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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

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Ca^{+2}-АТФаза, $Na^+/K^+/2Cl^-$-котранспортер, Na^+/H^+-антипортер, CAT-1, Ca^{2+}-зависимые K^+-каналы - каналы Гардо, активность аденилатциклазы и цАМФ, АМФ-зависимая активация системы L-аргинин/NOS и эритроцитарная NOS), таким образом, они модулируют объем клеток, реологические свойства (деформируемость, агрегация), интенсивность синтеза NO и высвобождение АТФ. Благодаря этим свойствам эритроциты, помимо транспорта газов, играют роль кислородных сенсоров и могут участвовать в механизмах вазорелаксации и поддержания нормального уровня микроциркуляции.

რეზიუმე

β-ადრენორეცეპტორების როლი ერითროციტების რეოლოგიური ფუნქციების რეგულაციაში (მიმოხილვა)

თ.შარაშენიძე, ხ.შველიძე, მ.ციმაკურიძე, ს.ტურაბელიძე-რობაქიძე, მ.ბულეიშვილი, თ.სანიკიძე

საქართველოს დავით აღმაშენებლის სახ. უნივერსიტეტი;
თბილისის სახელმწიფო სამედიცინო უნივერსიტეტი, საქართველო

სტატიაში განხილულია β-ადრენორეცეპტორების როლი ერითროციტების რეოლოგიური ფუნქციების რეგულაციაში.

β-ადრენორეცეპტორები მნიშვნელოვან როლს ასრულებენ ერითროციტების ფუნქციების და მეტაბოლიზმის რეგულაციაში. ისინი მონაწილეობენ მემბრანის სატრანსპორტო ცილების (Na^+/K^+-ATPაზა, Ca^{+2}-ATPაზა, $Na^+/K^+/2Cl^-$-კოტრანსპორტიორი, Na^+/H^+-ანტიპორტერი, CAT-1, Ca^{2+}-დამოკიდებული K^+-არხები (გარდოს არხები), ადენილატციკლაზას აქტივობა და cAMP–ის დამოკიდებული L-არგინინ/NOS სისტემის აქტივაცია და erNOS) და ამრიგად არეგულირებენ უჯრედის მოცულობას, რეოლოგიურ თვისებებს (დეფორმაბელობა, აგრეგაციულობა), NO სინთეზის ინტენსივობას და ATP–ის გამოყოფას.

ერითროციტების აღნიშნული თვისებები განაპირობებს, რომ გაზების ტრანსპორტის გარდა, ისინი ასრულებენ ჟანგბადის სენსორების როლს და მონაწილეობენ ვაზორელაქსაციის მექანიზმებში, მიკროცირკულაციის ნორმალური დონის შენარჩუნებაში.

VACCINATION: STATE-IMPLEMENTED MEDICO-SOCIAL AND LEGAL MEASURES

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Infectious diseases transcend all boundaries and tend to spread widely across the population causing high social, material, financial and manpower costs that exceed the resource costs required for the implementation of preventive measures. High levels of epidemic potential and serious consequences can be effectively prevented through vaccination.

The prevention of infectious diseases through vaccination is the most efficient investment in public health that promotes social justice and socio-economic consolidation of the nation. The moral aspect of immunization is also of great importance since everyone has a right to living a long and happy life without damages caused by a disease and its consequences, not to mention sufferings, disability and death.

High childhood vaccination coverage rates serve as a key indicator of public health, as they contribute to the formation of so-called herd immunity from a particular disease. Herd immunity is only effective when vaccinated citizens make up at least 95% of the entire population. It creates a specific shield: protects people who cannot be vaccinated for medical reasons from diseases, stops the spread of viruses and outbreaks.

However, achieving and maintaining this objective is not always an easy task for the state and it becomes even more difficult in case of increase of an overall number of refusals to get vaccinated. There are different vaccination policies around the world. Some countries focus on educating their population with relation to the benefits of vaccination leaving the choice to the citizens themselves, others offer financial incentives or make vaccination mandatory to ensure its high coverage [12]. Depending on national legislation, the legal consequences for those who do not accept vaccination may vary, ranging from not letting unvaccinated people to visit educational establishments to imposing fines. In some cases, for example in France, parents may even bear criminal responsibility.

