} + \nu_i + \bar{\epsilon}_i \quad (2)$$

where the content is calculated as follows:

$$\bar{y}_i = \sum_t y_{it}/T_i$$

$$\bar{\mathbf{x}}_i = \sum_t \mathbf{x}_{it}/T_i$$

$$\bar{\epsilon}_i = \sum_t \epsilon_{it}/T_i$$

Subtracting (2) from (1), it results that (3):

$$(y_{it} - \bar{y}_i) = \left(\boldsymbol{x}_{it} - \bar{\boldsymbol{x}}_i\right)\boldsymbol{\beta} + (\epsilon_{it} - \bar{\epsilon}_i) \quad (3)$$

These equations (1) – (3) are the basics for calculating fixed effects models. For the random effects model, the equation is in (4), see Stata manual for further information, *https://www.stata.com/manuals13/xtxtivreg.pdf*:

$$(y_{it} - \theta\bar{y}_i) = (1-\theta)\alpha + \left(\boldsymbol{x}_{it} - \theta\bar{\boldsymbol{x}}_i\right)\boldsymbol{\beta} + \{(1-\theta)\nu_i + (\epsilon_{it} - \theta\bar{\epsilon}_i)\} \quad (4)$$

Further, we consider that the dependent variable can be lagged and there are som endogenous relations between independent variables, so the equation for the second set of models is (5):

$$y_{it} = \boldsymbol{Y}_{it}\gamma + \boldsymbol{X}_{1it}\boldsymbol{\beta} + \mu_i + \nu_{it} = \boldsymbol{Z}_{it}\boldsymbol{\delta} + \mu_i + \nu_{it} \quad (5)$$

Where: $y_{it}$ is the dependent variable, $\mathbf{X}_{1it}$ is a vector of observations on the exogenous variables included as covariates, $\boldsymbol{\delta}, \gamma, \boldsymbol{\beta}$ are the vectors of coefficients and $\mathbf{Z}_{it} = [\mathbf{Y}_{it}\mathbf{X}_{it}]$ (as in Stata manual, *https://www.stata.com/manuals13/xtxtivreg.pdf*).

The results are presented in the following section.

## 4. RESULTS AND DISCUSSIONS

A naive attempt of OLS modelling on "complaints", "nosocomial", "medics", "nurses", "beds" and "logEXP" suggests a high VIF variance inflation factor, which can be explained by the high value of correlations between the implied variables. In this case, we will use the variables “medics", "nurses", "beds" as control interchangeable variables.

The main interest is in the effect of expenditures and nosocomial infections on the complaints, using as control medical variables (beds, medics, and nurses). We control for county particularities (every county has different financing, the medical skills differ and so on), for time changes (it consider time effect - the conditions in activity changes, see for example the COVID-19 effects), and we use option robust to control for the presence of heteroskedasticity.

The results are available in Table 8.

**Table 8. Fixed and Random Effects Models**

| | (1) Model: Fixed Effects Dependent variable: complaints | (2) Model: Fixed Effects Dependent variable: complaints | (3) Model: Fixed Effects Dependent variable: complaints | (4) Model: Random Effects Dependent variable: complaints | (5) Model: Random Effects Dependent variable: complaints | (6) Model: Random Effects Dependent variable: complaints |
|---|---|---|---|---|---|---|
| *VARIABLES* | | | | | | |
| *logEXP* | -40.44* | -47.18* | -40.66** | -7.066 | -13.20 | -21.01* |
| | (23.08) | (24.79) | (19.93) | (6.874) | (9.884) | (12.64) |
| *nosocomial* | 0.434* | 0.443* | 0.187* | 0.755* | 0.614* | 0.386* |
| | (0.710) | (0.765) | (0.459) | (1.047) | (0.871) | (0.637) |
| *beds* | -0.0268 | | | 0.00552*** | | |
| | (0.0174) | | | (0.00131) | | |

