



Urban Planning Organization and Development of Children's Medical Institutions in Ukraine

Irina Bulakh¹

[Received: 15 January 2020; accepted in final version: 5 March 2020]

Abstract. *The urban planning organization and development of children's medical institutions in Ukraine are considered in this article based on an analysis of the current state of its largest cities, metropolises. Existing problems are outlined, which are primarily related to the excessive number and specialization of medical facilities (compared to European indicators), duplication within the same territory and physical obsolescence of buildings and equipment for medical purposes. This paper contributes to reviewing the transition of planning approaches as well as proposing a fresh approach to the forming of an urban layout of children's healthcare institutions that is designed to replace the traditional territorial-administrative approach.*

Keywords. *Urban planning of healthcare institutions, children's medical institutions, hospital, outpatient clinic.*

[Diterima: 15 Januari 2020; disetujui dalam bentuk akhir: 5 Maret 2020]

Abstrak. *Artikel ini meninjau lembaga perencanaan kota dan pengembangan institusi medis anak-anak di Ukraina dengan fokus pada analisis kondisi eksisting di kota-kota terbesar, metropolis. Masalah yang ada diuraikan, terutama terkait dengan jumlah yang berlebihan dan spesialisasi fasilitas medis (dibandingkan dengan indikator Eropa), duplikasi dalam wilayah yang sama, keusangan fisik bangunan dan peralatan medis. Makalah ini berkontribusi untuk meninjau transisi pendekatan perencanaan serta mengusulkan pendekatan baru untuk pembentukan tata ruang perkotaan dari institusi kesehatan anak-anak, yang dirancang untuk menggantikan pendekatan tradisional teritorial-administratif.*

Kata kunci. *Sistem perencanaan kota dari institusi perawatan Kesehatan, lembaga medis anak-anak, Rumah Sakit, klinik rawat jalan.*

Introduction

Today, Ukraine is going through a complex but important process of reformation in the medical sector. The system organization, levels and forms of providing medical care, sources of funding, forms of subordination, and other components and elements of the complex mechanism of the outdated Soviet-era healthcare protection system are changing. This reformation should definitely also cover the level of architectural and urban organization of healthcare. The first steps in the formation of hospital districts have already been taken in this direction, but the problems of an excessive number and specialization of medical institutions and the duplication of medical facilities within the same territory are still unresolved issues. To determine the next steps of a rational and effective architectural-urban planning organization of medical and preventive treatment institutions it is necessary to study the actual state of urban planning

¹ Associate Professor, Department of Design Architectural Environment, Kyiv National University of Construction and Architecture, Kyiv, Ukraine. E-mail: bulakh.iv@knuba.edu.ua

related to medical treatment facilities in Ukraine and to analyze the experience of other countries around the world whose healthcare systems comply with modern quality standards of medical services (Bulakh, 2017; Bulakh, 2018; Bulakh, 2019).

In the whole civilized world, the current state of medicine development testifies to the living standard of a country's society, the attitude of the state toward the citizens of a country, and the concern for the health of the next generations. The health of the nation is regarded as one of the most important indicators of the development and civilization level of states and reflects the socio-economic status of a society as a whole. According to the UN, the health of the population is a key factor for the expediency and effectiveness of all spheres of a country's economic activity. It should be noted that according to research by the World Health Organization, about 75% of illnesses in the adult population are due to living conditions in childhood and young age (World Health Organization Regional Office, 2019). Unfortunately, today in Ukraine we cannot be proud of the quality of our medical care, especially concerning the level of medicine for the pediatric population. The vast majority of functioning children's healthcare facilities are an inheritance of the Soviet and even pre-Soviet era. Approaches to medical care systematization and organization, the conditions of existence for medical institutions within cities have changed, which has created an urgent need for the introduction of appropriate and effective changes in the architectural and urban-planning organization of children's medical institutions (Nickl, Nickl-Weller, 20017; Schirmer, 2007; World Bank Report, 2013). Healthcare facilities are an integral part of the social infrastructure of modern urban settlements, in which they play a key city-forming functions, actively shaping the architectural and urban-planning environment. Healthcare facilities stimulate the development of advanced components and elements of the urban-planning framework, mainly located in the dense texture of the city.

The purpose of this study was to conduct a retrospective analysis of the features of the formation of the urban planning network of healthcare institutions in Ukraine (the largest country in Europe and the 46th largest country in the world), describe its current state and suggest ways to improve it in accordance with global trends. The results can be useful to international readers and researchers in the field of urban planning and architectural issues related the development of national healthcare systems.

Formation Conditions for the Urban-Planning System of Children's Medical Institutions in Ukraine

The existing architectural and urban planning system of public healthcare services in Ukraine was formed in the 1970s and 1980s according to the nomenclature of the types of medical and preventive institutions in force at that time, which included hospitals, dispensaries, outpatient clinics, and outpatient establishments, ambulance services and emergency medical care, haemotherapy, maternity and child welfare service, a visual sanatorium-and-spa resorts (State Building Codes B.2.2-10-2001, 2001; SNiP II-69-78, 1978). Most of the healthcare institutions on this list were divided by age category (adult and child population) and were accordingly duplicated within the same territory. Sectional, district, central district, peripheral, central territorial, city, regional, regional and national polyclinics and hospitals were developed depending on their function and zone of influence (Norms of Planning, 1987). Depending on the type of care provided, they were divided into general, specialized and emergency facilities.

The guiding principle underlying the activity of the urban-planning system of healthcare institutions was and remains territorial, i.e. providing medical assistance to the population according to the place of residence in a fixed territory. In accordance with the territorial

principle, medical zoning took place in Ukraine, which in most cases was related to the administrative structure. Over time, this organizational approach has revealed a nonconformance between the administrative structure and the subsequent implementation of city master plans. Taking into account this fact, in the future it is necessary not to overlook the features of settlement planning and improvement of territorial-functional connections in medical district formation in order to allow for adjustment of the healthcare system in the further development of urban planning (Bulakh, 2019).