A problem of vaccination which seems to be of a purely medical nature at first glance became a field of conflict of different interests such as: the right to life, the right to respect for private and family life, freedom of thought, conscience, religion or belief, the right to education, and, on the other hand, gives rise to the issue of public health protection and even national security. Different states have different approaches to finding a legislative solution to the problem of ensuring the optimum balance between public and private interests in this respect.

*Literature review***.** The issue of vaccination is associated with various aspects of personal and social life and has its manifestation at both national and international levels. That is why the problem of vaccination is of interdisciplinary subject matter and is studied by experts in various fields of science.

A substantial scientific discussion of the ethical and legal aspects of vaccination was carried out by Capella, B. V. (2015) and Bioethics Committee of Spain (2016).

Social and economic impact of vaccination and refusals to be vaccinated in some particular countries served as a subject of a separate research with relation to the following countries: BRIKS countries [8], the USA [1]. Religious beliefs used as a basis for refusing from compulsory vaccination and considering such beliefs as an exception to general rules were studied by the following scientists: [4] and groups of authors [9]. An important role in the study of this issue, in particular in collecting and generalizing the statistical information, is played by the World Health Organization and its activities, the European Centre for Disease Prevention and Control and cooperation of scientists from research centres around the world [6].

The methods of the research include the comparative method, i.e. the comparison of Ukrainian and international medical and social initiatives related to vaccination of children; the statistical method which is used for generalization of vaccination-related information of the World Health Organization and the European Centre for Disease Prevention and Control; the systematic analysis aimed at identification of existing shortcomings and positive experience of state policies of children vaccination in different countries of the world; the linguo-cognitive analysis, i.e the analysis of reasons for judgements with relation to the role of vaccination in modern countries and those social and medical initiatives that are allowed to be used in certain states to ensure exercise of human rights.

Human life and health are recognized in Ukraine as the highest social value (Article 3 of the Constitution of Ukraine) (1996). The state took upon itself the constitutional duty of protecting human life and health and guaranteed the right to health protection, medical care and medical insurance for everyone (Article 27 of the Constitution of Ukraine).

The Law of Ukraine «On Ensuring Sanitary and Epidemic Safety of the Population» (1994) stipulates that prophylactic vaccinations aimed at preventing the spread of such diseases like tuberculosis, poliomyelitis, diphtheria, whooping-cough, stupor and measles shall be mandatory in Ukraine.

The Law of Ukraine «On Protection of Population against Infectious Diseases» (2000) stipulates that prophylactic vaccination of adult and capable citizens shall be carried out upon their consent and after providing unbiased information on vaccinations, possible consequences of refusal from them, and probable post-vaccination complications (Article 12). Children who have not undergone prophylactic vaccinations in accordance with the vaccination calendar shall not be allowed to attend children›s institutions.

By its Ruling No.682/1692/17 as of April 17, 2019, after the claim of the mother whose unvaccinated child had been denied of attending a kindergarten the Supreme Court reaffirmed the fact that vaccination is mandatory for all and those unvaccinated children are not allowed to visit pre-school educational institutions, including kindergartens. In its ruling, the Supreme Court noted that the state must ensure the maintenance of the optimum balance between the enjoyment by a child of his or her right to pre-school education and the interests of other children. When an individual interest is opposed to the general interest of society, the common good associated with safety and health must have priority. Parents may choose the form of their children›s education but the state sets certain rules for exercising such right so that not only the rights of an individual child to pre-school education but the rights of all children to safety and health would be taken into account. An interesting fact is that the mother had refused to be vaccinated «because of distrust of vaccines», but the Supreme Court did not receive any convincing arguments with regard to the reasons for such distrust of vaccines quality.

Unfortunately, vaccination indeed became a medical procedure scaring parents around the world. Many parents look for a legal way of avoiding vaccination of their children. As part of the research made within the framework the Vaccine Confidence Project [6] over 66,000 people were surveyed across 67 countries to discover their views on whether vaccines are important, safe, effective and compatible with their religious beliefs. Although overall sentiment towards vaccines was positive across the countries surveyed, the researchers found significant variation in attitudes around the world.

