

Behavioural determinants of the healthcare providers in Ukraine: Focus on competition context

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ABSTRACT

The development of the healthcare system is an important task for every country, given that long-term economic and social development is absolutely impossible without a healthy nation. Therefore, improving public health and ensuring that the maximum number of people have access to quality healthcare services is one of the state's strategic priorities. In this regard, the authors of the paper set a goal to establish how the reform of the healthcare system in Ukraine has led to changes in the behavioural determinants of healthcare providers and recipients in the domestic healthcare market. The paper uses such research methods as comparison, visualization, graphical data visualization tools, and statistical methods of data analysis. The study revealed that Ukrainian citizens got a chance to freely choose their physicians by signing declarations with them, which led to increased competition among physicians and other doctors and healthcare facilities; at the same time, the number of declarations signed with private healthcare facilities increased significantly. Furthermore, the developed econometric model allows us to identify statistically significant relationships between the amount of state funding and lifestyle and environmental indicators, which will allow us to improve the mechanisms and amount of funding in the sector, improving the health of the nation in the new competitive environment.

1. Introduction

Human health is the highest value for a person, which is declared in Article 49 of the Constitution (Law of Ukraine, 1996). Therefore, every citizen, regardless of social status, income, or origin, has the right to access quality healthcare services (Ta et al., 2020). The state healthcare policy in Ukraine is ensured by budgetary allocations in the amount that corresponds to its scientifically substantiated needs. At the same time, it cannot be less than ten percent of the national income (Law of Ukraine, 1993). In order to ensure territorial accessibility of quality healthcare to the population, the state promotes the development of healthcare institutions of all forms of ownership (Lee et al., 2022). Nevertheless, does the current system meet the challenges of our time?

The Ukrainian healthcare system that existed before 2014 and was based on the Semashko model required major reform. State funding of

the healthcare sector did not contribute to the provision of efficient and quality services (Beztelesna, 2010). Although in 2015, Ukraine allocated UAH 3630 per capita to the healthcare sector, the amount itself was not the critical factor. The problem was linked to the fact that patients had to pay almost half of this amount (49.3%) out of their own pockets. It is known that if less than 75% of the system's funding comes from public sources, i.e. more than 25% are from private sources, this system is unmanageable (Report). In such a system, patients cannot be protected from catastrophic healthcare costs.

The lack of funds for medical equipment, the purchase of medications, and the salary of medical staff is an important factor contributing to an additional problem, i.e. corruption. There were also issues with patients' access to medical services. Medical facilities located in cities were not accessible to people living in rural areas. The provision of high-quality healthcare services that met international standards was limited.

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This leads to a tradition of seeking healthcare only when the situation is critical and neglecting disease prevention, which allows for early detection of diseases, therefore reducing the financial burden on the entire healthcare system.

In 2014, the Ministry of Health initiated the development of the National Health Reform Strategy for Ukraine 2015–2020. A distinctive feature of the new system was a patient-centred approach, which would allow patients to receive medical care in the healthcare facility that best meets their needs (Verbivska et al., 2022). It was declared that the new approach would help the population save money on high-priced healthcare services; guarantee coverage with healthcare packages for the entire population, regardless of socio-demographics; and upgrade the material and technical, human, and information resources of healthcare institutions at all levels of care in line with international standards. These objectives have led to competition between healthcare institutions, driven by the desire to attract patients and the funding allocated to people. The involvement of providers of all forms of ownership creates incentives to provide better quality services, implement evidence-based and cost-effective practices, and ensure compliance with clinical protocols and professional standards.

The healthcare system includes patients, doctors who provide primary healthcare services as individual entrepreneurs or within the framework of hospitals (private or municipal ones), and the state. Needless to say, the state, as a market participant, has the most powerful financial capabilities, which it uses to fulfill its constitutional obligations to citizens. And, in the context of the reform, these obligations have been regulated by the Law of Ukraine “On State Financial Guarantees of Medical Care for the Population” (Law of Ukraine, 2018). The new law in the healthcare sector has not only transformed the mechanism and procedure for financing medical guarantees, but also the behaviour of healthcare market players, which has led to increased competition.

Concurrently, the competition in the healthcare sector is a complex issue that requires balancing competing entities (hospitals, clinics, private doctors’ offices), the needs of patients, and health insurance schemes (Horyslavets et al., 2018; Prokopjeva et al., 2020).

2. Literature review

The healthcare system is aimed at providing medical care to the population, as well as preventing and treating diseases among the population. Thus, the primary customer of medical services is the patient, who will determine the accepted quality of medical services and their acceptable price. In a market environment, patients form a demand for healthcare services, thereby demonstrating their interest in acquiring them (Propper et al., 2007).

Competition is a phenomenon that allows expanding the capabilities of the healthcare market (Cutler and Morton, 2013). It can provide greater flexibility for the system to meet the needs of the end user, i.e. the patient (Dafny and Lee, 2016). Proponents of competition believe in the inherent value of market-based resource allocation, which can enhance cost-effectiveness, stimulate investment, improve quality, and control costs by providing healthcare services in the least expensive (affordable) way (Shmygol et al., 2022; Barros et al., 2015). Critics of competition in the healthcare market believe that competition in this sector can lead to the inequality of access to healthcare services, which can lead to a decrease in the overall level of healthcare among the population (Brekke et al., 2011). Moreover, under competitive conditions of operation, healthcare providers may focus their activities on the most profitable areas, thereby creating an uneven distribution of access to healthcare services guaranteed by the state (Klapkiv et al., 2020). However, let’s consider: how to properly balance the emphasis in this system so that none of these components becomes deficient and fully performs the duties assigned to it by society.

Competition in the Ukrainian market implies that a patient can freely choose a healthcare provider among four possible groups: municipal institutions, state institutions, private institutions, and individual

entrepreneurs (sole proprietors). This division allows patients to choose a favourable price, quality, and scope of healthcare services by signing a declaration for primary healthcare with their chosen family physician. Patient choice is an important indicator of the functioning of the healthcare system (Baicker and Chandra, 2004). The patient, given alternatives to choose from, encourages not only an increase in the provision of a particular type of medical service by a particular service provider but also contributes to the redistribution of funding for services in each consumer group, including through the provision of free services. Richard A. Hirth argues that in a competitive environment, the factor of patients’ awareness of the quality of medical care in various healthcare institutions is also important. The scientist notes that well-informed patients simply choose a facility that offers the combination of quality and price they desire (Krabbe-Alkemade et al., 2016). Poorly informed patients can expect to receive the promised level of care based on the characteristics available for analysis (Huppertz et al., 2020). They choose an acceptable price, the form of ownership of the facility, and then the facility itself, knowing that they may not receive the promised level of care (Hirth, 1997). The aforementioned statements confirm that, in fact, it is the patient who can drive competition, as s/he demonstrates demand for different levels of quality of healthcare services and their prices.

