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INTERDISCIPLINARY APPROACH IN THE PREVENTION OF PNEUMOCOCCAL INFECTION: INTERNATIONAL EXPERIENCE

Introduction. Pneumococcal infection remains one of the significant public health issues worldwide [1]. According to the World Health Organization (2022), approximately 740,180 children under the age of five die from pneumonia each year, accounting for 14% of all deaths in this age group. As for children aged one to five, pneumonia is responsible for 22% of all deaths in this age group [2].
Objective. To analyze the global experience of implementing an interdisciplinary approach in the prevention of pneumococcal infection, as well as to assess the prospects of applying this principle in the Republic of Kazakhstan.
Materials and methods. The work is based on the results of a literature review from databases such as PubMed, Scopus, Google Scholar, Cyberleninka, and e-Library, using keywords like "pneumococcal infection," "pneumococcal pneumonia," "interdisciplinary approach," "prevention," and others.
Results. Pneumococcal infection is one of the leading causes of morbidity and mortality among children, especially in developing countries. The implementation of an interdisciplinary approach, involving the collaboration of pediatricians, infectious disease specialists, epidemiologists, mid-level healthcare workers, and social workers, has proven effective in reducing morbidity and mortality from pneumococcal infection in many developed countries, such as the United States, the United Kingdom, Australia, and others.
Discussion. An analysis of global experience shows that the implementation of an interdisciplinary approach in the prevention of pneumococcal infection contributes to increasing vaccination coverage and reducing the incidence rate. It should be noted that its implementation in Kazakhstan faces several barriers, including insufficient awareness among healthcare professionals, limited resources, and low vaccination adherence among the population.
Conclusions. The interdisciplinary approach is a key aspect of the global fight against infectious diseases. In the Republic of Kazakhstan, the interdisciplinary nature of pneumococcal infection prevention is still in its early stages. The implementation of interdisciplinary strategies in our country requires strengthening specialized knowledge and coordination within the healthcare system, as well as improving vaccination monitoring to enable scientific research on the impact of vaccination on morbidity and carriage.
Keywords: Pneumococcal infection, pneumococcal pneumonia, prevention, interdisciplinary approach.

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МЕЖДИСЦИПЛИНАРНЫЙ ПОДХОД В ПРОФИЛАКТИКЕ ПНЕВМОКОККОВОЙ ИНФЕКЦИИ: МЕЖДУНАРОДНЫЙ ОПЫТ

Введение. Пневмококковая инфекция остается одной из значимых проблем общественного здравоохранения во всем мире [1]. По данным Всемирной организации здравоохранения (2022), ежегодно в мире от пневмонии умирает около 740 180 детей до пяти лет, что составляет 14% случаев смертельных исходов в данной возрастной группе. Что касается детей в возрасте от одного года до пяти лет, то на долю пневмонии приходится 22% всех случаев смерти [2].
Цель исследования. Проанализировать мировой опыт внедрения междисциплинарного подхода в профилактике пневмококковой инфекции, а также оценить перспективу применения данного принципа в Республике Казахстан.
Материалы и методы исследования. В основу работы положены результаты обзора научной литературы в базах Pubmed, Scopus, Google Академия, Cyberleninka и e-Library с использованием таких ключевых слов, как «пневмококковая инфекция», «пневмококковая пневмония», «междисциплинарный подход», «профилактика» и другие.
Результаты. Пневмококковая инфекция является одной из основных причин заболеваемости и смертности среди детей, в особенности в развивающихся странах. Внедрение междисциплинарного подхода, включающего взаимодействие педиатров, инфекционистов, эпидемиологов, среднего медицинского персонала, социальных работников, показывает свою эффективность в снижении заболеваемости и смертности от пневмококковой инфекции во многих развитых странах, таких как США, Великобринания, Австралия и другие.

Обсуждение. Анализ мирового опыта показывает, что внедрение междисциплинарного подхода в профилактике пневмококковой инфекции способствует повышению охвата вакцинацией и снижению уровня заболеваемости. Следует отметить, что в Казахстане его реализация сталкивается с рядом барьеров, включая недостаточную осведомлённость медицинских работников, ограниченные ресурсы и низкую приверженность к вакцинации среди населения.
Заключение. Междисциплинарный подход является ключевым аспектом в глобальной борьбе с инфекционными заболеваниями. В Республике Казахстан междисциплинарный характер профилактики пневмококковой инфекции на данном этапе находится в начале своего пути. Применение междисциплинарных стратегий в нашей стране требует укрепления профильных знаний и координации в рамках системы здравоохранения, улучшения мониторинга вакцинации, позволяющего провести научное исследование по изучению влияния вакцинации на заболеваемость и носительство.
Ключевые слова: Пневмококковая инфекция, пневмококковая пневмония, профилактика, междисциплинарный подход.

