



Citation article: Titkova O. Ukrainian paediatrics of the future: current problems and prospects for improvement. *Futur Med [Internet]*. 2023;2(2):35-47. Available from: <https://doi.org/10.57125/FEM.2023.06.30.04>

Ukrainian paediatrics of the future: current problems and prospects for improvement

Olena Titkova ^{1*}

¹ Odessa National Medical University, Odessa, Ukraine, <https://orcid.org/0000-0002-8697-0950>

Abstract

This article focuses on "Ukrainian paediatrics of the future: current problems and prospects for improvement."

Aims: objectives of the research study are to identify the current problems and challenges facing paediatric healthcare in Ukraine, including issues related to healthcare professionals, infrastructure, vaccination coverage, healthcare spending and public awareness of paediatric health and prevention; areas for improvement after analyses of previous initiatives; potential for future improvements in paediatric healthcare in Ukraine, including prospects related to national vaccination programs, telemedicine and digital health, medical research, the patient-centered care, medical education and training, improved healthcare infrastructure, and public-private partnerships.

Study design: Descriptive cross-sectional study

Place and Duration of Study: The majority of the studies were conducted on patients, professionals' healthcare establishment and policy maker stakeholders in the Ukraine.

Methodology: In order to collect secondary data a questionnaire was used.

Results: Ukraine has just 665 hospital beds per 100,000 residents in 2019 compared to 417 doctors per 100,000 in 2000. The pace of replacement for most medical equipment is sluggish. Since 2019, the rates of infant, under-five, and neonatal death have been mostly steady. The rates of BCG and measles vaccination coverage have fluctuated, although they have typically gone down. The biggest problem with paediatric healthcare in Ukraine is a lack of money, which leads to a dearth of medical personnel, supplies, and equipment, as well as a high incidence of diseases that may be prevented because of a lack of public awareness of paediatric health.

Conclusion: Paediatrics faces challenges, including inadequate healthcare infrastructure and a high infant and child mortality rate. Prospects for improvement, such as the development of telemedicine and e-health services, improving maternal and child healthcare services, and increasing investment in research and development. By addressing these challenges and investing in these prospects, the country can significantly improve the health and wellbeing of its children.

Keywords: Ukrainian; paediatrics; current problems; prospects; future; improvement.

Received: March 6, 2023

Revised: March 21, 2023

Accepted: June 18, 2023

Published: June 30, 2023

* **Corresponding author:** elenatitkova555@gmail.com
DOI: <https://doi.org/10.57125/FEM.2023.06.30.04>

Introduction

The Ukrainian People's Republic was recognized in 1917. Following its engagement, the Soviet Union ruled the Ukrainian SSR for almost 70 years. The Ukrainian SSR expanded westward when Nazi Germany and the USSR invaded Poland in 1939. In 1954, it extended southward with the Crimea. Ukraine obtained independence in 1991 as the Soviet Union fell. Ukraine's market economy transition has caused a socioeconomic disaster for over 20 years [1].

Paediatrics is vital since it treats babies, children, and adolescents. Ukraine, like many other countries, must overcome a lack of funding, resources, medical equipment, and staff training to deliver efficient paediatric care. These issues are exacerbated by the nation's political and economic instability. Paediatricians and family physicians treat 50% of Ukraine's youngsters. Family and paediatricians treat children from birth to 18 years. A doctor sees 800 people every year [2].

The literature published between 2018 and 2021, emphasising the most recent advances in the discipline. The difficulties paediatric healthcare in Ukraine faces are caused by a number of variables. The high infant mortality rate, which is 6.5 deaths for every 1,000 live births, is an issue. In 2021, the mortality rate for infants in Ukraine was among the lowest in the world at 7 fatalities per 1,000 live births. Only 1.6 paediatricians are available for every 1,000 children in the nation, indicating a dearth of paediatric medical specialists. Other factors aggravating the issue include underfunding of the healthcare system, out-of-date medical technology, and a scarcity of critical pharmaceuticals [3].

The quality of primary medical care provided to mothers and babies, access to such services, especially for socially vulnerable groups and the rural population. The absence of national standards for child development, the lack of adequate access to a children's hotline that provides information, psychological, and legal assistance to children, and the number of registered internally displaced children reaching 215 are among the other current issues in paediatric health. This year, there have been at least 36 verified attacks on schools in communities situated within 15 kilometres of the contact line in combat zones. More than 400,000 children need ongoing support to cope with the psychological wounds left by growing up in the midst of a long fight [4]. In order to ensure both the mother's and the child's health and wellbeing, both must have access to primary medical care and for the purpose of lowering health inequalities and advancing fairness, it's crucial to provide socially disadvantaged populations and the rural population access to basic medical care equally preventive and curative. The quality of the given care to children may be improved, and it can be made sure that they get the right care at each stage of their life development process by creating national standards for child development. The access to a children's hotline that offers advice, counselling, and legal support may help guarantee that kids have the resources they need to be safe and healthy. Ensuring that internally displaced children get the attention and assistance they need during a difficult and stressful period is essential the difficulty of rising a universal approach to child development, which may not take into account individual characteristics and requirements, may be the cause of the lack of national standards for child development. The internally displaced children who have registered may not fully represent the entire number of internally displaced children since other families may choose not to do so out of mistrust or fear of the government. Attacks on schools in war areas are a larger problem connected to security and conflict that may go beyond the purview of paediatric health alone. Although it's crucial to continue supporting kids who are dealing with psychological wounds, doing so could not address the underlying reasons for the war and displacement that caused those wounds in the first place. All these issues are major concern associated with low quality paediatrics healthcare services.

In Ukraine, paediatricians care for the other half of the youngsters while family physicians serve the other half. From birth to age 18, paediatricians and family physicians care for children. Contracts have been signed between the NHSU and more than 600 primary healthcare providers, including non-profits, for-profits, and physician entrepreneurs. Since 2018, all primary healthcare providers have met with all requirements, registered with the eHealth system, and signed an agreement with the NHSU. Beginning in 2019, people will receive full reimbursement for primary care services via an NHSU-funded contract-based age-adjusted capitation system. [5].