A characteristic feature of the healthcare system development of Ukraine from 1980 to 1990 was an increase in the provision of specialty care. This, in turn, caused changes in the structure of the existing medical institutions and the emergence of new types of medical institutions. Antituberculosis, dermatovenerologic, psychoneurological and other dispensaries, specialized hospitals, outpatient clinics and centers, including children's ones, appeared at this time. In the same period, there were certain processes of integration and centralization. Centralization of, for example, medical-assisted services (laundry, catering units, sterilization rooms, etc.) made it possible to increase their operating and quality economy, and give a boost to the rate of progress due to the use of new technologies. The integration of specialized offices and departments in one institution helped to improve the quality of diagnosis and management, stimulated the effective use of premises and equipment, incentivized upgrade training of medical staff, etc. (Podchaska-Wyszynska, 1981; Rusin, 2001; Chuchmareva, 1998).

The increase in volume of outpatient-polyclinic care was another specific feature of the network growth of pediatric medical institutions in Ukraine during the period from 1980 to 1990. This has been linked to the state's task of transitioning to preventively examining the population. As a consequence, the capacity of outpatient-polyclinic clinics grew along with the increase in the proportion of visits.

Expanding the functions of outpatient-polyclinic facilities promoted the development of their structure. New sections and institutions emerged, such as children's diagnostic centers, day patient facility, etc. The system activity of the healthcare services during this period was overloading the outdated material and technical base formed in the last century. National medical statistics reveal the inconsistency of declaring bed capacity instead of actual use, quality and compliance with up-to-date standards and public demand, the presence of low-power medical institutions and small branches (less than 30 beds), irrational duplication of branches of a similar profile in the same location of exposure.

To remedy the shortcomings listed above, an attempt was made to counteract the overloading of the outdated material and technical base formed in the last century. The most important healthcare subsystems were identified for rural and urban populations. The following levels can be distinguished in the subsystem of medical assistance organization for rural populations (Bulycheva, 1984):

1. The first level is premedical care and first-aid provisions in feldsher-midwife stations.
2. The second level is medical care related to basic medical profiles (therapy, surgery, pediatrics, gynecology, obstetrics, infectious diseases, etc.) in district hospitals and rural dispensaries.
3. The third level is specialized and highly specialized medical assistance (neurology, cardiology, phthysiology, ophthalmology, otolaryngology, etc.) in district, central district hospitals, interdistrict departments within central district hospitals, dispensaries.

4. The fourth level is specialized treatment (urology, neurosurgery, oncology, orthopedics, etc.) in large-city health facilities: regional, territorial, and national hospitals.

Providing the necessary medical aid to the rural population began to be implemented by combining the work of medical staff of rural medical stations with mobile preventive medical examination centers, provided with special medical equipment, mobile laboratories, X-ray units, and dental equipment. The actual task today is to revise the structure of the rural health-care facilities and to establish medical dispensaries, taking into account their accessibility.

The urban healthcare subsystem can be divided into the following levels (Bulycheva, 1984):

1. The first level is polyclinic care related to basic and some specialized medical profiles (therapy, surgery, pediatrics, obstetrics and gynecology, dentistry, ophthalmology, otolaryngology, etc.) in urban territorial outpatient departments.
2. The second level is specialized and some types of highly specialized ambulatory care (gastroenterology, rheumatology, traumatology, allergiology, etc.) in specialized departments of large municipal polyclinics, separate or in assembly with hospitals; inpatient care in urban multidisciplinary hospitals, maternity hospitals, and district dispensaries designed for the administrative district population;
3. The third level is consultative and diagnostic assistance in specialized departments of urban polyclinics and hospitals, designed for the populations of several administrative districts or the whole city, pertaining to prophylactic medical care (endocrinology, psychoneurology, etc.).
4. The fourth level is consulting highly specialized assistance (microsurgery, neurosurgery, maxillofacial surgery, etc.) in non-diversified medical institutions (centers) that provide outpatient practice and inpatient care, designed for the population of the republic.

The principal conditions of the system organization of pediatric healthcare services and theoretical developments in this area were the background for the network formation, types, and architectural and planning structures of the buildings of children's medical institutions. The development of architectural and planning structures took into account the reinforcement of prophylactic orientation, specialization, integration and differentiation of medical care, hospital services centralization, and gradual system organization of pediatric medical care.

Modern Condition of the Urban-Planning System of Children's Medical Institutions in the Largest, Major and Big Cities in Ukraine

The question of the formation of an urban-planning system for the children's medical institutions network in Ukraine was the scope of this study. We conducted a comprehensive analysis of the actual state of the urban planning system of healthcare facilities intended for the servicing of the children's population of the country, their urban planning, and quantitative indicators of children's medical and preventive institutions in the territories studied. These territories were: major cities, with a population of more than 1 million people (Kyiv, Kharkiv, and Odessa); large cities, with a population of 500 thousand to 1 million people (Dnipro, Donetsk, Zaporozhe, Lviv, Kryvyi Rih); and the big city of Mykolaiv, with a population of 250 thousand to 500 thousand people (Figure 1, Figure 2). The available networks of healthcare institutions of these cities were considered in combination with population and population density (Figure 3, Figure 4), urban planning area, and north to south length, and west to east length.

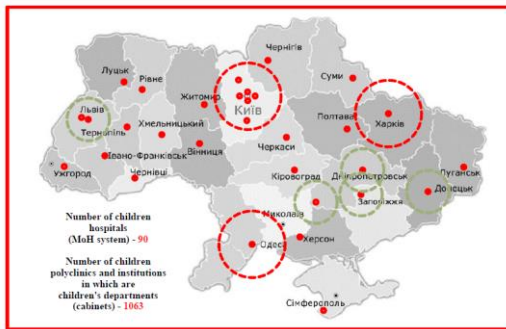


Figure 1. Urban planning system of children's medical institutions of Ukraine.