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ПНЕВМОКОКК ИНФЕКЦИЯСЫНЫҢ АЛДЫН АЛУЫНДАҒЫ ИНТЕРДИСЦИПЛИНАРЛЫҚ ТӘСІЛ: ХАЛЫҚАРАЛЫҚ ТӘЖІРИБЕ

Кіріспе. Пневмококк инфекциясы әлемдегі денсаулық сақтау саласының маңызды мәселелерінің бірі болып табылады [1]. Дүниежүзілік денсаулық сақтау ұйымының (2022) мәліметтері бойынша, әлемде жыл сайын 5 жасқа дейінгі балалардың шамамен 740 180-і пневмониядан қайтыс болады, бұл осы жас тобының өлім-жітім жағдайларының 14%-ын құрайды. 1 жастан 5 жасқа дейінгі балалар арасында пневмония барлық өлім жағдайларының 22%-ын құрайды [2].
Зерттеудің мақсаты. Әлемдік тәжірибеде пневмококк инфекциясының алдын алу үшін қолданылатын интердисциплинарлық тәсілді енгізуді талдап, Қазақстан Республикасында бұл принциптің қолданылу перспективасын бағалау.
Материалдар мен әдістер. Жұмыс негізінде Pubmed, Scopus, Google Академия, Cyberleninka және e-Library базаларындағы ғылыми әдебиеттерге шолу нәтижелері алынған, «пневмококк инфекциясы», «пневмококк пневмониясы», «интердисциплинарлық тәсіл», «пневмококк инфекциясын алдын алу» және басқа да кілт сөздер қолданылды.
Нәтижелер. Пневмококк инфекциясы балалар арасында аурушаңдық пен өлім-жітімнің негізгі себептерінің бірі болып табылады, әсіресе дамушы елдерде. Педиатрлар, инфекционисттер, эпидемиологтар, орта медициналық қызметкерлер, әлеуметтік қызметкерлер арасындағы өзара әрекеттестікті қамтитын интердисциплинарлық тәсілді енгізу пневмококк инфекциясынан аурушаңдық пен өлім-жітімді төмендетуде АҚШ, Ұлыбритания, Австралия және басқа да дамыған елдерде тиімділігін көрсеткен.
Талқылау. Әлемдік тәжірибе анализі көрсеткендей, пневмококк инфекциясын алдын алу саласында аралық салалық тәсілді енгізу вакцинацияның қамтылу деңгейін арттыруға және аурушаңдық деңгейін төмендетуге ықпал етеді. Қазақстанда оның жүзеге асырылуы бірқатар кедергілерге кездеседі, олардың ішінде медициналық қызметкерлердің жеткіліксіз ақпараттануы, шектеулі ресурстар мен халық арасында вакцинацияға деген төмен серпін бар.
Қорытынды. Интердисциплинарлық тәсіл инфекциялық аурулармен күрестегі жаһандық маңызды аспект болып табылады. Қазақстан Республикасында пневмококк инфекциясын алдын алу үшін интердисциплинарлық тәсілдің дамуы әлі бастапқы кезеңде. Интердисциплинарлық стратегияларды елімізде қолдану денсаулық сақтау жүйесінде кәсіби білімдер мен үйлестіруді күшейтуді, вакцинация мониторингін жақсартуды, вакцинацияның аурушаңдық пен тасымалдауға әсерін зерттейтін ғылыми зерттеулер жүргізуді талап етеді.
Түйінді сөздер: Пневмококк инфекциясы, пневмококк пневмониясы, алдын алу, интердисциплинарлық тәсіл.