| | (1) Model: Fixed Effects Dependent variable: complaints | (2) Model: Fixed Effects Dependent variable: complaints | (3) Model: Fixed Effects Dependent variable: complaints | (4) Model: Random Effects Dependent variable: complaints | (5) Model: Random Effects Dependent variable: complaints | (6) Model: Random Effects Dependent variable: complaints |
|---|---|---|---|---|---|---|
| *medics* | | 0.0709* | | | 0.0492*** | |
| | | (0.0462) | | | (0.0130) | |
| *nurses* | | | 0.0382* | | | 0.0247*** |
| | | | (0.0216) | | | (0.00639) |
| *Constant* | 582.8* | 561.5* | 466.7* | 81.58 | 156.1 | 242.0 |
| | (310.9) | (294.7) | (239.5) | (82.34) | (115.7) | (147.1) |
| *Obs.* | 336 | 336 | 336 | 336 | 336 | 336 |
| *R-squared* | 0.186 | 0.151 | 0.21 | | | |
| *Counties* | 42 | 42 | 42 | 42 | 42 | 42 |
| *Unit effects* | YES | YES | YES | YES | YES | YES |
| *Time effects* | YES | YES | YES | YES | YES | YES |
| *Robust* | YES | YES | YES | YES | YES | YES |

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Source: author's own calculations

The results suggest that the impact of the financing in hospitals (expenditures in logarithmic value) is negative and statistically significant in all models, as expected. The Hausman tests (available on demand) suggest that the fixed effects model should be considered. In the first case, when the control variable is number of *beds,* an increase with 10% in *expenditures* (logEXP) decreases the dependent variable with approximately 4 (3,8) complaints (40*log(1,1)), keeping other variables constant, *ceteris paribus*. The increase with 100 units (beds) reduces the number of complaints with 3 complaints (2,68), while an increase with 10 *nosocomial* infections increases the complaints by 4. For the control variable *medics,* the impact of *hospital expenditures* is evaluated at reducing the complaints by 5 (4.49), while using the *nurses,* the quantified negative effect is 4 (3,90). The conclusion is that the dimension of public expenditure has an important role in reducing the number of complaints in hospitals, as expected. The *nosocomial* variable has a positive impact on complaints (negative relative to medical services provided).

Other attempts to further analyses are considering the possibility of the influence of the previous complaints on actual ones. In this case, controlling for the fixed and time effects is not sufficient. The third lag is used (l3.complaints) as an instrumental variable for *l.complaints* (first lag). Being instrumented, the possible endogeneity is controlled. The results are available in Table 9 and Table 7 in the section methodology.

**Table 9. The third lag is used (l3.complaints) as an instrumental variable for *l.complaints* (first lag)**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | **Model:Fixed Effects with Instrumented variables** | **Model:Fixed Effects with Instrumented variables** | **Model:Fixed Effects with Instrumented variables** | **Model:Random Effects with Instrumented variables** | **Model:Random Effects with Instrumented variables** | **Model:Random Effects with Instrumented variables** |
| | **Dependent variable: complaints** | **Dependent variable: complaints** | **Dependent variable: complaints** | **Dependent variable: complaints** | **Dependent variable: complaints** | **Dependent variable: complaints** |
| ***VARIABLES*** | | | | | | |
| ***L.complaints*** | 0.0665 | 1.623 | 6.589 | 0.318 | 0.338* | 0.309 |
| | (0.607) | (2.743) | (23.25) | (0.207) | (0.205) | (0.208) |
| ***L2.complaints*** | 0.256** | 0.561 | 0.996 | 0.584*** | 0.571*** | 0.579*** |
| | (0.0995) | (0.350) | (2.282) | (0.165) | (0.164) | (0.164) |
| ***logEXP*** | -23.12* | -37.15* | -30.8* | -6.139*** | -4.002** | -5.893*** |
| | (27.73) | (114.4) | (948.9) | (2.115) | (1.811) | (2.030) |
| ***nosocomial*** | 3.414 | 10.01 | 26.81 | 2.121 | 2.270 | 1.693 |
| | (2.982) | (11.05) | (83.64) | (1.381) | (1.402) | (1.398) |
| ***beds*** | -0.0234*** | | | 0.00319*** | | |
| | (0.00903) | | | (0.000740) | | |
| ***medics*** | | 0.0803 | | | 0.0160*** | |
| | | (0.127) | | | (0.00385) | |
| ***nurses*** | | | 0.145 | | | 0.00754*** |
| | | | (0.458) | | | (0.00170) |
| ***Constant*** | 368.5 | 1,224 | 3,728 | 68.73*** | 45.68** | 66.88*** |
| | (370.8) | (1,437) | (11,730) | (25.23) | (22.08) | (24.43) |
| ***Observations*** | 210 | 210 | 210 | 210 | 210 | 210 |
| ***Number of County*** | 42 | 42 | 42 | 42 | 42 | 42 |
| ***Unit effects Country*** | YES | YES | YES | YES | YES | YES |
| ***Time effects Year*** | YES | YES | YES | YES | YES | YES |
| ***Robust*** | YES | YES | YES | YES | YES | YES |
| ***Instrumented*** | YES | YES | YES | YES | YES | YES |

