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QUALIFICATION WORK

on the topic: « **RESEARCH ON VACCINATION ISSUES IN THE EASTERN MEDITERRANEAN REGION** »

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ANNOTATION

The qualification work explores the state of vaccination in the Eastern Mediterranean Region, analyzing coverage rates, trends, and challenges across key vaccine-preventable diseases. The study focuses on evaluating progress towards immunization goals and identifying gaps that require targeted public health interventions.

The qualification work is set out on 42 pages and consists of an introduction, 3 chapters, conclusions and a list of references. The list of references includes 32 items. The work is illustrated with 5 tables and 4 figures.

Key words: immunisation, infectious diseases, vaccines, The Eastern Mediterranean Region.

АНОТАЦІЯ

У кваліфікаційній роботі досліджено стан вакцинації в регіоні Східного Середземномор'я, аналіз показників охоплення, тенденцій та викликів щодо основних керованих вакцинацією інфекцій. У роботі оцінюється прогрес у досягненні цілей імунізації та визначаються прогалини, що потребують цілеспрямованих заходів у сфері громадського здоров'я.

Кваліфікаційна робота викладена на 42 сторінках та складається зі вступу, 3 розділів, висновків та списку використаних джерел літератури. Список використаної літератури налічує 32 позиції. Робота ілюстрована 5 таблицями та 4 рисунками.

Ключові слова: імунізація, інфекційні хвороби, вакцини, регіон Східного Середземномор'я.

CONTENT

ABBREVIATIONS

BCG	–	Tuberculosis vaccine
CRS		Congenital rubella syndrome
DTP	–	Diphtheria, tetanus and pertussis vaccine,
GAVI		Global Alliance for Vaccines and Immunisation
Hib	–	Haemophilus influenzae type b
IPV	–	Inactivated polio vaccine
OPV	–	Oral polio vaccine
SDG	–	The Sustainable Development Goals
TB	–	Tuberculosis
WHO	–	World Health Organization

INTRODUCTION

Relevance of a subject. The study of vaccination in the Eastern Mediterranean region is an important aspect in the context of global health. The region covers countries with different levels of healthcare system development, which creates both opportunities and challenges for the effective implementation of vaccination programmes. In many countries of the region, vaccination issues are becoming particularly relevant in the context of the fight against infectious diseases such as coronavirus, polio, measles, and other dangerous infections.

An important factor affecting the vaccination situation in this region is the political, economic and social conditions, which can have a direct impact on the availability of vaccines and the level of vaccine coverage. In addition, climate change and the movement of refugees, especially due to conflict, can also pose additional challenges to vaccination in certain areas.

This study focuses on analysing the current state of vaccination programmes in the Eastern Mediterranean countries, examining vaccine coverage rates, reasons for refusal to vaccinate, and international initiatives to support and improve the situation.

The purpose and tasks of the research. The aim of the work was to study the current trends in the provision of vaccines to the population. In order to achieve the above goal it is necessary to solve the following tasks:

- To study the theoretical basis of immunisation of the population
- To give a general characteristic of diseases for which mandatory vaccination is carried out according to WHO recommendations
- To study the problems of ‘vaccine hesitancy’ and to analyse the national vaccination calendar in different countries
- To analyse the state of vaccination in the Eastern Mediterranean region

Objects of the study: data of scientific publications, statistical data of WHO

Subject of the study: statistical data on heritage vaccination coverage against the most dangerous infectious diseases.

Methods of researches: system and content analysis (study and review of domestic and foreign publications on the problem of vaccination, processing of statistical data); logical and mathematical analysis; graphical method (visual, schematic representation of research results), as well as methods of abstract and descriptive modelling and generalisation (formulation of conclusions).

Scientific novelty and practical significance of the obtained results lies in the systematisation and generalisation of literary data on the problem of vaccination in the world. The analysed data constitute a theoretical and scientific basis for practical improvement of the system of control and vaccination coverage of the population of the Eastern Mediterranean region.

The results of the study were approved at the XXXI International Scientifical and Practical Conference of Young Scientists and Students «Topical issues of new medicines development», that was held on 23-25 April 2025 in Kharkiv.

Structure and volume. The qualification work is set out on 42 pages and consists of an introduction, 3 chapters, conclusions and a list of references. The list of references includes 32 items. The work is illustrated with 5 tables and 4 figures.

CHAPTER 1. THEORETICAL ASPECTS OF POPULATION IMMUNISATION

Immunisation (as defined by the World Health Organisation) is an activity through which a person becomes immune or immune to an infectious disease. Immunisation is most often carried out by administering a vaccine [17].

By stimulating the body's own immune system, vaccines protect a person from the infection or disease in question, prevent its severe course and the appearance of complications from it. The use of vaccines helps to reduce the possibility of spread of the relevant infections by hundreds of times. To date, there are no alternatives to vaccination for the prevention of the relevant infections [18]. If a child is not vaccinated against certain infections, he or she is at high risk of becoming ill, especially if the number of such children increases every year.

1.1 Study of the theoretical basis of vaccination

The global vaccination efforts carried out in the second half of the 20th century represent one of the significant achievements of mankind. These campaigns have defeated smallpox, nearly defeated polio, and ensured the survival and well-being of many children beyond all previous records.

The year 2024 marks the fiftieth anniversary of the Expanded Programme on Immunisation, an opportunity to recognise the collective efforts to save and protect many lives from vaccine-preventable diseases and to call on countries to increase investment in immunisation programmes to protect future generations [32].

Over the past fifty years, our world has taken a huge step forward: every child, if vaccinated, now has a chance to survive and develop successfully, whereas previously the threat of death in infancy was far from uncommon.

Beginning in 1974 with a focus on protection against six childhood diseases, the Expanded Programme of Immunisation now includes 13 universal vaccines recommended throughout the life course, as well as 17 additional condition-specific vaccines. This programme, translated to life-cycle use, is now known as the Core Immunisation Programme [21].

However, progress on immunisation has slowed in recent years during the pandemic period. Although the number of vaccinated children increased by 4 million in 2022 compared to 2021, 20 million children were left without one or more doses of vaccines. This is due to various factors such as increased conflict, economic recession and increased hesitancy to vaccinate [18]. As a result, the world is experiencing sudden outbreaks of diphtheria and measles, diseases we thought we had virtually defeated.

Although vaccination coverage is quite high globally, with approximately 4 out of 5 children receiving the full course of vaccinations, we still have a lot of work to do. The points out the following possible solutions for increasing vaccine provision: [4]

- vaccination should be a top priority for all governments;
- a broad information campaign on the importance of vaccination should be an integral part of health policy planning and investment at all stages of life;
- it is important to take the necessary steps to ensure that vaccination programmes are fully funded and resourced in all countries;
- ongoing research and innovations that increase access to

Vaccination is the most effective, simple and safe means of protecting against disease before a person becomes infected or comes into contact with pathogens [4]. It activates the body's natural defence mechanisms to build resistance to various infectious diseases and makes the immune system stronger. Vaccines contain only killed or weakened forms of pathogens that do not cause disease or related complications.

Almost everyone can be vaccinated, but there are some exceptions for people with certain diseases or conditions. These may be chronic diseases or courses of treatment that suppress the immune system [12]. Acute and quite life-threatening allergic reactions to vaccines or individual vaccine components are also common, but extremely rare. High fever, possible serious illness at the time of vaccination may also be an exception. Often the need to consider these factors depends on the

type of vaccine. In this case, the doctor can help determine whether vaccination is necessary in a particular case.

Vaccines usually provide lifelong protection, immunity from birth to old age, and it is important to follow recommendations to receive them in time to prevent serious illness [11]. In most countries, a vaccination card is prepared for the patient, in which all data regarding the vaccines given are recorded. Side effects of vaccines are usually mild and temporary; severe or long-term cases are extremely rare and are continuously monitored to ensure safety. At the same time, putting off vaccination indefinitely puts a person at risk of becoming seriously ill. And during the height of an epidemic of a disease, it may be too late to receive the necessary doses of vaccine or the desired effect of vaccination [23]. Therefore, you should not wait until an emergency time to vaccinate

Like some other medicines, vaccines can have side effects. Side effects are most often mild, such as redness at the injection site, mild fever, and pain. Most often these side effects resolve within a few days or a week at most [30].

Very rarely, severe or prolonged side effects of vaccination may occur. Pharmacovigilance is concerned with the ongoing monitoring of vaccine safety, as well as collecting information and tracking rare adverse reactions.

Vaccines train the body's immune system to produce antibodies just as it would when the body is exposed to a disease. Because vaccines predominantly contain weakened or inactivated microorganisms (bacteria, viruses), the person does not develop the disease and there is no risk of complications to the body [17].

Vaccines have been developed to protect against many diseases, including the following:

- hepatitis B
- cervical cancer
- rubella
- pertussis
- measles
- COVID-19
- diphtheria
- rabies
- influenza
- Japanese encephalitis
- malaria
- pneumonia

- meningitis
- mumps (mumps)
- tetanus
- yellow fever
- polio
- typhoid
- rotavirus infection
- cholera

Nevertheless, not all vaccines may be equally necessary in different countries [17]. Some vaccines need to be given only before travelling, especially in at-risk areas or to people whose occupation is associated with the possibility of high risk of infection. Some of the vaccines listed above are required for people travelling, living in high-risk areas, or performing occupations with a risk of infection. You can ask your health care professional for information on which vaccines are needed for each individual patient.

Meanwhile, the OIE report on the draft global vaccine action plan recognises the importance of immunisation as one of the most effective and cost-effective preventive public health interventions [12]. This is considered a key element of the human right to health.

Significant progress has been noted in the development of vaccination programmes in many countries to ensure access to vaccines for all eligible citizens regardless of their place of residence, sex, age, level of physical ability, education, socioeconomic status, ethnicity or occupational setting [13].

The contribution of successful vaccination programmes to global public health goals, including the reduction of child mortality and morbidity, and their potential to reduce morbidity and mortality throughout the life course is highlighted. It is noted that the introduction of new vaccines against serious diseases such as cervical cancer, pneumonia, diarrhoea and in addition to reducing mortality could trigger additional interventions and create synergies between primary health care programmes[16]. These new vaccines can bring economic benefits and prevent morbidity in the first place .

It is worrisome that despite progress, the goals of eradication and elimination of diseases such as polio, measles, rubella, maternal and neonatal tetanus cannot be

achieved without high and equitable vaccination coverage. It is also alarming that low- and middle-income countries may not be able to access new and improved vaccines expected in the near future.