Introduction. Pneumococcal infection (PI) remains one of the major public health issues worldwide [1]. Pneumococci cause a wide range of diseases, from sinusitis and otitis media to life-threatening conditions such as pneumonia, bacteremia, and meningitis [3]. According to the World Health Organization (WHO) (2022), approximately 740,180 children under five years of age die from pneumonia annually, which accounts for 14% of all deaths in this age group. When discussing children aged one to five years, pneumonia accounts for 22% of all deaths [2].
Official statistics indicate that up to 70% of all pneumonias, about 25% of otitis media cases, 5-15% of purulent meningitis cases, and approximately 3% of endocarditis cases are caused by *S. pneumoniae.*
Pediatric pneumococcal infection is an increasing concern among pediatricians, particularly in countries with low adherence to the scheduled pneumococcal vaccination program. The disease is associated with significant morbidity and mortality in young children, especially those under the age of two [4]. In recent decades, there has been a trend toward implementing interdisciplinary and patient-centered approaches in the fight against infections, including pneumococcal infection [5].
Objective. To analyze the global experience of implementing an interdisciplinary approach in the prevention of pneumococcal infection, as well as to assess the prospects of applying this principle in the Republic of Kazakhstan.
Results. To achieve a reduction in morbidity and mortality caused by pneumococcal infections (PI), vaccines against pneumococcus have been developed over many years. These vaccines have proven highly effective in reducing the spread of

the bacteria and the development of related diseases, leading to a significant decrease in mortality, particularly in developing countries. Two types of vaccines have been developed in this regard: pneumococcal polysaccharide vaccines (PPSV) and pneumococcal conjugate vaccines (PCV) *(Figure 1).* However, significant challenges remain, primarily due to the phenomenon of serotype replacement, multidrug resistance, and high production costs for conjugate vaccines [6].