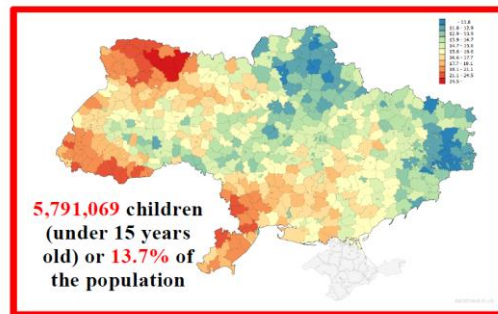


Figure 2. The number of the population in Ukraine under 15 years (%).

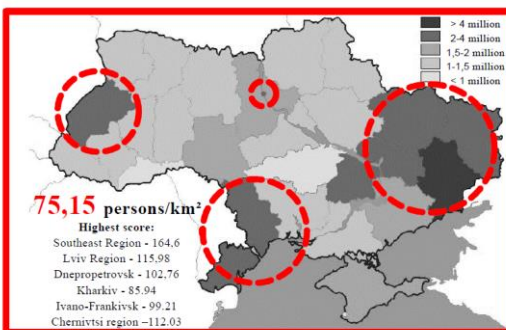


Figure 3. Population density in Ukraine.

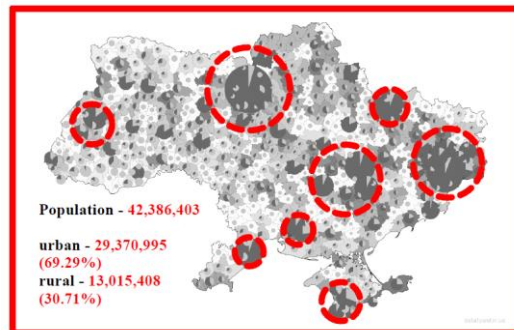


Figure 4. The population of Ukraine.

The Kyiv area covers 847.66 km², the N-S length is 50 km, the E-W length is 56 km, the population of the city is 2,951,482 people, population density is 3,517 people per km² (Zhezher, 2005). There are 915 primary medical assistance centers where family medical care is provided (*Primary Care Facilities of Ukraine*, 2019). Verifiable information on the number of private medical centers could not be obtained, but visually the city is characterized by a significant development of the private medical sector in comparison with other domestic urban settlements. Ten municipal children's hospitals and 4 private hospitals are part of the secondary level of medical care for Kyiv's pediatric population. The third level of medical care in Kyiv consists of 3 specialized children's hospitals. In addition, there are 7 municipal and 3 private maternity hospitals in Kyiv. The conducted location analysis of healthcare facilities in Kyiv intended for children's treatment revealed their unequal distribution within the city's territory. Due to their concentration and accumulation in the central right-bank part of the city, a significant disproportion in the number of medical institutions, including children's hospitals, was found relative to the city left bank, while the whole periphery of the urban environment was also almost uncovered (Figure 5).

The next most populated city in Ukraine, Kharkiv, is much smaller than Kyiv. Kharkiv's area covers 340 km², the N-S length is 24.3 km, the E-W length is 25.2 km, the population of the city is 1,446,107 people, the population density is 3,908 people per km² (Zhezher, 2005). There are 72 municipal primary care facilities in the city; no accurate data on private medical facilities were available (*Primary Care Facilities of Ukraine*, 2019). There are 10 children's municipal hospitals and 7 maternity hospitals. The location analysis of Kharkiv children's healthcare facilities revealed a more uniform spacing compared to Kyiv. The concentration of primary healthcare facilities gradually decreased towards the peripheral parts of the city. The children's

hospital locations were characterized by a uniform distribution along the N-S to E-W diagonal (Figure 5).

The area of Odessa covers 162.42 km², the N-S length is 35 km, the E-W length is 10-15 km, the population is 1,013,292 people, the population density is 6,228 people per km² (Zhezher, 2005). There are 107 municipal primary healthcare facilities (*Primary Care Facilities of Ukraine*, 2019). There are 6 children's municipal hospitals, 1 specialized private hospital (not identified), and 7 maternity hospitals. The location analysis of children's health facilities in Odessa confirms their asymmetrical location in the left coastal part of the city. Taking into account the E-W length of the urban area (10-15 km), it can be assumed that the detected disproportion does not significantly affect the accessibility of the medical institutions at the secondary and tertiary healthcare level.

Dnipro city is the first representative of the next group of urban settlements in Ukraine, whose populations fluctuate between 500 thousand and 1 million people. Dnipro's area is 415 km², the N-S length is 22 km, the E-W length is 33 km, the population is 998,103 people, and the population density is 2,405 people per km² (Zhezher, 2005). There are 99 municipal primary healthcare facilities and there are no private health facilities (*Primary Care Facilities of Ukraine*, 2019). There are 6 children's municipal hospitals, 1 specialized private healthcare facility (not identified) and 9 maternity hospitals. In Dnipro, as in Kyiv, the location analysis of children's healthcare facilities revealed that they are concentrated in a centrally located cluster, with almost no coverage of the peripheral urban territories (Figure 6).

The area of Donetsk is 358 km², the N-S length is 28 km, the E-W length is 55 km, the population is 913,323 people, the population density is 2,551 people per km² (Zhezher, 2005). Due to the military actions in the East of Ukraine it was not possible to identify the exact number of municipal and private primary healthcare facilities in the city. There are 5 municipal children's hospitals in Donetsk, specialized and private hospitals were not found. A distinctive feature of Donetsk is that there are no separate maternity hospitals in the city. Maternity hospitals are part of the city's 6 multidisciplinary hospitals. This approach is characteristic for many Western countries and needs further analysis regarding the framework of the reorganization of Ukrainian hospitals. An interesting fact is that the location analysis of children's hospitals in Donetsk clearly showed their perimeter and uniform distribution in urban areas, with some imbalance in the western part of the city (Figure 6). It was impossible to carry out a review of the location analysis of outpatient primary care facilities due to the lack of information.