In Ukraine acute respiratory illnesses, diphtheria, measles, chickenpox, and cholera are prevalent infectious diseases. People in crisis may also be more susceptible to infectious diseases. Critical factors include the ability of governments or non-governmental organisations to sustain fundamental childhood immunisation programs and the speed at which disease outbreaks are identified and treated with drugs designed for that illness. Ukrainian paediatricians have the opportunity to thrive as a result of the national immunisation program, telemedicine and digital health, medical research, medical education and training, enhanced healthcare infrastructure, and public-private collaboration [6].

Additionally, a number of organisations seek to provide healthcare institutions with medical supplies and equipment as well as training for healthcare professionals [7]. To stop the spread of infectious illnesses, it is crucial for governments and non-governmental organisations to maintain children vaccination programs and provide

digital health to the people who live in rural places or who are unable to leave their houses due to a crisis scenario. Improved alternatives for infectious disease prevention and treatment may result from medical research and education. Healthcare reforms may be funded and carried out with the aid of public-private partnerships. The quality of patient care in Ukraine may be enhanced by providing medical supplies and training for healthcare workers. Keeping in view the current frequency of infectious illnesses there, it is possible that present efforts at prevention and treatment are insufficient. Budget restrictions or political instability may make it difficult for governments and non-governmental groups to maintain vaccination programs. All Ukrainians may not have access to telemedicine and digital health, especially those who live in poverty or don't have stable internet connectivity. In times of crisis, medical research and education may not get enough money or attention. Disputed interests or a lack of accountability may make it difficult for public and private sectors to work together. Analysing earlier studies on resources, healthcare workers, and public knowledge on paediatric health and prevention in Ukraine, investigating the results of earlier efforts to enhance paediatric care in Ukraine the funding, healthcare workers, inadequate infrastructure, political and economic instability, corruption in the health sector, and public awareness of paediatric health and prevention are just a few of the previously studied aspects of paediatric healthcare in Ukraine [8-10].

In conclusion, there are a number of issues with paediatric healthcare in Ukraine. However, there are a number of efforts targeted at improving the system, and with continuous funding and assistance, paediatric healthcare in Ukraine seems to have a bright future. Paediatric healthcare in Ukraine has a promising future despite its difficulties. Although infectious illnesses are still widespread, attempts are being done to combat them. The prevention of disease outbreaks depends on effective childhood vaccination programs. The remote or crisis-affected communities may have better access to healthcare thanks to telemedicine and digital health. Better preventive and treatment options may result from medical research and education. A more efficient healthcare delivery may be supported by improved healthcare infrastructure. Initiatives may get money and assistance for their execution thanks to public-private partnerships. The supply of medical equipment and training for medical staff members may enhance the standard of service. To maintain and advance upon accomplishments established, ongoing financing and help are required. Paediatric healthcare in Ukraine has the potential to significantly advance with continued efforts and assistance.

Research Problem

The research problem of the study on "Ukrainian paediatrics of the future: current problems and prospects for improvement" include such questions:

1. What are the causes of the lack of medical personnel in Ukraine's paediatric sector?
2. How is the quality of paediatric healthcare in Ukraine impacted by the lack of suitable infrastructure, medical equipment, and supplies?
3. What illnesses affect children the most often in Ukraine?
4. What factors contribute to Ukraine's low immunisation rates, and how may they be raised?
5. How paediatric healthcare are services available and of a high standard in Ukraine affected by the country's inadequate healthcare spending?

Research Focus

The goal of the research study "Ukrainian paediatrics of the future: current problems and prospects for improvement" is to examine potential strategies for enhancing the quality and accessibility of paediatric care in the future by analysing the state of paediatric healthcare in Ukraine today, identifying the biggest difficulties and issues the healthcare system is currently facing, and analysing the current situation.

Research Aim and Research Questions

The objectives of the research study are:

1. To identify and examine the existing concerns and difficulties related to healthcare professional in paediatric healthcare in Ukraine.
2. To identify and examine the existing concerns and difficulties related to healthcare infrastructure and equipment in paediatric healthcare in Ukraine.
3. To identify and examine the existing concerns and difficulties related to vaccination coverage in paediatric healthcare in Ukraine.
4. To identify and examine the existing concerns and difficulties related to mortality (BOD) in children in Ukraine.

5. To identify and examine the existing concerns and difficulties related to healthcare spending in paediatric healthcare in Ukraine.

Research Methodology

General Background

In Ukraine, the medical discipline of paediatrics is dedicated to the treatment of new-borns, kids, and teenagers. The Ukrainian paediatric healthcare system confronts several difficulties despite recent advancements in healthcare services. The healthcare system is suffering from a lack of funds and antiquated infrastructure as a result of the nation's economic and political disorder. This has led to a lack of paediatricians, especially in rural regions with underfunded and understaffed healthcare institutions.

There are a number of measures that may be used to enhance the condition of paediatrics in Ukraine. These include boosting healthcare financing, raising the standard of doctor training and education programs, and implementing all-encompassing preventative healthcare initiatives. The general public understanding of the value of routine check-ups, vaccinations, and good lifestyle practices may also be raised.

Paediatric healthcare in Ukraine has many difficulties overall, but there is also a lot of room for progress. The nation can offer all children with top-notch paediatric care and guarantee a healthy future for the next generation by putting the aforementioned plans into practice.

Sample / Participants / Group

The following sample/participants/groups was involved in the research "the future paediatrics healthcare sector in in Ukraine":

1. Healthcare workers.
2. Healthcare institutions.
3. Patients.
4. Key stakeholders (healthcare policymakers, healthcare professionals, and experts in digital healthcare solutions).

Instrument and Procedures

For the purpose of gathering data, a questionnaire was used. Using both online and offline techniques, secondary data was gathered for the questionnaire from official sources and public data. Data analysis techniques may use both quantitative and qualitative methodologies. The study results might be shown as a table or graph.

Data Analysis

A quantitative data analysis with the implementation of descriptive statistics, such as frequency tables, mean, median, mode, standard deviation, and range, in order to summarise and characterise the obtained information from surveys was used. There was no data analysis and just a data comparison in the discussion part.