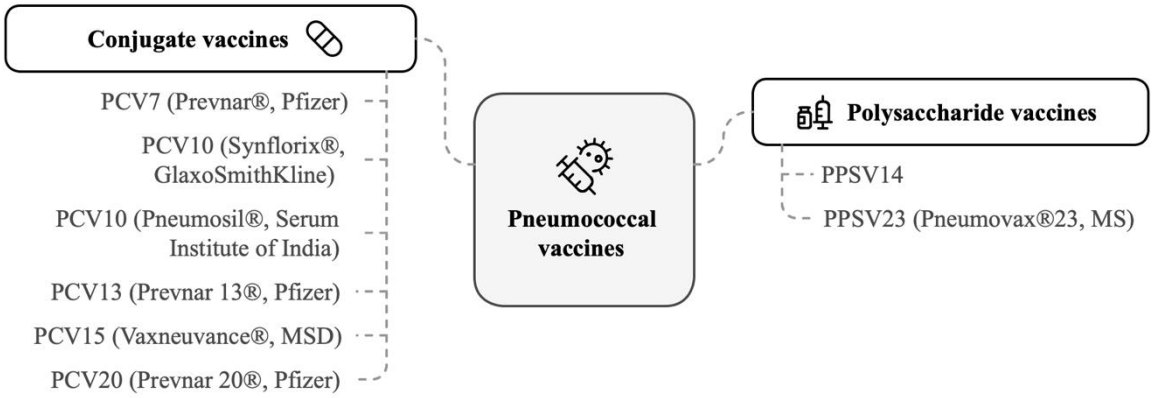

Figure 1 - Types of pneumococcal vaccines registered worldwide

Innovative developments in medicine can be productive only when using a comprehensive multidisciplinary approach. The solution to modern challenges in medical science requires new approaches and solutions [7].
The multidisciplinary approach, like the creation of multidisciplinary teams, involves the participation of many specialists working on one problem, one patient. Moreover, the number of participants in the team can be limitless, utilizing resources from social services, instructors, psychologists, etc. However, there is no unification of opinions, and barriers such as methodological, deontological, and scientific-disciplinary boundaries may hinder success. In contrast, the principle of interdisciplinarity implies the integration of knowledge and concepts to develop an effective solution to a problem [8].
The expansion of the role of mid-level medical personnel in the context of the interdisciplinary approach to the prevention of pneumococcal infections is currently viewed not only as a way to address the staffing shortage but also as a tool for optimizing the use of working time. Organizational solutions related to the expansion of the functions of mid-level medical staff are currently most common in healthcare organizations providing primary healthcare services: preventive work with the population, routine management of patients with chronic diseases, and vaccination organization. The widespread adoption of this experience requires the development of new regulatory documents defining the technologies for transferring some medical functions to mid-level staff. The effects of implementing such models to address staffing shortages should be assessed at the level of specific healthcare organizations [9, 10].
Modern approaches to treatment require a new attitude towards the patient, who is now seen as an active and equal participant in the process. Unlike the previous "doctor-patient" models based on a paternalistic approach, where the doctor made all the decisions for the patient, today the focus is on patient-centered care and personalization. However, this is not always viewed unambiguously by both specialists and the patients themselves. This principle reveals an insufficient coverage of the extended knowledge base of general practitioners, pediatricians, infectious disease specialists, and others regarding the effectiveness of vaccination. According to WHO data from 2015, pneumococcal pneumonia led to 2.6 million deaths, accounting for 15% of all pneumonia-related deaths. The rates of morbidity and mortality are higher in developing countries than in industrialized nations. It is worth noting that the highest number of fatalities is observed in Africa and Asia [11].
Despite the fact that the need for the division of responsibility between the doctor and the patient is enshrined in the Code of the Republic of Kazakhstan "On the Health of the People and the Healthcare System" dated January 13, 2025, No. 157-VIII [12], in practice, this remains largely a theoretical concept. Involving the patient in the decision-making process regarding their health requires a change in views on responsibility and management in healthcare, not only with respect to non-communicable diseases [13], but also with regard to bacterial and viral pathologies. In the new approach, the patient becomes part of the medical team and bears responsibility for the treatment outcomes. For the successful implementation of this model, it is important that the patient is not isolated from the process, but participates in decision-making, which requires a real balance and interaction between the patient and the medical staff [14, 15].
Pneumococcal infection is also the subject of active preventive actions in the United States. The national vaccination program includes recommendations for the vaccination of children, as well as elderly individuals and people with weakened immune systems. Pediatricians, infectious disease specialists, nurses, and other public health professionals participate in the prevention of pneumococcal infections based on an interdisciplinary approach and develop comprehensive strategies at local and national levels. Vaccination programs are coordinated using data from epidemiological reports that investigate vulnerable groups and methods of infection spread [16, 17].
According to Australian authors (2024), interdisciplinary teams in Australia actively develop and implement programs to raise awareness about pneumococcal infection among various population groups, including indigenous communities. In Australian awareness models, individual teams include epidemiologists, sociologists, healthcare workers, and social workers. Special attention is given to developing appropriate programs. Vaccination programs are adapted to cultural features and language barriers. Local community members are more likely to accept similar educational and preventive programs initiated by them.

Accordingly, these specifications suggest that such an approach is effective. After the introduction of this vaccination program, the incidence rate in these communities decreased [18].

The United Kingdom also uses an interdisciplinary approach in the prevention of pneumococcal infection [19].Since 2006, the United Kingdom and Northern Ireland have had a national vaccination program for children against pneumococcal infections. However, it should be especially emphasized that on January 1, 2020, the United Kingdom became the first country to transition from a 2+1 vaccination schedule to a 1+1 national immunization schedule for infants with the 13-valent pneumococcal conjugate vaccine (PCV13) at 12 weeks and 1 year of age [20]. English researchers, including Streeter, A. J. and others, consider this change in the vaccination schedule to show equally positive results in the conducted vaccination efforts. The national program in this country covers not only children but also other vulnerable groups of the population, including elderly individuals and people with chronic diseases. An important aspect is the participation of various specialists: pediatricians, nurses, social workers, and educational institution representatives. Healthcare workers actively involve parents and guardians in the decision-making process regarding vaccination, which helps increase awareness and trust in vaccines. Additionally, medical institutions regularly monitor the incidence rate and vaccination effectiveness [21]. We share the author's position on expanding the responsible parties involved in enhancing adherence to pneumococcal vaccination, with the possibility of adjusting the vaccination schedule.

When discussing the prevention of pneumococcal infections (PI) in the Republic of Kazakhstan, which began to actively develop with the introduction of the 13-valent conjugate vaccine (PCV13) into the National Immunization Schedule in 2010, the country implemented a phased introduction of the 13-valent vaccine [22]. It should be emphasized that currently, vaccination against PI is mandatory for all children from 2 months of age and follows the 2+1 schedule: two doses at 2 and 4 months, followed by a third dose at 12-15 months [23]. Having studied the latest data from statistical collections of Kazakhstan (2023), it is encouraging to note that the implementation of pneumococcal vaccination has significantly reduced the incidence and mortality from pneumococcal pneumonia, meningitis, and other severe infections [24]. However, the level of PI vaccination coverage at the level of primary healthcare still leaves a number of unresolved issues, particularly regarding low levels of adherence among parents and the adult population.