Some institutions, of course, can charge high prices while providing poor-quality care (Frakt and Mehrotra, 2019). Such behaviour can mislead poorly informed patients who tend to use price as a criterion for determining the expected level of quality. In a competitive environment, these patients will be forced to get used to searching for information about the level of care in different medical institutions (Aggarwal et al., 2017), thereby increasing the share of informed patients in the market and thus improving the quality of medical services in the market in general.

The division of healthcare institutions into different sectors allows for an additional increase in competition for patients (Zweifel, 2016). Such competition can manifest itself in two aspects.

1. Differentiation of institutions into commercial and non-profit ones. Non-profit institutions include municipal and state healthcare facilities. The former belong to local authorities and are funded from the local budget. They are predominantly managed by local authorities. Whereas the latter belong to the public sector, they are funded from the state budget and are managed by the relevant ministries and separate state bodies (Shahini and Grabova, 2023). Commercial healthcare institutions include private healthcare facilities, which are predominantly funded by their own resources or funds received from clients, as well as individual entrepreneurs who may own their own healthcare facility and engage in entrepreneurial activities in this field, financing it on similar principles. Although all healthcare institutions, regardless of their form of ownership, must comply with the law and provide quality and affordable services to their patients, there are different approaches to the specifics of their activities. The key difference in the functioning of commercial and non-profit healthcare facilities lies in their existing policies. Commercial institutions, driven by profitability, formulate an optimal price-to-quality ratio strategy for their services, aiming to increase the number of patients (Saver et al., 2015; Letunovska et al., 2023). Accordingly, non-profit institutions, in order to remain viable, cover their expenses at a relatively low price range, making their services accessible to a larger number of patients. In this context, another manifestation of competition, social entrepreneurship, is worth emphasizing (Chandra et al., 2022; Purushothama Bhat, 2020). Commonly in the medical field, social entrepreneurship targets the most vulnerable people and works where governments and markets have failed to cover basic health needs of those people (Qaiser and Mansoor, 2021). Thus, the market of mixed ownership forms inherently generates competition.

2. Establishing competition through the redistribution of state funding. In the context of healthcare system reform, the funding of healthcare institutions should be based on the quality and effectiveness of their services rather than the number of patients they serve. Hence, those institutions that provide high-quality and effective services receive more funding than those that do not meet these criteria (Bodheimer and Sinsky, 2014). Such an approach to funding is intended to encourage healthcare institutions to improve the quality of healthcare services and reduce the costs associated with unnecessary and inefficient procedures, thus creating a competitive environment in the healthcare market.

A policy aimed at strengthening competition in the provision of healthcare services should be based on an analysis of existing conditions, possible consequences, and predefined goals set by the state. Competition rules traditionally lead to an increase in the number of services provided, thereby increasing the overall costs of the entire healthcare system (Li et al., 2012; Pandey et al., 2018).

The state, acting as the guarantor of healthcare services, ensures their viability to its set standards. However, the commercial sector may differentiate these standards. The state has the exclusive right to control compliance with the rules for providing healthcare services, acting as the primary regulator in the healthcare market. Regulation is one of the most effective tools of government influence on the commercial and non-profit healthcare sector.

Therefore, public funding is a key tool for ensuring the availability and quality of healthcare services for the population across the entire healthcare market, regardless of the form of ownership of healthcare facilities. By making diagnoses, clinicians determine the demand for additional resources while simultaneously being responsible for preserving public savings or covering the additional costs they generate (Erickson et al., 2020). Thus, providing citizens with the opportunity to choose a physician and receive medical care within the framework of state guarantees stimulates the development of competition, changes in the behaviour of healthcare system actors, transforms the financial mechanism, and actualises the search for factors that influence their choice and the amount of funding for the sector. This statement constitutes the overall objective of our study.

3. Methodological approach

The research is based on the annual reports of the National Health Service of Ukraine (Report) (NHSU) and the State Statistics Service of Ukraine.

In order to study the behavioural determinants of the healthcare system of Ukraine, the study used the following data from the National Health Service of Ukraine in the regional context: the number of declarations submitted to primary care physicians by the form of ownership of service providers (2018–2022); the number of primary care physicians (2018–2021); the optimal patient volume by primary care physicians achieved (2020–2022); the number of healthcare providers and payments to them under the Healthcare Guarantee Programme by the type of ownership of service providers (2020–2022).

Additionally, the research used the data from the State Statistics Service regarding the disposable personal income per capita in 2018 and 2021.

In order to determine the factors that affect the amount of funding for the sector, we used regional data from the State Statistics Service for 2021, namely: the number of employed among the working-age population (age group 15–70); gross regional product per person employed; emissions from stationary sources of pollution; emissions of pollutants into the atmospheric air from mobile sources; capacity of the treatment facilities; energy value in the food consumed (the number of kilocalories, proteins, fats and carbohydrates consumed); the number of doctors, nurses and paramedical staff.

When conducting the research, a monographic method was used to

describe the behavioural determinants of market subjects and the peculiarities of their functioning. In addition, we used economic and statistical analysis and visualization to determine the dynamics of the structure of participants in the medical services market in terms of forms of ownership, regions, and amounts of financing. Furthermore, we used the correlation analysis method to determine the dependence between the size of the available income of the population and the forms of ownership of medical institutions. The Microsoft Excel software toolkit was used to construct the corresponding scatter graphs. Additionally, cause-and-effect relationships between the amount of state funding of the medical guarantee program and external factors were assessed by correlation-regression analysis.

4. Results

The development of competition among primary healthcare institutions that have signed agreements with the NHSU has contributed to the diversification of patients' choices. Given the availability of alternative options, such as the established format of municipal healthcare institutions based on traditional outpatient clinics, private healthcare facilities, and self-employed physicians (individual entrepreneurs, i.e. FOP), the number of signed declarations with physicians and private healthcare facilities is increasing. Hence, in 2022, compared to 2018, the number of declarations signed with municipally owned healthcare institutions increased by 1.2 times (from 24,258,216 to 29,659,749), with privately-owned institutions by 13 times (without individual entrepreneurs, i.e. FOPs) (from 93,348 to 1,243,335) and with individual entrepreneurs by 18 times (from 72,675 to 1,319,613). At the same time, in absolute terms, the number of declarations signed with municipal institutions remains significantly higher, and in 2022 it exceeds the total number of declarations with private entities and sole proprietors by 11 times. For comparison, in 2018, this difference was more than 148 times. Appendix A1 shows the dynamics of the share of declarations signed with doctors and institutions of different forms of ownership across the regions of Ukraine in 2018, 2021, and 2022. The geographical location and economic specialisation of Oblasts (e.g. West – East, industrial or agricultural regions) do not affect the shift in patient choice in favour of private facilities and sole proprietors. Although in 2022, we can see an increase in the share of consumer choice in favour of private care in Dnipro, Zaporizhzhia, Kyiv, Odesa, Sumy, and Kherson Oblasts (regions). On the other hand, in the Lviv and Poltava regions as well as in the city of Kyiv, the percentage of declarations signed with communal institutions increased. This may be due to the geography of hostilities and internal displacement. Similarly, there was no significant correlation between disposable personal income and the form of ownership of healthcare facilities (municipal versus private ones). That is, patients with middle- and higher-income levels are equally active in signing declarations with both private and municipal doctors (Fig. 1).