Research Results

Statistical data for Ukraine

The statistics results (Table 1) for Ukraine include information on the country's population's age distribution, ethnic composition, level of education, health, and other characteristics. The population of Ukraine, excluding Crimea and Sevastopol, was 41,130,432 as of the most recent statistics. According to reports, the country's population growth rate was 6.6 new residents per 1,000 inhabitants. In contrast to the mortality rate of 14.7 per 1,000 people, there were 8.1 births per 1,000 people. In Ukraine, the average lifespan was 71.76 years, with men living to an average age of 66.69 years and females living to an average age of 76.72 years. According to the population of Ukraine's age breakdown, 15.4% of people were under the age of 14, 68.4% were between the ages of 15 and 64, and 16.2% were 65 years of age or over. According to reports, 1.16 children were born for every woman in Ukraine in 2021. In 2015, there were 5.4 migrants per 1,000 persons, or the net migration rate. At birth, there were 1.06 more boys than females. The gender ratio for individuals under the age of 15 was 1.06 men to females. The sex ratio was 0.92 men for every female for those between the ages of 15 and 64, and 0.51 males for every female for those 65 and older [11].

Table 1. Demographic Characteristics

Variable	Frequency
Total population	41,130,432
Growth rate per 1000 population	6.6
Birth rate per 1000 population	8.1
Death rate per 1000 population	14.7
Life expectancy	71.76 years

Source: Authors' development based on state statistics service of Ukraine [14]

Status of Healthcare staff

The results according to a study conducted in Ukraine (Table 2) the number of doctors per 100,000 individuals, excluding dentists, decreased from 462 in 2000 to 417 in 2019. This suggests a decline in the availability of medical professionals in the country. The study also found that the number of nurses and midwives per 100,000 people in Ukraine decreased from 1103 in 2000 to 743 in 2019. This indicates a significant reduction in the number of healthcare professionals providing care to patients in the country. Moreover, the study reported that in 2019, there were 665 hospital beds per 100,000 individuals in Ukraine, down from 950 in 2000. This reduction in the number of hospital beds available per capita could potentially have an impact on the accessibility of medical care in the country [12].

Table 2. Status of healthcare professional in Ukraine Click or tap here to enter text.

Rates	2000	2019
Physicians per 100 000 population	462	417
Nurses and midwives per 100 000 population	1103	743
Number of hospital beds per 100 000 population	950	665

Source: Authors' development based on health systems in action: Ukraine [12]

The decline in the number of doctors and healthcare professionals in Ukraine indicates a potential lack of healthcare providers. The reduction in hospital beds per capita could lead to longer wait times and limited access to medical care. The decline in the number of nurses and midwives in Ukraine could lead to a shortage of caregivers, particularly for vulnerable populations. It is important to address the root causes of these reductions in order to improve access to healthcare in the country. Strategies such as increasing funding for medical education and expanding healthcare infrastructure may be needed to address these issues. The research does not take into consideration population fluctuations in Ukraine, which can have an impact on the number of physicians, nurses, and hospital beds per capita. The possible effects of technology and telemedicine on access to healthcare in Ukraine are not taken into account by the research. There may be a move toward greater outpatient treatment, as seen by the decrease in hospital beds per capita.

Status of Infrastructure, Equipment and Supplies

The results concerning the supply and maintenance of medical equipment in Ukraine's healthcare system showed that the majority of medical equipment in the country has been in use for 20 to 25 years, far beyond its recommended lifespan. Replacement rates for old and worn-out equipment have been slow, which has resulted in many hospitals and clinics operating with outdated and ineffective equipment. Furthermore, the COVID-19 pandemic has exacerbated the already existing problem of a shortage of hospital beds in Ukraine. The number of hospital beds available per 100,000 individuals decreased from 950 in 2000 to 665 in 2019. This decline of 665 hospital beds per 100,000 individuals has put additional pressure on the healthcare system during the pandemic.

It has become increasingly difficult to accommodate the rising number of COVID-19 patients, resulting in long wait times and insufficient medical care for those in need [12].

Status of burden of disease

Results of the available statistics showed the infant mortality rate (Table 3) were 7.3, 7.1 and 7 in year 2019, 2020 and 2021 respectively. Fewer than 5 mortality rates were 8.5, 8.4 and 8.2 in years 2019, 2020 and 2021 respectively while neonatal mortality rates were 4, 98, 4.89 and 4.83 in years 2019, 2020 and 2021 respectively. The following list of unfavourable childhood experiences was experienced by at least two of the 20.8% of Ukrainian children: Parental passing, child welfare involvement, major sickness or injury, home drug or alcohol misuse, household mental illness, parental divorce or separation, physical or sexual abuse, a family member serving time in jail or becoming a criminal [13,14].

Table 3. Mortality rate from 2019 to 2021 in Ukraine

Variable	2019	2020	2021
IMR	7.3	7.1	7
Under5 mortality	8.5	8.4	8.2
Neonatal Mortality	4.98	4.89	4.83

Source: Authors' development based on UNICEF data [13,14]

Vaccination status

The results of the available statistics (Table 4) showed that the year 2021, 88.5% of individuals received the first dose of the measles-containing vaccine, while in 2020 and 2019; the coverage rates were 84.9% and 93.2%, respectively. Similarly, for the second dose of the measles-containing vaccine, the coverage rates were 85.9%, 81.9%, and 91.7% in 2021, 2020, and 2019, respectively. The BCG vaccine coverage rates were 86.5%, 92.7%, and 83.8% in 2021, 2020, and 2019, respectively. For the DTP-containing vaccine, the coverage rate for the first dose was 90.8%, 92.6%, and 88.9% in 2021, 2020, and 2019, respectively. However, for the third dose, the coverage rates were 78.1%, 81.3%, and 79.9% in 2021, 2020, and 2019, respectively. The coverage rate for the third dose of Hib vaccine was 87.2%, 85.2%, and 80% in 2021, 2020, and 2019, respectively. The Hepatitis B vaccine coverage rate at birth was 90.4% and 100% in 2021 and 2020, respectively. The coverage rate for the third dose of polio vaccine was 78.3%, 84.2%, and 77.8% in 2021, 2020, and 2019, respectively. For the first dose of rubella-containing vaccine, the coverage rates were 88.5%, 84.9%, and 93.2% in 2021, 2020, and 2019, respectively [15].