Zaporizhzhya's area is 331 km², the N-S length is 40 km, the E-W length is 30 km, the city population is 738,728 people, the population density is 2,232 people per km² (Zhezher, 2005). There are 84 municipal primary care facilities (*Primary Care Facilities of Ukraine*, 2019) There are 4 municipal children's hospitals, 4 private children's hospitals, no specialized hospitals, and 5 maternity hospitals. Based on the location analysis of municipal and private children's health institutions in Zaporizhzhya, their distribution is uneven and heterogeneous within the urban environment, with a concentration and accumulation in the west-south part of the city along the water area (Figure 6).

Lviv's area covers 182 km², the N-S length is 18 km, the E-W length is 20 km, the population is 724,713 people, the population density is 3,982 people per km² (Zhezher, 2005). There are 79 municipal primary care facilities; private hospitals were not identified (*Primary Care Facilities*

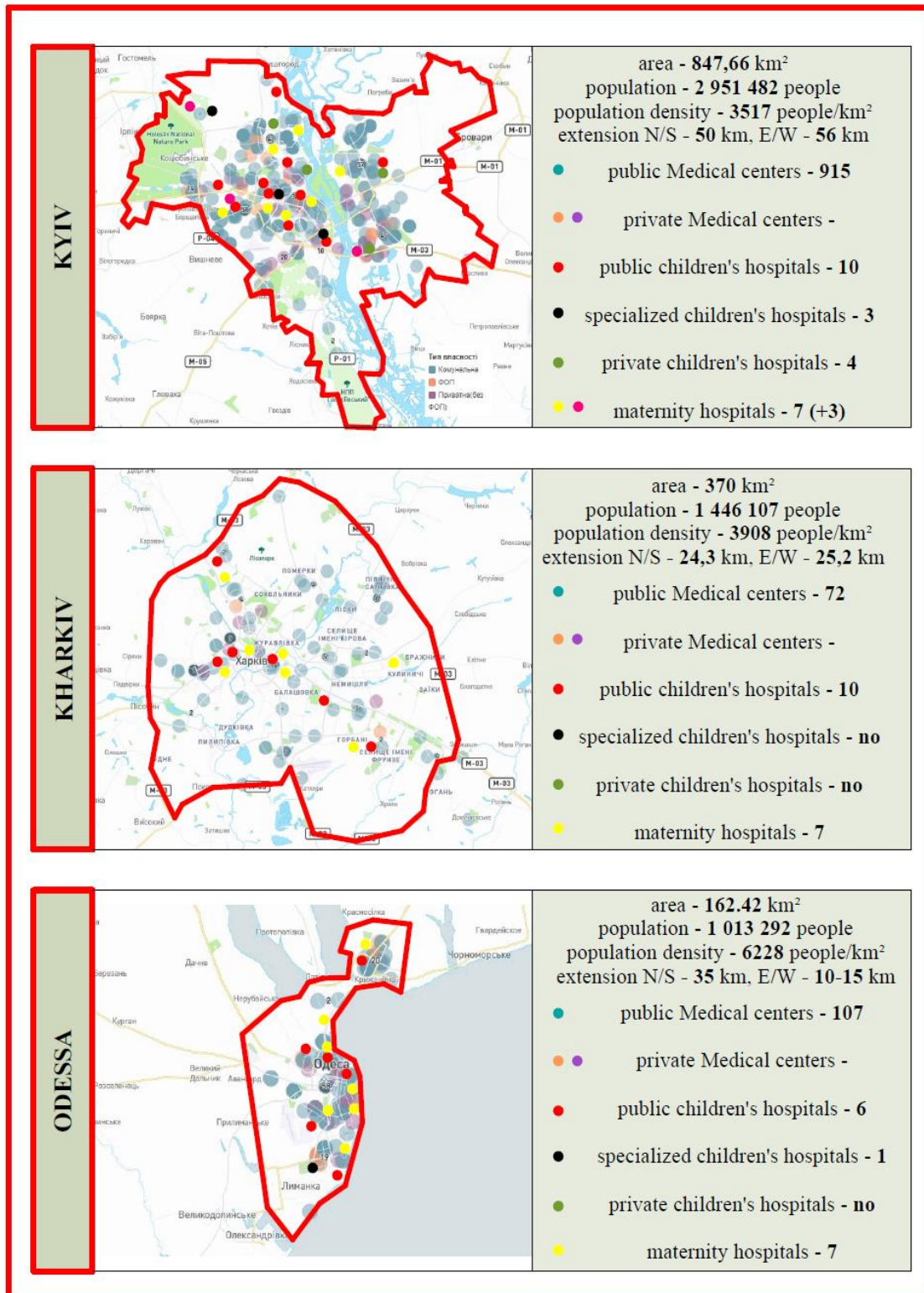


Figure 5. The networks of children's medical institutions in large cities of Ukraine, with a population of more than 1 million people (Kyiv, Kharkiv, Odessa).