The fact that over five years (2018–2022), the number of declarations signed with private practitioners (including individual entrepreneurs) has increased is largely due to the increase in the population's income (i.e., their ability to pay) rather than the increase in the supply of service providers and the decisive role of physicians' reputation. Typically, it is not novice doctors who open private practice, but rather doctors who have a good reputation in the profession. According to the License Terms (Resolution of the Cabinet of Ministers of Ukraine of 02.03.2016 No. 285), private practice can be started by specialists who meet specific requirements regarding education and work experience. Furthermore, their reputation is confirmed by patient reviews on the official websites of medical institutions and in the electronic medical information system for patients Helsi.me. This is confirmed by the fact that primary care (PC) physicians fulfill the optimal patient volume (OPV), which, according to the NHSU recommendations, is 1800 people per general practitioner (GP)/family physician, 2000 people per primary care provider, and 900 people per pediatrician. On average, in Ukraine, the share of doctors with completed OPVs is decreasing from 41.5% in

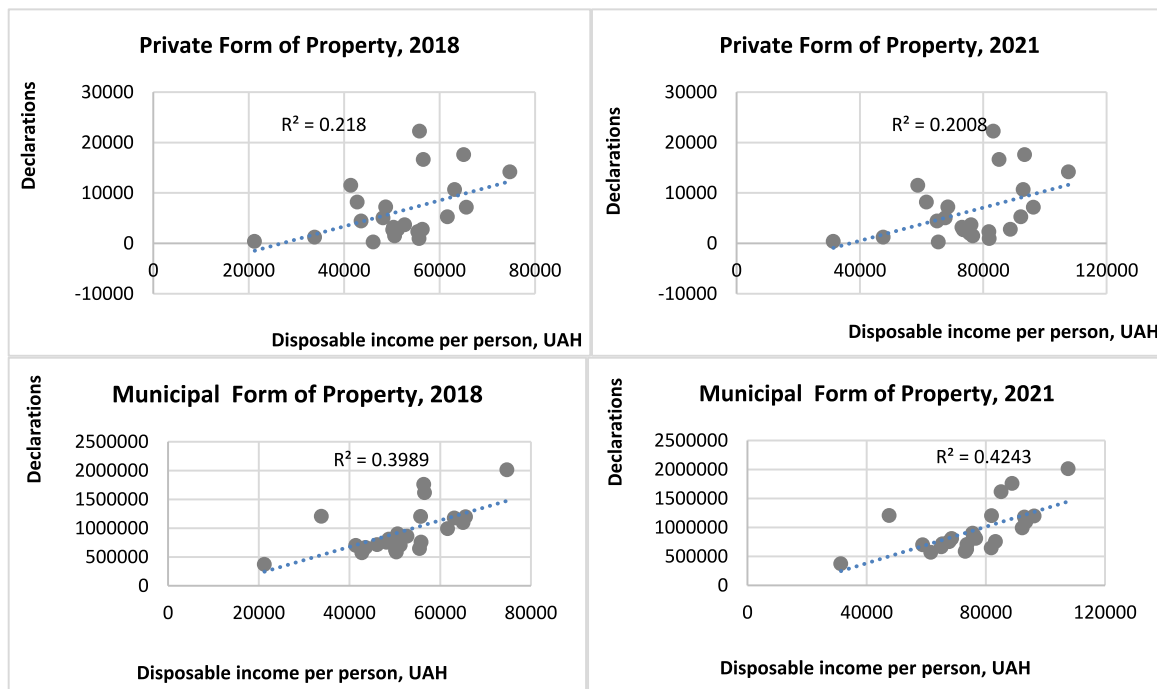


Fig. 1. Relationship between disposable personal income of the population and ownership of healthcare facilities, 2018, 2021. Source: Authors' computations on the basis of data from Report of the National Health Service of Ukraine (2018; 2021).

2020 to 38.97% in 2021 and 30.0% in 2022 (Fig. 2). At the same time, the analysis has not detected any changes in trends across the regions of Ukraine (Appendix A2), and there is no correlation between the level of primary healthcare physician availability to the population and the percentage of doctors who have met the optimal patient volume (Appendix A3). In other words, a patient's choice of a physician is a real phenomenon.

With the introduction of the Healthcare Guarantee Programme (HGP) in Ukraine, which includes a list of healthcare services that are guaranteed for every patient free of charge, particularly specialised, highly specialised, emergency, palliative care, and medical rehabilitation services, private doctors and individual entrepreneurs (FOPs) can participate in the provision of relevant services with payment covered by the state. In 2020–2022, there were changes in both the total number of service providers under healthcare guarantee programmes and their structure. In 2021, the total increase in the number of service providers was 11.7%, and in 2022, compared to 2021, there was a 0.51% decrease. In a structural comparison, the share of municipally owned institutions is decreasing, while the share of private ones is increasing by an average

of 5% (Appendix A4).

The volumes of services provided and payments made by the NHSU to private providers under the Healthcare Guarantee Programmes are also increasing. Therefore, the increase in funding for HGP per 1 provider for private institutions annually amounted to 86–87%, for individual entrepreneurs, it was 58% in 2021 and 64% in 2022, while similar indicators for municipal institutions were 145% and 24%, respectively (Table 1).

Such structural changes are the result of the opportunity provided and implemented by private institutions and physicians to attract public funding through participation in the Healthcare Guarantee Programme. Transparent payment mechanisms allow private providers, which build their businesses taking into account modern aspects of optimising business processes and costs (for example, the provision of medical services by a private FOP physician obliges him/her to maintain electronic records, reducing costs related to the employment of additional medical staff, maintenance, and depreciation of general premises, etc.) to compete for patients. Although the list of packages signed by private doctors and private healthcare facilities most often relates to primary,

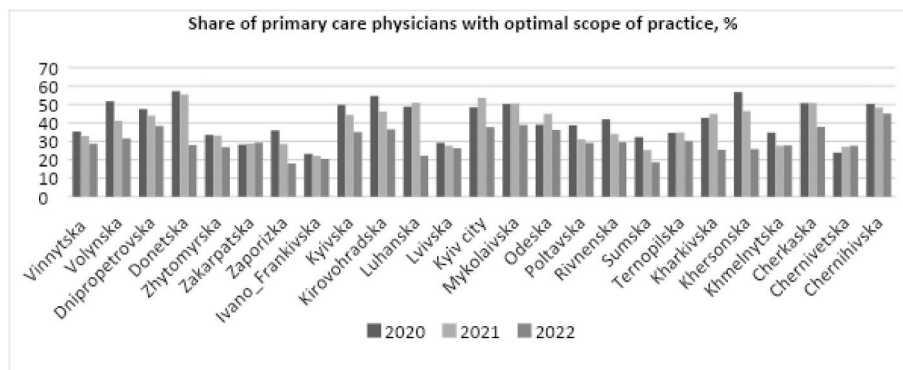


Fig. 2. Share of primary care physicians with optimal practice volume, 2020–2022. Source: Authors' visualization based on Report of the National Health Service of Ukraine (2020; 2021, 2022).