The European region had seven of the ten countries in the global sample that were the least confident in vaccine safety (France, Bosnia & Herzegovina, Russia, Ukraine, Greece, Armenia and Slovenia). France was the country least confident in safety, with 41% of those surveyed disagreeing that vaccines are safe, more than three times the global average of 12%. France was followed by Bosnia & Herzegovina (36%), Russia (28%) and Mongolia (27%), with Greece, Japan and Ukraine not far behind (25%). The Southeast Asian region was most confident in vaccine safety across countries, including Bangladesh (fewer than 1%), Indonesia (3%) and Thailand (6%).

Strange as it may seem, vaccination achieved the greatest results in those countries where it is treated with suspicion. The main enemy of vaccines is thus their proven success since they have made people believe some diseases had already disappeared. This makes some part of society suggest that vaccines are not needed any more is being just a profitable tool for the enrichment of the pharmaceutical industry (Bioethics Committee of Spain, 2016).

Because of vaccination hesitancy and lack of collective immunity Ukraine is now the world leader in the number of measles patients. In 2016 measles vaccination coverage in Ukraine embraced less than 50% of the population. Since summer 2017 more than 100 thousand people contracted measles, 38 of them died. In 2018 more than 54 thousand people contracted measles (Ministry of Health of Ukraine, 2019).

Because of the gaps in vaccination coverage, measles outbreaks occurred in all regions of the world and, according to the estimate of the World Health Organization, there were about 110,000 deaths associated with the disease.

Legal systems of some countries provide for an exemption from compulsory vaccination. One of the most common reasons for such exemption includes medical contraindications (for example, children with weakened immunity, those having allergic reactions to compound vaccines, children having moderate or difficult illnesses etc.), however, some countries provide exemption opportunities based on religious, social and philosophical beliefs. And if medical contraindications are quite easy to understand in terms of rational explanation and social necessity, the religious and philosophical exceptions to the general vaccination rule need additional justification.

Institutional religions do not prohibit any vaccinations. It›s more accurate to say that it is religious organizations and their leaders who confront vaccination based on dubious interpretation of religious provisions [9]. In addition, there are groups of people who oppose vaccination for other reasons: from non-religious philosophical or moral beliefs such as the intervention of vaccines in «the nature's genetic plan» to vague and undefined personal considerations.

In this regard, we can observe the conflict of individual freedom of thought, conscience, religion or belief on the one hand, and public interest on the other. In the United States, the authori-

ties of most of the states decided to exempt certain individuals from compulsory vaccination requirements, alleging as their reason that 100% vaccination is not necessary to ensure herd immunity and believing that communities can get herd immunity even without those individuals. Thus, 48 out of 50 states provide an exemption from vaccination to those people whose religious beliefs prohibit it, and 19 states saw even more controversial decisions allowing exemption for the people who claim to have a non-religious cultural or philosophical opposition to vaccines [11]. Such exemptions testify to deep respect for individual human freedoms, however, their implementation can be a threat over the long run. As recent experience shows, although nationwide measles vaccination rates in the USA appeared to be high enough, disproportionately low vaccination rates among blacks and Hispanics resulted in measles outbreaks in several large urban areas, most notably in Los Angeles [3]. Epidemiological diseases appear in the United States with ever-increasing frequency because of the loss of herd immunity across religious groups. This comes at a tremendous cost to society. Vaccination, on the contrary, would allow saving of $13.5 billion in direct health care costs [14] and help to avoid over 30,000 deaths [1].

However, those with genuine religious objections to vaccination do not represent the entirety of the threat to society. The situation is far more difficult in those countries allowing exemptions based on philosophical and other beliefs and people can take advantage of such philosophical exemptions ranging from «devotion to «natural» or alternative healing» to «libertarian opposition to state power» in order just to show their «mistrust of pharmaceutical companies» [4]. Unfortunately, parents' decisions on vaccinating a child or not in such cases are often determined by misinformation, erroneous statements regarding vaccines safety made by «Internet experts» and other sources having nothing to do with science and lacking official confirmation.