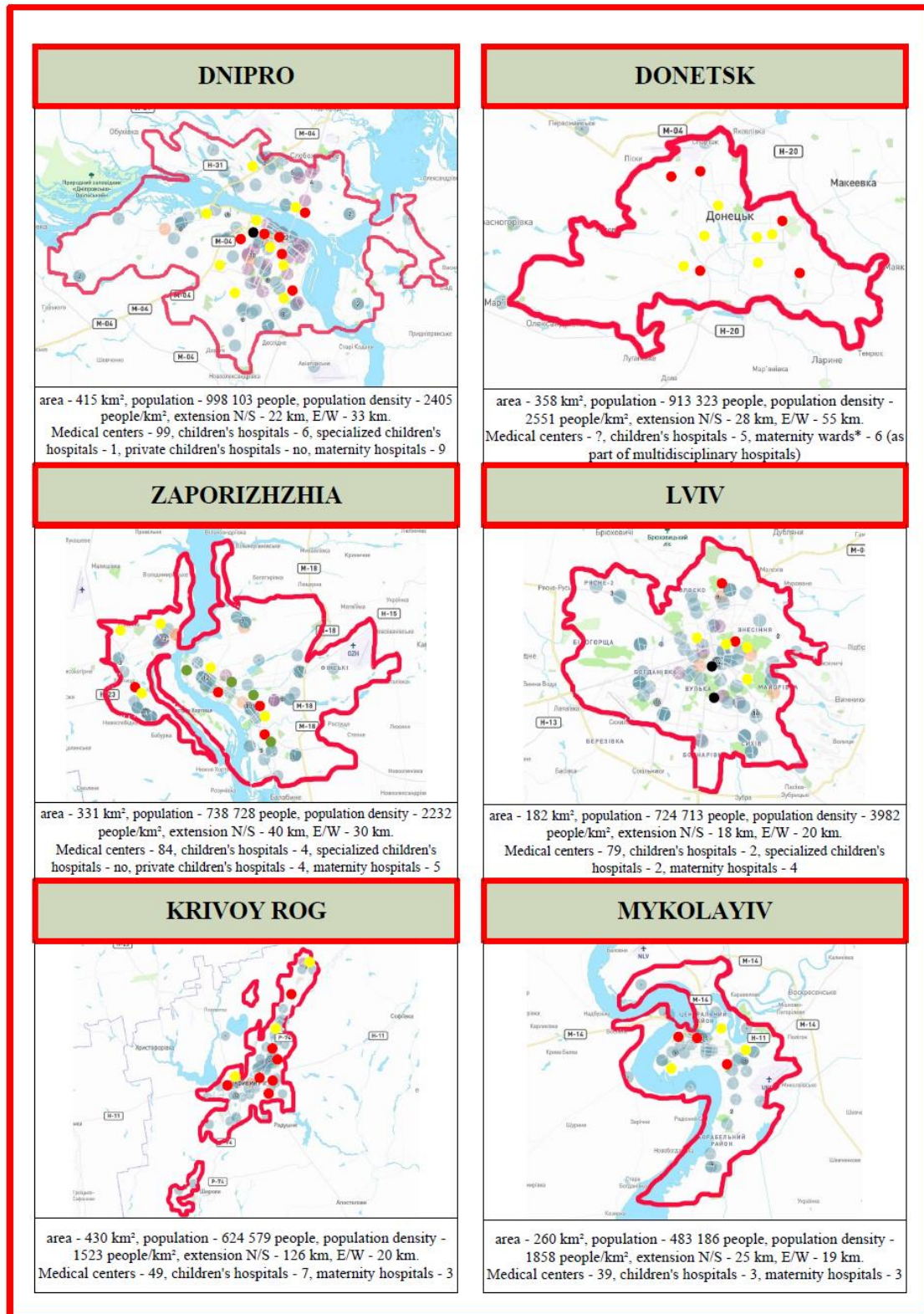


Figure 6. The network of children's medical institutions in the major cities of Ukraine, with a population of 450 thousand to 1 million people (Dnipro, Donetsk, Zaporizhzhia, Lviv, Krivoy Rog, Mykolayiv).

of Ukraine, 2019). There are 2 municipal children's hospitals, 2 specialized, and 4 maternity hospitals. The location analysis of children's health institutions in Lviv revealed a relatively uniform distribution of primary care facilities (except for the western part of the city), a concentration of maternity hospitals in the city center, as well as the placement of 4 children's hospitals in the north-central part of the urban environment (Figure 6).

Kryvyi Rih's area covers 430 km², the N-S length is 126 km, the E-W length is 20 km, the population is 624,579 people, the population density is 1,523 persons/km² (Zhezher, 2005). There are 49 municipal primary care facilities; private hospitals were not identified (*Primary Care Facilities of Ukraine, 2019*). There are 7 municipal children's hospitals, and 3 maternity hospitals. It should be noted separately that the financial conditions of most of the children's hospitals in Kryvyi Rih are unsatisfactory and a high number (7 hospitals) exist only on paper. Therefore, residents of the city and the surrounding areas are forced to seek medical help in Kyiv or the nearest major cities. The location analysis of formally existing children's healthcare facilities in Kryvyi Rih revealed a relatively uniform distribution with some clusters of hospitals in the central part of the city (Figure 6).

Mykolayiv's area covers 260 km², the N-S length is 25 km, the E-W length is 19 km, the population is 483,186. The population density is 1,858 persons/km² (Zhezher, 2005). There are 39 municipal primary care facilities (*Primary Care Facilities of Ukraine, 2019*). There are 3 municipal children's hospitals and 3 maternity hospitals. The location analysis of children's healthcare institutions in Mykolayiv revealed a relatively uniform distribution of primary care facilities with an accumulation of children's hospitals and maternity hospitals in the central part of the city (Figure 6).

New Approach Proposals to the Formation of an Urban Layout for Children's Healthcare Institutions

After having reviewed the old approach, some lessons can be learned to propose a new approach to the formation of an urban layout for children's healthcare institutions in Ukraine, which can also be applied in similar cases around the world.

Firstly, the urban layout of healthcare institutions was considered in this study as a complex and dynamic, hierarchical, multilayered subsystem of the general urban layout within a defined territory (country, region, area, settlement), which provides the interconnected operating of administrative, basic and auxiliary healthcare, scientific research, medical-educational and medical-industrial institutions and complexes within hospital clusters and districts. The multilayered structure of the urban layout of healthcare institutions implies the gradual integration and hierarchical subordination of the components of urban planning networks: tertiary healthcare hospitals at the hospital level of specialized medical care; secondary care hospitals at a multidisciplinary hospital level; primary care facilities in a variety of family medical care facilities. Each of these urban planning networks is responsible for organizing a separate hierarchical level of healthcare (primary, secondary, and tertiary) by deploying many healthcare facilities and complexes in an urban realm that are interconnected by systemic integrity. The systematic deployment of the whole composite network creates favorable conditions for the regular functioning and development of the healthcare system, the formation of medical and hospital clusters and complexes, including children's ones. The definition of the urban layout of healthcare institutions is a complex that is connected with the following features: system openness; need and governance; the hierarchy and sublevel poly-structure

(networks of primary, secondary and tertiary levels of medical care) of the organization; system reproducibility under conditions of systemogenesis.

