

# 54<sup>th</sup> Days of Preventive Medicine

International Congress

27-30. September 2022.

Niš, Serbia



## BOOK OF ABSTRACT



Public Health Institute Niš



Faculty of Medicine,  
University of Niš



Serbian Medical Society

Niš, 2022.

*122 years of Public Health Protection in Serbia  
from regular preventive activities  
to great challenges in COVID-19 pandemic time*

*122 године заштите јавног здравља у Србији  
од редовних превентивних активности  
до великих изазова у време пандемије COVID-19*

**PUBLIC HEALTH INSTITUTE NIŠ  
FACULTY OF MEDICINE, UNIVERSITY OF NIŠ  
SERBIAN MEDICAL SOCIETY, NIŠ**

**54<sup>TH</sup> DAYS OF PREVENTIVE MEDICINE  
INTERNATIONAL CONGRESS**

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Prof. dr Miodrag Stojanović

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- **Current parasitosis**
- **Theoretical and practical problems of communicable diseases**
- **Theoretical and practical problems of non-communicable diseases**
- **Health promotion – challenges and solutions**
- **Preventive aspect of healthcare organization**
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**PLENARY SESSION****122 years of health care in Serbia - from regular preventive activities to major challenges during the COVID-19 pandemic**

Prof. dr Miodrag Stojanović  
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After several years of struggle and great effort, on December 25, 1900, at the initiative of Colonel Dr. Mihajlo - Mika Marković, the first Royal Military Pasteur Institute in Serbia and the Balkans was founded, the forerunner of today's preventive health institutions. The Institute started its work on June 7, 1900 in Nis, only 15 years after Paris, 14 years after Moscow, Petrograd and Odessa and 10 years after New York and Chicago. At that time, the small and underdeveloped, poor country of Serbia, which had even more than 80% of the illiterate population, was classified as a modern country. This was a big step towards the real development of modern health care and raising the health culture of the people.

During that period, in Serbia, as well as in the entire Balkans, rabies, transmitted by dogs, was prevalent. The new institution in Niš was preparing "anti-rabies emulsion" for preventive pelting against rabies in the Department for the preparation of "animal lymph". Lymph was also prepared for vaccination against smallpox, and during the year 1900, 11,540 recruits were vaccinated with homemade lymph against smallpox. At the end of the same year, the first civilian patients with the bite of a rabid wolf arrived in Nis for treatment, people from the village of Čačanski srez. Until the opening of the Institute in Niš, people bitten by rabid animals, most often dogs, were sent alone or with a companion to the Pasteur Institute in Pest for treatment. There were between 100 and 200 such patients, half of whom were children.

In the first years of work, the institute gave enviable results: between 200-300 patients were vaccinated annually, in the first 4 years 1140 patients, mostly injured by dogs, including 9 injured by wolves, of which 7 died, and the mortality rate was comparable to other institutes in the world, which was a recognition of the quality of the Institute's work.

After 1904, the Pasteur institute expanded its activities, and the bacteriological department and the disinfection department began to work, and the first disinfection course was held. In 1915, the bacteriological department of the Pasteur Institute was preparing a tetravaccine and worked more on bacteriological diagnoses. The number of patients treated in the first 14 years of its work, from 1901-1915, totaled 8,649 or an average of 617 persons per year. According to the statistical yearbook of the Kingdom of Serbia and the data presented at the first congress of doctors and naturalists organized by the Serbian Medical Association, the death rate from rabies was 0.77%, and compared to the lowest death rate in Paris at 0.47%, our Institute was then ranked among the most developed health institutions in Europe.

After the First World War, the Pasteur Institute began its activities as a civilian institution. Under the leadership of the newly opened Ministry of Public Health, the Pasteur Institute with its then manager Dr. Gerasimos Alivizatos, began thorough work on the fight against the growing threat of rabies, and during that period developed its own method for the treatment of rabies, which was called the Alivizatos Ether method or the Mixed method .

On October 14, 1923, the Pasteur Institute grew into the Epidemiological Institute in Nis, which expanded its activities. As a competent scientific and professional institution, it has taken upon itself the fight against all infectious diseases using vaccines against intestinal infections, which were made according to the method of Dr. Alivizatos. As early as 1926, the institute changed its name to the Institute of Hygiene, the first of its kind in the Kingdom of Yugoslavia. It began to significantly expand its activity, so that in the following years it became a strong hygienic-anti-epidemic, sanitary-chemical, sanitary-technical and health-educational institution, which, in addition to fighting infectious diseases, began to change unfavorable hygienic conditions,

especially among rural population. It became the Institute of Hygiene in 1926 (this is the name that is still used most often in everyday speech).

In the 1930s, the Institute of Hygiene had several departments: Bacteriological-serological, Anti-rabies, Chemical, Sanitary-technical, and the Department for Medical Statistics, from which all further social-medical activities would originate. The merits of the Institute from that period include the construction of the long-awaited water supply system in Niš, but even more than that, the development and operation of the first Antituberculosis dispensary in Niš. Such a successful period of work between the two wars can be explained by the exceptional engagement of all employees, who combined the achievements of modern preventive medicine in the world with their own scientific research work. The quality of the work of the Institute of Hygiene in Niš is also shown by the data on the visits of numerous health workers from all over the world. These were mostly doctors with scholarships from the League of Nations, the Rockefeller Foundation or the World Health Organization. The purpose of their stay at the Hygiene Institute in Niš was to familiarize them with the organization and work of our health service, which was a model on a global scale.

In 1979, the Institute for Health Protection grew into the Institute for Health Protection in Nis, and from February 10, 1998, it grew into the Institute for Health Protection in Nis. From 27.12.2006 the Institute for Health Protection becomes the Public Health Institute Nis.

In recent history, the key year in the work of the Institute was 1960, the year the Faculty of Medicine was founded, when the Institute of Hygiene became a teaching base, and thus received a significant boost, in the scientific and professional sense. After the establishment of the Faculty of Medicine, and in a period of cultural, health, political and economic expansion, but also a very unfavorable epidemiological and hygienic situation in the south of Serbia, the initiative of the Institute of Epidemiology of the Institute for Health Care in Nis came to organize an expert meeting in the field of preventive medicine.

The idea for holding this meeting was presented by two teachers of the Faculty of Medicine in Niš - it was a preventive-clinical symbiosis, a joint plan of prof. Dr. Mladen Simić, epidemiologist, and prof. Milorad Stojšić, Ph.D., a clinical infectious disease specialist, was realized already in the same year, 1965, as the first gathering under the name "Days of Preventive Medicine for General Practitioners". The official organizer was the Serbian Medical Association", that is, "Active for Preventive Medicine SMA" - Branch in Niš. It was a modest professional meeting of a local character, hastily prepared, at which a total of 8 (eight) professional papers were referred, with about twenty participants, half of whom were authors - epidemiologists. The meeting lasted 2 days, October 2 and 3, with few presentations, but with a lot of discussion.

Since 1971, this meeting was no longer intended only for "general medicine doctors", but evolved into a professional meeting of preventive medicine doctors and other specialties interested in preventive work. Over time, the "small provincial expert meeting of a local character" grew into a scientific meeting with international participation, that is, an international scientific meeting.

Apart from 1967 and 1973 when the meeting was not held, the period of the 2020 and 2021 COVID-19 lock-down was the longest break in the existence of this international congress. Even after almost six decades of existence, the "Days of Preventive Medicine" remain a meeting that enables the exchange of knowledge and experiences and the acquisition of new skills in the daily struggle to preserve and raise the level of health of the population.

Today, the Institute has 6 centers where 215 employees work, 58 doctors of medicine, 26 doctors of science, 6 regular, 9 part-time professors, 7 docents and 2 assistants. In addition, we have the privilege that the Dean of the Faculty of Medicine in Niš is from among the professors of the Institute of Public Health Niš, which is another confirmation of the quality of our work and the importance of preventive medical branches. The institute is certified and accredited according to the ISO 9001 and ISO 17025 standards, and the results of the certification and accreditation commissions' checks are getting better every year. The position of the management and all employees is to permanently invest in equipment and follow modern world trends, and to invest in further education and advancement of all employees, without which daily work would not be possible.

During its long period of existence, the Institute encountered many challenges in the field of public health and found ways to overcome and solve all obstacles and problems. It successfully fought the epidemics of rabies from the beginning of the twentieth century, typhoid, diphtheria, smallpox, measles, swine (H1N1) and bird flu (H5N7) and others. However, one of the biggest remains the current epidemic of COVID-19, with all its consequences for public health.

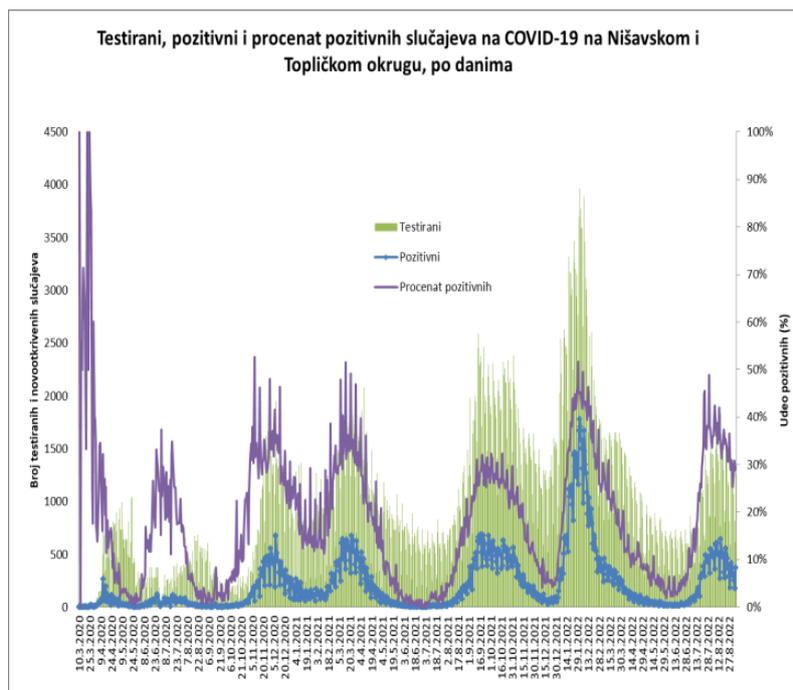
Unfortunately, the Niš Public Health Institute was of great importance in the current fight against COVID-19. From the moment the first case of this virus appeared in Serbia, it engaged in the fight against the epidemic by engaging all his resources. Sampling for PCR testing for Covid-19 in the territory covered by the activity of the Institute for Public Health Nis started on February 26, 2020. year, and the first positive cases were recorded on March 10. The samples were initially processed exclusively at the Torlak Institute, and from March 28, the National Reference Laboratory in Batajnica, the PHI Niš laboratory and the Veterinary Institute in Niš began to perform analyses, and from April 18, the Faculty of Medicine laboratory.