In some countries, there are significant gaps in vaccination coverage, so that despite efforts, unfortunately almost one in five children do not have access to routine immunisation [4].

1.2 General characteristics of diseases against which vaccination is mandatory according to WHO recommendations

The following are dangerous diseases against which vaccination has been introduced in almost all countries of the world:

Hepatitis B

Hepatitis B is a viral infection that affects the liver and can cause both acute and chronic disease. The virus is transmitted through contact with blood or other body fluids of an infected person. Outside the body, the hepatitis B virus can survive for at least 7 days, remaining capable of causing infection in an unvaccinated person. Hepatitis B is a serious global health problem because it can lead to chronic liver disease and an increased risk of death from cirrhosis and liver cancer. According to WHO, about 2 billion people worldwide are infected with the virus, with more than 350 million suffering from the chronic form of the disease. Approximately 780,000 people die from hepatitis B each year, of which 650,000 from cirrhosis and liver cancer due to chronic infection and another 130,000 from acute hepatitis B.

Vaccination effectiveness. As of 2013, 183 countries were vaccinating infants against hepatitis B as part of national immunisation programmes, and 81% of children had received the vaccine. This is significant progress from 1992, when only 31 countries were vaccinating after the World Health Assembly adopted a resolution on global hepatitis B vaccination. By 2013, 93 countries had also introduced hepatitis B vaccination at birth. Since 1982, more than one billion doses of vaccine have been used worldwide. In countries where previously 8 to 15% of children were

chronically infected with hepatitis B, vaccination has helped reduce chronic infection rates among vaccinated children to less than 1% [10].

To complete the vaccination series, the dose given at birth should be followed by two or three additional doses. Two options are usually optimal: A three-dose hepatitis B vaccination schedule where the first dose (monovalent vaccine) is given at birth, the second at one month of age to reduce the risk of infection from infected family members, and the third dose (monovalent or combination vaccine) at six months of age, together with the DPT vaccine to provide long-lasting immunity.

Diphtheria

Diphtheria - a disease of infectious nature caused by the bacterium Corynebacterium diphtheriae was discovered a very long time ago. Mention of diphtheria, then called ‘stabbing loop’ or ‘deadly ulcer of the pharynx’, is found as early as the first century AD. Before the advent of anti-diphtheria antitoxic serum, the lethality from this disease reached 50-60 per cent. With the introduction of serum, the mortality rate began to decline gradually to 20 per cent in adults and 10 per cent in children. After the start of active immunisation, the incidence of diphtheria significantly decreased and the disease ceased to be the main cause of death among children.

Effectiveness of vaccination. Since 1974, WHO has used diphtheria anatoxin in combination with tetanus and acellular pertussis vaccines (DPT) as part of the Expanded Programme on Immunisation. Between 1980 and 2000, the number of reported diphtheria cases decreased by more than 90 per cent. Mass immunisation against diphtheria in 1994 and repeated revaccination of adults in 2003-2004 provided high protection for the population. Modern vaccines are 95% effective and the World Health Organisation recommends vaccination in all countries[22].

Haemophilus influenzae infection

Haemophilus influenzae infection, caused by the bacterium Haemophilus influenzae type b (Hib), can lead to acute infectious diseases such as purulent meningitis, pneumonia, epiglottitis, arthritis and septicaemia. This infection mainly affects the respiratory organs, central nervous system and causes purulent foci in various organs. The H. influenzae bacterium is localised in the nasopharynx and is transmitted by airborne droplets. Most carriers of H. influenzae do not manifest the disease clinically, but they can be a source of spread of the pathogen [9]. In European countries, 26-43 cases of Hib-associated disease per 100,000 children are reported, with a mortality rate of 1-3%, with a high rate of neurological complications.

Before the widespread introduction of the Hib vaccine in resource-limited countries in 2000, the infection caused 8.13 million serious illnesses and 371,000 deaths in children aged 1 to 59 months. By 2008, when 136 nations introduced the vaccine, the number of deaths among children under 60 months of age had dropped to 203,000.

Vaccination is the only means of preventing this infection. WHO recommends vaccination against Hib to all children, with an efficacy rate of 95-100% [15]. Modern vaccines are chemically linked antigens of Hib capsule and tetanus anatoxin, which allows the development of immunity in children up to 18 months of age.

Infectious diseases rank first in the world in terms of prevalence and lethality. Specific immunoprophylaxis, consisting in the creation of artificial immunity, is the primary means of defence against infections. Vaccination is recognised by the world community as the most affordable method of infection control.

Measles

Measles is a highly contagious viral disease with a contagiousness index approaching 100%. Measles is one of the leading causes of death among young children, even though a safe vaccine is available. The virus is transmitted by airborne droplets through coughing, sneezing and close contact, remaining active in the air or

on contaminated surfaces for up to two hours. An infected person can transmit the virus four days before the rash appears and for four days after the rash appears. On the fifth day after the rash, the infected person becomes non-infectious [27].

An estimated 2.6 million measles deaths were reported in 1980 before the spread of vaccination. In 2013, the number of deaths decreased to 145,700 (almost 400 cases per day or 16 cases per hour), and in 2014 to 114,900 (314 cases per day or 13 cases per hour). Among highly malnourished groups and in the absence of adequate health care, up to 10 per cent of measles cases are fatal.

Vaccination effectiveness. WHO estimates that in 1980, before mass measles vaccination, 2.6 million deaths were recorded. In 2014, 85% of all children worldwide received one dose of measles vaccine in the first year of life, up significantly from 73% in 2000. Accelerated immunisation efforts have reduced measles deaths: between 2000 and 2014, vaccination prevented 17.1 million deaths. Global measles mortality decreased by 75%, from 544,200 cases in 2000 to 114,900 cases in 2014, making the measles vaccine one of the most effective public health achievements [26].

The measles vaccine was created in 1966. The measles vaccine is often combined with rubella and mumps vaccines. It is equally effective either as a monovaccine or as a combination preparation [18].

Parotitis

Parotitis, also known as mumps, is an acute infectious viral disease affecting predominantly glandular organs (salivary glands, pancreas, testes and ovaries) and/or the central nervous system. The causative agent of the disease is paramyxovirus. Generally, mumps is a mild childhood disease and is most common in children between the ages of three and fifteen, with boys being about one and a half times more likely to get the disease than girls. Adults under 40 years of age can also get mumps, but the disease is usually more severe in them than in children [11].

Effectiveness of vaccination. Until recently, mumps was widespread, with an average of 0.1% to 1% (up to 6% in some countries) of the population having the

disease. The current epidemiological features of the disease are determined by prophylaxis with live attenuated vaccine. In most countries of the world, the incidence of epidemic mumps ranges from 100 to 1000 per 100,000 population with epidemic outbreaks every 2-5 years. The maximum number of cases occurs in children aged 5-9 years.

Live culture vaccine as well as associated mumps, measles and rubella vaccines are used to prevent mumps [10]. Normal vaccine reactions such as fever, red throat and runny nose rarely occur after vaccination. In rare cases, there may be transient enlargement of the parotid salivary glands.

Rubella

Rubella is a contagious infection that is usually mild. The virus is transmitted by airborne droplets when an infected person sneezes or coughs. The person is the only carrier of the rubella virus. The disease is mild in children, but in pregnant women it can lead to serious consequences, including fetal death or birth defects known as congenital rubella syndrome (CRS). SRC includes damage to the cardiovascular system, eyes and auditory system [18]. Globally, approximately 110,000 children are born with SRC each year.

Rubella most commonly affects children and young adults, but adults can also become ill. If a woman becomes infected with rubella early in pregnancy, there is a 90% chance of transmission to the foetus. Children with SRC can excrete the virus for more than a year after birth. In 15% of cases, rubella in pregnant women results in miscarriage or stillbirth. If rubella is detected in a pregnant woman, artificial termination of pregnancy is often performed.

Effectiveness of vaccination. Rubella is easier to prevent than to treat. Rubella vaccination based on a live attenuated strain has been used for more than 40 years. A single dose of vaccine provides more than 95% long-lasting immunity. In the pre-vaccine period, up to 4 children in 1000 were born with SRC. Thanks to large-scale vaccination, rubella and SRC have been virtually eliminated in many developed and

some developing countries. No endemic cases of rubella have been reported in the WHO Region of the Americas since 2009 [9].

The rubella vaccine is either monovalent or combined (e.g. with measles and mumps vaccine or with measles, mumps and varicella vaccine). Adverse reactions to vaccination are usually mild and include pain and redness at the injection site, mild fever, rash, and muscle aches.

Poliomyelitis

Poliomyelitis is a highly contagious viral infection affecting mainly young children and is caused by one of three serotypes of poliovirus. The virus attacks the nervous system and can cause paralysis in a matter of hours. It is transmitted from person to person mainly by faecal-oral transmission or, less commonly, through contaminated water or food, multiplying in the intestine. Many infected people do not show symptoms but excrete the virus in their faeces, spreading it to others

Poliomyelitis mainly affects children under 5 years of age. According to the WHO, the number of polio cases has fallen by more than 99 per cent since 1988, from 350,000 to 359 cases in 2014 and 73 cases in 2015. In 1988, wild poliovirus was transmitted in over 125 countries, in 2014 in 9 countries, and in 2015 in only 2 countries (Afghanistan and Pakistan). Polio is incurable, it can only be prevented [12].

Effectiveness of vaccination.The Global Polio Eradication Initiative was established in 1988, which significantly reduced the incidence of the disease through the use of polio vaccine. Since 1988, the number of cases has decreased by more than 99 per cent, from 350,000 to 73 cases in 2015. In 2010, 1,349 children became paralysed by polio, a result of global efforts to eradicate the disease.

Two vaccines are used to prevent polio: live oral polio vaccine and inactivated polio vaccine (IPV). OPV provides long-lasting protection with repeated administration [27]. It is safe for pregnant women and HIV-infected persons, but can cause rare serious side effects such as vaccine-associated paralytic poliomyelitis. Giving at least one dose of IPV before OPV can prevent these side effects.