Table 4. Vaccinations Coverage from 2019 to 2021

Vaccination Name	2021	2020	2019
Measles-containing vaccine, 1st dose	88.5%	84.9%	93.2%
Measles-containing vaccine, 2nd dose	85.9%	81.9%	91.7%
BCG	86.5%	92.7%	83.8%
DTP-containing vaccine, 1st dose	90.8%	92.6%	88.9%
DTP-containing vaccine, 3rd dose	78.1%	81.3%	79.9%
Hib, 3rd dose	87.2%	85.2%	80%
HepB, 3rd dose	77%	80.9%	76.5%
HepB, birth dose (given within 24 hours of birth)	56.3%	68.6%	60.3%
HepB, birth dose total (including those given within and after 24 hours of birth)	90.4%	100%	
Flu for all persons above >6 months (universal recommendation)	0.27%		
Influenza child age group 1	0.68%	1.11%	40%
Influenza child age group 2			52%
Polio, 3rd dose	78.3%	84.2%	77.8%
Rubella-containing vaccine, 1st dose	88.5%	84.9%	93.2%

Source: Authors' development based on WHO Immunisation data portal [15]

The results of the available statistics (Table 5) showed that Ukraine has a higher infant mortality rate of 7% than neighbouring European nations like Belarus and Russia, which had infant mortality rates of 2% and 5%, respectively. The death rate for children under the age of five is 8% in Ukraine, 3% in Belarus, and 6% in Russia. In Russia, Belarus, and Ukraine, the death rate for children aged 5 to 14 is 2%, 1%, and 2%, respectively. In Russia, 6% of infants are born weighing less than 2500g, compared to 5% in Belarus and 6% in Ukraine

Table 5. Mortality Status in Ukraine and neighbouring countries, according to 2021 UNICEF report [Click or tap here to enter text.](#)

Vaccination Name	Ukraine	Belarus	Russia
Under-5 mortality (%)	8	3	6
Infant mortality (%)	7	2	5
Mortality rate, children 5-14 years (%)	2	1	2
Low birth weight <2500g (%)	6	5	6

Source: Authors' development based on UNICEF [30]

Status of Healthcare spending

The lack of sufficient finance is one of the main issues paediatric healthcare in Ukraine is experiencing. Due to this, there is a lack of healthcare workers as well as medical supplies and equipment. A high prevalence of avoidable children's diseases is also a result of a lack of public understanding about paediatric health and prevention [16]

The results from the data that is currently available show that domestic general health expenditure per capita, PPP (the current international \$), domestic general government spending on health (% of current health expenditure), and external health spending per capita, PPP (current international \$) in 2019 are 51.12, 54.53, and 248.13 respectively. PPP (current international dollars) domestic health care expenditure per person is 907.16 [17].

The Ukrainian paediatric healthcare system is afflicted by a lack of medical experts, antiquated equipment, and inadequate money. There are 41.1 million people, with a birth rate of 8.1 and a death rate of 14.7. Ukraine has a life expectancy of 71.76 years. Ukraine lost physicians and hospital beds per 100,000 people between 2000 and 2019, restricting medical services. Slow replacement rates have exacerbated the hospital bed shortage, which has decreased from 950 in 2000 to 665 in 2019 and has resulted in excessive wait times and inadequate medical care. In Ukraine, the infant mortality rate was 7.3, 7.1, and 7 per 1,000 live births in 2019-2021, respectively. The mortality rate for children under the age of five has remained high, with rates of 8.5, 8.4, and 8.2 per 1,000 children in 2019, 2020, and 2021, respectively. Ukraine's newborn and child mortality rates are greater than those of Belarus and Russia due to the above-mentioned causative factors. In Ukraine, vaccination coverage rates are very poor. The coverage rates for the first measles immunization dose, polio, and DTP third-dose coverage were very low. Hepatitis B birth immunisation has recently gained popularity in Ukraine. The Ukrainian paediatric healthcare system is very weak, medical expertise, equipment, and supplies are scarce due to underfunding, and children are at risk of avoidable infections. Foreign health spending per person is 248.13 PPP, whereas domestic general government health spending is 54.53 PPP and domestic general health spending is 51.12 PPP. Healthcare in the United States costs \$907.16 PPP per person; this also shows very low budget spending on health. Finally, Ukraine's paediatric healthcare system is plagued by a lack of medical staff and equipment, inadequate funding, and high new-born and child death rates and requires a comprehensive strategy that tackles the underlying reasons while also funding appropriate medical experts, equipment, and supplies.

Discussion

Status of Healthcare staff

The paediatric healthcare system in Ukraine offers services via specialists in 50% of cases and regular physicians in 50% is suffering from a physician and nurse lack, particularly in rural regions. In recent years, there have been fewer doctors in Ukraine. The workforce is aging; as of 2019, 24.7% of active physicians were retired, which **one reason is** contributing to this trend. Additionally, there has been a rise in doctors looking for employment outside the public health system as well as in the emigration of healthcare professionals.

While when paediatric primary care is compared in other countries in Europe, variations exist among them, as shown by a study conducted in 29 countries. A family doctor or general practitioner system was used by 41% of them, a paediatrician-based system by 24%, and a combination system of healthcare services by 35%. There were

82 078 paediatricians in all of the 29 nations. 40.4% of these were employed in primary care. The issue of healthcare personnel lack in many nations is complex. The dearth of health professionals was mostly caused by elements like poor pay, lengthy working hours, heavy workloads, and a lack of opportunity for training and professional growth [18].

The provision of high-quality healthcare services is largely dependent on nurses and midwives, who also provide care for mothers, babies, and children, administer life-saving vaccines, provide health advice, and look after the elderly. There is a lack of nursing and allied health professionals in Ukraine, like all other European countries, and the Middle East [19-21].

When comparing with Pakistan, the result showed that child health care is being provided with specialist doctors as well as mostly by general medical practitioner but the situation is better than in Ukraine. Both the physical infrastructure and the workforce have steadily risen to support public health initiatives. The overall number of beds available in these healthcare institutions is expected to be 123394, and they include 1201 hospitals, 5518 basic health facilities, 683 rural health facilities, 5802 dispensaries, 731 maternal & child health clinics, and 347 TB centers. Additionally, the population is receiving primary healthcare services from about 95000 Female Health Workers through the health houses. Pakistan has greater training and development resources than Ukraine [22].