After only 3 months of preparation and construction, on July 30, 2020, the laboratory for molecular detection of infectious agents "Vatreno oko 2" ("Fire Eye 2") was opened, a unique diagnostic laboratory that enabled the testing of a large number of patients, and which has been working continuously since its opening, 365 days a year. The laboratory is a donation from the Chinese institute BGI under the auspices of the Government of the Republic of Serbia and the company Zijin. The laboratory is the second such in Serbia, next to "Vatreno oko 1" in the Clinical Center of Serbia in Belgrade. The total area of the laboratory is 790 square meters, of which 450 square meters are under the so-called controlled negative pressure, which prevents the infectious agent from leaving the laboratory. Including the protective equipment worn by personnel, the Fire Eye 2 laboratory is BSL -3 (biosafety level 3). Within the "Vatreno oko 2" Niš laboratory, there is also a laboratory for serological diagnostics.

The National Laboratory for Molecular Detection of Infectious Agents Vatreno oko 2 Niš started operating on July 31, 2020. The capacity of the laboratory is 2000 samples per day. The laboratory has state-of-the-art equipment including two MGISP-960 automatic systems for isolating viral RNA from samples and 4 LineGene 9600 Plus Real-time PCR machines. Since the beginning of the work of the laboratory, 451,263 samples have been processed. In the last quarter of 2021 81287 analyzes were performed, and the record number was 2000 on 01.27.2022. with 984 positive results, that is, 2254 analyzes on February 8, 2022, with over 1000 positive results for the SARS-Cov-19 virus. In January 2022 alone, 38,088 analyzes were performed, which is a record number of analyzes performed in one month. During this entire period, only during four days there were no positive results, namely at the end of July and the beginning of August 2022. A total of 852,388 samples from the territory covered by the Nis Public Health Institute were analyzed until September 5, 2022, of which 190,521 (22.35%) were positive. In 2020 alone, the Institute's call center made over 25,000 calls and provided consultative assistance in over 5,000 cases. 17,161 people tested positive for SARS-Cov-2, 22,000 of their contacts were placed in self-isolation, and 139,737 tests were performed using the PCR method, of which 18,585 were positive. 47,580 people (16,003 positive) were tested with the antigen test. In 2021, 72,330 Covid-19 + persons were registered, 48,019 contacts were quarantined, 41,066 PCR tests and 211,555 antigen tests were performed. In 2022, 60,016 cases of Covid-19 positive persons were reported, 5,395 persons were placed under medical supervision, 40,767 PCR tests and 142,525 antigen tests were performed, as of March 2022.

Chart 1 shows the trend in the number of tested, positive and percentage of positive cases in the territory of Nišava and Toplica districts since the beginning of the pandemic. Two smaller waves are observed in April and July 2020 and five large waves, the first of which in November and December 2020, the second from March to April 2021, the third from September to November 2021, the fourth from January to April 2022 and the fifth wave that started in July 2022.

Chart 1: Movement of the number of tested, positive and percentage of positive cases for SARS-Cov-2 in the territory of Nišava and Toplica districts



At the same time, the Institute for Public Health Nis performed all its usual activities. In contrast to other institutions of this type, microbiological examinations, analyzes of the quality of water, food, social nutrition and items of general use were carried out unhindered and continuously, activities related to health promotion took place, and the work of the epidemiological service continued unhindered.

Of great importance in the fight against the SARS-Cov-19 virus was the DDP service of the Institute, which worked overtime for months visiting a large number of institutions of public importance, thus enabling safe work. Since the beginning of the COVID-19 epidemic, more than 1,563,870 m<sup>2</sup> of surfaces have been disinfected, and more than 1,000,000 m<sup>2</sup> during 2020, 548,870 m<sup>2</sup> in 2021 and 15,000 m<sup>2</sup> (UCC Niš, Institute of Niška Banja, social welfare institutions) until 30.06.2022. This includes premises owned by the city of Niš (schools, kindergartens, markets, city administration, secretariats, etc.), the municipalities of Aleksinac, Kuršumljija, Merošina, permanent and temporary Covid hospitals, institutions for the elderly, disabled and other social protection institutions, and more.

Antirabična stanica je i dalje funkcionisala kao i pre pandemije. Sanitarni pregledi su mogli da nastave sa radom nesmetano tokom cele pandemije, za razliku od drugih zavoda gde su sanitarni pregledi bili potpuno obustavljeni, pa je posle ukidanja vandrednog stanja pritisak na službe bio znatno veći i duže trajao.

In addition to all regular activities, we also hosted a Chinese delegation that toured Vatreno oko 2 and we opened the doors of the Pasteur institute, the museum of the history of medicine, and introduced them to the rich history of our Institute.

From 25.12.2022, vaccination started in the Niš region. Vaccination and vaccine distribution is nothing new to the Institute of Public Health, but what a logistical nightmare it was to distribute the vaccine for COVID-19 only those who were directly involved in it know. For the first time, we encountered vaccines that must be kept at -70°C. In addition to special freezers, this also requires special handling of the vaccines themselves, transport, portable transport refrigerators, speed of work and other things. The personnel involved had to undergo training and follow all measures regarding the distribution of the vaccine, which had never been so rigorous before. From December 2020 to September 2022, over 630,000 vaccines were successfully administered in various institutions. Most of the vaccinated opted for Sinopharm, slightly less for Pfizer, while the other vaccines were given significantly less. The response was good even for the second dose, while it was drastically lower for the third and fourth one.

We are faced with the great task of preserving the health of the population during the pandemic, a task that we did not fight alone. The Public Health Institute Niš owes special thanks for the cooperation and help in the fight against COVID-19 not only to the medical staff, but also to the Government of the Republic of Serbia, the Ministry of Health of the Republic of Serbia, the Ministry of Internal Affairs, the Security and Information Agency, the Ministry of Defense of the Republic of Serbia, Republic Health Insurance Fund, Institute for Public Health of Serbia "Dr. Milan Jovanović Batut", Torlak Institute, Border Police Administration, Niš City Assembly, Mayors and leaders of Niš municipalities, Niš City Inspectorates, University Clinical Center, Niš Health Center, Military Hospital in Niš, Institute for Health Protection of Workers Niš, Institute Niška Banja, Institute for Emergency Medical Aid Niš, Faculty of Medicine Niš, Veterinary Specialist Institute Niš, Institution "Mara", as well as "Car Konstantin" Airport in Niš, without whose unreserved help it would be impossible to implement all activities in the fight against the epidemic of COVID-19.

The emergence of the COVID-19 pandemic has changed the world. It would be good if COVID-19 managed to unite it, because it should function according to the same principles and act together in the challenges that are put before it. Now, more than ever, we need the cooperation of medical workers, scientists, those who lead countries and make decisions, and the population as a whole. After the appearance of the Spanish Flu, the world responded by forming the World Health Organization, so the question arises whether the appearance of this pandemic will lead to the creation of something new, greater, which would improve health and the fight for it to a higher, better level. The Institute for Public Health Nis is proud of the fact that it adequately responded to the challenges that were put before it and will continue to work and fight for the health of the population in the days and years ahead of us.

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## **Strategy and Implementation in Healthcare for Pandemic Preparedness and Response**

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The WHO constitution states: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." Well-being is facing huge challenges today as we see how a pandemic threaten individuals' lives causing economic losses and social disruption, emerging and/or re-emerging in unpredictable regions and unpredictable times.

It is essential to consider the strong correlation from the above elements when dealing with pandemic preparedness and response. It is particularly notable that the incubation time of a vector-borne infective agent within its vector organism is typically very sensitive to climate change, usually displaying an exponential relationship with for example level of precipitation, sea level elevation, wind and sunlight. For centuries humans have known that climatic conditions affect epidemic infections well before the basic notion of infectious agents was understood late in the nineteenth century. The Roman aristocracy for instance took refuge in their hill resorts each summer to avoid malaria.

The introduction of antibiotics and vaccines in recent decades has probably inspired an optimistic view of our ability to eliminate or even eradicate specific diseases. But new and old diseases (influenza, cholera, tuberculosis, malaria, etc.) continue to invade communities causing illnesses and mortality worldwide. So if the incidence of a communicable disease is the resultant reaction of an infective agent and a susceptible host in a favorable environment what are we doing to contrast the environmental degradation in fact? Efforts directed at the control of communicable diseases need to take into account a wide range of social factors that explain emergence, determine transmission, affect control efforts and therapy, and facilitate or contrast preventive measures. Such social factors range from behavior of individuals as it influences transmission dynamics to large-scale social factors as they shape the epidemiology for preparedness and response.

There is a two way interaction between economy and Communicable disease: the incidence of the disease affects labor supply and investment in health capital affects the capacity to contrast the disease and therefore the incidence of the disease. Being prepared and being able to respond require strong coordination/cooperation across many stakeholders from different sectors. In the absence of good governance, opportunities are created for disease to emerge or re-emerge, while at the same time, an effective response is delayed. Failures in coordination/cooperation result in huge challenges for political legitimacy. Only well-planned and well-resourced systems can protect us from a pandemic. These systems should be organized by means of equity and sustainability by adopting the SMARTTEST approach: Specific, Measurable, Achievable, Relevant, Time Based (SMART) turns to Specific, Measurable, Achievable, Relevant, Time Based, Environmental/Equitable, Sustainable, Team-builder approach (SMARTTEST).

**SESSION: ENVIRONMENT AND HEALTH****INVITED LECTURES:****1. INSPECTION SURVEILLANCE AT THE TIME OF THE COVID-19 PANDEMIC IN SERBIA**

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Mirjana Veljković, B Scing Technology, Head of the Department of Border Sanitary Inspection  
Rasa Milanov, PhD, Border Sanitary Inspector - coordinator in the Department of Border Sanitary Inspection

The new coronavirus that appeared in 2019 was called SARS-CoV-2. It was discovered in China at the end of 2019. It is a new strain of coronavirus that had not been discovered in humans before. The disease caused by that virus is called COVID-19.

Given that it was a unknown form of the virus, as well as the absence of precise scientific data about it, it caused a certain apprehension and panic fear of this disease and mistrust among people around the world. There were many questions that needed to be answered: what are the most common symptoms, are some people at a higher risk of getting sick than others, what are the best methods of treatment, how to protect yourself and how to avoid infection, where to get tested, how to behave if you were in close contact with a person suffering from this disease, which vaccine is the most effective, should you get vaccinated, etc.

Big challenges faced the Ministry of Health. It was necessary to organize all services in the shortest possible time in the best way so that the entire health care system could cope with the new situation.

Work in emergency situations is not new for the inspection services of the Ministry of Health, and above all for the sanitary inspection. With all the available resources, we responded to all the tasks and challenges we encountered during the state of emergency, as well as after it.

In addition to regular and extraordinary inspections, through the coordinated work of the inspection services in the supervision of compliance with all prescribed anti-epidemic measures to prevent the spread of the infectious disease COVID-19, as well as a large number of held educations and participation on various platforms, the sanitary inspection of the Ministry of Health makes a huge contribution to raising awareness and knowledge about this disease.