Tetanus

Tetanus is an infectious disease caused by toxic strains of the bacterium Clostridium tetani, often fatal. The disease is a serious public health problem, especially in poor regions of developing countries in the tropics. Clostridium tetani enters the body through wounds or cuts, as well as burns, frostbite and even minor scratches. Deep puncture wounds and inflammatory diseases (gangrene, abscesses, ulcers, bedsores) are particularly dangerous. Newborns can become infected through the umbilical cord. Tens of thousands of newborns die from tetanus each year, mostly in developing countries. 80% of tetanus cases occur in newborns (infection through the umbilical cord) and boys under 15 years of age due to increased trauma [17]. Among adults, 60% of cases occur in the elderly, and the majority of cases and deaths occur in rural areas.

The lethality of tetanus is very high, second only to rabies and the pneumonic form of plague. The high mortality is due to complications such as pneumonia, septicaemia and cardiac paralysis. About 61,000 deaths were recorded in 2010, but including unreported cases, the total loss of life may be 350,000-400,000 annually.

Vaccination effectiveness. The introduction of tetanus vaccination in the US in the 1940s reduced the incidence from 0.4 per 100,000 population in 1947 to 0.02 per 100,000 in the late 1990s. In a double-blind controlled trial in a rural region of Colombia, neonatal tetanus did not occur in children whose mothers received two or three doses of the vaccine, compared with 78 neonatal deaths in the unvaccinated control group. Similar significant reductions in neonatal tetanus mortality have been reported in other countries following large-scale vaccination [15].

Vaccination is the only means of tetanus prophylaxis, with an efficacy rate of 95-100%.

Tuberculosis

Tuberculosis (TB), known since antiquity, is caused by the bacterium Mycobacterium tuberculosis, most commonly affecting the lungs. It is the second leading cause of death from a single infectious agent after HIV/AIDS and is airborne.

When people with pulmonary TB cough, sneeze or expectorate, they release the bacteria into the air. Inhaling a small amount of these bacteria is enough to cause infection. Without proper treatment, up to two-thirds of patients die. In 2013, 9 million people contracted TB and 1.5 million died from it [4].

Effectiveness of vaccination. The number of annual TB cases is slowly declining. From 1990 to 2013, TB deaths decreased by 45%. WHO estimates that diagnosis and treatment saved 37 million lives from 2000 to 2013. BCG vaccination is mandatory in 64 countries and recommended in 118 of the world's 270 countries and territories. Hundreds of millions of people have been immunised over the past 70 years. In developed countries with low incidence, only at-risk groups such as immigrants from high incidence countries and persons in contact with patients are vaccinated [10].

BCG vaccine, the only vaccine against tuberculosis, protects against tuberculous meningitis and disseminated tuberculosis in infants and young children, but does not prevent primary infection or reactivation of latent tuberculosis, which is the main source of mycobacterial spread. In the absence of treatment, both conditions usually result in death.

Whooping Cough

Whooping cough is one of the most common childhood infections caused by the bacterium Bordetella pertussis. It is airborne and causes a severe whooping cough. There is no innate immunity to pertussis, so even newborns can get sick. The incidence after contact with a sick person reaches 100%. The infection is especially dangerous for children under 2 years of age [17] .

According to WHO estimates, 16 million cases of pertussis were reported in 2008 and 195,000 children died from the disease. In 2013, pertussis caused 63,000 deaths in children under 5 years of age. Epidemic cycles of pertussis occur every 2-5 years, even with effective immunisation programmes, so pertussis vaccination remains a priority .

Effectiveness of vaccination. The highest incidence of pertussis is between 1 and 5 years of age. In the past, the incidence was almost universal, second only to measles. As a result of widespread vaccination between 1950 and 1960, pertussis morbidity and mortality decreased significantly (by more than 90%) [12].

In 2008, 82% of all infants were vaccinated with three doses of pertussis vaccine, preventing about 687,000 deaths. In countries where vaccination coverage drops to 30% or lower, the incidence of the disease returns to pre-vaccine levels.

A reliable means of preventing pertussis is the vaccine, usually given in combination with diphtheria and tetanus anatoxins (DPT for primary vaccination or AaDPT for revaccination).

Conclusion to chapter I

Immunization is one of the most effective, cost-effective and safe methods of preventing infectious diseases, which protects both individuals and the entire population. Vaccination activates the human immune system, forming a specific defense against specific pathogens. An important achievement of global vaccination programs is the reduction of morbidity, mortality and complications associated with vaccine-preventable infections.

A review of the history of immunization programs, including the Expanded Programme on Immunization, shows the significant progress made over the past 50 years. The increase in the number of recommended vaccines, their integration across the lifespan, and the emphasis on reaching the most vulnerable populations demonstrate the breadth and depth of modern vaccine prevention. At the same time, the challenges of the COVID-19 pandemic, growing doubts about vaccination, and inequalities in access to immunization have slowed progress, requiring increased communication and financial measures by governments

This chapter describes the diseases against which vaccination is mandatory according to WHO recommendations. These are infections with a high level of contagion, complex complications, and significant mortality: measles, polio, tetanus, tuberculosis, pertussis, hepatitis B, diphtheria, rubella, mumps, and others. Their common feature is the possibility of effective control through vaccination, which makes vaccination the basis of preventive medicine.

Despite the successes, there are barriers to full vaccination coverage, particularly in low- and middle-income countries. This poses a risk to global health through outbreaks of infections that should have been eradicated by now. Therefore, enhanced international cooperation, long-term funding, information support, and equal access to vaccines for all social groups are needed.

CHAPTER 2. ANALYSIS OF CURRENT TRENDS IN THE PROVISION OF VACCINES TO THE POPULATION

Immunization is a proven public health intervention that effectively and economically saves the lives of millions of children and protects them from disease and disability. It not only increases life expectancy, but also contributes to economic development: every dollar invested in immunization yields about sixteen dollars in health care savings and increased economic productivity [1].

In most countries in Europe and Central Asia, more than 95% of the population receives three doses of diphtheria, tetanus and pertussis (DPT) vaccine, which is an indicator of successful immunization. However, although average vaccination rates against these diseases in a country are high, the average vaccination rate is about 92%, which is insufficient to fully protect the population from the diseases [14].

Some countries need additional funding for immunization, but donor support is dwindling. Other countries face challenges to sustainable financial development of immunization programmes after the withdrawal of support from the Global Alliance for Vaccines and Immunization [6].

Reforms in some countries are affecting the structure and financing of immunization programmes. Due to multiple priorities and high vaccine prices on the global market, some countries faced vaccine shortages in 2015-2016, causing major disruptions in health services. This particularly affected middle-income countries, which purchase vaccines on their own and continue to face challenges to the financial sustainability of their immunization programs [16].

Some countries lack adequate mechanisms to monitor vaccination coverage, which is necessary to identify and address deficiencies. More than 70% of unvaccinated infants in the European Region live in middle-income families, and the lowest immunization coverage and greatest challenges are found in Ukraine . In Ukraine, immunization rates conceal lower coverage among Roma children as well

as children from other ethnic and vulnerable groups, including refugees and migrants [26].

2.1 Exploring the problem of “vaccine hesitancy”

There is a problem of so-called 'vaccine hesitancy' - a growing mistrust of immunization among some parents, fueled by myths and misinformation [21]. This hesitancy can arise from negative stories in the media that link a child's death to vaccination without providing the full facts. Indecision is also influenced by regional anti-vaccination movements that spread anti-vaccination messages [30]. Combating this hesitancy and building parental trust is complicated by the lack of dialogue about the importance of immunization and minimal risk (Table2.1)

Despite the existence of “vaccine hesitancy,” myths, and misinformation, the publication of negative stories in the media often does not provide complete facts, and myths are not scientifically substantiated [25]. From a scientific point of view, vaccination is an effective method of disease prevention. Vaccines help prevent infectious diseases and save lives, as many dangerous diseases can be avoided thanks to timely vaccinations.

Table 2.1

The most common myths about vaccination

Myth	Fact
1	**2**
Vaccines contain substances dangerous to a child's health, such as mercury, which can cause irreversible effects, up to and including autism.	Misunderstanding the issue leads to false conclusions and unfounded fears. Some adult vaccines contain an organic mercury compound as a preservative that is safe in small amounts. Its volume in a single dose of vaccine is less than what we consume with food or inhale with air. Numerous studies confirm that there is no link between vaccinations and developmental disorders, including autism. Rumors of a link between vaccines and autism began with the work of England's Dr. Andrew Wakefield, whose findings were refuted by the WHO and the Ministry of Health due to gross irregularities in research methodology. Experts confirm that autism is hereditary in nature.
Vaccinations cause body reactions similar to the symptoms of the disease itself or its complications.	Unlike natural infection, which attacks the body with live pathogens, vaccines contain weakened or killed strains of viruses that cannot cause disease. Natural infection often leads to complications, which is not the case with vaccinations.

Contin. of the table. 2.1

1	2
Children have natural immunity that can be compromised by multiple immunizations.	The immune system cannot be overwhelmed by vaccines, and not getting vaccines can seriously harm health because a child has no innate immunity to dangerous infections. Vaccination helps develop defense mechanisms safely and in a controlled manner from the first days of life. Modern vaccines contain a minimal amount of antigens, enough to produce memory cells that will help the body respond effectively to a real infection. The immune system works constantly to protect against many infections, and vaccinations do not overload it, but help it fight specific diseases.
It is easier for the body to cope with a viral load if vaccines are administered one at a time rather than at the same time.	*Fact:* The immune system does not have a load limit after which the defense wanes. It is constantly fighting multiple bacteria from the environment. Studies have shown that multi-component vaccines are taken up by the body in the same way as single-component vaccines, with no cumulative effect. Administering vaccines at the same time reduces stress for children and parents, reducing the number of visits to the clinic.
Many people do not vaccinate their children and do not get sick.	Statistics show that vaccinated people have significantly fewer cases of illness than unvaccinated people. To understand the benefits of vaccination, you need to consider gender, age, and social conditions that affect health. It is also important to remember collective immunity: when vaccination rates are high in a community, diseases spread more slowly, protecting both vaccinated and unvaccinated people.