Dr. Poonam Khetrpal Singh, Regional Director, WHO South-East Asia, assumed on World Health Day that it is imperative intensifying the efforts in order to ensure that the workforce of doctors, nurses, and midwives has the power, abilities, and support to attend to all people's health needs. To attain health for everyone by 2030, South-East Asian nations must step up efforts to develop and increase their cadre of nurses and midwives by 1.9 million [23, 24].

Status of Infrastructure, Equipment and Supplies

There have long been problems with the supply and maintenance of medical equipment especially in child healthcare hospitals. The majority of the equipment has been in operation for 20 to 25 years, far beyond its useful life, and the pace of replacing aging and damaged equipment is fairly sluggish. During the COVID-19 pandemic, there were 665 fewer hospital beds available per 100,000 persons in 2019 than there were in 2000. Hospital bed averages for Ukraine have continued to be higher than those for the EU and WHO's European Region. This may be due to the lack of effectively and efficiently use of available beds. This shows inappropriate training and development of health care staff resulting overcrowding in terms of hospital facilities and unneeded hospitalisations and shortage of equipment's and medical supplies. In addition, the COVID-19 epidemic has made it clear that Ukraine's hospitals need to be reorganised [25].

While a different research carried out in Romania revealed that the number of hospital beds has been steadily declining over the last 30 years. There were 4630 beds for neonates and preterm infants and 7666 beds for children. Although over the past 30 years the infant mortality has steadily declined in Romania. It continues to be the highest in the EU. The most thorough indicator of a health system's effectiveness is infant mortality. Even if there have been significant advancements in children's healthcare, more has to be done to guarantee a higher standard of care for our country's future, both in terms of infrastructure and human resources [26].

Studies carried out in Bangladesh revealed that the healthcare facilities there were inadequate in many of areas, particularly in the areas of medical supplies and equipment, diagnostic abilities, and medical supplies inventory [27, 28].

Status of burden of disease

The available statistics indicate a decrease in the infant mortality rate from 7.3 in 2019 to 7 in 2021, and a similar trend for the under-5 mortality rate and neonatal mortality rates in Ukraine. However, the decline in neonatal mortality rates is slow. The infant mortality rate and under-5 mortality rate have improved significantly from 17 and 19 per 1,000 live births in 1990 to 7 and 8 per 1,000 in 2019. In contrast, Pakistan's infant mortality rate was much higher at 57.998 deaths per 1000 live births in 2021 and 59.109 deaths per 1000 live births in 2020. Therefore, Ukraine has better health indicators than Pakistan [29].

When comparing with other European countries, statistics showed that Ukraine has a higher infant mortality rate of 7% than neighbouring European nations like Belarus and Russia, which had infant mortality rates of 2% and 5%, respectively. Similar to this, the death rate for children under the age of five is 8% in Ukraine, 3% in Belarus, and 6% in Russia. In Russia, Belarus, and Ukraine, the death rate for children aged 5 to 14 is 2%, 1%, and 2%, respectively. In Russia, 6% of infants are born weighing less than 2500g, compared to 5% in Belarus and 6% in Ukraine [30, 31].

The danger for children in Europe and North America is 14 times higher than that in sub-Saharan Africa, where there are 74 fatalities for every 1,000 live births, the worst mortality rate in the world. In 2020, the global under-5

mortality rate dropped to 37 fatalities for every 1,000 live births. The main causes of death in children under the age of five include preterm birth complications, birth asphyxia or trauma, pneumonia, diarrhoea, and malaria. With access to low-cost health and sanitation programs, all of these illnesses might be prevented or cured [32, 33]. The disparity in mortality between Europe and North America and sub-Saharan Africa may be ascribed to issues like poverty, a lack of proper healthcare facilities, and restricted access to clean water and sanitary facilities. These elements contribute to a greater prevalence of illnesses and diseases that may be avoided, which raises the mortality rates of children in sub-Saharan Africa.

Compared with Asia-Pacific countries the literature claims that the infant mortality rate in lower-middle and lower-income Asia-Pacific nations decreased from 54.4 deaths per 1,000 live births in 2000 to 27.2 in 2018. In a similar vein, over the same time period, upper-middle income Asia-Pacific nations reported a drop from 18.2 to 10 fatalities per 1,000 live births. Eastern Asian nations have lower infant mortality rates than South and South-East Asian nations. The cities of Hong Kong, Japan, China, Singapore, and the Republic of Korea had the lowest rates in 2018, with three fatalities or fewer per 1,000 live births. These results show how far Asia-Pacific nations have gone in lowering infant death rates, especially in lower-income areas [34, 35].

Vaccination status

The WHO's objective criteria for herd immunity for some of the most severe illnesses were never reached in Ukraine, which has one of the lowest vaccination rates in all of Europe. 20% of Ukrainian youngsters were not properly immunised against measles in 2021, and 13% were not poliovirus-protected [36, 37].

When comparing with other European countries, the literature showed that children vaccinated against measles in 2021 were 99.8% in Hungary, 99.5% in Portugal, 97.3% in Russia, 96.1% in Turkey, 96% in Finland, and 80.3% in Poland. By the year 2021, virtually all of Hungary's youngsters have received the measles vaccine. To eradicate the illness and halt its transmission to people in high-risk categories, it is advised that at least 95% of the populace take the measles vaccination [38, 39]. Ukraine's poor measles and poliovirus immunisation rates increase the risk of outbreaks and susceptibility. Compared to other European countries with greater measles vaccination rates, Ukraine needs more vaccine promotion and access activities. Herd immunity protects persons who cannot acquire vaccines due to medical conditions or age. Thus, high immunisation rates are essential for individual and group health. Ukraine's poor vaccination rates are due to vaccine aversion, misinformation, and limited healthcare availability. Health education campaigns targeting parents and medical professionals should promote vaccination's benefits and safety. Improved healthcare systems and universal vaccine access should be implemented. To raise vaccination rates in Ukraine, a public health priority, the government, medical specialists, and the public must work together.