Source: computed by the author

The results are in line with previous models, the *complaints* could be possibly explained by the first and second lag (in some models the results are statistically significant), and mainly by the *expenditures*. We can explain the effect of financing as follows: an increase in *expenditures* by 10%, reduces the *complaints* by 2 complaints (around 2 and 3 when control variables used are *medics* and *nurses)*. The rise in the number of *beds* also decreases the number of *complaints,* but the effects are not considerable (under 1).

The analysis shows the importance of hospital financing, as a primordial factor in increasing the quality of medical acts and reducing the complaints in hospitals.

The difficulties experienced in Romania during the early phases of the COVID-19 outbreak have provided important insights into areas that require significant improvement. The healthcare system, where a mix of poor management, disregarded complaints from medical professionals, and inadequate infrastructure severely undermined the capability of the pandemic response, was where the most glaring problems were uncovered. But an unchecked spread was prevented by quickly resolving these important problems.

Despite this mostly beneficial conclusion, the COVID-19 pandemic has brought to light elements of the Romanian healthcare system that need to be improved in order to properly manage situations similar to this in the future. However, the early phases of this crisis demonstrated the significance of both acting quickly and taking certain societal factors into account when dealing with an epidemic. The optimal use of the resources and communication channels will be made possible by such future strategies throughout a continuing health crisis.

In Romania the absence of strategic planning at the national level and the lack of coordination and integration of care at the regional and local levels are major issues with governance structures. Another issue is building public trust in decision-makers and public authorities, which is crucial for the success of many different public programs (Cylus and Papanicolas, 2015; Vladescu *et al.,* 2016; Dimova *et al.,* 2018; Džakula *et al.,* 2021; OECD, 2021).

Geographic inequalities in the distribution of healthcare workers and infrastructure are another frequent problem, with rural areas frequently underserved and bigger cities frequently oversupplied. In general, there is an excess of specialists in cities and a scarcity of general practitioners and nurses in rural regions. Although they have had mixed results thus far governments have made some initiatives to address these issues with the health workforce.

The COVID-19 epidemic has caused significant problems for the healthcare systems, which were already dealing with issues including inadequate primary and preventive care, low health spending, and several other issues with how healthcare is organized and how the population is doing in terms of health.

## 5. CONCLUSIONS

Shocks can cause a health system to become unstable, but they can also lead to change. Governments have a special chance to increase the health system's resilience because to COVID-19. A window of opportunity is opened by the health sector's priority position. The health system's ability to evolve is demonstrated by the reform process's forward movement while under shock. A health system's resilience is also developed through enhancing its performance and guaranteeing universal access. To further understand the best ways to progress reforms and increase resiliency to shocks in various nations, more study is required.

The pandemic crisis offers a rare chance to investigate whether the healthcare finance model is to blame for the diversity in health system performance in the face of the pandemic or whether other factors have a stronger impact on performance (Kumagai, 2021). It is crucial to comprehend this in order to learn how to regulate medical assistance systems. Measures that improve medical assistance management, increase performance, and streamline financial allocation are vulnerable to the severe pandemic impact and cannot offset its effects on the population's access to medical care (Antohi *et al.,* 2022).

The pandemic has made institutional engagement in the public health system more crucial than ever. Major pandemic-related issues including controlling the spread of COVID-19, managing labour shortages, and offering financial assistance to individuals and organizations have been handled by public health mandates, loosened rules, and policy expansion initiatives.

Numerous indicators suggest that Romania's healthcare system was not ready for the epidemic. First, Romania spends far less on public health services than the rest of the EU as a whole. Compared to the EU average of 9.8%, Romania's allocation to health as a percentage of GDP is 5%. The lack of suitable medical facilities and supplies is reflected in the low healthcare spending. For instance, hospitals have inadequate beds for acute care units and poor testing capacity. In general, the epidemic had little access to medical supplies.