Table 1

Payments under the healthcare guarantee programme to providers by the form of ownership (Per 1 provider, UAH).

Year	Municipal Ownership	Year-Over-Year Growth, %	Private Ownership	Year-Over-Year Growth, %	Individual Entrepreneur	Year-Over-Year Growth, %
2020	19,361,168.52	–	1,744,307.24	–	559,164.58	–
2021	47,439,927.08	145.02	3,249,208.56	86.27	888,502.60	58.89
2022	58,851,023.63	24.05	6,090,336.64	87.44	1,458,876.43	64.19

Source: Authors' computations on the basis of data from the Report of the National Health Service of Ukraine (2020; 2021, 2022).

specialised, and dental care, regional practices of providing other healthcare services show further prospects for the entry of commercial healthcare guarantee programmes into the market.

The amount of public (state) funding under the Healthcare Guarantee Programme is one of the performance indicators of the functioning of the entire healthcare system in Ukraine. On the one hand, it serves as an indicator of the state's commitment to ensuring the population's access to guaranteed free medical care. On the other hand, it reflects the state's response to external factors that influence changes in the population's health status in conditions of limited resources. In order to identify the factors influencing the funding levels in the healthcare sector, we used the approach described in the Lalonde model (Lalonde, 1981). According to this model, the main factors that determine human health are heredity, environmental conditions, the state of the healthcare system, lifestyle factors, and standard of living. Considering heredity in this system as a factor that a person cannot influence, we interpret the model to the subject of the study and determine the correlation and regression impact of factors on the amount of public funding for the Healthcare Guarantee Programme (Fig. 3).

The factors influencing the amount of funding for healthcare services were divided into four groups (Table 2). All factors are based on the data of the State Statistics Service of Ukraine for 2021.

Group 1 consists of factors that characterise the economic activity of the population, particularly their position in the labour market and their performance. Factor X1 represents the employed population of working age (according to the ILO methodology, all persons aged 15–70), which forms the basis of the economy and actively influences the GDP formation. The second factor (X2) is GRP per 1 employed person, which indicates the economic efficiency of the employed population. Both indicators are a source of resources to meet social needs.

Group 2 is characterised by three factors: X3 represents the emissions of pollutants from stationary sources, X4 represents the emissions of pollutants into the atmospheric air from mobile sources, and X5 represents the capacity of treatment facilities. Apart from reflecting the state of the environment, this group also primarily characterises the impact on public health. Factor X3 is one of the key indicators for assessing the impact of industrial enterprises on the environment and human health. It allows analysis of the number of different types of pollutants (heavy metals, hydrocarbons, nitrogen, and sulphur oxides, ammonia, and other toxic substances) emitted into the air from industrial sources such as plants, factories, and power plants. This

Table 2

Variable factors to determine the impact on the amount of state funding for the healthcare guarantee programme.

Groups	Variable Factors
H1 – lifestyle	X1 – employed population of working age (persons aged 15–70) X2 – GRP per 1 person employed
H2 – state of the environment	X3 – emissions of pollutants from stationary sources X4 – emissions of pollutants into the atmospheric air from mobile sources X5 – capacity of treatment facilities
H3 – standard of living	X6 – the number of kcal consumed X7 – amount of proteins consumed X8 – amount of fats consumed X9 – amount of carbohydrates consumed
H4 – state of the healthcare system	X10 – number of doctors X11 – number of nurses and paramedical staff

Source: Authors' concept.

factor is complemented by factor X4, which indicates the amount of various pollutants emitted into the atmospheric air from mobile sources, such as vehicles, aircraft, or ships. Controlling emissions of pollutants from mobile sources can help reduce air pollution and improve air quality in cities and areas with a high number of vehicles (Czyżewski et al., 2020). Factors X3 and X4 complement the over-all environmental situation, but their negative impact is mitigated by the state policy to counter the environmental crisis. In this regard, factor X5 was also included in Group 2. The “capacity of the treatment facilities” indicator reflects the amount of wastewater that can be treated and purified by the treatment facilities, removing various bacteria, chemical compounds, solid particles, and other pollutants.

It is well-known that the amount of calories a person consumes during the day affects his/her weight, overall health, and, consequently, their quality of life. If a person consumes more calories than his/her body burns, this can lead to weight gain and an increased risk of obesity, cardiovascular diseases, and other health conditions. Proteins, fats and carbohydrates are the main components of food that are essential to sustain the body's functions. Their balance can help maintain an optimal level of health. This is the reasoning behind the inclusion of the factors that characterise the balanced eating behaviour of Ukrainians in Group 4, namely: the number of kcal consumed (X6), the number of proteins consumed (X7), the number of fats consumed (X8) and the number of carbohydrates consumed (X9).

When selecting the factors for the last group, we were guided by the fact that any infrastructural and financial indicators of the healthcare system are already included in the resulting indicator of funding through the indicators of capital expenditures, depreciation, and labour costs. Therefore, there may be mathematical autocorrelation between the resulting and variable indicators, which should be taken into account when determining relationships and dependencies. This group includes indicators related to the availability of medical staff: the number of doctors (factor X9) and the number of nurses and paramedical staff (factor X10). On the one hand, an insufficient number of doctors, nurses, and paramedical staff may lead to higher healthcare costs, but on the other hand, an increase in the number of medical staff may reduce the risk of errors, unproductive procedures, and inefficient use of resources, which can reduce healthcare costs in general. Moreover, insufficient

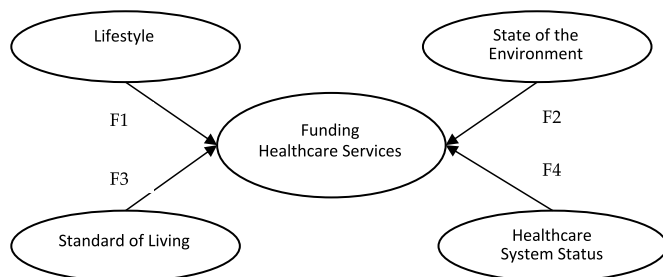


Fig. 3. Factors influencing the amount of funding for healthcare services. Source: Authors' concept.

funding for healthcare may result in a reduction in the number of doctors, nurses, and paramedical staff in the healthcare system, which may affect the quality and accessibility of healthcare services.