In the Republic of Kazakhstan, several types of pneumococcal vaccines have been registered, including both conjugated and polysaccharide types *(Figure 2)*. These vaccines are an essential tool in the prevention of diseases caused by *Streptococcus pneumoniae*, which help reduce morbidity and mortality, especially among children under 2 years of age, as well as elderly individuals over 65.

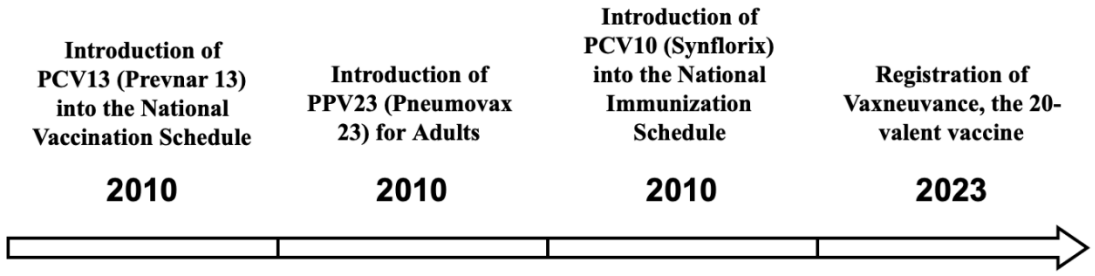

Figure 2 - Timeline of the Practical Application of Pneumococcal Vaccines

In 2023, the Ministry of Health of the Republic of Kazakhstan registered the 20-valent pneumococcal vaccine (Vaxneuvance 20), although it has not yet been used in practical healthcare. In this regard, Kazakhstan became the first country in the European Economic Union region, Central Asia, and the Caucasus to register this vaccine. The new vaccine provides the broadest coverage of pneumococcal serotypes among all available conjugated vaccines, protecting against 20 strains of Streptococcus pneumoniae [25].

Discussion. After analyzing the above, it can be concluded that Kazakhstan offers a wide range of vaccines, including both well-established and the newest products, which ensures more effective prevention of pneumococcal infection and covers a broad spectrum of pneumococcal serotypes, thereby increasing the effectiveness of immunization and reducing morbidity among the population. The fight against pneumococcal infections, particularly among children, remains a priority issue in public health. However, pediatricians and general practitioners do not show adequate interest in improving the practical application of vaccines.

Regarding the implementation of an interdisciplinary approach in the prevention of pneumococcal infection in the Republic of Kazakhstan, it should be emphasized that this principle of integration has been adopted as a cornerstone in the national healthcare program. Interdisciplinary coordination of actions by various specialists in one direction can ensure the full functioning of the system, including elements of deepening and developing interaction between doctors of different specialties, as well as various levels of qualified medical staff and physicians; epidemiologists, and pharmacists in the rational use of medications against pneumococcal "aggression." Public health organization leaders continue to optimize interactions between different healthcare sectors, including medical-social services and the disease prevention system. Special attention should be given to the widespread implementation of a patient-centered approach, involving patients in decision-making about prevention and the active use of resource-saving technologies in outpatient healthcare organizations.

Conclusions. As a result of studying and synthesizing various scientific perspectives on the integration of different disciplines in the prevention of pneumococcal infection, it can be concluded that the interdisciplinary approach is a key aspect in the global fight against infectious diseases.

As evidenced by international practices, effective collaboration between pediatricians, general practitioners, mid-level medical staff, and public health specialists yields positive results in addressing the problems of prevention and disease control.
In countries with highly developed healthcare systems, such as those in Western Europe and the United States, interdisciplinary vaccination programs are successfully implemented to increase coverage and reduce the incidence of pneumococcal infections. It is important to emphasize how relevant and beneficial the integration of knowledge across various fields is in addressing global epidemiological challenges. Only through such interaction can long-term, sustainable, and improved strategies for tackling global health challenges, including the prevention and control of infectious diseases, be developed.
In Kazakhstan the interdisciplinary nature of pneumococcal infection prevention is still in its early stages. However, several steps have been taken to improve the interaction between medical and epidemiological services. This is essential for effective disease monitoring and tracking. It is important to note that the implementation of interdisciplinary strategies requires strengthening specialized knowledge and coordination within the healthcare system, improving vaccination monitoring, and conducting scientific research on the impact of vaccination on disease incidence and carriage. Thus, the integration of disciplines in the prevention of pneumococcal infection in Kazakhstan will bring new meaning to methods and tools for prevention. In the long term, this will lead to improved public health outcomes.

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