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4. Regulation on measures to prevent and suppress the infectious disease COVID-19 ("Official Gazette of RS", Nos. 151/20, 152/20, 153/20, 156/20, 158/20, 1/21, 17/21, 19/21, 22/21, 29/21, 34/21, 48/21, 54/21, 59/21, 60/21, 64/21, 69/21, 86/21, 95/21)
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6. Decision on lifting the state of emergency ("Official Gazette of RS", No 65/20)
7. Instructions on the method of applying restrictions on entering the Republic of Serbia for persons coming from countries affected by the epidemic of the infectious disease COVID-19 ("Official Gazette of the RS", No 69/21)
8. Instructions on the method of applying restrictions on entering the Republic of Serbia for persons coming from countries with a special risk of the infectious disease COVID-19 ("Official Gazette of the RS", No 69/21)

9. Decision on the formation of the Crisis Staff for the suppression of the infectious disease COVID-19 ("Official Gazette of the RS", No 132/20)
10. Decision on the formation of the Working Group for the coordination of activities and determination of the needs of microbiological laboratories in public property that perform laboratory tests for the presence of the SARS-CoV-2 virus ("Official Gazette of the RS", No 104/20)
11. Rulebook on preventive measures for safe and healthy work to prevent the occurrence and spread of infectious disease epidemics ("Official Gazette of RS", No 94/20)

## 2. BREATHE IN AND REMEMBER. ALZHEIMER'S DISEASE AND AIR POLLUTION

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The connection between cardiovascular and pulmonary disorders on the one hand and air pollution on the other, is well-known and a widely accepted fact. Increasing evidence shows also adverse effects of air pollution on cognitive function and neurological diseases, as Alzheimer's disease (AD) and Parkinson's disease (PD). AD, as the most prominent neurodegenerative disease, affects nearly 50 million people worldwide and is predicted to reach 135 million people by 2050. Given these high incidences, it is of great importance to discuss the link between air pollution and neuroinflammation as well as AD, respectively.

The most important air pollutants increasing risk of AD that have to be considered: particular matter (PM), ozone (O<sub>3</sub>), diesel exhaust particles (DEP), nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOT), cigarette smoke and carbon dioxide (CO<sub>2</sub>). Studies suggest that especially increase of PM is strongly relevant for the central nervous system (CNS) and is present in the urban air as the mixture of liquid droplets and solid particles of different sizes (aerodynamic diameter (diameter from 2.5 to 10 μm), fine particles (diameter <2.5 μm) and ultrafine particular matter (diameter <0.1 μm). An increase per 11 ppb of O<sub>3</sub> concentration, can more than double the risk AD. Ozone can reach brain using two main mechanisms, through inhalation, directly through bloodstream but also through production of reactive oxygen species (ROS) that cause oxidative stress. Air pollution has also been show to exert changes in DNA methylation, histone acetylation or/and micro RNA expression. Air pollution plays an important role as the pro-inflammatory stimulus to the CNS. Entry of the air pollutants into the CNS happens mainly using two pathways: nasal pathway and respiratory intake. Regardless of the route of entry, PM is mostly responsible for triggering of the release of soluble inflammatory mediators (TNFα, IL-1β, IL-6 etc.). PM intake causes pro-inflammatory signals in peripheral tissues giving rise to systemic cytokine response that transfers inflammation to the brain. The cytokines disrupt the blood-brain-barrier (BBB) or trigger signalling cascade that leads to mitogen-activated protein (MAP) kinase, and nuclear factor kappa B (NFκB) transcription factor pathways. Astroglia, brain capillaries, and microglia respond to the air pollution components over the additive/synergistic interaction of multiple pathways, which can be linked to PD, AD and other neurological disorders.

Data suggest very strong influence of air pollution on development and prevalence of neurodegenerative diseases. There is an urgent need for the society to include measures to contribute to better air quality. Actual data of air pollution for Nis and Duesseldorf will be presented.

### **3. OUTDOOR AIR QUALITY IMPACT ON THE CITY OF NOVI SAD POPULATION HEALTH DURING COVID-19 PANDEMIC**

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Objective: Air pollution health risk assessment in the City of Novi Sad using the air pollution scenarios associated with COVID-19 related state of emergency and two others. Methods: Daily air quality data (nitrogen dioxide, sulfur dioxide, ground-level ozone and particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) in Novi Sad during the COVID-19 related state of emergency in 2020 (lockdown) in Republic of Serbia (RS), as well as pre-lockdown period and same period in previous years, were analyzed. Using the AirQ+ software, with PM<sub>2.5</sub> data (during COVID-19 related state of emergency, the same period of the previous and the following year) and total mortality data, health effects was estimated. Results: It is recognized concentration reduction in all analyzed air pollutants, except of ozone. The actions taken to prevent the spread of the COVID-19 disease in the RS, during lockdown, made it possible to quantified the number of premature deaths associated to air pollution that can be avoided with different air pollution scenario than usually in the City of Novi Sad. Conclusion: Scenario of air quality during lockdown, which was unexpected spotted by all activity during pandemic COVID-19, bring the opportunity that could be used for improving the air quality management and human health.

Key words: Air Pollution, Environment, COVID-19, Health Impact Assessment

## INTERNET USE DURING THE COVID-19 PANDEMIC

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### Introduction

World Health Organization (WHO) declared the begging pandemic on 11 March 2020 (1-3). The coronavirus disease of 2019 (COVID-19) pandemic is, in number of ways, specific. In order to protect the health of the populations and restrain the spread of the infection, many European countries have introduced containment measures, including physical distance, quarantine and isolation. Activities such as keeping remote social contacts with friends/families in order to reduce psychological impacts of isolation, access to entertainment and even access to sources supporting physical exercise are performed through information and communications technology (ICT). Moreover, maintaining such activities using ICT is a strategy recommended by the WHO in the time of pandemic (4). In accordance with these recommendations, it has been expected that populations would be able to receive the necessary health information, work or study from home using ICT. Increased use of social networks has also been anticipated. The increased use of Internet technologies is presumably directed towards compensating for the lack of direct, real-life communication. The Internet usage during the pandemic has taken on a new dimension.

Social networks allow users to share publicly or semi-publicly (in a selected group) their contents, contents from other sites, photos, or to join different groups according to their interests. They also allow them to play games, to shop, or to find the information of interest. In addition to these favourable aspects of social network use, a large body of research speaks of their detrimental impacts (5). For instance, Instagram is a social network with the fastest growth in the number of users (6), which may speak in favour of its addictive potential. TikTok, a social network, whose use has not been part of any major research so far, could also be added to the list.

In addition to social networks, the Internet provides number of contents that could have negative consequences for health. Persisting in these behaviours in moderate and controlled ways, especially during the pandemic, is an imperative.

It is to be noted that monitoring the use of the Internet was the subject/topic of many studies over a few decades before the pandemic. Although the latest recommendations on Internet use underline the proven harmfulness of some contents and online activities, especially playing online games (7), there is still a lot of ambiguity and doubt regarding the Internet use. Therefore, research into Internet use during the pandemic poses a challenge of specific importance and value for researchers.

Bearing in mind the previous studies (8,9), it is to be expected that the increased Internet use may have both positive and negative implications, in terms of better quality of life (contents such as health, culture, education, business, computers and technology, sports, science, arts, politics) on the one hand, and addictive potential (Instagram, sexual contents, etc.) on the other hand. As the Internet use is expected to be expended or even encouraged by the regulations, assessing its implications may be of particular value in general population or even more in special populations. Various studies have shown the impact of COVID-19 pandemic on mental health, identifying that people with a strong fear of getting infected are more prone to become stressed, depressed, anxious and to experience sleeping disturbance. However, few studies focused directly on the impact that the use of the Internet during the pandemics has on sleeping disturbances. The foregoing analysis contributed to make researchers examine primarily the use of the Internet during the pandemic: how much is the Internet used, which contents are browsed more frequently since the pandemic has been declared as well as which activities are mostly present on the Internet. The next step would be to correlate the use of the Internet with the impact on the quality of life and the quality of sleep. *The aim of our study was to investigate the Internet use during the pandemic. Our secondary aim was to examine if quality of life and sleep during the pandemic can be predicted by Internet-related variables.*

**Methods and materials:** This cross-sectional study is a part of a wider international multicentre research. The study was approved by the Ethics Committee of the Clinical Centre of Serbia and the Board of Clinic of Psychiatry, of the Clinical Centre of Serbia. The study included 3330 participants (71.1% of females, the average age was  $40.78 \pm 12.21$  years). The participants filled in an anonymous online self-report questionnaire, comprising the following: 1) socio-demographic questionnaire; 2) questionnaire on the Internet use during the pandemic (designed for the purpose of this study), assessing whether 7vedr/ participants had more frequent use of the Internet, and performed any of the online activities more (e.g., playing online games, using Instagram, Facebook), or browsed more any of the Internet contents (e.g. sexual contents) during the pandemic; 3) the Insomnia Severity Index (ISI); 4) the COVID-19 - Impact on Quality of Life (COV19-QoL) scale. Multivariate linear regression was used to produce two models, with COV19-QoL during the pandemic and the ISI score as outcomes, and Internet-related variables as predictors.

### Internet Use During the Covid-19 Pandemic

Around two thirds of the sample (70%) reported using the Internet more during the pandemic, and more than 10% of participants spent over 8 hours on Internet daily. Average time spent on the Internet was  $4.81 \pm 3.44$  hours. The descriptive parameters of the Internet use since the pandemic among participants are presented in Table 1 and Table 2.

**Table 1.** Percentage of participants who used more any kinds of the Internet activities during the pandemic

Activity	%
Chatting	43.0
Surfing	50.7
Playing online games	16.4
Downloading various contents (books, music, paper)	39.2
Internet for studies/school/work	59.8
Attending online courses	28.6
Using Instagram	36.7
Using TikTok	6.5
Using Facebook	37.9

**Table 2.** Percentage of participants who browsed more each of the Internet contents during the pandemic

Content	%
Health and medicine	64.1
Sports	11.5
Science	33.2
Politics	42.5
Contents specific for COVID-19	49.3
Sexual contents	10.8
Pop culture	19.3
Business	12.3
Computers and technology	10.8
Arts and culture	34.4
Education	34.1
Music	39.9
Travel/tourism	25.0
Religion	8.1

The most prevalent activities on Internet, that participants engaged in more during the pandemic, were Internet for job/school/studies, surfing, chatting, downloading various contents (books, music, paper), using Facebook and Instagram, whereas TikTok, online gaming and taking educative online courses were the least present in

the sample. When it comes to specific Internet contents browsed more since the pandemic by participants, health and medicine and contents specific for COVID-19 were the most prevalent. Although it was expected that the largest number of participants would use the Internet more than before the pandemic, it is interesting to note that the increased use of the Internet above all refers to activities leading to the decrease of stress and whose purpose is to entertain. On the other hand, it is logical that the highest percentage of information browsed on the Internet is related to health and tracking information about COVID-19. In a paper published at the end of the first wave (10), we conducted a series of multivariate logistic regression models with Internet variables as outcomes as gender, age, marital status, previously diagnosed psychiatric disorder, and the total time spent on the Internet per day as predictors. The regression model of spending over 8 hours per day on the Internet, and using the Internet in general more during the pandemic as outcomes, included the beforementioned socio-demographic and psychiatric variables as predictors. Our results demonstrated that younger participants used the Internet more, were chatted, surfed, played games, downloaded different contents, used the Internet for studies, attended online courses, used Instagram, Facebook and TikTok more and browsed sexual and politics related contents more since the pandemic. Older participants were more engaged in browsing sports, health and medicine, computers and technology, as well as music and education related contents. Women were more prone to downloading different contents, music, books, surfing, using the Internet for work and school, and using Instagram, Facebook and TikTok. In addition, they were browsing contents related to sports, science, politics, business and computers more. Men were more likely to play games, browse general health and medicine as well as contents specific for COVID-19, sexual contents, arts and culture, and education. Those who were married were more likely to browse arts, music and play games, whereas single participants searched more for the contents related to COVID-19 and health, and downloaded various texts, articles, books and music. Spending over 8 hours per day on the Internet was predicted by younger age, male gender, and being single. Reporting a previously diagnosed psychiatric disorder was a significant predictor of greater Instagram use, browsing sexual and sport related content since the pandemic.