Contin. of the table. 2.1

1	2
A post-vaccine reaction to DPT is more dangerous than the diseases it protects against.	More than 70% of postvaccine reactions involve a pertussis component, which is a concern for parents. Reactions are usually limited to fever, restlessness, drowsiness or allergies and resolve within 24 hours. Compare this to complications from whooping cough: one in ten cases is pneumonia, twenty in a thousand are seizures, and four in a thousand are brain damage. The risks of disease far exceed post-vaccine reactions.
People with allergies and chronic diseases should not be immunized because they are immunocompromised.	People with weakened immune systems have a hard time with infections, so vaccination is especially important for them. Vaccines help the body build the immune memory needed to defend against a real infection. Under a doctor's supervision, vaccinations are safe and can prevent serious complications, such as death from whooping cough or chickenpox.
There's no point in getting vaccinated against the flu because you'll get sick anyway.	Influenza is a serious illness that claims hundreds of thousands of lives each year. The vaccine protects against the three most common strains, reducing the chances of getting sick. Even if a vaccinated person gets sick, he or she is protected from serious complications such as otitis media, asthma, and pneumonia. Vaccination reduces hospitalizations and deaths, and reduces the number of sick days for working parents.
Vaccinations are much more dangerous than official medicine admits, and the number of complications is underreported	All cases of serious complications are thoroughly investigated and recorded by Pharmacovigilance. Each report is taken into account and, if necessary, the vaccine batch is withdrawn. Virtually all reactions to vaccines are known to the medical profession, and doctors are ready to provide the necessary care in case of post-vaccine reactions.

2.2 Analysis of the national vaccination calendar in different countries

Today, vaccines are successfully used worldwide to prevent more than 30 diseases, and a significant number of new vaccines are being developed. Each country has an immunization calendar, a regulatory act of health authorities that establishes a list of mandatory preventive vaccines and optimal timing of their introduction [20]. Compulsory vaccinations are also carried out for certain categories of workers depending on their professional activity. In the event of a threat of a particularly dangerous infectious disease or its mass spread, mandatory preventive vaccinations may be introduced in the relevant territories and facilities [2].

WHO member countries have their own vaccination calendar [5]. A comparative analysis showed that polio vaccination is mandatory in all countries of the world. In 194 countries (98.5% of all countries) vaccination against diphtheria, pertussis and tetanus is mandatory. Vaccination coverage for Haemophilus influenzae and hepatitis B has increased, with vaccination mandatory in 193 and 190 countries, respectively [3]. Rubella vaccination is mandatory in 137 countries and measles vaccination is already mandatory in 188 countries, whereas in 2020. Was mandatory in 111 countries. Vaccination against pneumococcal infection is included in the National Vaccination Calendar in 153 countries, although it is not mandatory in Ukraine [29]. Vaccination coverage against papillomavirus and rotavirus infections is increasing, HPV is mandatory in 130 countries against 62 in 2020 [9].

The next step was to survey the national vaccination calendars in some countries, including Morocco (Table 2.2).

Table 2.2

Results of comparative analyses of the inclusion of vaccinations against infectious diseases in the National Vaccination Calendar in different countries

Infection	Morocco	Ukraine	United States	United Kingdom	Germany	Number of countries where the vaccine is mandatory
Chickenpox	-	-	+	-	+	*
Haemophilus influenzae	+	+	+	+	+	193
Hepatitis A	-	-	+	-	-	*
Hepatitis B	+	+	+	-	+	190
Influenza			+	+	+	*
Diphtheria	+	+	+	+	+	194
Whooping cough	-	+	+	+	+	194
Measles	+	+	+	+	+	188
Rubella	+	+	+	+	+	137
Meningococcal infection	-	-	+	+	+	*
Papillomavirus	-	-	+	+	+	62/130
Parotitis	-	+	+	+	+	120
Pneumococcal infection	+	-	+	+	+	153
Polio	+	+	+	+	+	All countries
Rotavirus	+		+			75
Tetanus	+	+	+	+	+	194
Tuberculosis	+	+	-	-	-	more than 100

*- data on the number of countries are not available.

Thus, a comparative analysis of the inclusion of vaccinations against infectious diseases in the National Vaccination Calendar in different countries has shown that absolutely all WHO member countries (which is 98.5% of the world's countries) have mandatory vaccination against poliomyelitis, diphtheria, whooping cough, tetanus. 99.5 and 97.9% of countries respectively are vaccinated against Haemophilus influenzae and hepatitis B. At the same time, measles vaccination is mandatory in 96.9% of countries and rubella vaccination only in 70.6% [8]. At the same time, measles vaccination is mandatory in 96.9% of countries, and rubella vaccination is mandatory only in 70.6% [8]. It should be noted that vaccination against pneumococcal infection is included in the National Vaccination Calendar in 78.9% of countries. For papillomavirus infection and mumps vaccination is mandatory in 67 and 62% of countries, respectively. Rotavirus infection is vaccinated in less than 40% of countries (Fig. 2.1)

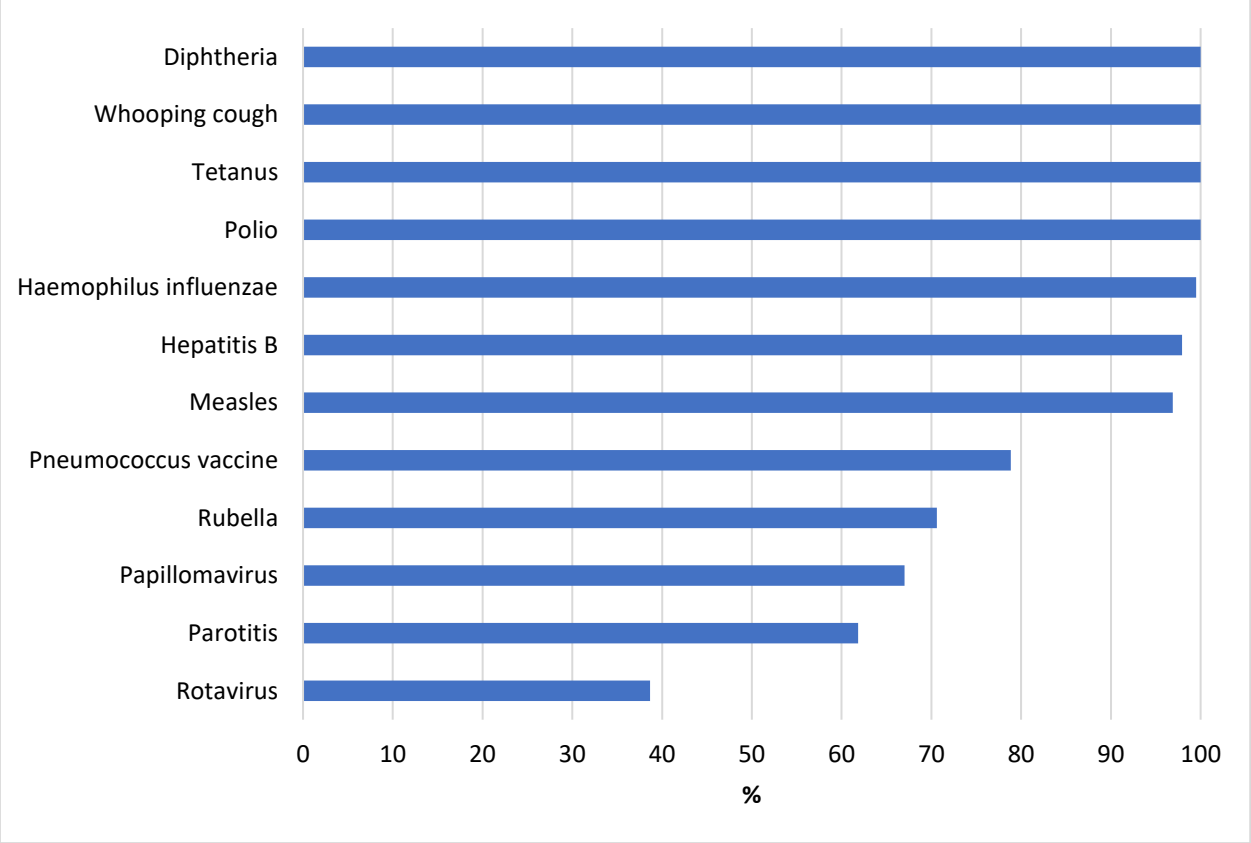

Fig. 2.1. Proportion of countries where vaccination against these infections is included in the national vaccination calendar

Conclusions to chapter 2

In all countries participating in WHO, the vaccination calendar is a legal act of the health authorities that establishes a list of mandatory preventive vaccines and the optimal time for their administration to humans.

Today, vaccines are successfully used worldwide to prevent more than 30 diseases, and a significant number of new vaccines are being developed. in all countries of the world, a doctor's examination is mandatory before vaccination and the consent of the patient or his/her representative is required. The patient or his/her legal representative has the right to refuse vaccination, and all information about vaccination is recorded in the patient's medical records.

A comparative analysis of the inclusion of vaccinations against infectious diseases in the National Vaccination Calendar in different countries has shown that in 98.5% of the countries of the world, which are WHO member states, there is mandatory vaccination against poliomyelitis, diphtheria, pertussis, tetanus. 99.5 and 97.9% of countries respectively are vaccinated against Haemophilus influenzae and hepatitis B, 96.9% of countries have mandatory vaccination against measles, and only 70.6% of countries have mandatory vaccination against rubella.

Vaccination against pneumococcal infection is included in the National Vaccination Calendar in 78.9% of countries, and papillomavirus and mumps vaccination is mandatory in 67 and 62% of countries, respectively.

CHAPTER 3. ANALYSIS OF THE STATUS OF VACCINATION IN THE EASTERN MEDITERRANEAN REGION

3.1 The role of immunisation in achieving the Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs), also known as the Global Goals, are a universal call to action to eradicate poverty, protect the planet, and ensure peace and prosperity for all people. Goal #3 aims to achieve and sustain “Good Health”. Immunization plays a key role in achieving this goal, reaching more people than any other health or social service. It is the backbone of primary health care and an important factor in achieving universal access to health services, making it critical to realizing SDG 3 - ensuring health and well-being for all at all ages [28]. Health is the foundation of development, so improving it will contribute to the realization of the other SDGs as well.

The SDGs came into force in January 2016 and will guide UNDP policy and funding for the next 15 years. As the main UN development agency, operating in nearly 170 countries and territories, UNDP is uniquely positioned to achieve these goals.

The Sustainable Development Goals (SDGs) are a global initiative established by the UN to improve people's lives and protect the planet, covering a wide range of issues such as fighting poverty, promoting equality and improving health. One of the most important goals in the initiative is SDG 3, which aims to ensure ‘health and well-being for all and at all ages’. In this context, immunisation plays a key role in achieving sustainable health for the world's population.