In terms of polio vaccine, according to the World Health Organisation, the whole continent of Europe was deemed polio-free in 2002. However, this status requires continued polio immunisation of children. In 2018, 98 percent of children in Turkey and 99.9 percent of youngsters in Hungary got the polio vaccine. In contrast, just 71% of youngsters in Ukraine got a polio immunization this year [40, 41]. Low vaccination rates in Ukraine are the result of a number of issues, including widespread vaccine reluctance, which has been exacerbated in part by social media campaigns that propagate false information about vaccines and erode public confidence in Ukrainian institutions.

In Ukraine, outbreaks of illnesses that are preventable by vaccination have lately occurred as a consequence of low vaccination rates. The greatest outbreak in Europe in more than ten years, over 115 000 cases of measles and 40 fatalities connected to the disease were documented in Ukraine between 2017 and 20. A confirmed epidemic of type 2 vaccine-associated paralytic poliovirus occurred in 2021. More than 20 kids were found to have poliovirus, and two of them had acute flaccid paralysis. While there were significant increases in measles outbreaks in the other European Economic Area in 2017 and 2018, with about 3.5 thousand cases. Measles rates peaked in 2019 at a lesser rate than they did the two years before, but the current rise in cases may be linked to the growth of anti-vaccination sentiment throughout several European countries. However, the monthly reported cases of measles were at their lowest levels in the years 2020 and 2021, which might have been impacted by increased social isolation measures implemented in response to the COVID-19 pandemic and people's belief in vaccination as a preventative measure [42-44].

Status of Healthcare spending

Paediatric healthcare in Ukraine has substantial budget issues, which contribute to a lack of medical staff, equipment, and supplies. Furthermore, a high frequency of avoidable children illnesses has been attributed to a lack of public knowledge about paediatric health and prevention. In 2021, the public spending ratio the proportion of state spending to GDP - varied across the member states of the European Union in relation to other European nations. The largest public spending per GDP was in Belgium (54.91%), followed by Portugal (48.15%), Poland (44.2%), Bulgaria (40.425%), and Hungary (47.92%) [45,46]. The well-being of children in Ukraine is negatively impacted by the inadequate financing for paediatric healthcare. This problem is probably exacerbated

by the low public expenditure on healthcare in comparison to other European nations since less money is available to invest in enhancing the healthcare system. It is crucial that Ukrainian politicians give priority to increasing public expenditure on healthcare, especially paediatric healthcare and must remember that public healthcare expenditure is only one element that influences the quality of healthcare. Other elements, such the effectiveness of healthcare systems and the accessibility of medical staff and resources, are also quite important.

When comparing the results with the countries among the OECD, the United States spent the most on healthcare per person in 2021. Germany, which came in second with spending of \$12,318 per person, was well behind the United States in terms of healthcare spending at the time. On a per capita basis, the Netherlands, Switzerland, and Norway are among the top five nations. The United States spends the most of its GDP on health care, almost 19 percent of it, making it the country with the highest health care spending [47]. This comparison create a helpful way to assess a nation's commitment to the welfare of its population is to compare healthcare expenditures among nations. Despite having the largest healthcare expenditure per capita and GDP, the United States does not have the best healthcare results when compared to other high-income nations. The results show that better health outcomes are not necessarily associated with more healthcare expenditure. Because of all this, policymakers must take into account not just the quantity of money allocated to healthcare, but also how effectively those resources are distributed and used to provide the population with high-quality treatment.

But the situation is different when comparing Ukraine with low- and middle-income countries and the European region. The literature showed that Ukraine spends more per capita on health than lower-middle-income countries (\$426) but less than the WHO European Region average. Health expenditure as a proportion of government spending increased to 6.8% in 2018 from 6.8% in 2008. In 2018, Ukraine spent 3.7% of its GDP on health, greater than the LMIC average (2.8%) but less than the WHO European Region (4.9%) and the EU (5.9%). Private health spending was 51% in 2018, up from 39.1% in 2006. This is an increase from 39.1% in 2006. Private expenditure, which is nearly completely out-of-pocket, has the potential to bankrupt families while also preventing patients from receiving required treatment. Many people may become bankrupt due to medical expenses. In 2019, 16.7% of Ukrainian families spent catastrophically on health care, which was more than in many other WHO European Region nations. Coverage gaps in publicly funded health care cost patients a lot of money. Different economic developments, political systems, and health care systems, among other things, may be blamed for the disparity in health spending and funding between Ukraine and other nations.

Conclusions and Implications

Numerous obstacles that affect children's health and welfare exist in paediatrics in Ukraine. Despite these difficulties, there are a number of opportunities for advancement in paediatrics that might help to enhance the quality of child healthcare in the nation.

1. The inadequate healthcare infrastructure is one of the main issues in Ukrainian paediatrics. Paediatric experts, healthcare facilities, and medical supplies are in limited supply. Children's health suffers as a consequence of lengthy appointment wait times, insufficient diagnosis, and treatment. Additionally, the advancement of paediatric healthcare is hampered by a lack of funding for the study and development of novel therapies and medications.

2. The high new-born and child mortality rate is still another serious issue. This is caused by a number of things, including insufficient nutrition, a lack of access to clean water and sanitary facilities, and avoidable illnesses including pneumonia, diarrhoea, and TB. Neonatal mortality is very high, with the majority of fatalities happening within the first 24 hours following birth.

3. The COVID-19 epidemic has exacerbated the issues that Ukraine's children's healthcare system already faced. The pandemic has reduced the number of regular vaccines, made it more difficult to access medical facilities, and disrupted the delivery of crucial services. These factors have increased the number of avoidable diseases and the strain on the already overburdened healthcare system.

4. Despite these issues, there are still many possibilities able to improve paediatrics in Ukraine. The government has launched a variety of projects in an effort to enhance children's health care. These include creating a national strategy for women's and children's health care, raising the health care budget, and enhancing the infrastructure for health care. Additionally, a number of non-governmental organisations and foreign assistance organisations are striving to enhance children's healthcare in the nation.

5. The emergence of telemedicine and e-health services is one of the most important opportunities for advancement. This will provide kids in isolated and rural locations access to specialised treatment while also addressing the scarcity of paediatric experts. Additionally, telemedicine may assist cut down on appointment wait times and increase the effectiveness of healthcare delivery.