The European Court of Human Rights developed a certain practice aimed at balancing the controversy between the public interest and fundamental human rights and freedoms protected by international acts, in particular, the right to life, the right to respect for private and family life, freedom of thought, conscience, religion or belief.

Considering the case «Carlo Boffa and 13 others v. San Marino» (no. 26536/95, 15 January 1998) the European Commission of Human Rights found no violations by the state of Articles 2, 8 and 9 of the Convention with regard to compulsory vaccination. Giving the reasons for making such decision in light of the absence of any violations of the right to life, the Court noted that even assuming that the provision of Article 2 of the Convention guarantees a right not to be physically injured, vaccination does not in itself constitute a prohibited interference with that right. On the other hand, with regard to Article 8 of the Convention, the Court established that a requirement to undergo vaccination is an interference with the exercise of the right to respect for private life, but under paragraph 2 of Article 8 of the Convention a lawful requirement to undergo vaccination is considered as necessary in a democratic society for the protection of public health. The notion of «necessity» implies that the interference corresponds to a pressing social need and is proportionate to the aim pursued by the State in this area. Regarding the freedom of thought, conscience, religion or belief the Commission noted that Article 9 of the Convention does not always give a right to act in the public sphere in the manner dictated by the abovementioned convictions. The Commission noted that «religious practice» does not imply actions which, in their turn, fail to directly express such convictions even though such actions are motivated or influenced by it.

Conclusions. The analysis made suggests that even insignificant reduction in the number of vaccinated children caused by parents' vaccination hesitancy because of personal, non-medical, religious and philosophical belief will have negative consequences for the public health of country's society and its economy. The research confirms the pressing need for legal certainty with regard to this issue. Looking for a balance of human rights and public interest when it comes to vaccination resulted in establishing by the supranational judicial institutions of the prevalence of social necessity over individual rights. These findings should play a key role in the public policy associated with the vaccination of children.

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SUMMARY

VACCINATION: STATE-IMPLEMENTED MEDICO-SOCIAL AND LEGAL MEASURES

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The article reviews the medical and social vaccination-related initiatives in different countries of the world aimed at maintaining the balance between the public interest and respect for rights. A separate emphasis is put on exceptions to general rules of compulsory vaccination of children based on religious, philosophic and other personal beliefs of their parents. The connection between the medical and social initiatives applied in different countries, exemption from vaccination for non-medical reasons and reduction of herd immunity is determine.

The methods of the research include the comparative method, i.e. the comparison of Ukrainian and international medical and social initiatives related to vaccination of children; the statistical method which is used for generalization of vaccination-related information of the World Health Organization and the European Centre for Disease Prevention and Control; the systematic analysis aimed at identification of existing shortcomings and positive experience of state policies of children vaccination in different countries of the world; the linguo-cognitive analysis, i.e the analysis of reasons for judgements with relation to the role of vaccination in modern countries and those social and medical initiatives that are allowed to be used in certain states to ensure exercise of human rights.

Even a slight reduction in numbers of vaccinated children caused by parents' hesitancy due to certain non-medical reasons, religious and philosophic beliefs will have negative consequences for the public health and country's economy. Looking for a balance of human rights and public interest when it comes to vaccination resulted in establishing by the supranational judicial institutions of the prevalence of social necessity over individual rights. These findings should play a key role in the selection by different states of vaccination-related medical and social initiatives.

Keywords: vaccination, herd immunity, health care, public interest, religious convictions.