Immunisation is an effective and cost-effective way to prevent infectious diseases. It saves millions of lives every year and prevents diseases that can significantly reduce quality of life or even be fatal. Thanks to vaccination, diseases such as polio, diphtheria, measles and rubella have been virtually eliminated or greatly reduced in most countries.

1. Eradicate Poverty and Achieve Equality

Sustainable Development Goal #1 is to eradicate world poverty, and immunisation plays an important role in this process. It helps prevent diseases that can be financially devastating to individuals and families, especially in low- and middle-income countries. Vaccination reduces treatment costs and increases people's productivity, improving their quality of life and enabling them to work and learn, which in turn contributes to economic growth.

2. Improving the quality of health care

Sustainable Development Goal #3 focuses on improving the quality of health care and ensuring universal access to health care. Vaccination is the backbone of primary health care because it is affordable, safe and effective. Vaccination helps manage epidemics and reduces the burden on health systems, allowing them to focus on other, more complex diseases. The higher the vaccination coverage, the less likely infectious diseases are to spread, making the health system more resilient.

3. Progress in health and well-being

In addition, immunisation contributes to other SDG goals such as improved education (SDG 4), reduced inequalities (SDG 10) and sustained economic growth (SDG 8). Healthy children are more likely to have successful education and careers, and healthy individuals are more likely to be active contributors to society. In addition, vaccinated people are not only protected from disease but are also vector-free, promoting a healthy and safe environment for the entire community.

4. Reducing inequalities in access to health services

Health inequalities are another important issue that immunisation addresses. In countries with highly developed health systems, populations have high vaccination rates, which contributes to low rates of disease. However, in developing countries, access to vaccines may be limited due to various factors, including financial constraints, political instability, or the distance of the population from health facilities. Addressing this problem and making vaccines more accessible to all segments of the population helps to reduce health inequities and improve the health of the entire population.

5. Partnerships and global co-operation

Achieving the SDGs cannot be achieved without international co-operation and co-ordination of efforts. Vaccination is an example of how global co-operation can lead to significant health progress. The World Health Organization (WHO), UNICEF and other international organisations actively work with national governments to ensure access to vaccines through global programmes such as the Global Alliance for Vaccines and Immunisation (GAVI). These programmes not only help procure vaccines, but also improve logistics, training of health workers and public awareness of the importance of vaccination.

Immunisation is thus of great importance in the context of the Sustainable Development Goals. It not only protects human health, but also contributes to many other important goals, such as improving quality of life, fighting poverty, reducing inequalities and strengthening global health systems

In 2020, WHO and UNICEF reported an alarming downward trend in the number of children receiving life-saving vaccines worldwide. This decline is due to disruptions in the provision and uptake of immunization services caused by the COVID-19 pandemic. According to new data from WHO and UNICEF, there is a risk that these disruptions will reverse the hard-won progress in expanding vaccination coverage that preceded a decade of stagnation [26].

Each country has its own immunization calendar. The national vaccination calendars of developed countries include vaccinations against hepatitis A, meningococcal disease, human papillomavirus, and rotavirus (e.g., in the United States), so, for example, the U.S. national vaccination calendar is more comprehensive than that of Ukraine or other countries

3.2 Analysis of current vaccination coverage rates in the Eastern Mediterranean Region

As of 2023, the Eastern Mediterranean region, which includes Morocco [3, 7], has the highest vaccination coverage rates for DTP, first dose (85%) and BCG (84%). Coverage rates were also high (79-80%) for DTP, third dose (79%), hepatitis B, third dose (79%), measles, first dose (79%) and polio, third dose (80%). Coverage

rates are lowest for the first dose of hepatitis B vaccine administered in the first 24 h after birth (46 per cent), although coverage has increased by 15 per cent since 2022 (Figure 3.1).

When comparing the vaccination coverage rates for 2013 and 2023, the following was observed: (Fig. 3.1) The maximum increase was recorded for rotavirus vaccine (by 36% to 54%), and there was also a significant increase in coverage for rubella vaccine (by 34% to 69%) and hepatitis B, 1 dose for newborns (by 29% to 46%). However, it should be emphasised that, in general, vaccination coverage against these three diseases does not even reach 70%.

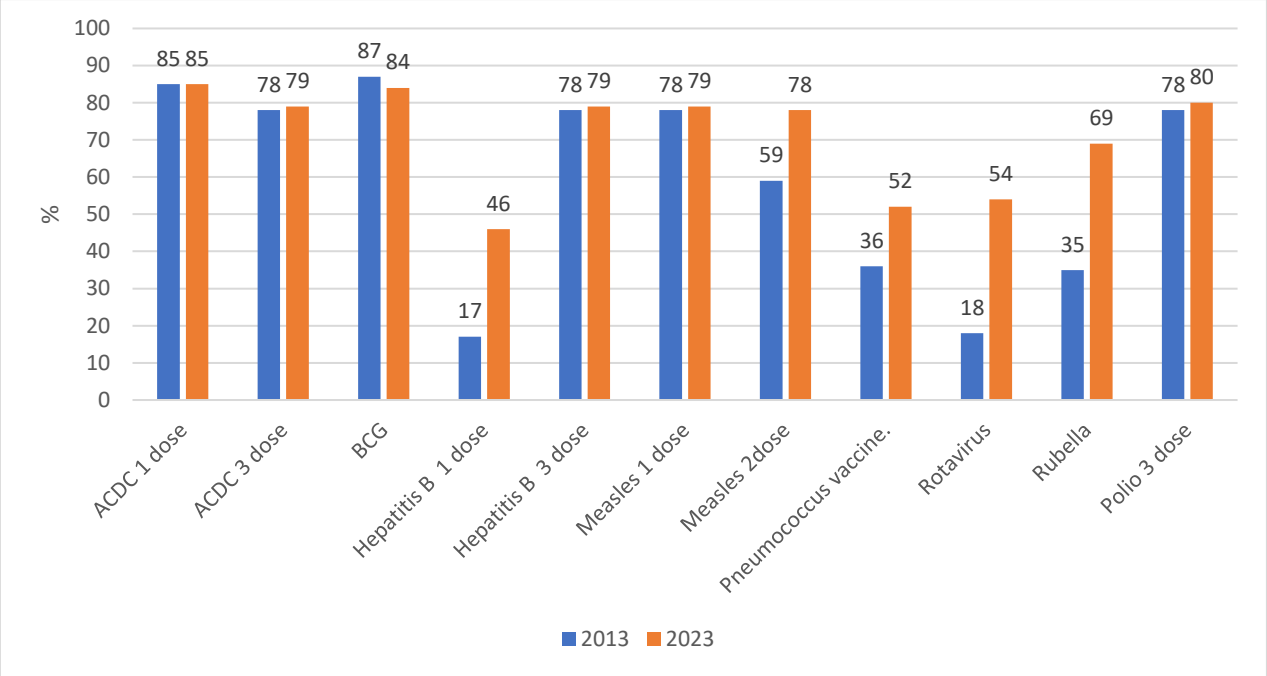

Fig 3.1 . Vaccination coverage in the Eastern Mediterranean Region in 2013 and 2023

We have analysed the vaccination coverage in the Eastern Mediterranean Region, for the period 2010-2023. The results of the calculated the growth coefficient (GC), growth rate (GR), increase rate (IR) of vaccination coverage in the Eastern Mediterranean Region are presented in Tables 3.1-3.3. The calculations were carried out according to the formula:

GC = current year indicator : previous year indicator

GR. = current year indicator : previous year indicator*100

IR. =GR. - 100%,

Table 3.1

Results of the calculation of the growth coefficient of vaccination coverage in the Eastern Mediterranean Region

	2011/ 2010	2012/ 2011	2013/ 2012	2014/ 2013	2015/ 2014	2016/ 2015	2017/ 2016	2018/ 2017	2019/ 2018	2020/ 2019	2021/ 2020	2022/ 2021	2023/ 2022
DTP 1 dose	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
DTP 3 dose	1,1	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
BCG	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Hepatitis B 1 dose	1,0	1,1	1,1	1,1	1,0	1,1	1,6	1,0	1,0	1,0	1,0	1,0	1,5
Hepatitis B 3 dose	1,1	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Measles 1 dose	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Measles 2dose	1,1	1,0	1,1	1,1	1,1	1,1	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Pneumococcus vaccine	1,8	1,6	3,3	1,3	1,1	1,0	1,1	1,0	1,0	1,0	1,0	1,0	1,0
Rotavirus	—	—	1,5	1,0	1,1	1,1	1,3	1,7	1,2	1,0	1,0	1,0	1,0
Rubella	1,0	1,0	1,0	1,1	1,1	1,0	1,0	1,0	1,0	1,0	1,0	1,7	1,0
Polio 3 dose	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0

Table 3.2

Results of the calculation growth rate in vaccination coverage in the Eastern Mediterranean Region

	2011/ 2010	2012/ 2011	2013/ 2012	2014/ 2013	2015/ 2014	2016/ 2015	2017/ 2016	2018/ 2017	2019/ 2018	2020/ 2019	2021/ 2020	2022/ 2021	2023/ 2022
DTP 1 dose	103,6	98,8	100,0	101,2	100,0	98,8	101,2	102,3	100,0	97,7	101,2	100,0	97,7
DTP 3 dose	105,4	98,7	101,3	101,3	100,0	102,5	100,0	101,2	102,4	95,2	100,0	101,3	97,5
BCG	103,6	101,2	100,0	100,0	97,7	102,4	98,9	101,2	100,0	100,0	98,9	100,0	97,7
Hepatitis B 1 dose	100,0	106,7	106,3	105,9	100,0	105,6	163,2	100,0	100,0	100,0	100,0	100,0	148,4
Hepatitis B 3 dose	105,6	98,7	104,0	101,3	100,0	102,5	100,0	101,2	102,4	95,2	100,0	101,3	97,5
Measles 1 dose	100,0	100,0	102,6	101,3	101,3	101,3	100,0	101,2	100,0	100,0	97,6	100,0	98,8
Measles 2dose	105,9	101,9	107,3	108,5	106,3	107,4	101,4	100,0	102,7	101,3	100,0	101,3	100,0
Pneumococcus vaccine	175,0	157,1	327,3	127,8	110,9	98,0	110,0	100,0	101,8	96,4	98,1	100,0	98,1
Rotavirus	—	—	150,0	100,0	111,1	110,0	127,3	167,9	117,0	101,8	101,8	98,2	96,4
Rubella	102,9	100,0	100,0	111,4	110,3	102,3	97,7	97,7	97,6	97,6	97,5	174,4	101,5
Polio 3 dose	104,0	98,7	101,3	101,3	101,3	102,5	100,0	98,8	103,7	97,6	98,8	101,2	97,6