6. The expansion of services for maternity and paediatric healthcare is still another opportunity. This entails expanding access to maternity care, delivering better prenatal care, enhancing nutrition, and lowering the

incidence of illnesses that can be prevented. The health results for children in the nation may also be greatly improved by expanding vaccine access and fostering public health education.

In conclusion, the field of paediatrics in Ukraine faces a number of obstacles, the most significant of which are a shortage of first-quality medical facilities and a high death rate among infants and young children. But there are things that can be done to make the situation better, such as expanding telemedicine and e-health services, improving care for mothers and children, and spending more money in research and development. By addressing these concerns and providing financing for these opportunities, the country has the potential to greatly enhance the physical health of its children as well as their overall level of happiness.

Author contributions: All authors have sufficiently contributed to the study and agreed with the results and conclusions.

Funding: No funding source is reported for this study.

Ethical statement: This study does not require IRB approval as it does not involve human subjects/data.

Declaration of interest: No conflict of interest is declared by authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

References

1. Romanyshyn Y, Voznytsa Y, Romanyshyn B, Lischuk-Yakymovych K, et al. Diarrhoea in a 2-year-old boy – thinking beyond the gut. *Pediatr Med Rodz* [Internet]. 2018;14(2):237–40. Available from: <http://dx.doi.org/10.15557/pimr.2018.0025>
2. Loboda A. Child healthcare system in Ukraine. *Turk Pediatri Ars* [Internet]. 2020; 55: Supplement S98-S104 Available from: <http://dx.doi.org/10.14744/turkpediatrics.2020.82997>
3. Ukraine - infant mortality rate 2011-2021 [Internet]. Statista. [cited 2022 May 12]. Available from: <https://www.statista.com/statistics/807836/infant-mortality-in-ukraine/>
4. 430,000 children continue to bear the brunt of eastern Ukraine conflict [Internet]. Unicef.org. [cited 2022 May 12]. Available from: <https://www.unicef.org/press-releases/430000-children-continue-bear-brunt-eastern-ukraine-conflict>
5. National Health Service of Ukraine first reports on its activities and identifies top five most active regions [Internet]. Gov.ua. [cited 2022 May 12]. Available from: <https://www.kmu.gov.ua/en/news/moz-yaki-regioni-stali-liderami-za-viplatami-vid-nacsluzhbi-zdorovya>
6. Ottolini M, Cirks B, Madden KB, Rajnik M. Pediatric infectious diseases encountered during wartime-part 1: Experiences and lessons learned from armed conflict in the modern era. *Curr Infect Dis Rep* [Internet]. 2021;23(12):27. Available from: <http://dx.doi.org/10.1007/s11908-021-00770-1>
7. Rynhach NO, Moiseenko RO. Calculation of loss of child mortality in Ukraine as an instrument for estimation of achievements of sustainable development goals in Ukraine. *Wiad Lek* [Internet]. 2019 [cited 2022 May 12];72(5 cz 2):1145–9. Available from: <https://pubmed.ncbi.nlm.nih.gov/31175761/>
8. Bate R, Mathur A. Corruption and medicine quality in Latin America: A pilot study. *B E J Econom Anal Policy* [Internet]. 2018;18(2). Available from: <http://dx.doi.org/10.1515/bejeap-2017-0076>
9. Vian T. Anti-corruption, transparency and accountability in health: concepts, frameworks, and approaches. *Glob Health Action* [Internet]. 2020;13(sup1):1694744. Available from: <http://dx.doi.org/10.1080/16549716.2019.1694744>
10. García PJ. Corruption in global health: the open secret. *Lancet* [Internet]. 2019;394(10214):2119–24. Available from: [http://dx.doi.org/10.1016/S0140-6736\(19\)32527-9](http://dx.doi.org/10.1016/S0140-6736(19)32527-9)
11. Klas J, Grzywacz A, Kulszo K, Grunwald A, Kluz N, Makaryczew M, et al. Challenges in the medical and psychosocial care of the paediatric refugee-A systematic review. *Int J Environ Res Public Health* [Internet]. 2022;19(17):10656. Available from: <http://dx.doi.org/10.3390/ijerph191710656>
12. Health systems in action: Ukraine [Internet]. Who.int. [cited 2022 May 12]. Available from: <https://eurohealthobservatory.who.int/publications/i/health-systems-in-action-ukraine>
13. Ukraine (UKR) - demographics, health & infant mortality [Internet]. UNICEF DATA. 2020 [cited 2023 May 12]. Available from: <https://data.unicef.org/country/ukr/>