Secondly, the dynamism of the urban layout of healthcare is connected with the accelerated development of medical and pharmaceutical technologies, treatment and diagnosis methods, medical process robotics and computerization. Economic, social, demographic and other circumstances change over time, including the superior spectrum of morbidity and population changes in the processes of urbanization or migration. These and other variables and factors require the updating and self-organization of the urban healthcare layout structure. The hierarchical construction of the system is manifested in the sequence and interconnectedness of the constituent sublevels of medical (basic and auxiliary), research, educational, industrial, and administrative facilities. These sublevel systems, characterized by a dynamic integrity, require adaptation to the changing conditions of the internal and external environment.

Thirdly, a children's treatment complex is a hierarchically subordinate set of primary medical assistance (PMA), secondary (SMA), tertiary (TMA) levels of medical care intended for the treatment of children that is functionally interconnected within the designated area. Primary children's care is conducted in primary care facilities within the framework of family practice; at the secondary level in children's wards of hospitals of the secondary medical network care and at the tertiary level in specialized children's and other tertiary care network hospitals. The area of influence and placement conditions in the structural elements of the residential areas of the urban environment (housing groups, housing complexes, residential areas, city, region, country) are considered separately for each network (primary, secondary and tertiary levels) of medical institutions. The children's therapeutic complex as a system element has the following properties and characteristics: continuity (allows to consider the complex children's treatment system at the same time both as a whole and as a subsystem); hierarchy (the presence of many constituent elements that are located on the basis of subordination of lower-level elements to higher-level elements); structure (provides the system with the features of the components and parts and organizations; forms and organizes the spatial and functional connections of the system elements; provides continuity and consistency of medical care); relative autonomy and self-sufficiency (contributing to the determination of the external and internal boundaries of the urban layout of children's therapeutic complexes located in residential areas, with research, educational and industrial institutions, and administrative health authorities acting as external elements in relation to the defined system while remaining an integral part of the urban healthcare system of Ukraine); comprehensiveness; cooperation (outpatient, inpatient and specialized children's healthcare facilities within the same institution, complex or territory); integrity (harmonious inclusion and interaction of the system of children's medical complexes in the environment: architectural-urban, natural, medical, etc.); emergence (designed to reorganize children's therapeutic complexes in the urban layout of healthcare institutions through abrupt qualitative improvements as a result of combining several components of the system with different properties).

Results and Discussion

Consequently, there is no clear step-by-step distribution of the urban system of public healthcare services in the urban population, especially in the major and large cities. The following step-by-step hierarchical division of health-care centers in the urban health-care layout is proposed: the first level is a network of primary healthcare facilities (family doctors' offices, dispensaries, family medical centers); the second level is a network of multidisciplinary hospitals and medical centers that differ in the degree of intensity of treatment; the third level is a network of

specialized and highly specialized hospitals and medical centers (*Transformation of the Healthcare System of Ukraine*, 2020). High-density construction and well-developed transport connections reduce the time it takes people to reach the medical institutions. The availability of private, departmental and other institutions that do not have clearly defined areas of influence is also helpful to this. In addition, the administrative and territorial distribution, which is the basis of network planning, does not always reflect the peculiarities of the formation of residential urban areas and creates unequal conditions for receiving medical care for the population in each district. To these reasons is added uneven development of the physical and technical infrastructure of healthcare facilities and the lack of promising schemes for the placement of medical institutions' buildings that would reflect the main tendencies of the medical care system organization (Kucherenko, Semenov, Grishin, Syrtsova, 2000; Shimko, 2004; Kovalska, Merylova, Bulakh, 2019). The worn-out state of the material and technical base of the healthcare institutions is due to the fact that most of them were built with the typical industrial building methods from the 1970-80s and lack the necessary modernization of the buildings (energy-efficient, engineering, planning and other) (Bulakh, 2017). The following aspects should be attributed to global tendencies in the architecture of medical institutions: urban planning (cluster system of urban organization; space-saving property development of the territory; extensive network of primary care facilities, medical complexes and cities); architectural (typological diversity of primary care facilities; design; enlargement of medical establishments; 'hotel' architecture of hospitals); medical (family medical care; child specialization; diversity of medical institutions as an exception), economic (distribution of private medicine; competition as an incentive for development), environmental (ecological project approach and energy-efficiency of medical institutions), technologically innovative (smart hospital; rational approach; incubator of medical technologies; robotics for direct care) (Ministry of Health, 2015; Bulakh, 2019).

Despite the current conditions, the introduction of public healthcare has led to the emergence of offices, departments and institutions, which can be attributed to the various stages of network formation. The first level is formed at the residential area level of 40,000 to 80,000 people in major and large cities and 25,000 to 40,000 thousand people in big and medium-sized cities. For city and town residents of district resettlement systems, the central district hospital's polyclinic represents the first stage of outpatient service and there is also a territorial polyclinic. Interregional and regional institutions fully represent the second and third levels, in which medical and consultative-diagnostic help is provided. In major cities, one or two outpatient clinics with pedestrian accessibility (10 to 12 minutes) are located in each residential area. The high density of the population in residential areas (in practice usually exceeding the norm) allows the formation of clinics with a significantly different composition of specialized offices and departments. The most powerful outpatient clinics include fully fledged units that provide specialized care while the low-power outpatient clinics have only the main and most mass specialized offices: an ophthalmologist, an otolaryngologist, etc. (Bulakh, Didichenko, Kozakova, 2019).