Table 3.3

Results of the calculated rate of increase in vaccination coverage in the Eastern Mediterranean Region

	2011/ 2010	2012/ 2011	2013/ 2012	2014/ 2013	2015/ 2014	2016/ 2015	2017/ 2016	2018/ 2017	2019/ 2018	2020/ 2019	2021/ 2020	2022/ 2021	2023/ 2022
DTP 1 dose	3,6	-1,2	0,0	1,2	0,0	-1,2	1,2	2,3	0,0	-2,3	1,2	0,0	-2,3
DTP 3 dose	5,4	-1,3	1,3	1,3	0,0	2,5	0,0	1,2	2,4	-4,8	0,0	1,3	-2,5
BCG	3,6	1,2	0,0	0,0	-2,3	2,4	-1,1	1,2	0,0	0,0	-1,1	0,0	-2,3
Hepatitis B 1 dose	0,0	6,7	6,3	5,9	0,0	5,6	63,2	0,0	0,0	0,0	0,0	0,0	48,4
Hepatitis B 3 dose	5,6	-1,3	4,0	1,3	0,0	2,5	0,0	1,2	2,4	-4,8	0,0	1,3	-2,5
Measles 1 dose	0,0	0,0	2,6	1,3	1,3	1,3	0,0	1,2	0,0	0,0	-2,4	0,0	-1,3
Measles 2dose	5,9	1,9	7,3	8,5	6,3	7,4	1,4	0,0	2,7	1,3	0,0	1,3	0,0
Pneumococcus vaccine	75,0	57,1	227,3	27,8	10,9	-2,0	10,0	0,0	1,8	-3,6	-1,9	0,0	-1,9
Rotavirus	—	—	50,0	0,0	11,1	10,0	27,3	67,9	17,0	1,8	1,8	-1,8	-3,6
Rubella	2,9	0,0	0,0	11,4	10,3	2,3	-2,3	-2,3	-2,4	-2,4	-2,5	74,4	1,5
Polio 3 dose	4,0	-1,3	1,3	1,3	1,3	2,5	0,0	-1,2	3,7	-2,4	-1,2	1,2	-2,4

When examining the rate of increase in vaccination coverage in the Eastern Mediterranean Region with the combined diphtheria- tetanus-pertussis vaccine, the highest increase in coverage was found in the period 2010/2011 (+5.4%, which may indicate the effectiveness of the vaccination expansion programmes adopted in that period. At the same time, a maximum decline in DTP vaccination rates for both the first and third doses was observed in 2020, probably due to the COVID-19 pandemic and associated disruptions in health systems. [14]. It should be noted that the coverage rate for the said vaccine, both first dose and full course, has not fallen below 74% for third dose DTP (minimum 74% in 2010, maximum 84% in 2019) . For DTP with the first dose, the minimum value was recorded in 2010 - 83%, the maximum in 2019 - 88% (Fig. 3.2)

Thus, it can be concluded that DTP vaccination in the region remains a priority and demonstrates sustainable coverage, but episodic declines, as in 2020, underline the need to create flexible mechanisms for adapting immunisation programmes in emergency situations.

Fig 3.2. Rates of increase in Diphtheria, Pertussis, Tetanus vaccination between 2010 and 2023

Calculations of the rate of increase in measles vaccination coverage showed a relatively stable situation for the first dose of measles vaccine (coverage ranges from 78 to 82%), with a slight decrease of 2.4% in 2021, while the second dose of measles vaccine showed an increase during 2013-2016, after which vaccination coverage relatively stabilised at 76-78%. (Fig. 3.3)

For rubella vaccine, there was a significant increase of 11.4 and 10.3 per cent between 2014 and 2016. In the Period 2015-2022, rubella vaccine coverage was 43-41%, remained relatively stable, with a significant increase in 2022 (up to 68%).
For polio vaccine, the third dose, the maximum increase in coverage was recorded in 2019 at 3.7%. The maximum decrease was recorded in 2020 and in 2023 and was -2.4 per cent.

Analysis of measles, rubella and polio vaccination coverage demonstrates both positive trends and challenges in maintaining a stable level of immunisation of the population:

Measles vaccination: first dose coverage remains relatively stable (78-82%), indicating a well-established primary immunisation system. The slight decrease in 2021 may be due to the effects of the pandemic or logistical difficulties. The second dose has also stabilised, indicating that more efforts are needed to improve vaccination completion.

Rubella vaccination: there was a significant increase between 2014 and 2016, which may be related to campaigns to increase coverage. However, rates have remained low in subsequent years (up to 43%) despite a surge to 68% in 2022 - this requires further monitoring and confirmation of the sustainability of success.

Polio vaccination (3rd dose): trends are less stable and point to the vulnerability of coverage to external factors and the need to strengthen vaccination systems in times of crisis.

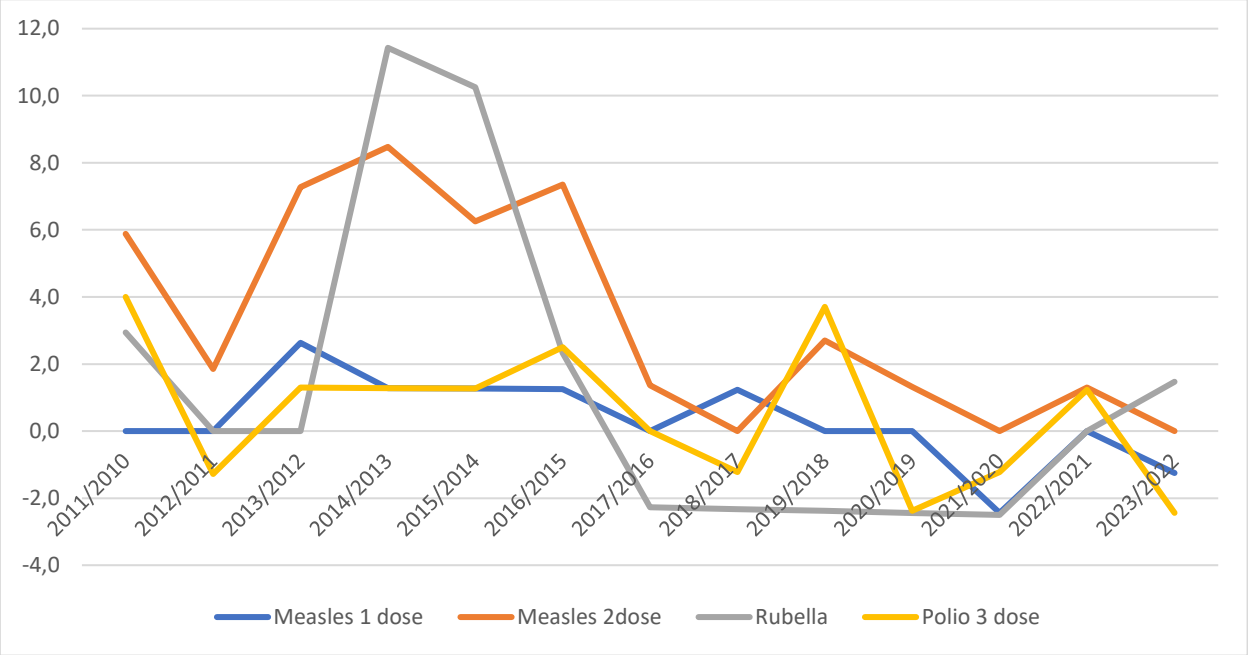

Fig.3.3 Rates of increase in vaccination of measles, rubella, polio in the period 2010-2023

Coverage of vaccination of newborns against hepatitis B vaccine up to 2017 was up to 19%, in the period 2016-2017 there was a significant rate of increase, which amounted to 63%, the next significant increase of 48.4% is noted in 2023. The coverage rate of hepatitis vaccine, 1st dose in 2023 was 46%. In turn, the coverage rate for the third dose is much higher at 79% in 2023, up from 15% and 72% respectively in 2010, indicating significant progress in hepatitis B vaccination coverage of newborns in the Eastern Mediterranean region. Particularly significant increases in first-dose coverage have been observed since 2016, indicating increased efforts to introduce the vaccine in maternity hospitals and improved access to primary health care. Although first-dose coverage in 2023 (46%) is still below the desired level, the stable and high coverage rates for the third dose (79%) indicate high parental commitment to completing the full course of vaccination.

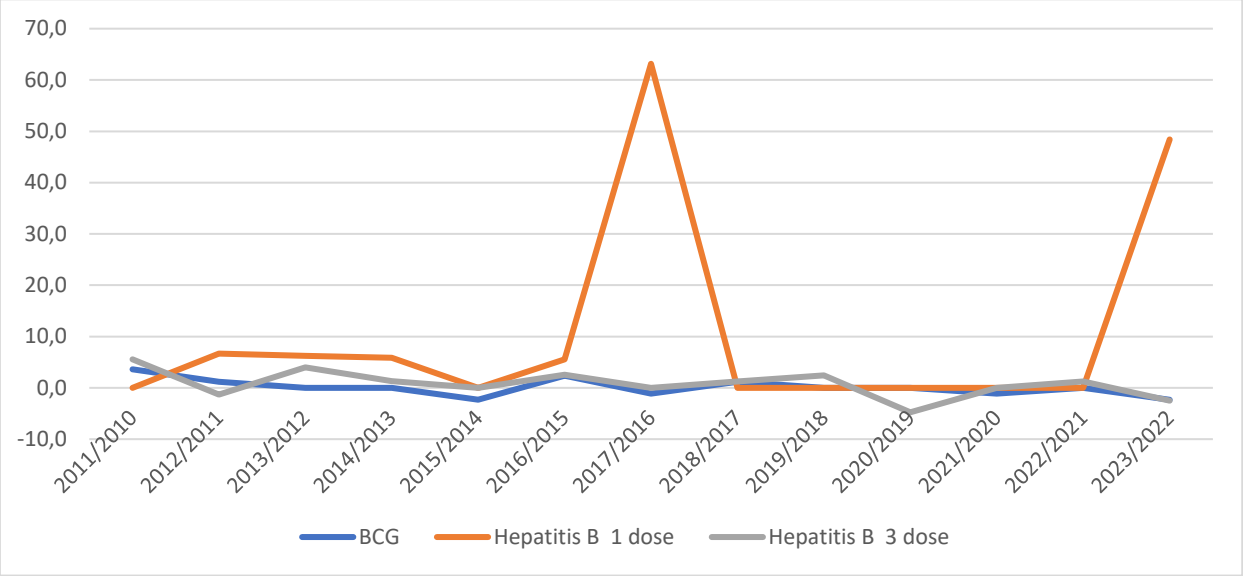

Fig. 3.4 Rates of increase BCG, hepatitis in the period 2010-2023

As of 2010, the vaccination coverage against such infectious disease as tuberculosis was 83%, which was the minimum for the period 2010-2023. for 2023, the vaccination coverage was 84%, with maximum values of 87% for the period 2012-2014, 2016, 2018-2020. (Fig. 3.4)

The analysis of vaccination coverage in the Eastern Mediterranean region for 2010-2023 shows stable coverage of basic vaccinations, especially DPT, measles, polio, hepatitis B and BCG. The highest increase in DPT coverage (first dose +5.4%) was observed in 2010/2011, indicating the effectiveness of immunisation scale-up programmes. The maximum decline in coverage was recorded in 2020 due to the impact of the COVID-19 pandemic, which highlights the vulnerability of immunisation systems to global crises.