14. Ukraine - infant mortality rate 2011-2021 [Internet]. Statista. [cited 2023 May 12]. Available from: <https://www.statista.com/statistics/807836/infant-mortality-in-ukraine/>
15. WHO immunization data portal [Internet]. Who.int. [cited 2023 May 12]. Available from: <https://immunizationdata.who.int/listing.html?topic=coverage&location=UKR>
16. Ukraine [Internet]. Who.int. [cited 2023 May 12]. Available from: <https://www.who.int/countries/ukr>
17. External health expenditure per capita, PPP (current international \$) - Ukraine [Internet]. World Bank Open Data. [cited 2023 May 12]. Available from: <https://data.worldbank.org/indicator/SH.XPD.EHEX.PP.CD?locations=UA>
18. Strategic-paediatric-alliance.org. [cited 2023 May 12]. Available from: <http://www.strategic-paediatric-alliance.org/content/page/13/paediatric-primary-care-europe-variation-between-countries>
19. Sawyer SM, all authors. Avoiding a rigid age of paediatrics - Authors' reply. *Lancet Child Adolesc Health* [Internet]. 2019;3(12):e15. Available from: [http://dx.doi.org/10.1016/S2352-4642\(19\)30344-X](http://dx.doi.org/10.1016/S2352-4642(19)30344-X)
20. Who emro [Internet]. World Health Organization - Regional Office for the Eastern Mediterranean. [cited 2023 May 12]. Available from: <https://www.emro.who.int/nursing/countries/>
21. Nurses & allied healthcare professionals [Internet]. ESICM. 2017 [cited 2023 May 12]. Available from: <https://www.esicm.org/the-esicm/nahp/>
22. English publisher. Health service delivery [Internet]. World Health Organization - Regional Office for the Eastern Mediterranean. [cited 2023 May 12]. Available from: <https://www.emro.who.int/pak/programmes/service-delivery.html>
23. Countries in WHO South-East Asia Region need 1.9 million more nurses, midwives to achieve health for all [Internet]. Who.int. [cited 2023 May 12]. Available from: <https://www.who.int/southeastasia/news/detail/07-04-2020-countries-in-who-south-east-asia-region-need-1.9-million-more-nurses-midwives-to-achieve-health-for-all>
24. Nursing and midwifery [Internet]. Who.int. [cited 2023 May 12]. Available from: <https://www.who.int/southeastasia/health-topics/nursing>
25. Pecoraro F, Luzi D, Clemente F. The efficiency in the ordinary hospital bed management: A comparative analysis in four European countries before the COVID-19 outbreak. *PLoS One* [Internet]. 2021;16(3):e0248867. Available from: <http://dx.doi.org/10.1371/journal.pone.0248867>
26. Pop TL. Overview of the pediatric healthcare system in Romania. *Turk Pediatri Ars* [Internet]. 2020; Available from: <http://dx.doi.org/10.14744/turkpediatrics.2020.77775>
27. Health System Strengthening: Transforming the health information system in Bangladesh [Internet]. Unicef.org. [cited 2022 May 12]. Available from: <https://www.unicef.org/rosa/reports/health-system-strengthening-transforming-health-information-system-bangladesh>
28. Shawon MSR, Adhikary G, Ali MW, Shamsuzzaman M, Ahmed S, Alam N, et al. General service and child immunization-specific readiness assessment of healthcare facilities in two selected divisions in Bangladesh. *BMC Health Serv Res* [Internet]. 2018;18(1):39. Available from: <http://dx.doi.org/10.1186/s12913-018-2858-7>
29. Manickavasagar V, Mace A, Skull S. Clinician and caregiver experience of telehealth during COVID-19 pandemic supports future use. *J Paediatr Child Health* [Internet]. 2022;58(1):211-3. Available from: <http://dx.doi.org/10.1111/jpc.15831>
30. United Nations Children's Fund. The state of the world's children 2021: On my mind promoting, protecting and caring for children's mental health [Internet]. United Nations; 2021. Available from: <https://www.unicef.org/reports/state-worlds-children-2021>
31. Liang F-W, Chen M, Wu M-H, Lue H-C, Chiang T-L, Lu T-H. Infant mortality rates based on two registration criteria for live births: A comparison of Taiwan with 26 European countries. *Pediatr Neonatol* [Internet]. 2019;60(2):224-6. Available from: <http://dx.doi.org/10.1016/j.pedneo.2018.06.00>
32. Child mortality (under 5 years) [Internet]. Who.int. [cited 2022 May 12]. Available from: <https://www.who.int/news-room/fact-sheets/detail/levels-and-trends-in-child-under-5-mortality-in-2020>
33. OECD, World Health Organization. Health at a glance: Asia/pacific 2020: Measuring progress towards universal health coverage. [Internet] OECD; 2020. Available from: <https://doi.org/10.1787/26B007CD-EN>.
34. Infant mortality [Internet]. Oecd-ilibrary.org. [cited 2022 May 12]. Available from: <https://www.oecd-ilibrary.org/sites/f7b3e551-en/index.html?itemId=/content/component/f7b3e551-en>

35. Smiiianov VA, Zaitseva HS, Kurganskaya VA, Dyachenko AG, Zbarazhskiy VP, Smiiianov YV, et al. Vaccination coverage rates and the incidence of vaccine preventable diseases among children in sumy region of Ukraine. *Wiad Lek* [Internet]. 2019;72(2):255-60. Available from: <http://dx.doi.org/10.36740/wlek201902121>
36. Measles immunization in Europe 2021 [Internet]. Statista. [cited 2022 May 12]. Available from: <https://www.statista.com/statistics/1122312/measles-immunization-in-europe/>
37. Immunisation and childhood vaccination [Internet]. European Centre for Disease Prevention and Control. 2018 [cited 2023 May 12]. Available from: <https://www.ecdc.europa.eu/en/all-topics-z/measles/prevention-and-control/immunisation-and-childhood-vaccination>
38. Polio immunization rate in Europe in 2018, by country [Internet]. Statista. [cited 2023 May 12]. Available from: <https://www.statista.com/statistics/1122618/polio-immunization-in-europe/>
39. GHO | By category | Polio (Pol3) - Immunization coverage estimates by country. [cited 2023 May 12]; Available from: <https://apps.who.int/gho/data/node.main.A831?lang=en>
40. Measles cases reported in Europe 1999 to 2022 [Internet]. Statista. [cited 2022 May 12]. Available from: <https://www.statista.com/statistics/1122761/measles-cases-in-europe-timeline/>
41. Measles cases reported in Europe 2021, by country [Internet]. Statista. [cited 2022 May 12]. Available from: <https://www.statista.com/statistics/632154/measles-cases-reported-in-europe/>
42. Public spending ratio in EU countries 2021 [Internet]. Statista. [cited 2022 May 12]. Available from: <https://www.statista.com/statistics/263220/public-spending-ratio-in-eu-countries/>
43. Global health expenditure database [Internet]. Who.int. [cited 2022 May 12]. Available from: https://apps.who.int/nha/database/country_profile/Index/en
44. Per capita health expenditure by country 2021 [Internet]. Statista. [cited 2023 May 12]. Available from: <https://www.statista.com/statistics/236541/per-capita-health-expenditure-by-country/>
45. How does health spending in the U.S. compare to other countries? [Internet]. Peterson-KFF Health System Tracker. 2023 [cited 2023 May 12]. Available from: <https://www.healthsystemtracker.org/chart-collection/health-spending-u-s-compare-countries/>
46. Health systems in action: Ukraine [Internet]. Who.int. [cited 2023 May 12]. Available from: <https://eurohealthobservatory.who.int/publications/i/health-systems-in-action-ukraine>
47. Rice T, Rosenau P, Unruh LY, Barnes AJ. United States: Health system review. *Health Syst Transit*. 2020;22(4):1-441.