### How do Internet-related variables affect the quality of life and sleep during the pandemic

A high percentage of our participants reported sleeping problems during the pandemic. On the ISI scale, only 6% didn't have any sleeping problems, whereas 61% had subclinical insomnia. Around one quarter of test subjects (25.2%) has a moderate severity insomnia, while 7.8% has severe clinically manifested insomnia. This data is disturbing. Similar results have been revealed in worldwide research (11). The average score on the scale COV19-QoL was  $2.35 \pm 0.99$ . If we consider the fact that the minimum score on this scale is 1 and the maximum 5, we come to the conclusion that our test subjects have reported the high negative impact of the current pandemic on the quality of life and sleep. In order to examine the use of the Internet on the quality of life and sleep during the pandemic, multivariate linear regression was used to produce two models, with COV19-QoL during the pandemic and the ISI score as outcomes, and Internet-related variables as predictors.

**Table 3.** Model of multivariate linear regression and COV19-QoL score during the pandemic as a dependent variable

Independent variable	B	p
1. Gender (woman 1, man 2)	-0.231	<b>0.000</b>
2. Gaming	0.091	<b>0.051</b>
3. Use of Instagram	-0.071	0.088
4. Use of FB	-0.099	<b>0.011</b>
5. Sexual contents on the Internet	0.177	<b>0.004</b>
6. Hours spent on Internet	0.323	<b>0.000</b>
7. Internet used more than before the pandemic	0.323	<b>0.000</b>
8. Age	0.002	0.188

The whole model represented in Table 4 is significant and explains 6.1 % of the variance. Statistically significant predictors with higher score on the scale which measures the quality of life during the pandemic

are female gender, gaming, the lack of use of Facebook, browsing sexual contents, more time spent on the Internet.

**Table 4.** Model of multivariate linear regression and the ISI score as a dependent variable

Independent variable	B	p
1. Gender	-0.945	<b>0.000</b>
2. Gaming	0.228	0.384
3. Use of Instagram	0.130	0.561
4. Use of FB	0.203	0.331
5. Sexual content on the Internet	1.848	<b>0.000</b>
6. Hours spent on Internet	0.198	<b>0.000</b>
7. Internet used more than before the pandemic	1.122	<b>0.000</b>
8. Age, kontinualna	-0.005	0.549

As we can see in Table 4, higher insomnia severity was predicted by female gender, browsing sexual contents, more time spent on the Internet and generally increased use of the Internet. This model is also statistically significant and explains 5.8% of the variance

The fact that more time spent on the Internet has worse impact on the quality of life and sleep is disturbing. Other research as well implicate the decline of the quality of life (12). However, even before the pandemic, research imply that problematic Internet use may have the negative impact on general health, especially mental health, which results in worse quality of life. Behaviours such as gambling, video gaming, TV series watching, pornography watching, or surfing the Internet are often used to reduce stress and anxiety and to alleviate depressed mood. These potentially addictive behaviours may help alleviate stress of everyday life (often reflected as “escapism”) and avoid problems and difficult thoughts (13-16). Let us revise the fact that both models refer only to behaviours on the Internet and explain a relatively small percentage of the variance, although they are statistically significant. This tells/shows us that many other factors have an impact on the quality of life as well as on the quality of sleep. Sexual contents browsing and gaming have been recognized as highly addictive since a long time ago. They have been also recognized before the pandemic. The particularity of the use of the Internet during the pandemic is the fact that people who used Facebook had a better quality of life. This positive social medias’ impact has been discussed a lot in several articles (17). Nevertheless, the number of test subjects who reported sleeping disturbances has been surprising. That could lead to another health issues, among which are decreased immunity and lower working ability.

One of our conclusions would be that the use of the Internet during the pandemic demonstrates certain particularities. There are however some regularities that continued to exist during the pandemic. The findings of this study speak in favour of the negative association between the general and specific use of the Internet on the one hand, and the quality of life and sleep during the pandemic, on the other. These findings may have important implications for both prevention and further research.

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## **ORAL PRESENTATIONS:**

### **1. HAND HYGIENE: A COVID-19 PERSPECTIVE**

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The significance of hand hygiene has been brought into focus following the coronavirus (COVID-19) pandemic. Objective of this work is to highlight the hand hygiene role during the COVID-19 pandemic. **METHODS:** A review of the literature was conducted using PubMed and own experiences were presented. **RESULTS:** Frequent handwashing with soap and water and the use of alcohol-based hand rub is recommended by WHO as the most effective strategy to prevent the spread of COVID-19. SARS-CoV-2 was inactivated more rapidly on skin surfaces than on other surfaces. The 9-hour survival of SARS-CoV-2 on human skin may increase the risk of contact transmission. Hand drying after washing is important in controlling the spread of microorganisms and maintaining healthy skin integrity. Alcohol-based sanitizers are less likely to cause irritant contact dermatitis than handwashing. Use of emollients in combination with alcohol-based sanitizers allows for effective hand hygiene without irritating the skin. **CONCLUSION:** The COVID-19 pandemic does not necessarily improve hand hygiene levels. Effective control of SARS-CoV-2 in hospital conditions was achieved by institutions where protocols and logistical support for hand hygiene were developed. Ongoing efforts is needed to ensure high hand hygiene levels.

**Key words:** Hand hygiene; pandemic; COVID-19

## **2. CONSUMER FOOD SAFETY KNOWLEDGE, FOOD HANDLING PRACTICE AND THE KITCHEN HYGIENE**

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Many consumers are unaware that their home environment poses a serious risk for foodborne illness outbreaks. Objectives: The aim of the study was to investigate Slovenian consumers' food safety knowledge, their food handling practices of selected foods, and the kitchen hygiene. Methods: Food safety knowledge was analysed among 380 consumers using an online questionnaire, and 16 consumers were observed preparing specific foods. Hygiene conditions in the kitchens were examined microbiologically using contact agar plates, while adequacy of cleaning was determined by measuring ATP bioluminescence. Results: The results indicated a lack of knowledge about certain food safety issues. Consumers aged 36 to 55 years and women generally exhibited the highest level of knowledge. In some cases, the observed consumers did not take adequate preventive measures in food preparation. The increased number of total bacterial count, coliform bacteria, and *Escherichia coli* were found in 12.7% of the observed home kitchens. The results of ATP measurements showed that more than half of the surfaces were not satisfactorily cleaned. Conclusion: It is therefore necessary to raise awareness of food safety and better inform consumers about food safety requirements in home kitchens.

Keywords: consumers; food safety; knowledge; practice; observation

### 3. ASSESSMENT OF THE IMPACT OF COVID19 LOCKDOWNS ON AIR QUALITY AND HEALTH BURDEN IN THE CITY OF PANČEVO

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This study examines the impact of air quality in Pančevo during the COVID-19 pandemic lockdown period on health burden in Pančevo.

**Objectives:** The objective is to show the changes in air quality during COVID-19 lockdowns during 53 days in 2020 compared to the same periods in 2019 and 2018, the relationship between meteorological factors and air pollutants, and to quantify the short-term health outcomes caused of air quality changes. **Methods:** Data were obtained from two manual stations for SO<sub>2</sub>, NO<sub>2</sub>, NH<sub>3</sub> and from one automatic station for PM<sub>10</sub> and PM<sub>2.5</sub>. The total mortality data were analyzed using AirQ+ software to estimate the burden of health attributed to the air quality. **Results:** Air pollution in 2020 compared to 2019 showed a decrease in SO<sub>2</sub> (1%), NO<sub>2</sub> (35%), PM<sub>10</sub> (34%), PM<sub>2.5</sub> (17%) and an increase in NH<sub>3</sub> (38%). A reduction in PM<sub>2.5</sub> concentration resulted in a quantified number of avoided deaths from all causes. In 2019, 13 (95%CI: 5-21, AP 5.25%) deaths were attributed to short-term exposure to a mean daily PM<sub>2.5</sub> concentration (44.10  $\mu\text{g}/\text{m}^3$ ), and in 2020, 10 (95%CI: 4-6, AP 4, 39%) deaths for PM<sub>2.5</sub> of 36.71  $\mu\text{g}/\text{m}^3$ . **Conclusion:** Air quality was improved during lockdowns. The decrease in the attributive proportion and the number of deaths attributed to air pollution with short-term exposure to PM<sub>2.5</sub> indicate that even small improvements in air quality can reduce mortality in the population.

**Keywords:** lockdowns, Covid-19, air quality, AirQ+, health burden

**POSTER PRESENTATIONS:****1. HEALTH RISKS AND CONSEQUENCES OF WAR ACTIONS - EXCEPTIONS OR THE RULE?**

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**Objectives:** The aim of the paper is to point out the inadequate recognition of health consequences which occurred due to the health risks to which individuals and population groups were exposed to during and after war operations. **Materials and methods:** The research was carried out as a case series, and conducted by survey, with respondents and the local inspection of the field for the defined critical ecological point, and which connects the consequences with the exposure to health risk caused by the war actions of the NATO pact in the FRY in 1999. **Results:** One of the respondents participated in the clearing of the ruins of the heating plant in Kruševac, and the other was exposed to the actions of NATO aviation during the war, having spent some time in the crater created by the explosion of a missile. The respondent from Kragujevac was clearing up the remains of the factory hall of the company he worked at, while the respondents from Vranje and Štrpce were engaged in clearing up of the aftereffects of the war actions on the transmitters. They were all diagnosed with cancer after that, and they attest that most of their colleagues who they worked with in the mentioned actions also got a disease. After war actions on the radar on Kopaonik, different projectiles were left behind in the area of the water source from which water is being supplied to most of the municipality Leposavić citizens, who believe that there has been an increase in morbidity in the population and who are expressing growing concern for their health. **Conclusion:** The data obtained by this research point to a possibility of a connection between the respondents' morbidity and exposure to risk factors arising as a consequence of war actions. Taking into account the limitations of this research, complexity of sources and a small number of respondents, we can't confirm that and that's exactly why we think that as a society we have an obligation to confirm or refute the connection between war actions and health outcomes in individuals or population groups, through scientifically based research.

**Keywords:** War, Environmental and health risks and consequences, Morbidity

## 2. ENVIRONMENTAL NOISE MONITORING IN NOVI SAD, 2021

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**Objectives:** Considering environmental noise as a public health problem, monitoring environmental noise, in order to assess noise annoyance of urban population, is one of the key step. Methods: During 2021, City of Novi Sad provided in total 87 daily (24-hour) noise measurements on eight measuring spots, while Public Health Institute of Vojvodina, according to legal basis and standardized / accredited methodology, taken 23 measurements during October – December. Results: Based on the results, daily noise indicator ( $L_{day}$ ) was increased in 55% of measurements, evening noise indicator ( $L_{evening}$ ) in 52%, and night noise indicator ( $L_{night}$ ) in 67%, while 6-16% of the population during the day, i.e. 4-9% during the night (depending on the part of the city) were highly annoyed (%HA) by environmental noise, predominantly traffic noise. Observed by urban areas, the environmental noise levels are in accordance with norms in „city center and city traffic area“, also in „residential area“, while the noise levels were increased in „recreation area and hospital area“, „school area“ and „busines and residential areas“ Conclusion: The results indicate high levels of noise in the urban environment with the population annoyance, as a consequence, which represent the main issue and challenge for the public health system.