Conclusions to chapter 3

Analyses of vaccination coverage in the Eastern Mediterranean region as of 2023 showed relatively Sustained high coverage with basic vaccines. Thus, DPT (first and third dose), BCG, polio/(3rd dose) and hepatitis B (3rd dose) show coverage rates of 79-85%, indicating a mature vaccination infrastructure and high levels of public confidence in these immunisations.DPT vaccination remains a priority, with sustained coverage rates even in crises.

The first dose of hepatitis B vaccine, administered within the first 24 hours after birth, has low coverage (46%), although it has shown a significant increase (+29%) since 2013. Similarly, despite significant increases in rubella (+34%) and rotavirus (+36%) vaccine coverage, their overall levels are still below 70% in 2023, requiring continued active programmes and increased access in maternity facilities.

During the COVID-19 pandemic in 2020, almost all key vaccines (DPT, polio, etc.) showed declining coverage, indicating the vulnerability of immunisation systems to external challenges. However, the subsequent recovery in coverage indicates the flexibility and adaptability of national vaccination programmes.

Measles vaccination coverage (1st dose) remains consistently high (78-82%), but there is a risk of under-vaccination with the 2nd dose, which is important for building collective immunity. Rubella vaccination shows a sharp increase in 2022 (up to 68%), but has fluctuated between 41-43% in previous years, which requires sustained consolidation of success

CONCLUSIONS

Immunisation is one of the most effective measures to prevent infectious diseases, helping to prevent severe disease and reduce the spread of diseases by hundreds of times. Today, there are no alternatives to vaccination as a means of mass protection.

The national vaccination schedules adopted in most WHO member states include mandatory vaccination against polio, diphtheria, pertussis, tetanus (in 98.5% of countries), hepatitis B (in 97.9%), haemophilus influenzae (in 99.5%) and measles (in 96.9%). However, vaccination against rubella, rotavirus, papillomavirus and pneumococcus still covers a smaller proportion of countries, indicating that there are global differences in approaches to immunoprophylaxis.

In the Eastern Mediterranean region, as of 2023, there is a consistently high level of coverage with the core vaccines: DTP (first dose - 91%, third dose - 84%), BCG - 90%, polio (third dose) - 85%, hepatitis B (third dose) - 84%. These figures indicate a well-developed immunisation infrastructure and a high level of public trust in vaccination programmes.

The low coverage of the first dose of hepatitis B vaccine, which is administered in the first 24 hours after birth (46%), as well as rubella (68%) and rotavirus (less than 70%) vaccines, indicates a need to expand access to newborn immunisation and strengthen relevant programmes in healthcare facilities.

The COVID-19 pandemic in 2020 had a negative impact on coverage of key vaccines, exposing the vulnerability of immunisation systems to external challenges. However, the subsequent recovery in coverage demonstrates the flexibility and adaptability of national programmes.

To achieve sustainable results in the field of immunoprophylaxis, a comprehensive strengthening of the healthcare system is needed: investments in infrastructure, training of healthcare professionals, public awareness and the introduction of systematic monitoring of vaccination coverage.

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ANNEX

Annex A

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ

АКТУАЛЬНІ ПИТАННЯ СТВОРЕННЯ НОВИХ ЛІКАРСЬКИХ ЗАСОБІВ

МАТЕРІАЛИ
XXXI МІЖНАРОДНОЇ НАУКОВО-ПРАКТИЧНОЇ
КОНФЕРЕНЦІЇ МОЛОДИХ ВЧЕНИХ ТА СТУДЕНТІВ

23–25 квітня 2025 року
м. Харків

Харків
НФаУ
2025

XXXI Міжнародна науково-практична конференція молодих вчених та студентів
«АКТУАЛЬНІ ПИТАННЯ СТВОРЕННЯ НОВИХ ЛІКАРСЬКИХ ЗАСОБІВ»

СЕКЦІЯ 11. СОЦІАЛЬНО-ЕКОНОМІЧНІ, ОРГАНІЗАЦІЙНІ ТА ПРАВОВІ ДОСЛІДЖЕННЯ У ФАРМАЦІЇ
SOCIO-ECONOMIC, ORGANIZATIONAL AND LEGAL RESEARCH IN PHARMACY

Based on the data obtained, a number of recommendations have been formulated aimed at improving the mechanisms for disseminating pharmaceutical information using Internet resources and mobile technologies.

- It is necessary to develop official digital platforms with reliable pharmaceutical information.
- It is advisable to implement programs to improve media literacy of the population.
- The role of healthcare professionals as consultants in matters arising from patients' questions after reading online information should be enhanced.
- It is recommended to support the development of functional mobile applications for self-management of pharmacotherapy.
- A certification system for reliable information sources should be introduced to reduce the risk of misinformation.

Conclusions. The study showed the high popularity of Internet resources and mobile applications as sources of pharmaceutical information among the population. At the same time, an average level of trust in online data and insufficient communication with medical professionals after independent information search was found. The findings emphasize the need to develop official digital platforms, increase media literacy of the population, and introduce mechanisms for verifying the accuracy of information.

RESEARCH ON VACCINATION ISSUES IN THE EASTERN MEDITERRANEAN REGION

Zhouri Rania
Scientific supervisor: Nozdrina A.A.
National University of Pharmacy, Kharkiv, Ukraine
Almira.nozdrina@nuph.edu.ua

Introduction. Immunization is a key component of the global public health strategy, preventing the spread of more than 30 infectious diseases. In the Eastern Mediterranean region, which includes countries with different levels of economic development, the effectiveness of vaccination programs plays a crucial role in maintaining public health. Studying the level of vaccination coverage and existing challenges in this region is relevant in view of the need to achieve the Sustainable Development Goals, in particular SDG 3 – "Ensure healthy lives and well-being for all at all ages".

Aim. To analyze the current state of vaccination coverage in the Eastern Mediterranean region, to identify the main trends

Materials and methods. The WHO reports on immunization coverage were studied using the methods of substantive, comparative analysis and synthesis.

Results and discussions.The analysis of WHO statistics for the period 2010-2023 showed that as of 2023, the region demonstrates a relatively high level of coverage with basic vaccines: DTP (1 dose – 85%, 3 doses – 79%), BCG – 84%, polio (3 doses) – 80%, hepatitis B (3 doses) – 79%. Thus, most countries in the region successfully vaccinate children against major infections and most children receive the necessary doses of vaccine to ensure their protection against these dangerous infections.

Low coverage of the first dose of hepatitis B (46%) and rubella vaccines (68%) indicates the need to strengthen newborn immunization. During the COVID-19 pandemic, a temporary decline in vaccination coverage was recorded, but in subsequent years, the recovery of indicators shows the adaptability of health systems. There has been a gradual increase in coverage of new vaccines, such

as rotavirus and pneumococcal, but their implementation is uneven. In particular, rotavirus vaccine coverage was 18% in 2013, and tripled to 54% in 2023. The pneumococcal vaccine covered 36% of the population in 2013, and 52% in 2023, which is almost 1.5 times more.

Conclusions. The Eastern Mediterranean region has made significant progress in basic immunization coverage, but systemic challenges remain related to access to immunization in the first hours of life, uneven introduction of new vaccines, and vulnerability to external challenges. Further improvements will require investment in health infrastructure, expanded public awareness campaigns, and strengthening national immunization schedules in line with WHO global recommendations.

Annex B


НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ
МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ
СЕРТИФІКАТ УЧАСНИКА
Цим засвідчується, що
Zhouri Rania
Scientific supervisor: Nozdrina A.A.
брав(ла) участь у роботі
XXXI Міжнародної науково-практичної конференції молодих вчених та студентів
«АКТУАЛЬНІ ПИТАННЯ СТВОРЕННЯ НОВИХ ЛІКАРСЬКИХ ЗАСОБІВ»
В.о. ректора
Національного фармацевтичного університету
Алла КОТВІЦЬКА
23-25 квітня 2025 р, м. Харків

Ф А 2.2.1–32-366

National University of Pharmacy

Faculty farmaceutical
Department of social pharmacy

Level of higher education master

Specialty 226 Pharmacy, industrial pharmacy
Educational and professional program Pharmacy

APPROVED
The Head of Department
of Social Pharmacy

_____
Alina VOLKOVA
"11" of September 2024

ASSIGNMENT
FOR QUALIFICATION WORK
OF AN APPLICANT FOR HIGHER EDUCATION

Rania ZHOURI

1. Topic of qualification work: «Research on vaccination issues in the Eastern Mediterranean region», supervisor of qualification work: Almira NOZDRINA, PhD, associated professor,
approved by order of NUPh from "27th" of September 2024 № 237

2. Deadline for submission of qualification work by the applicant for higher education: May 2025.

3. Outgoing data for qualification work: data from scientific and periodical literature in accordance with research objectives; reports of international organizations, statistical data.