The majority of Romania's healthcare facilities are out-of-date, were constructed during the communist era, have undergone sporadic renovation over the years, and are disproportionately concentrated in a few regions. The network of medical facilities in the territory was ill-prepared to handle intensive care or other forms of specialized treatment. In several of Romania's poorest counties, where the number of general practitioners has dropped noticeably over the past ten years, even early diagnostic and at-home treatment proved challenging (Social Monitor, 2021).

Massive employee departures from the Romanian healthcare system are a problem, particularly for critical pandemic specialties like nurses and intensive care professionals. Romania's public sector salaries were historically quite low when compared to those in the private sector. Healthcare earnings were reduced by a further 25% as a result of the 2009 austerity measures, which caused medical professionals to leave the country. Although healthcare worker salaries have increased significantly in recent years, there is a gap in keeping the next wave of medical specialists.

The impact of the COVID-19 pandemic's effects on society and the global economy serves as a compelling reason to examine the effectiveness of health systems in combating the current pandemic and to draw lessons for improving health systems' readiness for future pandemics.

## References


1) Abrams, E. M. and Szefler, S. J. (2020). COVID-19 and the impact of social determinants of health. *The Lancet Respiratory Medicine*, 8(7), pp. 659-661.
2) Alameddine, M., Fouad, F. M., Diaconu, K., Jamal, Z., Lough, G., Witter, S. and Ager, A. (2019). Resilience capacities of health systems: accommodating the needs of Palestinian refugees from Syria. *Social Science & Medicine*, 220, pp. 22-30. https://doi.org/10.1016/j.socscimed.2018.10.018.
3) Ammar, W., Kdouh, O., Hammoud, R., Hamadeh, R., Harb, H., Ammar, Z., Atun, R., Christiani, D. and Zalloua, P.A. (2016). Health system resilience: Lebanon and the Syrian refugee crisis. *Journal Of Global Health*, 6(2), pp. 1-9. https://doi.org/10.7189/jogh.06.020704.
4) Antohi, V. M., Ionescu, R. V., Zlati, M. L., Mirica, C. and Cristache, N. (2022). Approaches to Health Efficiency across the European Space through the Lens of the Health Budget Effort. *International Journal of Environmental Research and Public Health*, 19, 3063. https://doi.org/10.3390/ijerph19053063.
5) Barasa, E. W., Cloete, K. and Gilson, L. (2017). From bouncing back, to nurturing emergence: Reframing the concept of resilience in health systems strengthening. *Health Policy and Planning*, 32(3), pp. iii91–iii94.
6) Behr, A. and Theune, K. (2017). Health system efficiency: a fragmented picture based on OECD data. *PharmacoEconomics – Open*, 1(3), pp. 203-221. https://doi.org/10.1007/s41669-017-0010-y.
7) Catussi Paschoalotto, M. A., Lazzari, E. A., Rocha, R., Massuda, A. and Castro, M. C. (2023). Health systems resilience: is it time to revisit resilience after COVID-19?. *Social Science & Medicine*, 320, 115716.
8) CDC (2021). *Estimated Disease Burden of COVID-19*. [online] Available at: https://www.cdc.gov/coronavirus/2019-ncov/casesupdates/burden.html [Accessed 20.06.2023].
9) Cetin, V. R. and Bahce, S. (2016). Measuring the efficiency of health systems of OECD countries by data envelopment analysis. *Applied Economics*, 48(37), pp. 3497-3507. https://doi.org/10.1080/00036846.2016.1139682.
10) Cylus, J. and Papanicolas, I. (2015). An analysis of perceived access to health care in Europe: How universal is universal coverage?. *Health Policy*, 119(9), pp. 1133-1144.
11) CNSCBT (Romanian National Centre for the Surveillance and Control of Communicable Diseases) (2020). *The Prevention and Control of Suspected Infections with the New Coronavirus Within Sanitary Units*. [online] Available at: https://www.cnscbt.ro/index.php/ghiduri-si-protocoale/1331-prevenirea-si-controlul-infectiilor-suspecte-cu-noul-coronavirus-in-unitatile-sanitare/file [Accessed 20.06.2023].
12) Corbaz-Kurth, S., Juvet, T.M., Benzakour, L., Cereghetti, S., Fournier, C. A., Moullec, G., Nguyen, A., Suard, J. C., Vieux, L., Wozniak, H., Pralong, J. A., Weissbrodt, R. and Roos, P. (2022). How things changed during the COVID-19 pandemic's first year: A longitudinal, mixed-methods study of organisational resilience processes among healthcare workers. *Safety Science*, 155, 105879.