**Keywords:** environmental noise, monitoring, annoyance, population

### **3. PEST CONTROL EFFECTIVENESS IN ACCORDANCE WITH THE EUROPEAN STANDARD EN 16636:2015 CEPA CERTIFIED**

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**Introduction:** Pest control plays an important role in the food industry, while pests present a major threat to public health. Among other things, they are causing great economic damage to products and facilities as well. Pest control includes processes for the reduction or elimination of damage caused by rodents, arthropods, vertebrates, and microorganisms. **Objectives:** The study aims to present the process flow of professional services regarding the European standard EN 16636:2015 and define its importance for public health. **Results:** CEPA is the only European standard for pest control with an external, independently audited quality control system. It specifies the requirements, recommendations, and basic competencies under which pest management service institutions must operate to meet the needs of their customers. Expert examination, determination of the type of pest, informing stakeholders about the work plan, pest control, and evaluation of the efficiency are the five essential steps of pest control services. In addition, the staff of the professional service provider must be appropriately qualified and regularly acquire the knowledge and skills required by this standard. **Conclusion:** European standard for pest control has been developed to raise the entire pest control sector to a higher professional level, thereby protecting customers, general public health, and environmental protection.

**Keywords:** pest control, public health, standard EN 16636:2015, CEPA

#### 4. PLANT DERIVATES AS POTENTIAL UV FILTERS

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**Objectives:** Organic UV filters used in sunscreen preparations have disadvantages, such as poor photostability, allergic potential and problem of potential resorption through the skin. For this reason, an increasing number of natural substances that are safer to use and can play a role in protecting against harmful actinic radiation are being tested. **Methods:** A survey of relevant literature was done in order to clarify the current knowledge on use of plant materials as photoprotective agents. **Results:** Phenols and flavonoids, as substances with an aromatic ring, as well as carotenoids, can absorb UV rays and protect against skin damage originating from the sun. The bioactive compounds found in herbal extracts can also have antioxidative activity which is important for both treatment and prevention of the sunburns. For many plant extracts and plant oils *in vitro* determination of SPF factor was performed, and some of them that showed good potential were: wheat germ oil, carrot seed oil, olive oil, coconut water extract, marigold flower extract, green tea extract etc. **Conclusion:** Compounds derived from natural sources have gained considerable attention for use in sunscreen products.

**Keywords:** UV protection, natural compounds, UV filters

## 5. SAFETY OF COSMETIC PRODUCTS WITH HOMOSALATE – DISAGREEMENT OF LAW AND SCIENCE?

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**Objective:** The objective of the survey was to get insight into the use of UV-filter homosalate (HMS) in sunscreen products, related to a disagreement of law and science: Cosmetic regulation (EC No 1223/2009) allows HMS concentration up to 10%, while SCCS adopted a new opinion, advising that HMS concentration should be 20-x reduced, or, in case of face creams, 1.4-x, due to concerns related to its potential endocrine disrupting properties.

**Method:** A total of 44 sunscreen products and 23 face creams, was subjected to the examination of labelling, with respect to the order of listed UV-filters, legally demanded to be quantitatively descending. The premise for drawing conclusions was the fact that appropriate amounts of UV filters are needed to provide labelled sun protection factors.

**Results:** HMS was the leading or second-leading UV-filter in 45% of sunscreen products, while it was ranked third in 9% of face creams.

**Conclusion:** The dominance of HMS among UV-filters in numerous sunscreen products obviously points to the fact that SCCS scientific advice has not yet been taken into account. Such findings lead to the conclusion that a large number of currently commercialized sunscreen products, although in compliance with the regulation, potentially pose a risk for the users, especially children.

**Keywords:** Homosalate, UV-filter, Cosmetic product, Safety

## **SESSION: NUTRITION AND HEALTH**

### **INVITED LECTURES:**

#### **1. SAFE DRINKING WATER, CLEANING AND DISINFECTION OF HOUSEHOLDS A PUBLIC HEALTH APPROACH TO COVID-19**

Prof. dr Mihail Kochubovski, Senior Environmental Health Officer,  
Institute of Public Health, Medical Faculty, University Ss Cyril and Methodius, Republic of North Macedonia

Safely managed water, sanitation, and hygiene (WASH) services are an essential part of preventing and protecting human health during infectious disease outbreaks, including the current COVID-19 pandemic. Good WASH and waste management practices, that are consistently applied, serve as barriers to human-to-human transmission of the COVID-19 virus in homes, communities, health care facilities, schools, and other public spaces. Ensuring evidenced-based and consistently applied WASH practices in communities, homes, workplaces, schools and health care facilities will help prevent human-to-human transmission of pathogens, including SARS-CoV-2, the virus that causes COVID-19. Hand hygiene and environmental cleaning are key measures to limit exposure to infection in school settings, among other precautionary measures. Paper is related to a North Macedonian positive Case-study done in 2020-2022 on integrated digital assessment in schools for water, sanitation, hygiene and infection prevention and control (IPC). It has been introduced an online Dashboard consisted by a digital questionnaire covering the topic of WASH & IPC in Schools through questions and indicators that can be used by schools as a self-evaluation tool and by Regional Public Health Centers for verification. Training on WASH & IPC in Schools has been provided by the Institute of Public Health in 2020-2022 to all Primary Schools in North Macedonia in cooperation with the Ministry of Education and Science and State Educational Inspectorate. The entire process has been supported by UNICEF.

**Keywords:** Protocol on Water and Health, WASH in Schools, public health

## 2. DIETARY SUPPLEMENTATION OF PROBIOTIC AND VITAMIN D DURING PANDEMIC OF COVID-19

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The beneficial effects of probiotics have been demonstrated in wide range of pathological conditions. One of the major mechanisms of action is through the regulation of host immune response. Likewise, the probiotics that colonize the human host are most numerous in the intestines. The commensal intestinal microbiome contributes to increased resistance against infections, host immune system differentiation, and synthesis of nutrients.

Probiotics such as *Lactobacillus* and *Bifidobacterium* can restore host-health by eliminating pathogens and regulating immune responses in intestinal epithelial cells. Also, circumstantial evidence has supported the presumption that probiotic supplementation decreases the severity of COVID-19 responses. Literature data show that the immunomodulating activity of vitamin D, which absorption could improve by probiotics, plays a role in viral infections. An analytical retrospective approach to the data of 34 pharmacies of Association Apoteka plus from all country region showed a significant increase in sales of probiotics (2019/20 by 29% and 2020/21 by 47%) and vitamin D (2020/21 registered drug 53.6%, supplements 19.9%). In addition, sales of *Over the counter* (OTC) cold and flu medicines remained flat. In conclusion, self-care and prevention have been at a high position during the last three years, but still, due to serious health problems such as COVID 19, patients are seeking professional health services and prescription drugs.

**Keywords:** Probiotics, vitamin D, COVID-19, dietary supplements

### 3. NUTRITION AND CARDIOVASCULAR DISEASE - FINDING THE PERFECT RECIPT

Doc. dr Dijana Stojanović

Faculty of Medicine , Department of Pathophysiology, University of Niš, Serbia

Inappropriate dietary behavior is undeniably associated with the increasing burden of cardiovascular diseases, which is evidenced to be the leading cause of death in Western countries, accounting for almost 30% of deaths worldwide. Therefore, the prevention of cardiovascular disease and its related consequences has to become a public health priority, particularly through healthy lifestyle interventions. Up until now, there is a strong scientific rationale that Western dietary patterns lead to the synthesis of a great number of proinflammatory cytokines, followed by the lower production of protective, anti-inflammatory molecules. Therefore a healthy dietary pattern should be based upon the pathophysiological observation that some food components are evidenced to be cardioprotective, owing to their pathophysiological nature.

Coenzyme Q10 is evidenced as a protector of the heart and vessels, while its antioxidant properties improve endothelial function, and lipid profile, and increase ATP production in the heart and muscle cells. Multiple bioactive compounds, including omega-3 fatty acids, lycopene, or polyphenols, upon incorporation into the diet, have been associated with beneficial effects on atherosclerosis development. All of them act to reduce levels of LDL-c, improving inflammatory and oxidative stress biomarkers. PUFAs, such as Omega-3 fatty acid ( $\Omega$ -3 PUFA),  $\alpha$ -linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA), have been reported as potential anti-atherogenic agents during the atherosclerotic process development. Mechanisms, through which they might reduce cardiovascular risk, include improvements in the lipid and lipoprotein profile, oxidation, thrombosis, endothelial function, blood pressure, plaque stability, cardiovascular mortality, platelet aggregation, modulating concentration or expression of pro-inflammatory markers (adhesion molecules, cytokines, etc.), and immune cells. Lycopene is a lipophilic and unsaturated carotenoid, present in red-colored fruits and vegetables, might reduce atherosclerotic risk, particularly in the early stages of atherosclerosis, preventing endothelial dysfunction and LDL oxidation, improvement of the metabolic profile (by impairing cholesterol synthesis) and blood pressure, through reductions in arterial stiffness, and modulation of the expression of pro-inflammatory markers and platelet aggregation. Polyphenols, including anthocyanins, flavonols, and flavonoids, behave similarly, whereas their incorporation in a dietary pattern is significantly associated with lowering blood pressure, improvement of endothelial function and lipid profile, and overall reduction of cardiovascular disease development.

Based upon strong evidence on pathophysiological mechanisms implicated in the cardioprotective effect of nutrients, dietary antioxidants, or bioactive compounds, a great number of foods account for a reduction in cardiovascular risk factors or directly decrease cardiovascular disease development. However, it is still challenging to promote healthy dietary habits, as well as an active lifestyle, as early as possible in children and young adults. Therefore, the public health community should join forces to set the stage for better implementation of scientific knowledge in a real life.

**Keywords:** healthy diet, cardiovascular disease, coenzyme Q10, omega-3 fatty acid, lycopene, polyphenols

#### 4. BLACK CURRANTS (*RIBES NIGRUM* L.) AS A NOVEL SOURCE OF NUTRITIVE AND BIOACTIVE COMPOUNDS WITH BENEFICIAL IMPACT ON HEALTH

Doc. dr Bojana Miladinović<sup>1</sup>, Dušica Stojanović<sup>1,2</sup>, Milica Randelović<sup>1</sup>, Milica Milutinović<sup>1</sup>, Suzana Branković<sup>3</sup>, Dušanka Kitić<sup>1</sup>

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Black currant (*Ribes nigrum* L.) belongs to the group of berries that stands out for its polyphenolic composition and vitamin C content. The abundance of sugars, vitamins, minerals, organic acids and polyphenols results in this fruit having protective and healing effects while tasting pleasant. These berries with their compounds help in preventing and treating many chronic non-communicable diseases. It is reported that black currants (BC) can lower blood glucose and ameliorate glucose tolerance in experimental animals, as well as decrease postprandial blood glucose levels in humans (Iizuka, 2018). Their use expressed hypocholesterolemic effects in mice with diet-induced obesity (Kim, 2018). The BC extracts decreased mean arterial pressure and total peripheral resistance in male cyclists and reduced oxidative stress-related injuries that cause fatigue and damage (Cook, 2017). They also expressed spasmolytic effects. Black currants improve cognitive performance, cognitive function as well as modulation of blood flow (Watson, 2018).