4. Contents of the settlement and explanatory note (list of questions that need to be developed):
- to study the theoretical basis of immunisation of the population
- to give a general characteristic of diseases for which mandatory vaccination is carried out according to WHO recommendations
- to study the problems of 'vaccine hesitancy' and to analyse the national vaccination calendar in different countries
- to analyse the state of vaccination in the Eastern Mediterranean region

5. List of graphic material (with exact indication of the required drawings):
tables – 5, figures – 4

6. Consultants of chapters of qualification work

Chapters	Name, SURNAME, position of consultant	Signature, date	
		assignment was issued	assignment was received
1	Almira NOZDRINA, associated professor of higher education institution of department Social Pharmacy	11.09.2024	11.09.2024
2	Almira NOZDRINA, associated professor of higher education institution of department Social Pharmacy	21.11.2024	21.11.2024
3	Almira NOZDRINA, associated professor of higher education institution of department Social Pharmacy	24.12.2024	24.12.2024

7. Date of issue of the assignment: «11» of September 2024.

CALENDAR PLAN

№	Name of stages of qualification work	Deadline for the stages of qualification work	Notes
1	Analysis of scientific, periodic literature on the topic of qualification work	September 2024	**done**
2	Study of the theoretical basis of population immunization	October-November 2024	**done**
3	Study of the problems of “vaccine hesitancy” and analysis of the national vaccination calendar in different countries	December-January 2024-2025	**done**
4	Analysis of the state of vaccination in the Eastern Mediterranean region	February-March 2025	**done**
5	Summary of the results of the study	April 2025	**done**
6	Finalizing the work, preparing the report	May 2025	**done**

An applicant of higher education Rania ZHOURI

Supervisor of qualification work Almira NOZDRINA

ВИТЯГ З НАКАЗУ № 237

По Національному фармацевтичному університету

від 27 вересня 2024 року

Затвердити теми кваліфікаційних робіт здобувачам вищої освіти 5-го курсу Фм20(4,10д) 2024-2025 навчального року, освітньо-професійної програми – Фармація, другого (магістерського) рівня вищої освіти, спеціальності 226 – Фармація, промислова фармація, галузь знань 22 Охорона здоров'я, денна форма здобуття освіти (термін навчання 4 роки 10 місяців), які навчаються за контрактом (мова навчання англійська та українська) згідно з додатком № 1.

Прізвище, ім'я здобувача вищої освіти	Тема кваліфікаційної роботи		Посада, прізвище та ініціали керівника	Рецензент кваліфікаційної роботи
по кафедрі соціальної фармації				
Журі Ранія	Дослідження питань вакцинації в регіоні Східного Середземномор'я	Research on vaccination issues in the Eastern Mediterranean	Асистент Ноздріна А.А.	Доцент Бондарєва І.В.

Ректор

Вірно: Секретар

ФА2.8-03-317

ВИСНОВОК

експертної комісії про проведену експертизу
щодо академічного плагіату у кваліфікаційній роботі

здобувача вищої освіти

«08» травня 2025 р. № 331149848

Проаналізувавши кваліфікаційну роботу здобувача вищої освіти Журі Ранія, групи Фм20(4,10д) engl-01, спеціальності 226 Фармація, промислова фармація, освітньої програми «Фармація» навчання на тему: «Дослідження питань вакцинації в регіоні Східного Середземномор'я / Research on vaccination issues in the Eastern Mediterranean», експертна комісія дійшла висновку, що робота, представлена до Екзаменаційної комісії для захисту, виконана самостійно і не містить елементів академічного плагіату (компіляції).

Голова комісії,
проректор ЗВО з НПР,
професор **Інна ВЛАДИМИРОВА**

Ф А 2.2.1-32-353

REVIEW

of scientific supervisor for the qualification work of the master's level of higher education of the specialty 226 Pharmacy, industrial pharmacy

Rania ZHOURI

on the topic: «Research on vaccination issues in the Eastern Mediterranean region»

Relevance of the topic. Vaccination is one of the most effective means of preventing infectious diseases and maintaining public health. Immunization significantly reduces the incidence of disease, prevents epidemics and saves millions of lives every year, especially among children. In light of increasing migration, globalization, and the spread of misinformation about vaccine safety, research on vaccination remains extremely relevant in both global and regional contexts.

Practical value of conclusions, recommendations and their validity. The practical value of the conclusions and recommendations lies in their ability to be used to improve immunization programs and increase vaccination coverage of the population. They are based on a thorough analysis of scientific sources and statistical data, which ensures their reliability and practical feasibility for implementation in public health policy.

Assessment of work. During the research the student showed a creative approach to the solution of the tasks, diligently conducted research work, summarized and presented the results properly, which indicates the awareness of the problem and the proper level of its development. The work is carried out at a sufficient scientific level.

General conclusion and recommendations on admission to defend. In general, the qualification work of Rania ZHOURI on the topic: «Research on vaccination issues in the Eastern Mediterranean region» is performed at the proper level, meets the requirements of the "Regulations on the preparation and protection of qualification works at the National University of Pharmacy" and can be recommended for defense in the Examination commission.

Scientific supervisor Almira NOZDRINA

«12th» of May 2025

Ф А 2.2.1-32-356

REVIEW

for qualification work of the master's level of higher education, specialty 226 Pharmacy, industrial pharmacy

Rania ZHOURI

on the topic: «Research on vaccination issues in the Eastern Mediterranean region»

Relevance of the topic. The research topic is extremely relevant given the global public health challenges. Vaccination remains one of the most effective tools for the prevention of infectious diseases, and the study of its features and problems in specific regions, such as the Eastern Mediterranean, allows timely response to epidemiological threats and improve the effectiveness of immunization programs.

Theoretical level of work. The work demonstrates a high theoretical level: it discusses in detail the basics of immunization, provides up-to-date scientific data, summarizes international recommendations and provides an analysis of statistics on vaccine-preventable infections. The author competently uses the sources of WHO and other authoritative structures, which confirms the scientific validity of the material

Author's suggestions on the research topic.

The author proposes a number of directions for improving vaccination programs in the region: from increasing the immunization coverage of vulnerable groups of the population to awareness-raising campaigns aimed at overcoming vaccine hesitancy. The need for international cooperation and sustainable financing of immunization programmes is also highlighted. The work contains a comprehensive presentation of key aspects of immunization, includes modern scientific approaches, reflects the provisions of international normative documents and contains an analysis of the epidemiological situation of vaccine-preventable infections.

Practical value of conclusions, recommendations and their validity.

Acquaintance with the qualification work gives reasons to affirm the expediency of the conducted research and the practical value of the recommendations.

Disadvantages of work. Minor typos and grammatical errors are present in the text.

General conclusion and assessment of the work. According to the relevance and the results of the research qualification work of Rania ZHOURI on the topic: «Research on vaccination issues in the Eastern Mediterranean region» meets the requirements for master's works and can be recommended for official defense in the Examination commission.

Reviewer Associate professor Iryna BONDARIEVA

«14th» of May 2025

Ф А2.5-32-231

ВИТЯГ
з протоколу засідання кафедри соціальної фармації
№ 21 від «16» травня 2025 року

ПРИСУТНІ: зав. каф. доц. Аліна ВОЛКОВА, проф. Ганна ПАНФІЛОВА, проф. Вікторія НАЗАРКІНА, доц. Галина БОЛДАРЬ, доц. Наталія ГАВРИШ, доц. Тетяна ДЯДЮН, доц. Юлія КОРЖ, асист. Альміра НОЗДРІНА, доц. Вікторія МІЩЕНКО, доц. Ірина ПОПОВА, доц. Олександр СЕВРЮКОВ, доц. Ірина СУРІКОВА, доц. Любов ТЕРЕЩЕНКО, доц. Наталія ТЕТЕРИЧ.

ПОРЯДОК ДЕННИЙ:

Про представлення до захисту в Екзаменаційній комісії кваліфікаційних робіт.

СЛУХАЛИ: завідувачку кафедри доц. Аліну ВОЛКОВУ з рекомендацією представити до захисту в Екзаменаційній комісії кваліфікаційну роботу здобувачки вищої освіти спеціальності 226 Фармація, промислова фармація Раніа ЖУРІ на тему: ««Дослідження питань вакцинації в регіоні Східного Середземномор'я».

Науковий керівник: PhD, асистент кафедри СФ Альміра НОЗДРІНА.

Рецензент: к. фарм. н., доцент кафедри ММЗЯФ Ірина БОНДАРЄВА.

УХВАЛИЛИ: Рекомендувати до захисту в Екзаменаційній комісії кваліфікаційну роботу здобувачки вищої освіти Раніа ЖУРІ на тему: ««Дослідження питань вакцинації в регіоні Східного Середземномор'я».

Завідувачка каф. СФ, доцент Аліна ВОЛКОВА

Секретар, доцент Наталія ТЕТЕРИЧ

Ф А2.2.1-32-042

НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ

ПОДАННЯ
ГОЛОВІ ЕКЗАМЕНАЦІЙНОЇ КОМІСІЇ
ЩОДО ЗАХИСТУ КВАЛІФІКАЦІЙНОЇ РОБОТИ

Направляється здобувачка вищої освіти Раніа ЖУРІ до захисту кваліфікаційної роботи за галуззю знань 22 Охорона здоров'я
спеціальністю 226 Фармація, промислова фармація
освітньою-професійною програмою Фармація
на тему: «Дослідження питань вакцинації в регіоні Східного Середземномор'я».

Кваліфікаційна робота і рецензія додаються.

Декан факультету _____ / Микола ГОЛІК/

Висновок керівника кваліфікаційної роботи

Здобувачка вищої освіти Раніа ЖУРІ під час виконання кваліфікаційної роботи продемонструвала уміння працювати з науковими даними, проводити їх узагальнення, аналізувати та узагальнювати результати дослідження. Усі поставлені завдання відповідно до мети роботи було виконано у повному обсязі. Результати дослідження належним чином оброблені і представлені.

Таким чином, кваліфікаційна робота може бути рекомендована до офіційного захисту в Екзаменаційній комісії Національного фармацевтичного університету.

Керівник кваліфікаційної роботи Альміра НОЗДРІНА

«12» травня 2025 р.

Висновок кафедри про кваліфікаційну роботу

Кваліфікаційну роботу розглянуто. Здобувач вищої освіти Раніа ЖУРІ допускається до захисту даної кваліфікаційної роботи в Екзаменаційній комісії.

Завідувачка кафедри
соціальної фармації Аліна ВОЛКОВА

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Qualification work was defended

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With the grade _____

Head of the State Examination commission,

DPharmSc, Professor

_____ / Volodymyr YAKOVENKO/