One of the variants for network formation of specialized offices and departments is to connect them to one of the large polyclinics of the administrative district. Such departments serve the population of several zones of influence in district polyclinics and provide the second level of buildings with a network of health facilities. However, with this specialized healthcare organization, the frequency of contact of specialists with district therapists and other doctors from territorial polyclinics declines and the gap between patient care in the clinic and at home is increased. Another form of specialized polyclinic healthcare, unlike the first one, is not practically but only functionally associated with the polyclinic department for physicians of one

profession. They belong to the staff of one institution, but the largest number of appointments is performed in the territorial polyclinic, working directly with district therapists and other doctors and only on a particular day in the standard polyclinic. Such an approach, on the one hand, makes it possible to bring the specialist closer to the patient and to take full advantage of centralization in order to ensure the rational placement of personnel on the other hand. In large and big cities, urban polyclinics are also organized to provide consultative and diagnostic assistance to the population of the entire city. Such clinics represent the third level of the network.

The first stage in the urban development of a network of children's inpatient facilities is represented by multidisciplinary hospitals, designed primarily to serve local residents within the administrative district (Potekhina, 1980; Bulakh, 2019). General therapeutic and surgical facilities are concentrated in departments that first of all have to provide basic types of inpatient care. Specialized and highly specialized inpatient care is provided by the departments of multidisciplinary and specialized hospitals designated for the population of several administrative districts or the whole city. These departments and hospitals represent the second and third levels of the inpatient facilities network. They are spread inside the territory depending on the organizational form of medical care, availability of material and technical base, and other factors. Patients need to visit several healthcare facilities to receive specialized care. This inconvenience for the population also creates an uneven distribution in the network of specialized units in the city. One of the main reasons for this is the planning of specialized assistance to healthcare providers without linking to the general layout because of the absence of direct consultation with architects and urban planners.

It was revealed that the existing urban network lacks some types of assistance in certain areas, whose residents are forced to go to institutions of neighboring areas, which are not able to increase their patient load. In such a healthcare system, in addition to overloading the material base and disturbing the rhythm of the work of medical institutions, the amplitude of accessibility norm also increases. This is especially true for new residential areas, where healthcare facilities are hardly built, which leads to a shortage in the capacity of healthcare facilities in proportion to the housing stock.

It should also be noted that the network formation of urban health facilities took place without consideration of regional and departmental institutions, which in turn led to their duplication in the same areas of influence. The distribution of highly specialized beds in urban and regional healthcare institutions is, in practice, formal. Highly specialized offices in existing city-level hospitals often serve not only the urban but also the rural population so they serve as a regional or national institution in a number of specialized types of care. On the other hand, residents of these centers occupy a share of visits to regional and national institutions.

The population of administrative districts tends to vary widely. For example, the figures for Kyiv range from 50,000 to 300,000 people. In this case, the lower boundary of the population is equal to the residential area, and the upper boundary is half of the urban planning area. If such a division of the territory is based on the formation of a network, it is practically impossible to organize equivalent medical care in each district with observance of the amplitude of the accessibility norm. From this point of view, it is advisable to bring the administrative-territorial distribution in line with the functional-planning organization of the city's territory, which will facilitate the task of developing the general layout and will allow to introduce a systematic approach to the formation of the network of healthcare institutions.

In the process of researching the state of the network of children's healthcare facilities in Ukraine, one of the most important tasks was to determine the actual status of the financial and technical base of medical buildings. The last comprehensive survey of healthcare institutions in Ukraine was carried out at the end of the last century by the HypRIal Health Center in Kyiv. The results showed that more than 40% of medical buildings were adapted for medical purposes and did not meet the necessary requirements, while 20% had considerable technical wear and tear. The tendency of bed and outpatient-polyclinic increase in outdated areas facilitated their renovation. About 25% of medical buildings did not allow full offices to be opened. Undoubtedly, it can be predicted that over the next 40 years these figures will only increase significantly.

Conclusions

Children's medical institutions in Ukraine are an integral part of an extensive urban network of healthcare institutions, which today consists of numerous elements: hospitals, dispensaries, outpatient clinics, emergency and primary healthcare, haemotherapys, maternal care, and maternal care resorts. The division of healthcare institutions into categories (age, area of influence and functions performed, type of assistance) leads to a numerical duplications of healthcare facilities within the same territory. The formation of the urban planning network of medical institutions in Ukraine requires research and optimization in accordance with the architectural and urban planning organization of the best world healthcare systems. Comprehensive analysis of the urban development network of children's health institutions of the major, large and big cities of Ukraine (Kyiv, Kharkiv, Odessa, Dnipro, Donetsk, Zaporozhye, Lviv, Kryvyi Rih, Mykolaiv) revealed their heterogeneous distribution in the structure of the urban environment, concentration mainly in the central zone of the cities.

The most important conclusions of this study and recommendations for further development of the architectural and urban planning network of healthcare are:

1. Organize the primary care based on family medical care without age categories (for adults and for children).
2. Increase the number of various types of primary healthcare facilities (offices of family doctors, outpatient clinics, medical centers).
3. Reduce the number of specializations of hospitals by age categories – both children and adults should receive medical care inside one hospital building (complex).
4. Increase the number of hospitals with children's specialization in unique medical complexes at the state or regional level.

These conclusions and recommendations may be useful not only for Ukraine but also for other countries that require optimization of their healthcare system at the architectural and urban level in order to reduce the number of hospitals. These countries primarily include the former Soviet republics, as well as the United States of America.

References

- Bulakh, I.V. (2017) Problematic Area of Assignments for Reorganization of Children's Medical Institution Network in the Ukraine. *Urban Development and Territorial Planning* 63, 45-51.
- Bulakh, I.V. (2017) Prerequisites for Reorganization of Children's Medical Institution Network in the Ukraine. *Modern Problems of Architecture and Urban Development* 47, 444-450.