Black currant is a significant source of one polyphenols group - flavonoids, namely the classes of anthocyanins, flavonols, flavanols, and phenolic acids. Anthocyanins, one of the most abundant classes of BC polyphenols, in addition to their antioxidant and protective role, are also responsible for the color of currants and are used in the food industry as natural dyes. The use of BC has expanded from colors and flavors in food and beverages, to antioxidants in meat and preservatives in meat products. Black currants are also used for the production of wine, liqueur, beer and vinegar. Recently, the investigation of the potential use of BC buds, flowers and leaves as rich sources of natural antioxidants has begun, while currant seeds, rich in the essential fatty acids and vitamin E, are used in various cosmetic products.

Anthocyanins are anthocyanidins heterosides and represent the dominant group of polyphenols in berry fruits. Anthocyanins can make up to 90% of polyphenols, and 73% reach the colon which are broken down by the microbiome. Anthocyanin content is highest in BC (up to 400 µg/g). These fruit pigments are responsible for the dark purple color of the ripe fruit and most abundant in the epidermal layer of the berry skin. The color of BC is responsible for the quality of this fruit. The anthocyanins production is influenced by various environmental factors, such as light, temperature, presence of minerals, climate and many other factors.

Anthocyanins are primarily associated with antioxidant activity. In BC juice, about 70% of the antioxidant activity stems from anthocyanins and vitamin C, while the rest is attributed to other present potent antioxidants. Borges (2010) found that the third of the antioxidant capacity of BC comes from delphinidin-3-rutinoside (32.9%), and 18.9% from cyanidin-3-rutinoside. Myricetin and quercetin glycosides participated with 3.8% and 1.2% respectively in the antioxidant activity.

Black currants anthocyanins are proven to possess anti-adhesion properties. They inhibited the adhesion of *Salmonella enterica* serovar Typhimurium to Caco-2 cells by up to 39%. These properties stem from delphinidin-3-rutinoside and cyanidin-3-rutinoside in the dose-dependent matter (Parkar et al, 2014). Anthocyanins from BC juice can pass through both the blood-retinal and blood-aqueous barriers in experimental animals so they can potentially be used in the treatment of ophthalmological diseases.

Flavonols make up to 30% of the total phenol content of BC, with each variety differing in their qualitative and quantitative composition. The glycosides of myricetin, quercetin, and kaempferol are most often present (Miladinović, 2021). These compounds show great biological activity.

The antioxidant role of myricetin, the dominant flavonol of BC, is well known, as well as its positive effect on the cardiovascular system. This phytoestrogen significantly increases motility, vitality and all other biochemical changes of human sperm even in small doses (up to 100 nM) by activating  $\alpha$ - and  $\beta$ -estrogen receptors. These doses are achieved only by moderate consumption of red wine, because larger amounts no longer have this effect due to excessive receptor stimulation (Aquila et al., 2013). Myricetin enhances bone marrow stromal cell differentiation *in vitro* (Ying, 2014). Myricetin showed no cytotoxic effect on the viability

of bone marrow stromal cells at concentrations of 1, 10 and 20  $\mu\text{M}$ . Myricetin could be used as a potential medicine for the improvement of the bone system diseases, as well as for their prevention. Myricetin was found to be a hypoglycemic substance that exhibits an insulin mimetic effect. Myricetin also slows down skin aging. It stops the formation of wrinkles on the skin that occur under the influence of UV-B radiation *in vitro*, by inhibiting the expression of the protein UVB-induced matrix metalloproteinase-9 as well as the enzymatic activity itself (Jung, 2010).

Quercetin also exhibits numerous pharmacological effects. Quercetin lowers blood pressure in both experimental animals and humans. It acts as a vasodilator on human arteries *in vitro* and *in vivo*, given in an acute dose to people with normal blood pressure and normal lipid status. Aqueous extracts of quercetin have a hepatoprotective effect and inhibit DNA damage in rats fed food contaminated with aflatoxins. It also reduced the accumulation of adipose tissue and improved the expression of genes that regulate fat and sugar metabolism, and mitochondrial transport in mice fed a Western diet. Quercetin, with the addition of ascorbic acid, maintains normal levels of monoamine oxidases, which are known to be elevated and partly responsible for the pathology of depressive disorders. Quercetin has also shown hepatoprotective, antifibrotic and anti-inflammatory activity in cholestasis.

Kaempferol shows antioxidant, anti-inflammatory and immunomodulatory activity, as well as myricetin and quercetin. All three flavonols inhibit the release of histamine from mast cells. Quercetin and kaempferol inhibit the release of inflammatory mediators TNF- $\alpha$ , IL-1 $\beta$  and IL-6, while myricetin has an inhibitory effect only on TNF- $\alpha$  and IL-6 in RBL-2H3 mast cell culture (Park, 2008). Kaempferol improves the secretory role of insulin, as well as its synthesis in beta-cells of the pancreas. This indicates that kaempferol can be used in the treatment of diabetes and preservation of pancreatic function. In addition to all of the above, kaempferol also exhibits antihypertensive and lipolytic effects. This flavonol is cytotoxic in high doses ( $\geq 30 \mu\text{M}$ ), causing apoptosis of osteosarcoma and lung cancer cells, while it does not exert a cytostatic effect on other cells at the same concentrations. This data indicates that dietary intake of kaempferol will not have significant adverse effects, as physiological levels of flavonoids in the circulation are up to 10  $\mu\text{M}$  after oral intake.

Black currants are a promising food for improving overall health. The black currants alone as well as their products exhibited good antioxidant and biological activity and they can be used to improve health and prevent disease in humans, as well as to improve the functional characteristics of the respective products.

#### Acknowledgements

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## **ORAL PRESENTATIONS:**

### **1. DIETARY SUPPLEMENTS AND DIET IN COTHERAPY OF COVID-19 – AN ONLINE SURVEY RESULTS FROM REPUBLIC OF SERBIA AND REPUBLIC OF SRPSKA**

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**Objectives:** The aim was to investigate the use of dietary supplements and specific types of diet with the purpose of prevention and treatment of COVID-19 during the declared pandemics. **Materials and methods:** A prospective, cross-section study in a form of online survey was performed. Research was focused on residents on the territory of Republic of Serbia and Republic of Srpska. The responses were collected from December 2020 to May 2021. **Results:** A total of 1704 responses were collected. High usage of non-herbal dietary supplements was recorded, with 41.14% interviewees declaring use. Most frequently reported supplements contained vitamin C, zinc, vitamin D, magnesium and selenium. Concerning diet, only 7.16% reported adhering to specific types of diet during COVID-19 pandemics. Most frequently, people opted for diet with increased amounts of fresh fruits and vegetables, diet with organic food, vegetarian/vegan diet and raw food diet.

**Conclusion:** Results of this study suggest that dietary supplements are recognized as nutritional aid in fight against COVID-19.

**Keywords:** survey, coronavirus, COVID-19, supplements, diet

## 2. SATISFACTION LEVEL WITH THE FOOD SERVICES IN COVID HOSPITAL

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**Objective:** To determine the factors affecting general satisfaction level of patients with the food services in the covid hospital. **Methods:** 100 patients hospitalized due to covid-19 in a covid hospital participated in the research. A questionnaire was used as data collection tool on measuring satisfaction of the patients with the food services. **Results:** The results showed that of 100 patients 52% evaluated food service quality adequate, 30 % said that the food quality was inadequate, and 12 % stated that they were uncertain. A logistic regression model was estimated in determining the most important and statistically significant factors affecting patient satisfaction with hospital foods. Patients with a higher level of education were statistically significantly, more dissatisfied with the quality of food compared to patients with a lower level of education (OR = 2.20, p=0.050). The male sex showed a higher degree of satisfaction with food compared to the female (OR = 0.42, p=0.052). There is a high statistical significance of patients suggestions for improving food in terms of making it more varied (OR= 12.06, p< 0.001), tastier (OR= 9.10, p< 0.001). **Conclusion:**The results of this study would be helpful in making decision on increasing the level of satisfaction of patients with the food services in covid hospital.

**Keywords:** Food services, covid hospital, patient satisfaction.

## POSTER PRESENTATION

### 1. BACTERIOLOGICAL SAFETY OF DRINKING WATER FROM PUBLIC TAPS WITH NATURAL WATER IN BELGRADE 2018-2021

Dušan Avramović, MD, PhD, Dara Jovanović, MD, PhD  
GZZJZ - City Institute for Public Health of Belgrade

**Objectives:** Current climate changes, manifesting in prolonged periods of hot weather with occasional occurrence of heat waves, increase demand for fresh water, put pressure on central and local water supply and distributive systems, with expected water shortages and restrictions. Such need motivates habitants to use public taps with natural water as potential alternative source of fresh water for household use, and even as drinking water, so bacteriological quality is of great importance. **Methods:** During 2018-2021, 1778 water samples were collected from 32 objects of public taps with natural groundwater on the territory of Belgrade, according to applicable standards SRPS ISO 5667-5:2008, SRPS EN ISO 19458:2009. Water samples were analysed in the laboratory of GZZJZ, according to requirements of basic microbiology program defined in Regulation on Hygienic Standards of Drinking Water (Official Gazette FRY, n° 42/98 and 44/99, and „Official Gazette RS“, n° 28/2019). **Results:** 1073 (60.3%) of analyzed samples do not fulfill microbiological requirements of the Regulation, predominantly due to presence of different non-fecal and fecal coliform bacteria (Citrobacter sp. 33.3%, Enterobacter sp. 32.6%, E.coli 34.1%).

**Conclusion:** Due to frequent presence of microbiological indicators of fecal contamination, bacteriological safety of natural water from public taps can be compromised without proper maintenance of such objects and their closest environment.

**Keywords:** natural water, public health, microbiology

## 2. MONITORING OF DRINKING WATER QUALITY FROM THE PUBLIC WATER SUPPLY SYSTEM IN THE CITY OF NOVI SAD IN 2021

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**Objectives:** The objective of this work was to evaluate the drinking water quality from the Novi Sad Public Water Supply System for the city of Novi Sad and its settlements.

**Methods:** An assessment of drinking water safety was carried out in 2021 on 6, 571 samples collected from Novi Sad Public Water Supply System. The sampling and analysis were performed according to accredited and standardized methods of the Institute of Public Health of Vojvodina, Novi Sad. The risk assessment for the population connected to the Public Water Supply System was done based on present microbiological, physical, and chemical hazards in analyzed drinking water samples. **Results:** More than 98% (6, 447) of analyzed drinking water samples had no hazards. The most recognized hazard in the remaining drinking water samples was microbiological. The presence of microbial hazards was highest in two settlements: Ledinci (9%), and Novi Sad (1%). Drinking water samples were not in line with national proposed levels also in following settlements: Veternik (3%), Rumenka, Čenej, Futog, and Kovilj (each 2%). Participation of drinking water samples that were not in line with national proposed levels in other settlements were  $\leq 1\%$ . Exposure to microbiological risk was found for 17% of the population living in settlements mentioned above, primarily sensitive ones (children, pregnant women, elderly). **Conclusion:** To improve water supply and prevent the burden of disease caused by unsafe water, building capacities for the treatment, especially disinfection at the end of the colossal drinking water pipe system in the city of Novi Sad, is recognized as a necessary one.