The correlation and regression analysis and step-by-step optimisation of the model (Appendix A5) revealed a statistically significant relationship between the amount of public funding for the HGP in 2021 and lifestyle indicators (X1 – employed population in the working age (15–70 years) and X2 – GRP per 1 person employed), as well as the environment (X4 – emissions of pollutants into the atmospheric air from mobile sources). The elasticity coefficients for these indicators show the decisive influence of the employed population in the working age on the amount of public funding for the HGP ($E1 = 0.831$) and the multi-directional, less significant, and almost unambiguous influence of the other two indicators ($E2 = 0.234$, $E4 = -0.277$). It should be noted that the results obtained describe only the situation in 2021 and cannot be extrapolated to subsequent years, as they are largely (16% of the total HGP funding) influenced by the spread of coronavirus disease (COVID-19) and the algorithms for its diagnosis, treatment, and vaccination implemented at that time, which were especially widespread among the working population. This explains the significance of the impact of two factors: not only the quantitative employment indicator but also the qualitative indicator of its productivity in the year of quarantine restrictions. For reference, in 2020, among similar indicators, statistically significant correlations were found between the amount of funding and lifestyle indicators (employed population in the working age, i.e. factor X1) and the environment (capacity of the treatment facilities, i.e. factor X5). At the same time, the impact of lifestyle was also decisive (elasticity coefficient $E1 = 0.83$), while the environmental indicator was insignificant after the final optimisation of the model (elasticity coefficient $E5 = 0.06$). Thus, lifestyle and environment are the factors that largely determine the health status of the population in Ukraine and influence the extent of government involvement in its provision and restoration.

5. Conclusion

The reform of the healthcare system in Ukraine has led to a change in the behavioural determinants of actors in the healthcare market. Through the healthcare system reform, citizens gained the opportunity to freely choose their primary care physician by signing declarations with them. This also led to increased competition among physicians providing this type of medical care. Physicians began offering medical services to citizens while working in municipal or private healthcare facilities or as individual entrepreneurs, significantly expanding consumer choice options. As a result of the opportunities available to citizens and physicians, there has been an increase not only in the total number of declarations signed but specifically in the number of declarations with physicians and privately owned facilities. Such options can encourage the development of social entrepreneurship in the medical field. In Ukraine, the issue of social entrepreneurship is becoming more relevant if consider the current military actions and the manifestations of their prolonged consequences. The latter means physical and psychological injuries of both the military and the civilian population and the massive need for prosthetics and rehabilitation, atypical for the Ukrainian healthcare system. Additionally, this field has an extremely large potential for the formation of social entrepreneurship with various financing models based on the implementation of international experience and the development of one's own practice against the background of a protracted Russian-Ukrainian war. Hence, in 2022, compared to 2018, the number of declarations signed with municipally owned healthcare institutions increased by 1.2 times, with privately-owned institutions by 13 times (without individual entrepreneurs, i.e. FOPs) and with individual entrepreneurs by 18 times. At the same time, in absolute terms, the number of declarations signed with municipal institutions remains significantly higher, and in 2022 it exceeds the total number of declarations with private entities and sole proprietors (individual entrepreneurs) by 11 times, although in 2018 this difference was

more than 148 times. At the same time, the study did not reveal any correlation between the place of residence, the consumer's ability to pay, and the ownership form of the institution where the physician works. Based on the constructed correlation dependencies, it has been proven that Ukrainian citizens indeed have freedom of choice when it comes to selecting a physician.

The reform of the healthcare system at the secondary level has enabled the state to focus on meeting the needs of patients and to finance medical care provided within the framework of guarantees, not municipal institutions. Alongside municipal institutions, private physicians and individual entrepreneurs have been able to participate in providing relevant services with payment covered by the state. This led to changes in both the total number of service providers under healthcare guarantee programmes and their structure. Thus, in 2021, the overall increase in the number of service providers was 11.7%, and in 2022, compared to 2021, there was a 0.51% decrease. This drop is relatively insignificant, given the conditions that have existed in the country since 2022. During the reform period, the share of municipally owned healthcare institutions is decreasing, while the share of private ones is increasing by an average of 5% annually.

In order for the state to fulfill its obligations in the field of medical guarantees, it is important to know what influences and determines its financial capabilities, and therefore, in the course of the study, we developed a model in which a significant number of factors influence the performance indicator, i.e. the amount of funding for healthcare services. The research used Lalonde model approach to select the influencing factors. The study formed four groups of influence, namely: lifestyle and standard of living, state of the environment, and healthcare system, which are characterised by 14 factors, the values of which were obtained from the State Statistics Service. The correlation and regression analysis and step-by-step optimisation of the model revealed a statistically significant relationship between the amount of public funding for the HGP in 2021, lifestyle indicators, and environmental indicators. The elasticity coefficients for these indicators showed the decisive influence of the employed population in the working age on the amount of public funding for the HGP ($E1 = 0.831$) and the multi-directional, less significant, and almost unambiguous influence of the other two indicators, i.e. GRP per 1 person employed and emissions of pollutants into the atmospheric air from mobile sources ($E2 = 0.234$, $E4 = -0.277$). The results obtained describe only the situation in 2021 and cannot be extrapolated to subsequent years, as they are largely influenced by the spread of coronavirus disease (COVID-19) and the measures to overcome it.

Therefore, the ongoing reform of the healthcare system in Ukraine significantly modifies the behavioural determinants of the system actors and sometimes has positive consequences. However, it would be necessary to conduct an in-depth study of the impact of the pandemic and the geopolitical conflict in Ukraine on the processes of reforming the industry to determine the severity of the impact of crisis situations on changing the behaviour of consumers and service providers and prolong the dynamic series of research. It is worth noting that the information can contribute not only to improving the system adopted in the country of origin but can also serve as a guide for other countries adopting similar practices.

6. Limitations and future research

The time period of the study is determined by the fact that the medical reform in Ukraine was introduced in 2018 and is still ongoing at the time of writing. As of the date of writing the article, the following stages are being implemented:

The first stage (2018) is the reform of primary healthcare services, which allows patients to choose a doctor freely.

The second stage (2020) is the implementation of the medical guarantee programs financed by the state regardless of the form of ownership of the institutions that provide them. However, it should be

exercised when relevant contracts are signed between the state and the medical institution. Such contracts provide for the need to comply with a number of personnel and material and technical requirements regarding the quality of the services provided. Since the Medical Guarantee Program (MGP) was implemented in April 2020, but not from the beginning of the calendar year (as it is typical for reporting in Ukraine), this year cannot be considered representative. The base year for the study is 2021, but dynamic comparisons are made over the entire period of available comparative data.

The third stage (2023), which involves forming a capable network of hospitals that provides territorial accessibility to high-quality medical and rehabilitation care, is just beginning to be implemented.

This course of the reform makes it challenging to access and compare data in the National Health Service's annual reports, even for the period of study, which is too short for reasonable conclusions. Therefore, the research focuses on tracking the common trends caused by the reform's implementation but not on a critical analysis of the problems associated with its implementation.