13) Dascalu, S. (2019). Measles epidemics in Romania: lessons for public health and future policy. *Frontiers in Public Health*, 7(98), pp 1-8. https://doi.org/10.3389/fpubh.2019.00098.
14) Dimova, A., Rohova, M., Koeva, S., et al. (2018). Bulgaria: Health System Review. *Health Systems in Transition series*, 20(4), pp. 1-256.
15) Džakula, A., Vocanec, D., Banadinovic, M., Vajagic, M., Loncarek, K., Lukacevic Lovrencic, I., et al. (2021). Croatia: Health System Review. *Health Systems in Transition series*, 23(2), 146.
16) Džakula, A., Banadinovic, M., Lukacevic Lovrencic, I., Vajagic, M., Dimova, A., Rohova, M., Minev, M., Scintee, S. G., Vladescu, C., Farcasanu, D., Robinson, S., Spranger, A., Sagan, A. and Rechel, B. (2022). A comparison of health system responses to COVID-19 in Bulgaria, Croatia and Romania in 2020. *Health policy*, 126, pp. 456-464.
17) Evans, D. B. and Over, M. (2020). The Economic Impact of COVID-19 in Low- and Middle-Income Countries. *Centre for Global Development: Commentary and Analysis. Washington DC: Centre for Global Development.* [online] Available at: https://www.cgdev.org/blog/economic-impact-covid-19-low-and-middle-income-countries [Accessed 20.06.2023].
18) Ferraz, D., Mariano, E. B., Manzine, P. R., Moralles, H. F., Morceiro, P. C., Torres, B.G., et al. (2021). COVID health structure index: the vulnerability of Brazilian microregions. *Social Indicators Research*, 158(1), pp. 197-215. https://doi.org/10.1007/s11205-021-02699-3.
19) Hadad, S., Hadad, Y. and Simon-Tuval, T. (2013). Determinants of healthcare system's efficiency in OECD countries. *The European Journal of Health Economics,* 14(2), pp. 253-265. https://doi.org/10.1007/s10198-011-0366-3.
20) Hollnagel, E. (2018). *Safety-II in Practice: Developing the Resilience Potentials*. Routledge.
21) Jakovljevic, M., Mouselli, S., Al Ahdab, S. and Hammoudi Halat, D. (2022). Editorial: Does healthcare financing explain different healthcare system performances and responses to COVID-19?. *Frontiers in Public Health*, 10(1062425). https://doi.org/10.3389/fpubh.2022.1062425.
22) Kruk, M. E., Myers, M., Varpilah, S. T. and Dahn, B. T. (2015). What is a resilient health system? Lessons from Ebola. *Lancet,* 385(9980), pp. 1910-1912. https://doi.org/10.1016/S0140-6736(15)60755-3.
23) Kumagai, N. (2021). The impact of the COVID-19 pandemic on physician visits in Japan. *Frontiers in Public Health*, 9(743371). https://doi.org/10.3389/fpubh.2021.743371.
24) Ling, E. J., Larson, E., MacAuley, R. J., Kodl, Y., Vandebogert, B., Baawo, S. and Kruk, M. E. (2017). Beyond the crisis: did the Ebola epidemic improve resilience of Liberia's health system?. *Health Policy and Planning*, 32(3), pp. iii40–iii47. https://doi.org/10.1093/heapol/czx109.
25) Lupu, D. and Tiganasu, R. (2022) COVID-19 and the efficiency of health systems in Europe. *Health Economics Review*, 12(14). https://doi.org/10.1186/s13561-022-00358-y.
26) Neagu A. (2019). Map of the Medical Staff Deficit: 424 Localities in Romania Have No Family Doctor, and 1,098 Localities Have Insufficient Family Doctors. [online]

Available at: https://www.hotnews.ro/stirisanatate-23561486-harta-deficitului-medici-424-localitati-din-romanianu-niciun-medic-familie-iar-1-098-localitati-medici-familie-insuficientipentru-acoperi-populatia.htm [Accessed 20.06.2023].

27) Nuzzo, J. B., Meyer, D., Snyder, M., Ravi, S. J., Lapascu, A., Souleles, J., Andrada, C. I. and Bishai, D. (2019). What makes health systems resilient against infectious disease outbreaks and natural hazards? Results from a scoping review. *BMC Public Health,* 19(1310). https://doi.org/10.1186/s12889-019-7707-z.