**Keywords:** drinking water, quality, risk, microbiological hazard.

## 3. SAFETY OF PUBLIC WATER SUPPLY IN THE MUNICIPALITY OF PIROT FOR THE PERIOD 2012-2021

Jovanović Miloš, Vidanović T. Institute of Public Health Pirot, Serbia

**Objective:** Presenting the characteristics and health safety of water supply in the Municipality of Pirot. **Methods:** Data are collected from protocols and reports in Institute of Public Health Pirot. Sanitary and hygienic control of water facilities were conducted. **Results:** Sampling and testing was carried out by Institute of Public Health Pirot, evaluated on the basis of the valid Regulations (Official Gazette FRY 42/98, 44/99, RS 28/2019). In the period 2012-2021, 7993 samples of drinking water were taken from the public water supply in Pirot (124 physicochemically, 391 microbiologically irregular). Between 2012 and 2018, physicochemical irregularity ranged from zero to 3.55% of the tested samples and 2.49% to 10.38% of the microbiological samples. During 2019, drinking water production company, invested in the maintenance of water filtration facility. In 2019, percentage of irregularity was physicochemically 0.12% and 1.23% microbiologically. In 2020, irregularity was 0.75% physicochemically, 2.64% microbiologically. In 2021 are 99.88% physicochemically and 96.80% microbiological regular samples. **Conclusion:** It is necessary to systematically control the health safety of public water supply. Responsible water management reduces health risks. Constantly insist on measures that ensure the safety of drinking water from the public water supply.

**Keywords:** water supply, drinking water, health safety

## 4. CONCENTRATION OF NITRITE IN DRINKING WATER IN THE MUNICIPALITY OF ŠID 2016 – 2020

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**Objectives:** The aim of this work is to determine concentration of nitrite in drinking water and whether the population of the municipality of Šid is exposed to increased concentration of nitrites. **Methods:** In the period 2016 - 2020, 2247 samples of untreated chlorinated water were analyzed to determine the concentration of nitrites in drinking water according to accredited and standardized methodology of Institute of Public Health of Sremska Mitrovica. The number of inhabitants who have access to untreated chlorinated water is 34,188. The exposure of the population was determined on the basis of exceeding the prescribed limit value of nitrite in drinking water. **Results:** The highest exceedances of the nitrite concentration limit values were found in the settlement of Gibarac (90%), Šid (80%) and Kukujevci (65%). The percentage of the population of the Municipality of Šid that has access to untreated chlorinated drinking water without hazard (increased concentration of nitrites) is 6%, while 94% of the population is exposed to hazard. **Conclusions:** The obtained results indicate the need for purification of drinking water and provision of healthy drinking water for the entire population of the Municipality of Šid and the need for quantitative assessment of the risk of determined concentrations of nitrites for human health.

**Keywords:** nitrite, drinking water, Šid

## 5. SILICATE IN BOTTLED WATERS

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**Objectives:** In our country, bottled natural waters are monitored by the Rulebook on the hygienic suitability of drinking water (Official Gazette of the FRY, 42/98 and 44/99) and the Rulebook on the quality and other requirements for natural mineral water, natural spring and table water (Official Gazette Gazette SCG 53/2005 and Official Gazette RS 43/2013). Silicon dioxide ("silica") present in some mineral waters is very important for the creation of bone collagen and connective tissue, for healthy nails, skin and hair, for the absorption of calcium, for the flexibility of the arteries and thus plays a role in the prevention of cardiovascular diseases, as well as for prevention of "Alzheimer's disease". It stimulates the immune system and prevents the aging process of cells in tissues. **Material and methods:** 23 different waters on our market, ranging from low-mineral to highly carbonated, were tested. The method used for the determination is ICP OES, on the Shimadzu ICPE 9820 apparatus. The regulations do not provide MDK values for Si in water. **Results:** The highest concentrations of silicon in groundwater ( $\geq 50$  ppm) are the result surface decomposition of rocks containing high-temperature silicate minerals. Thermal waters are also rich in silicon, as well as highly alkaline underground waters, due to the increased solubility of  $\text{SiO}_2$  at high temperatures and at high pH values. **Conclusion:** Regular hydration reduces the risk of viral and bacterial infections entering the respiratory system. Also, with sufficient intake of water, we nourish all our organs and strengthen the immune system, which is our defense mechanism in the fight against infectious diseases.

**Keywords:** Bottled water, silicate, silicon dioxide.

**6. DIETARY CHOLINE INTAKE IN CHILDREN AT PRESCHOOL INSTITUTION NIS (SERBIA)**Lazarevic Konstansa<sup>1, 2</sup>, Stojanovic D.<sup>2, 3</sup>, Stosic Lj.<sup>2, 3</sup>, Bogdanovic D.<sup>1, 2</sup><sup>1</sup> State University of Novi Pazar, Serbia<sup>2</sup> Public Health Institute Nis, Serbia<sup>3</sup> School of medicine Nis, University of Nis, Serbia

**Objectives:** Choline is a nutrient required for methyl group metabolism, neurotransmitter synthesis, and the function of cell membranes. The EFSA (European Food Safety Authority) proposed choline adequate intakes to be 170 mg/day for children aged 4 to 6 years. The aim of this study to calculate choline intake through daily meals (breakfast, lunch and snack) in preschool institution Nis (Serbia). Methods Dietary intake data for choline intake per child were collected by 40 daily food warehouse lists at preschool institution Nis in 2020-2021 period. Choline content in foods was assessed in accordance with the United States Department of Agriculture Nutrient Database. Results Average (SD) daily intake of choline per child was 134.5 (40.9) mg or 78.1 (24.1) % of adequate intake recommended by EFSA. The main food groups contributing to choline intake were meat - 28.7%; vegetables and related products (mainly legumes) - 21.8%; and milk and dairy (mainly milk) - 18.4%. Eggs contributed 9.4% of total choline intake. It was observed that children through their preschool meals consume only about one portion of milk and dairy. Conclusion Consumption of at least one portions of milk and dairy products for snack/ dinner at home may fulfill the daily recommended choline intake.

**Keywords:** diet, choline, preschool children

## 7. BETAINE CONTENT IN COMMERCIAL FERMENTED DAIRY PRODUCT SAMPLE

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**Objectives:** Betaine has a double function in the human organism as an osmolyte and a methyl group donor. Although it is a non-essential nutrient, numerous studies in recent years reported a wide range of its health benefits. This study aimed to measure and compare the betaine content in commercial yoghurt, kefir and fermented probiotic dairy product.

**Materials and methods:** Betaine content was determined using the HPLC method that we previously developed for betaine estimation in the commercial milk sample. The milk fat content was determined following the Gerber method. Commercial fermented dairy products from companies in Serbia were purchased from local shops. **Results:** Betaine content ranged from 6.64 mg/L in kefir with 2.5% fat to 9.72 mg/L in milk fermented probiotic dairy products with 1.5% fat. A positive but not significant correlation between fat and betaine content ( $r = 0.36$ ) was obtained. The average betaine concentration in the fermented dairy products (8.39 mg/L) was higher in comparison with (7.21 mg/L), which was the level we estimated in commercial cow milk purchased from the same market. **Conclusion:** Considering the action of betaine, principally lipotropic and antioxidant, their higher content in fermented dairy compared with milk slightly increased the health benefits of these products.

**Keywords:** Fermented dairy product, betaine, fat content, HPLC method.

## **8. DIETARY SUPPLEMENTS**

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Nutritional supplements (dietary supplements) are foods that supplement the usual diet, and which represent concentrated sources of nutrients or other ingredients with a nutritional or physiological effect, individually or in combination, and are available in the market in dosage forms such as capsules, lozenges, tablets and similarly, powder sachets, liquid ampoules, dropper

bottles, and other similar forms of liquids and powders intended to be taken in small, dosed amounts.

Dietary supplements may be on the market of the Republic of Serbia only if they meet the conditions stipulated in the Rulebook on Nutritional Supplements (Dietary Supplements) "Official Gazette of RS", No. 45/2022. Regulations and standards related to products of the usual composition in terms of general and nutritional declaration and labeling, measurements and limits of deviation from the declared amount of packaged foods, quality, conditions of use of additives, aromas, enzymes and auxiliaries, requirements for microbiological correctness and maximum permitted amounts contaminants and residues, also apply to food supplements, unless otherwise prescribed by this regulation.

The declaration, labeling and advertising of nutritional supplements cannot attribute the properties of disease prevention, treatment or cure, or refer to such properties.

Only such dietary supplement is registered in the database maintained by the Ministry of Health for 5 years period, which confirms that the nutritional supplement is healthy and is in free circulation in the Republic of Serbia, and for products that are registered in the database and were produced in another country, that they are in free circulation in the Republic of Serbia.

## **9. DIETARY SUPPLEMENTS FOR IMMUNE FUNCTION INTENDED FOR USE IN PEDIATRIC POPULATION AVAILABLE AT THE SERBIAN MARKET**

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**Objectives:** The aim of this research was to identify dietary supplements (DS) for immune function intended for use among children available at the Serbian market and assess their characteristics. **Methods:** DS available on the market were identified using the National dietary products' database and online pharmacies' inventories. Data on specific DS were obtained from their labels. **Results:** A total of 33 DS for immune function of children have been identified (67% in the form of syrups and chewable tablets). Majority of DS (91%) had more than one active ingredients, namely vitamins, minerals and/or botanicals. The most common active ingredients were vitamin C (76%), zinc (51%), vitamin D (47%), vitamin B<sub>6</sub> (45%) and vitamin A (45%). Botanicals were present in 67% of DS and included dog rose, elderberry, echinacea, cranberry and ganoderma extracts. In 80% of the cases, health claims made on DS declarations were not compliant with the national rulebook. Excipients with the potential for causing adverse effects were present in 67% of DS. **Conclusion:** The versatility of DS for children's immune function makes it hard for parents/caregivers to choose between them properly. Therefore, healthcare professionals should be considered essential links between DS and DS users.