Also, the research period (2018–2022) includes two significant events that can significantly affect the results of the study: the COVID-19 pandemic (2020) and Russian invasion of Ukraine alongside the occupation of part of its territories (2022). We did not investigate the separate impact of these events on the processes studied in the article, but if there is a visible impact, it is emphasized in our work. However, we recognize the need for a further detailed study of the impact of the COVID-19 pandemic and Russian invasion of Ukraine on the reforming processes in the medical sphere.

The Russian invasion of Ukraine alongside the occupation of part of its territories have also caused problems with the collection and publication of statistics since 2022. Therefore, 2021 is the last year with available and comparable statistics.

This study used the idea of a model regarding the determinants of the impact on health, which focuses on the selection of 4 groups of factors. State financing is a key tool for ensuring the availability and quality of medical services, and therefore the health of the population. Taking Lalonde's factors as a basis, we assumed that the volume of state financing of the medical industry is influenced by 4 groups of factors identified by Lalonde. The selection of specific indicators of 11 factors is the author's interpretation, the selection of which was influenced by the availability of domestic statistical data. Of course, there are other factors that were overlooked in this case due to data limitations and could be taken into account in future studies.

Therefore, one of the important prospective areas of research is expanding the time range and increasing the amount of data to identify

trends and regularities in the formation of the efficiency of the medical reform in Ukraine. Another important direction of research is the identification of determinants, barriers and drivers of the development of social entrepreneurship in the medical field of Ukraine.

CRediT authorship contribution statement

Lyudmila Beztelesna: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Pawel Marzec:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Olha Pliashko:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Viktoriia Vovk:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Sergii Khomych:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Lesia Kucher:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Anatolii Kucher:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

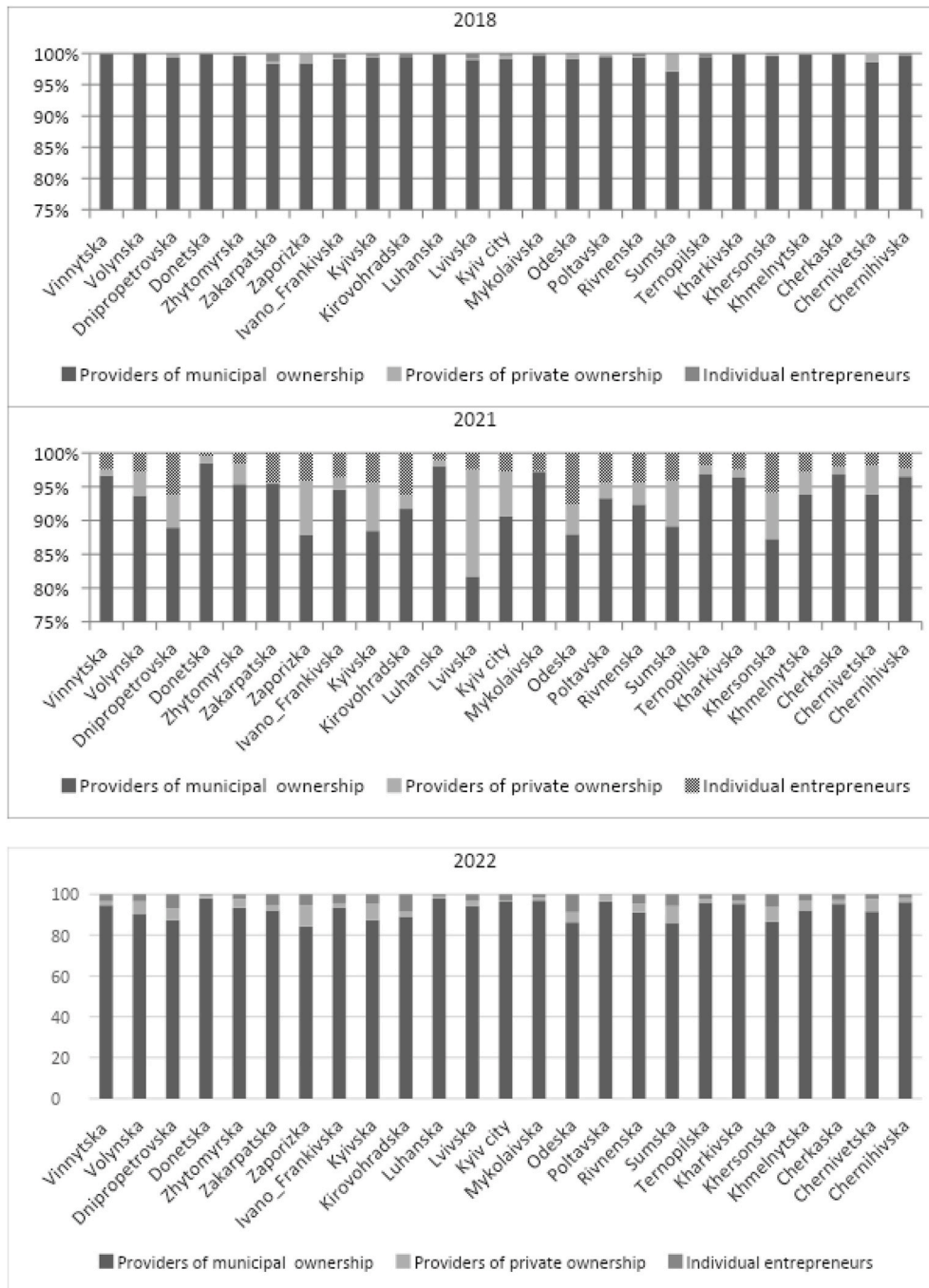
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