- Bulakh, I.V. (2018) The Main Trends in Organization of Architectural Environment of Medical Institutions. *Web of Scholar* 5(23), Vol. 1, 59-62.
- Bulakh, I.V. (2019) Common Features of Architectural Design of the Medical Purpose Building. *Science & Technique* 18(4), 311-318. DOI:10.21122/2227-1031-2019-18-4-311-318
- Bulakh, I.V. (2019) Complex Public Health Institutions as a Complex Urban Development System. *Colloquium-journal* 1(25), 4-6. DOI: 10.24411/2520-6990-2019-00001
- Bulakh, I.V. (2019) *Energy Efficiency Use of Bioclimatic Facades in Medical Buildings. Development of Modern Science: The Experience of European Countries and Prospects for Ukraine: Monograph / Edited by Authors*. 3rd ed. Riga, Latvia: Baltija Publishing, 597-616.
- Bulakh, I.V. (2019) New Approaches to the Functional Planning of Hospitals and Entrance Groups of Medical Institutions. *Colloquium-Journal* 9(33), 8-10. DOI: 10.24411/2520-6990-2019-10213
- Bulakh, I., M. Didichenko, and O. Kozakova (2019) The Innovative Trends in Architecture and Urban Planning of Healthcare Institutions. *International Journal of Innovative Technology and Exploring Engineering* 9(1), 317-323. DOI: 10.35940/ijitee.A4111.119119
- Bulakh, I.V. (2019) Artistic-aesthetic Formation and Evolution of Architectural and Urban Planning Space. *Science and Innovation* 15(5), 57-66. DOI: 10.15407/scine15.05.057
- Bulakh, I., O. Kozakova, and M. Didichenko (2019) The Landscape Creation and Integration in Design and Urban Planning of Medical Institutions. *Landscape Architecture and Regional Planning* 4(4), 61-71. DOI: 10.11648/j.larp.20190404.11
- Bulakh, I., O. Kozakova, and M. Didichenko (2019) Spatial and Temporal Principles and Methods of the Historical Urban Environment Composition Transformations. *Urban and Regional Planning* 4(4), 144-151. doi: 10.11648/j.urp.20190404.13. <http://www.sciencepublishinggroup.com/journal/paperinfo?journalid=241&doi=10.11648/j.larp.20190404.11>.
- Bulakh, I., L. Kozakova, M. Didichenko, and O. Chala (2019) Healthcare Architectural and Urban Planning Systems in the United States of America and France. *International Journal of Innovative Technology and Exploring Engineering* 9(2), 1622-1627. DOI: 10.35940/ijitee.B7377.129219
- Bulycheva, T.A. (1984) *Central District Hospitals*. Moscow.
- Chuchmareva, E.Z. (1998) Principles of Network Formation, Calculation Procedure and Typology of Outpatient Facilities (Using the Example of the Largest Soviet Cities): Abstract of the Dissertation of the Candidate of Architecture. Moscow.
- Kovalska, G., I. Merylova, I. Bulakh (2019) Urban Improvement of Comprehensive Schools and Out of School Educational Establishments in Ukraine. *International Journal of Innovative Technology and Exploring Engineering* 8(12), 1765-1770. DOI: 10.35940/ijitee.L3229.1081219
- Kucherenko, V.Z., V.Yu Semenov, V.V. Grishin, L.E. Syrtsova (2000) *Healthcare Reform Abroad*. Moscow.
- Nickl, H., C. Nicki-Weller (2007) *Hospital Architecture*. Verlagshaus Braun.
- Schirmer, C. (2007) *Hospital Architecture: Specialist Clinics & Medical Departments, Germany*.
- Norms of Planning Elements of Residential and Public Buildings: Medical Buildings. *Hospitals*. Moscow (1987).
- Norms of Planning Elements of Residential and Public Buildings: Medical Buildings (1987) *Hospitals: Issue*. NP 6.1.1.2-82. Departments of Anesthesiology and Intensive Care, Intensive Care and Intensive Care. Department of Blood Transfusion. Moscow.
- Podchaska-Wyszynska, V. (1981) *Designing of Children's Medical Institutions*. Moscow.
- Potekhina, M.V. (1980) *Building a Network of Inpatient Medical Facilities Serving the Adult Population in Cities*. Moscow: VNI Social. Hygiene and Org. Health.

- Primary Care Facilities of Ukraine. Retrieved from <https://nszu.gov.ua/gromadyanam/elektronna-karta-misc-nadannya-pmd>.
- Rusin, V.V. (2001) Formation of a Network and Types of Medical Institutions in Modern Social Conditions of a Big City (On the Example of Poltava): Abstract of the Dissertation of the Candidate of Architecture. Kharkov.
- State Building Codes B.2.2-10-2001 Buildings and Structures. Healthcare Facilities (2001) *Gosstroy of Ukraine*. Retrieved from <https://zakon.rada.gov.ua/rada/show/v0002241-01>.
- SNiP II-69-78 (1978) Building Regulations. Part II Chapter 69. Medical Institutions. Moscow. Retrieved from <http://gostrf.com/normadata/1/4293831/4293831907.htm>.
- Shimko, V.T. (2004) *Typological Foundations of Artistic Design of the Architectural Environment*. Moscow, Architecture.
- World Health Organization Regional Office for Europe: Ukraine. Retrieved from <https://www.who.int/countries/ukr/ru/>.
- Zhezher, A.I. (2005) *Administrative and Territorial Administration of Ukraine*. Kyiv, State Cartographic and Geodesic Fund of Ukraine.
- Ministry of Health: National Strategy for Reforming the Healthcare System in Ukraine for the Period 2015-2020. Retrieved from <http://moz.gov.ua/uploads/0/691-strategiya.pdf>.
- Transformation of the Healthcare System of Ukraine. Retrieved from <http://moz.gov.ua/plan-reform>.
- World Bank Report (2013) Getting Better: Improving Health Systems Outcomes in Europe and Central Asia. Retrieved from <http://documents.worldbank.org/curated/en/953751468250295078/Getting-better-improving-health-system-outcomes-in-Europe-and-Central-Asia>.