РЕЗЮМЕ

ВАКЦИНАЦИЯ: МЕДИКО-СОЦИАЛЬНЫЕ И ПРАВОВЫЕ МЕРЫ ГОСУДАРСТВА

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В статье исследуются медико-социальные мероприятия по проведению вакцинации в разных странах мира в контексте обеспечения баланса между общественным интересом и соблюдением прав человека. Отдельный акцент делается на практике исключений из общего правила обязательной вакцинации детей на основе религиозных, философских и других личных убеждений родителей. Анализируется связь между социально-медицинскими мерами, применяемыми странами, освобождением от вакцинации по немедицинским обстоятельствам и уменьшением коллективного иммунитета. Использованы методы исследования: сравнительный метод – сопоставление украинских и зарубежных примеров медико-социальных мероприятий, связанных с вакцинацией детей; статистический метод – для обобщения данных Всемирной организации здравоохранения, Европейского центра профилактики заболеваний по вопросам вакцинации; систематический анализ – выявление имеющихся недостатков и положительного опыта государственной политики по вакцинации детей в мире; лингвокогнитивный анализ – анализ аргументаций судебных решений о роли вакцинации в современных странах и тех социально-медицинских мероприятий, которые разрешаются государствам к применению в аспекте обеспечения прав человека. Делается вывод, что даже незначительное сокращение количества вакцинированных детей, вызванное религиозными и философскими убеждениями родителей, чреваты негативными последствиями для здоровья населения и экономики страны. Поиск баланса прав человека и общественного интереса к вакцинации привел к установлению судебными учреждениями преимущества общественной необходимости над правами человека, что и должно являтся ключевым критерием в выборе государствами медико-социальных мер, связанных с вакцинацией.

რეზიუმე

ვაქცინაცია: სახელმწიფოს სამედიცინო-სოციალური და სამართლებრივი ღონისძიებები

[1]მ.აფანასიევა, [1]ნ.სტოიანოვი, [1]კ.კული-ივანჩენკო, [2]ა.ივანჩენკო, [2]ა.შოტოვა-ნიკოლენკო

[1]ეროვნული უნივერსიტეტი "ოდესის იურიდიული აკადემია"; [2]ოდესის სახელმწიფო ეკოლოგიური უნივერსიტეტი, უკრაინა

სტატიაში შესწავლილია სამედიცინო-სოციალური ღონისძიებები ვაქცინაციის ჩატარებასთან დაკავშირებით მსოფლიოს სხვადასხვა ქვეყანაში საზოგადოებრივ ინტერესსა და ადამიანის უფლებების დაცვას შორის ბალანსის უზრუნველყოფის კონტექსტში. აქცენტი გაკეთებულია სავალდებულო ვაქცინაციის საერთო წესიდან ბავშვებთან დაკავშირებულ გამონაკლისზე, გამომდინარე მშობლების რელიგიური, ფილოსოფიური და სხვა პიროვნული მრწამსიდან.

კვლევის მიზანს წარმოადგენდა კავშირის ანალიზი ქვეყნების მიერ გამოყენებულ სოციალურ-სამედიცინო ღონისძიებებს, არასამედიცინო გარემოებების გამო ვაქცინაციისაგან გათავისუფლებასა და კოლექტიური იმუნიტეტის შემცირებას შორის.

გამოყენებულია კვლევის მეთოდები: შედარებითი მეთოდი – უკრაინის და სხვა სახელმწიფოების მაგალითები ბავშვების ვაქციანასთან დაკავშირებული სამედიცინო-სოციალურ ღონისძიებების შესახებ; სტატისტიკური მეთოდი - ჯანმო-ს, დაავადებათა პრო-

ფილაქტიკის ევროპული ცენტრის მონაცემების განზოგადება ვაქცინაციასთან დაკავშირებით; სისტემატური ანალიზი – არსებული ხარვეზების და დადებითი გამოცდილების გამოვლენა სახელმწიფო პოლიტიკაში ბავშვების ვაქცინაციასთან დაკავშირებით მსოფლიოში; ლინგვოკოგნიტიური ანალიზი – სასამართლო გადაწყვეტილებათა არგუმენტაციის ანალიზი ვაქცინაციის და იმ სოციალურ-სამედიცინო ღონისძიებათა როლის შესახებ სხვადასხვა ქვეყანაში, რომელიც სახელმწიფოს მიერ ნებადართულია გამოყენებისათვის ადამიანის უფლებათა უზრუნველყოფის ასპექტში.