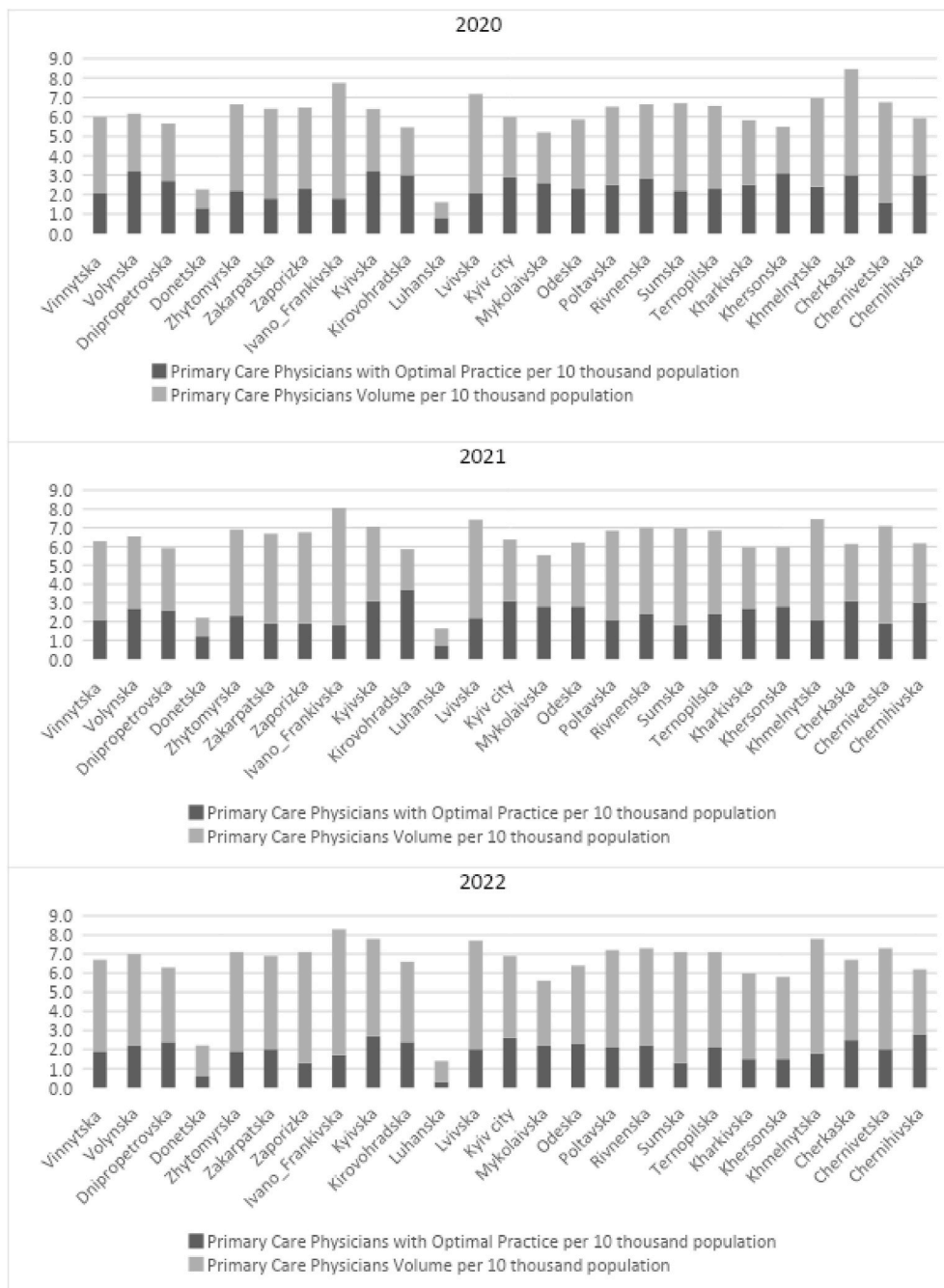
Appendix A1

Declarations Signed with Doctors and Institutions of Different Forms of Ownership by Oblasts (Regions) of Ukraine in 2018, 2021 and 2022, %
Source: Authors' visualization based on Report of the National Health Service of Ukraine (2018; 2021, 2022).



Appendix A2

Ratio of the Total Number of Primary Care Physicians and Primary Care Physicians with Optimal Practice Volume by Oblast (Region), 2020–2021.
 Source: Authors' visualization based on Report of the National Health Service of Ukraine (2020; 2021, 2022).



Appendix A3

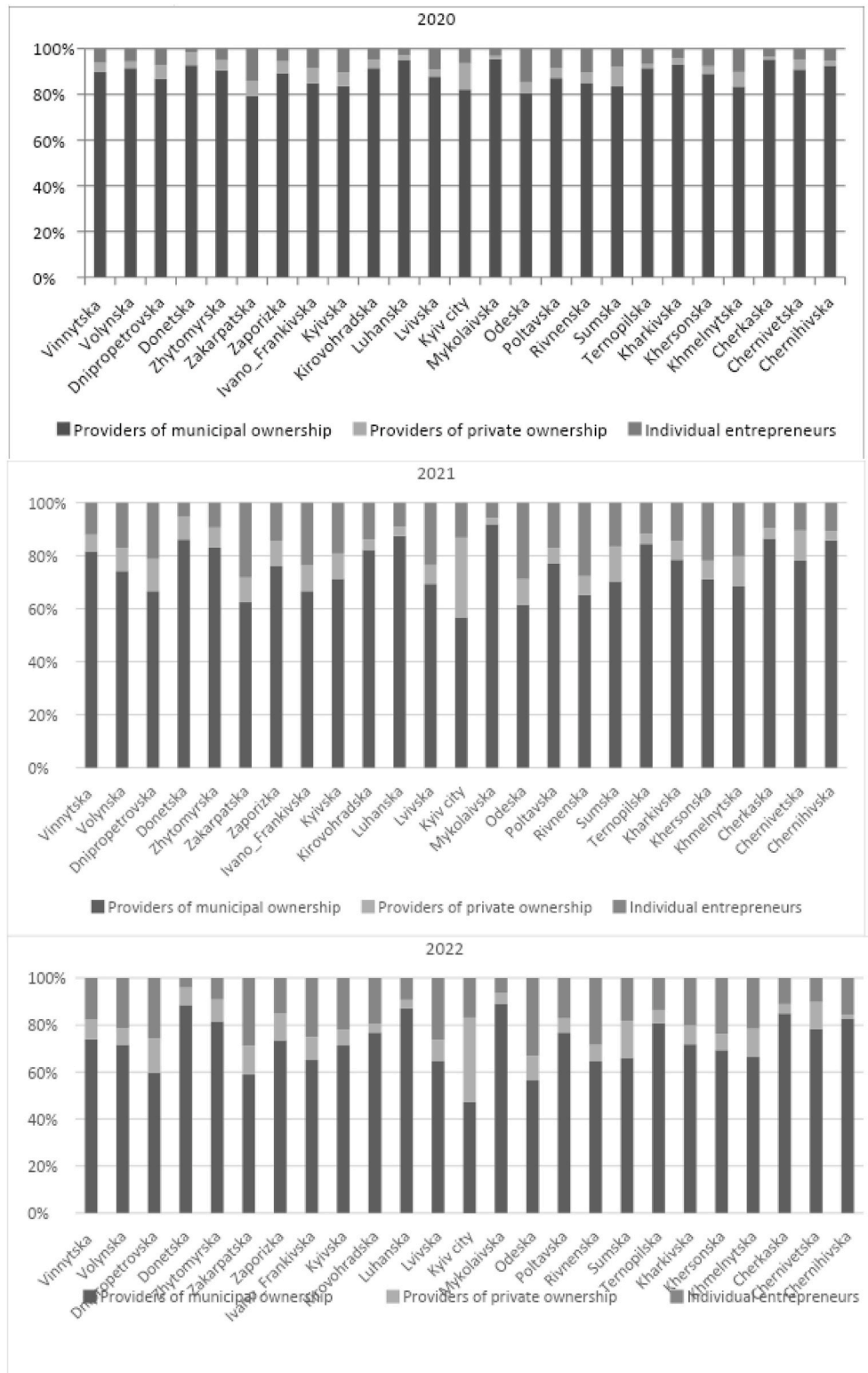
The correlation coefficient between indicators of population provision with primary care physicians and the proportion of primary care physicians who have performed the optimal scope of practice (per 10 thousand population).