28) OECD (2016). *Scoping paper on health system efficiency measurement*. [online] Available at: https://www.oecd.org/health/health-systems/Scoping-Paper-Measuring efficiency-in-health-system.pdf [Accessed 20.06.2023].

29) OECD (2021). *European Observatory on Health Systems and Policies Romania: Country Health Profile 2021*. State of Health in the EU. Paris: OECD Publishing.

30) Øyri, S. F. and Wiig, S. (2022). Articulating concepts matters! Resilient actions in the Norwegian governmental response to the COVID-19 Pandemic: Comment on Government actions and their relation to resilience in healthcare during the COVID-19 pandemic in New South Wales, Australia and Ontario, Canada. *International Journal of Health Policy and Management*, 11(9), pp. 1945–1948. https://doi.org/10.34172/ijhpm.2022.6892.

31) Romanian Ministry of Internal Affairs (2016). *Report on the Lessons Learned from the Colectiv Nightclub Fire*. [online] Available at: https://gov.ro/fisiere/comunicate_fisiere/raport_c.pdf [Accessed 20.06.2023].

32) Social Monitor (2021). *Accesul la îngrijire medicală (The Access to Medical Care).* [online] Available at: https://monitorsocial.ro/indicator/accesul-la-ingrijire-medicala-din-ce-in-ce-mai-usor-in-orasele-mari-din-ce-in-ce-mai-dificil-in-restul-tarii/ [Accessed 20.06.2023].

33) Stephenson, A. (2010). Measuring and comparing organisational resilience in Auckland. *Australian Journal of Emergency Management*, 25(2), pp. 27-32.

34) The Lancet, R. (2021). Too long to wait: the impact of COVID-19 on elective surgery. *The Lancet Rheumatology*, 3(2):e83.

35) Thomas, S., Sagan, A., Larkin, J., Cylus, J., Figueras, J. and Karanikolos, M. (2020). European Observatory on Health. Strengthening health systems resilience: key concepts and strategies. *Health Systems and Policy Analysis*, Policy brief 36. Copenhagen: World Health Organization. Regional Office for Europe.

36) Thomas, S., Keegan, C., Barry, S., Layte, R., Jowett, M. and Normand, C. (2013). A framework for assessing health system resilience in an economic crisis: Ireland as a test case. *BMC Health Services Research*, 13(450). https://doi.org/10.1186/1472-6963-13-450.

37) Vavken, P., Pagenstert, G., Grimm, C. and Dorotka, R. (2012). Does increased health care spending afford better health care outcomes? Evidence from Austrian health care expenditure since the implementation of DRGs. *Swiss Medical Weekly*, 142 (2324): w13589. https://doi.org/10.4414/smw.2012.13589.

38) Vindegaard, N. and Benros, M. E. (2020). COVID-19 pandemic and mental health consequences: Systematic review of the current evidence. *Brain, Behavior, and Immunity*, 89, pp. 531-542. https://doi.org/10.1016/j.bbi.2020.05.048.

39) Vladescu, C., Scintee, S. G., Olsavszky, V., Hernandez-Quevedo, C. and Sagan, A. (2016). Romania: Health System Review. *Health Systems in Transition series*, 18(4), pp. 1-170.
40) Zamiela, C., Ibne Hossain, N. U. and Jaradat, R. (2022). Enablers of resilience in the healthcare supply chain: A case study of U.S healthcare industry during COVID-19 pandemic. *Research in Transportation Economics*, 93, 101174. https://doi.org/10.1016/j.retrec.2021.101174.
41) WHO (2020). *Strengthening the health system response to COVID-19 Recommendations for the WHO European Region Policy brief (1 April 2020)*. [online] Available at: https://apps.who.int/iris/handle/10665/333072. [Accessed 20.06.2023].
42) WHO (2023). Global Health Expenditure Database. Web page. [online] Available at: https://apps.who.int/nha/database/Select/Indicators/en [Accessed 20.06.2023].
43) Wiig, S. and O'Hara, J. K. (2021). Resilient and responsive healthcare services and systems: challenges and opportunities in a changing world. *BMC Health Services Research*, 21(1), 1037. https://doi.org/10.1186/s12913-021-07087-8.