მიღებული შედეგები იძლევა დასკვნის გაკეთების საშუალებას იმის შესახებ, რომ ვაქცინირებული ბავშვების რაოდენობის უმნიშვნელო შემცირებაც კი, გამოწვეული მშობლების მიზეზით და არასამედიცინო გარემოებებით, იწვევს ნეგატიურ შედეგებს მოსახლეობის ჯანმრთელობისა და ქვეყნის ეკონომიკისათვის. ბალანსის ძიებამ ადამიანის უფლებებსა და ვაქცინაციისადმი საზოგადოებრივ ინტერესს შორის გამოიწვია სასამართლო უწყებების მიერ საზოგადოებრივი აუცილებლობის უპირატესობის დადგენა ადამიანის უფლებებზე,რაც უნდა წარმოადგენდეს საკვანძო კრიტერიუმს სახელმწიფოს მიერ ვაქცინაციათან დაკავშირებული სამედიცინო-სოციალური ღონისძიებების შერჩევისათვის.

ПРАВОВАЯ ЗАЩИТА И ОСОБЕННОСТИ ПРИМЕНЕНИЯ ТЕХНОЛОГИЙ ВИРТУАЛЬНОЙ РЕАЛЬНОСТИ В МЕДИЦИНЕ

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Современный научный прогресс обусловил сближение технологий и медицины как никогда ранее в истории человечества. Цифровизация общества постоянно ведет к поискам оптимальных моделей применения современных технологий во всех сферах современной жизни человека, в том числе - медицине. В связи с этим в медицинской практике появилась возможность применять технологии виртуальной, дополненной и смешанной реальности.

Виртуальная реальность это технологии создания искусственных образов и ощущений для человека [32]. Дополненная реальность уже широко используется в сфере здравоохранения и с помощью этой технологии реальный мир «дополняется» виртуальными элементами и сенсорными данными. При комбинировании технологий дополненной и виртуальной реальности имеет место смешанная реальность [12].

В то же время правовое регулирование применения технологий виртуальной реальности в медицинской деятельности является фрагментарным. что приводит к проблеме защиты прав медицинских работников и пациентов.

Материал и методы. В ходе исследования применен системный подход к анализу проблемы виртуальной реальности в медицине, который включает как сравнительно-правовой, так и системный метод. При исследовании использованы научные разработки в области проблем внедрения виртуальной реальности в медицине, а также законодательство в контексте регулирования таких технологий.

Результаты и обсуждение. Внимание ученых и практических врачей привлечено к виртуальной реальности, поскольку известно, что в человеческом мозге нейроны реагируют на виртуальные элементы также как и на элементы реального мира. Поэтому человек воспринимает виртуальную среду и реагирует на происходящее внутри виртуального мира на события точно также как на имеющие место в реальности [13].

Первые попытки создания интерактивных устройств, позволяющих взаимодействовать с имитируемой или дополняющей реальность, были еще в начале XX века. Сазерленд И. [27] еще в 1965 году предложил концепцию «предельного показа» (the ultimate display), в которой описывался кинестетический дисплей. Данная концепция и заложила начало виртуальной реальности. Хотя, следует отметить, что «отцом виртуальной реальности» считается Хейлиг М., который запатентовал в 1962 году машину «Sensorama» - симулятор, который создает иллюзию реальности с помощью трехмерного движущегося изображения с запахом, стереозвуком, вибрациями сиденья и ветром в волосах для иллюзии [25]. М. Хейлинг также впервые изобрел головное устройство стереоскопического телевидения в форме очков. Устройство создавало ощущение периферийного зрения и передавало запахи и звуки [26].

Виртуальная реальность расширенной формы создает взаимосвязь между человеком и компьютером, которая позволяет пользователю взаимодействовать и погружаться в генерируемую компьютером среду естественным образом [19]. Сама система виртуальной реальности, как правило, состоит из: программного обеспечения для построения базы данных и моделирования виртуальных объектов; инструмента ввода (трекеры, перчатки или пользовательский интерфейс) системы графического рендеринга (визуализации) инструмента вывода - визуального, слухового и тактильного, сенсорных стимулов виртуальной реальности с использованием различных форм технологии визуального отображения, объединяет компьютерную графику в реаль-