Total number of primary care physicians with optimal scope of practice	Total number of primary care physicians	
	2020	2021
	0.4756	0.3959

Appendix A4

Service Providers under Healthcare Guarantee Programmes by Oblast (Region) and Form of Ownership, 2020–2022.

Source: Authors' visualization based on Report of the National Health Service of Ukraine (2020; 2021, 2022).



Appendix A5

Step-by-step regression analysis of the impact of factors of the external environment (x1-x11) on the amount of state funding for the healthcare guarantee programme (y), 2021.

Resulting indicator (y)	Impact factors (x)	Equation	Parameters			
			Correlation coefficient, R	Coefficient of determination, R ²	F fact, (p = 0.95)	t-fact , (p = 0.95)
Amount of state funding for the healthcare guarantee programme	Step 1. Initial model x ₁ - x ₁₁	Y = - 673.56 + 4.28x ₁ +0.01x ₂ -1.46x ₃ -36.46x ₄ +1.17x ₅ +1.84x ₆ -2.13x ₇ -20.63x ₈ -4.72x ₉ -0.21x ₁₀ +0.31x ₁₁	0.9958	0.9917	F crit = 2.1979 F fact = 140.9189	t-crit = 2.1448 x ₁ =4.0352 x ₂ =5.1419 x ₃ =1.9999 x ₄ = -4.1342 x ₅ =2.2647 x ₆ = 0.7699 x ₇ =0.0477 x ₈ = 1.0565 x ₉ = 0.4286 x ₁₀ = 1.5070 x ₁₁ = 3.0270
	Step 2. Disapplication of statistically insignificant factors x ₃ , x ₆ , x ₇ , x ₈ , x ₉ , x ₁₀ x ₁ , x ₂ , x ₄ , x ₅ ,x ₁₁	y = 412.33 + 3.85x ₁ +0.01x ₂ -28.14x ₄ +0.74x ₅ +0.18x ₁₁	0.9937	0.9874	Fcrit = 2.6030 F fact = 297.6109	t-crit = 2.0860 x ₁ =5.3116 x ₂ =6.4712 x ₃ =4.2517 x ₅ =1.7743 x ₁₁ =3.7202
	Step 3. Disapplication of statistically insignificant factor x ₅ x ₁ , x ₂ , x ₄ , x ₁₁	y = 414.12 + 4.41x ₁ +0.01x ₂ -32.94x ₄ +00.18x ₁₁	0.9926	0.9853	Fcrit = 2.7587 F fact = 335.2190	t-crit = 2.0796 x ₁ =6.4067 x ₂ =6.6097 x ₃ =5.1843 x ₁₁ =3.7202
	Step 4. Disapplication of the least statistically significant and most correlated factor x ₁₁ x ₁ , x ₂ , x ₄	y = 1040.13 + 6.55x ₁ +0.01x ₂ -36.10x ₄	0.9882	0.9764	F crit = 2.9912 F fact = 293.2153	t-crit = 2.0739 x ₁ =18.8678 x ₂ =5.3312 x ₃ =4.6715
Elasticity coefficient Ex ₁ = 6.55 * $\frac{\bar{x}_1}{\bar{y}}$ = 6.55 * $\frac{624.4}{4920.27}$ = 0.8316						
Elasticity coefficient Ex ₂ = 0.01 * $\frac{\bar{x}_2}{\bar{y}}$ = 0.01 * $\frac{118794.56}{4920.27}$ = 0.2341						
Elasticity coefficient Ex ₄ = - 36.10 * $\frac{\bar{x}_4}{\bar{y}}$ = -36.10 * $\frac{37.768}{4920.27}$ = -0.2771						
Average error of the model approximation = 6.81%						

Legend:

- X1 – employed population of working age (persons aged 15–70).
- X2 – GRP per 1 person employed.
- X3 – emissions of pollutants from stationary sources.
- X4 – emissions of pollutants into the atmospheric air from mobile sources.
- X5 – capacity of treatment facilities.
- X6 – the number of kcal consumed.
- X7 – amount of proteins consumed.
- X8 – amount of fats consumed.
- X9 – amount of carbohydrates consumed.
- X10 – number of doctors.
- X11 – number of nurses and paramedical staff.

Step-by-step regression analysis of the impact of factors of the external environment (x1-x11) on the amount of state funding for the healthcare guarantee programme (y), 2020.

Resulting indicator (y)	Impact factors (x)	Equation	Parameters				
			Correlation coefficient, R	Coefficient of determination, R ²	F fact, (p = 0.95)	t-fact , (p = 0.95)	
Amount of State Funding for the Healthcare Guarantee Programme	Step 1. Initial model						
	x ₁ - x ₁₁	$Y = -1197.397 + 1.609x_1 + 0.001x_2 - 1.127x_3 - 5.226x_4 + 1.625x_5 + 0.432x_6 + 28.494x_7 - 11.560x_8 - 2.494x_9 - 0.134x_{10} + 0.219x_{11}$	0.9969	0.9938	<i>F crit</i> = 2.1979 <i>F fact</i> = 189.92	<i>t-crit</i> = 2.1448 x ₁ =2.4224 x ₂ =0.4491 x ₃ =2.0309 x ₄ = 0.9321 x ₅ =3.0580 x ₆ = 0.3500 x ₇ =1.2336 x ₈ = 1.0953 x ₉ = 0.4353 x ₁₀ = 2.4930 x ₁₁ = 4.7684	
	Step 2. Disapplication of statistically insignificant factors x ₂ , x ₃ , x ₄ , x ₆ , x ₇ , x ₈ , x ₉	x ₁ , x ₅ , x ₁₀ , x ₁₁	$y = 79.224 + 1.655x_1 + 0.902x_5 - 0.057x_{10} + 0.167x_{11}$	0.9941	0.9882	<i>F crit</i> = 2.7587 <i>F fact</i> = 417.3766	<i>t-crit</i> = 2.0796 x ₁ =3.9337 x ₅ =3.4253 x ₁₀ =1.8660 x ₁₁ =4.7693
	Step 3. Disapplication of statistically insignificant factor x ₁₀	x ₁ , x ₅ , x ₁₁	$y = 269.063 + 1.711x_1 + 0.983x_5 + 0.115x_{11}$	0.9931	0.9862	<i>F crit</i> = 2.9912 <i>F fact</i> = 501.3696	<i>t-crit</i> = 2.0739 x ₁ =3.8751 x ₅ =3.5965 x ₁₁ =5.5836
Step 3. Disapplication of the most correlated factor x ₁₁	x ₁ , x ₅	$y = 325.062 + 3.903x_1 + 0.808x_5$	0.9827	0.9658	<i>F crit</i> = 3.3852 <i>F fact</i> = 310.529	<i>t-crit</i> = 2.0687 x ₁ =12.5185 x ₂ =1.9322	
Elasticity coefficient $E_{x_1} = 0.8349$							
Elasticity coefficient $E_{x_5} = 0.0558$							
Average error of the model approximation = 6.97%							

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