**Keywords:** dietary supplements; immune function; children

## 10. MELATONIN-CONTAINING DIETARY SUPPLEMENTS AVAILABLE AT THE SERBIAN MARKET

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**Objectives:** The aim of this research was to identify and assess the characteristics of dietary supplements (DS) of melatonin available at the Serbian market. **Methods:** DS available on the market were identified using the Dietary products' database (Ministry of Health) and online pharmacies' inventories. Data on specific DS were obtained from their labels. **Results:** A total of 24 DS containing melatonin have been identified. Declared recommended daily doses ranged from 0.5 mg to 3 mg (average – 1 mg). Doses up to 1 mg were recommended for jet lag, whereas larger doses were recommended for insomnia. The majority of DS were in solid forms (tablets and capsules, 71%) and the remainder in aerosol form. Around half of the DS (54%) contained other substances such as botanicals (valerian, lemon balm), magnesium, folic acid, myo-inositol. Most of the health claims on melatonin DS were compliant with the national regulations (80%). Excipients with the potential for causing adverse effects were present in 37% of melatonin-containing DS. **Conclusion:** As the demand for melatonin-containing DS is expected to rise, healthcare professionals should be aware of the differences between the available DS in order to counsel DS users to the best of their knowledge

**Keywords:** dietary supplements; nutritional supplements; melatonin; insomnia

## 11. NEWLY INCLUDED PLANT SPECIES IN THE SERBIAN DIET DURING THE COVID PANDEMIC

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**Objectives:** Plant-based foods are not only nutritious but also have a variety of health-promoting properties. COVID pandemic pointed out importance of balanced diet for immune boosting. **Methods:** The aim of this study was to identify new plant species that were included in the diet during the COVID pandemic. A study was performed using an anonymous questionnaire that was available *online* for completion in January 2021. Participation was completed anonymously and voluntarily. **Results:** Since the start of the pandemic, 80 out of the total 408 responders have added some new fruits, vegetables, or medicinal plants to their diet. Most were female (83.75%). According to the survey's findings, 43 new medicinal plants, fruits, or vegetables were added to the diets for the first time since the pandemic began. Ginger, avocado, pomegranate, pineapple, garlic, lemon, mango, Japanese apple, kaki, olives, cauliflower, pomelo, coconut, zucchini, beet, sweet potato, celery, parsley, and kiwi were mentioned most often. Yet, all participants from the survey agreed that fruits and vegetables contribute to a stronger immune system and should be more present in their diet. **Conclusion:** The current pandemic has had an impact on dietary patterns and behavior. A new plant species has been included into the diet as a result of the COVID pandemic.

**Keywords:** plant species, diet, COVID pandemic

## 12. THE TOTAL PHENOLIC AND FAVONID CONTENT IN GREEN TEA LEAF EXTRACTS OBTAINED BY EXTRACTION USING DIFERENT AXTRACTION SOLVENTS

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**Objectives:** The purpose of this study was to investigate the influence of the extraction solvent on the total phenolic and flavonoid content of green tea leaf extracts, prepared by the ultrasound assisted extraction. **Materials and methods:** The extraction was carried out at extraction ratio 1:10 in ultrasonic bath for 1 hour at a temperature of 30°C. Extraction solvents used were: water, 50% ethanol, aqueous solution of glycerol 30%, 50% and 70%, as well as a mixture of water, glycerol and ethanol (1:1:1). Total phenolic content (*Folin-Ciocalteu* method) and total flavonoid content were determined using UV-Vis spectrophotometer Evolution 60, Thermo-Fisher Scientific (USA). **Results:** The total phenolic content (TPC) of extracts varied from 21.65 to 80.56 mg GAE/g dry extract (GAE – galic acid equivalent), while total flavonoid content (TFC) ranged from 3.56 to 6.48 mg RE/g dry extract (RE – rutin equivalent). Strong correlation was observed between the results – the flavonoid content followed the phenolic content in the extracts. The extract with the highest TPC and TFC is the one where mixture of water, glycerol and ethanol (1:1:1) was used as a solvent, followed by 50% ethanolic and 50% glycerolic extract. **Conclusion:** Varying extraction solvent used can improve the extraction process.

**Keywords:** Green tea leaf, Total phenolic content, Total flavonoid content, Ultrasound assisted extraction

### 13. THE CHEMICAL CHARACTERISATION OF CISTUS SALVIIFOLIUS L. VOLATILE ORGANIC COMPOUNDS

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**Objectives:** The aim was to investigate the chemical composition of volatile organic compounds (VOCs) in *Cistus salviifolius*. **Materials and methods:** Plant samples were collected on two locations, on Rhodes, Greece. The essential oils (EOs) were isolated from dried leaves by hydrodistillation. Furthermore, dried leaves of *C. salviifolius* were crushed in headspace vials and VOCs were sampled by mean of headspace sampling. The chemical characterization of VOCs was performed using gas chromatography coupled to mass spectrometry detector. Mass spectral database NIST, as well as literature data were used for VOC identification. **Results:** Sesquiterpene hydrocarbons were the most abundant group of compounds (65.3-79%), followed by oxygenated sesquiterpenes (9.95-11.53%). The EOs contained notably higher amount of sesquiterpene hydrocarbons and aromatic sesquiterpene hydrocarbons. Comparison of chemical profile of dried leaves and EOs, demonstrated significant amounts of all subclasses of monoterpenes and aliphatic compounds in former sample. Single most abundant component (approximately 40%) in all tested samples was germacrene D, followed by (E)- $\beta$ -farnesene and caryophyllene oxide. **Conclusion:** *Cistus salviifolius* represents an aromatic species rich in VOCs. The abundance of sesquiterpene hydrocarbons was recorded, with germacrene D being the main compound. This investigated species can be used as source for isolation of these compounds.

**Keywords:** *Cistus salviifolius*, volatile organic compounds, essential oil, mass spectrometry

#### 14. STUDY OF THE EFFICIENCY OF POOL WATER PURIFICATION

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**Introduction:** Swimming pools are sports facilities where sports and recreational swimming is performed. Recently, the recreational swimming of the younger generation of users has become more and more prominent, especially in urban conditions.

**Aim:** The most important activity at the swimming pools is the management of the quality of the water for swimming, which must meet the norms for microbiological and chemical parameters prescribed by the relevant regulations. **Material and methods:** The paper used the results of routine analyzes of parameters that are tested in pool waters. Analytical methods for determining the values of parameters in pool water are prescribed in Annex 3 of the Rulebook on the Healthiness of Pool Water ("Official Gazette of RS", no. 30/17 and 97/17). **Results:** In the event that there is a deviation of one parameter, attention must be paid to all parameters, in accordance with the aforementioned Rulebook on the Healthiness of Pool Waters ("Official Gazette of RS", no. 30/17 and 97/17). The results of laboratory analyzes are a good sign that a problem exists, but understanding the problem and solving it requires careful analytical work by a hygiene specialist.

Getting to know all the specifics of a given sports facility, especially in urban conditions, resolves the dilemmas left by seemingly unexpected deviations in parameters, which become understandable after a sanitary-hygienic inspection and additional confirmatory analyses. **Conclusion:** It is necessary: knowledge of water purification and disinfection technology, technical-technological equipment of the swimming pool, organizational and personnel skills of the entity that manages the swimming pool.

Knowledge of all the aforementioned elements, which require hard field work, can improve the analytics of the impact assessment, help in the interpretation of laboratory results and lead to the resolution of problems of a technical-technological nature.

**Keywords:** Pool, water quality in the pool, quality indicators, analyses.

## **15. BACTERIOLOGICAL QUALITY OF SULPHURIC THERMO-MINERAL WATER IN PHYSICAL THERAPY POOLS BEFORE AND AFTER DISINFECTION BY SILVER HYDROGEN PEROXIDE**

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**Objectives:** Efficiency evaluation of the disinfectant based on silver and hydrogen peroxide (50-30% hydrogen-peroxide and 0.5% silver-nitrate). **Methods:** Bacteriological analysis of 90 sulphuric water samples were categorized into two groups, 45 samples from the male and 45 samples from the female pool, was conducted in the accredited laboratory of the Public Health Institute Šabac according to SRPS EN ISO 6222:2010 and SRPS EN ISO 9308-1:2017/A1:2017. A total of 74 water samples (37 samples from the male and 37 samples from the female pool) were sampled in the period before disinfection, and 16 samples from the beginning of disinfection with hydrogen-peroxide and silver-nitrate (8 samples from male and 8 samples from female pool). Total coliforms, faecal coliforms and E.coli were detected using Colilert test. On Pseudomonas agar using the membrane filtration method were counted Pseudomonas aeruginosa colonies. **Results:** The total number of samples, which were contaminated with pathogenic or conditionally pathogenic bacteria before disinfection was 94.6% (35 samples from each of the examined pools). An increased number of mesophilic bacteria and total coliform bacteria in the male pool were in 70.3% of samples, while this same of contamination in the female pool was detected in 67.6% and 81.1% of samples, respectively. Faecal coliforms and E. coli were detected in the male and female pools in 73% and 83.8% of samples, respectively, while P. aeruginosa was present in 62.2% and 81.1% of samples, respectively. After water disinfection, all tested samples were bacteriologically safe.

**Conclusion:** The disinfectant showed an effective bactericidal effect in 100% of the samples in disinfected sulphur thermo-mineral waters.

**Keywords:** therapy pool, hydrogen peroxide-silver, bacteriologically safe, sulphur thermo-mineral water

## 16. CONSUMPTION OF POTASSIUM PERMANGANATE BEFORE AND AFTER USE OF PREPARATIONS HYDROGEN-PEROXIDESILVER COMPOSITION IN THE DISINFECTION OF SULPHUR THERMAL SPRING WATERS IN THERAPEUTIC POOLS

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**Objectives:** Increasing the consumption of potassium permanganate (KMnO<sub>4</sub>) after use of preparations hydrogen-peroxide-silver composition in the disinfection of sulphur water in therapeutic pools. **Methods:** Physicochemical analysis of 90 sulphur water samples (45 samples from the male and 45 samples from the female pool), was conducted in the accredited laboratory of the Public Health Institute Šabac. A total of 74 water samples (37 samples from the male and 37 samples from the female pool) were sampled in the period before disinfection, and 16 samples from the beginning of disinfection with preparations hydrogen-peroxide-silver (8 samples from male and 8 samples from female pool) and same were analysed by volumetric method. Distilled water with the addition of disinfectant in a concentration of 0.14 ml/l was used as a control sample. **Results:** The consumption of KMnO<sub>4</sub> in the control sample was 112.6mgKMnO<sub>4</sub>/l. The average consumption of KMnO<sub>4</sub>, in the period from 2017 to 2020, in female and male therapeutic pool before disinfection was 8.2mgKMnO<sub>4</sub>/l and 9.4mgKMnO<sub>4</sub>/l, respectively. After disinfection, there was an increase in the average consumption of KMnO<sub>4</sub> in female and male sulphuric pool to 108.6mgKMnO<sub>4</sub>/l and 98.3mgKMnO<sub>4</sub>/l, respectively. **Conclusion:** The consumption of KMnO<sub>4</sub> were ten times higher in the reaction with hydrogen-peroxide and silver-nitrate after disinfection and five times the value prescribed by the Regulations on the health safety of pool water. The authors of the paper suggest that the obtained values of KMnO<sub>4</sub> consumption are not considered a risk to the human health and that the pool water is assessed as "health safety".

**Keywords:** sulphuric pool, hydrogen peroxide-silver, disinfection, potassium permanganate, health safety

## **17. ATTITUDES OF MEDICAL SPECIALISTS TOWARDS NUTRITION AND NUTRITION CARE - ARE THEY ASSOCIATED WITH NUTRITION COUNSELLING PRACTICE**

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**Objectives:** The aim of the study was to review existing literature on medical specialists' attitudes towards nutrition and nutrition care and their association with nutrition counseling practice. **Methods:** Literature search of PubMed, SCOPUS and Google Scholar databases was performed using terms and keywords relevant to the topic. **Results:** Medical specialists expressed positive attitudes towards the significance of nutrition and nutrition care in the prevention and treatment of diet-related diseases. Attitudes of specialists were no different from those of non-specialized medical doctors, nor between specialists in different areas of medicine. Favorable attitudes of medical specialists towards nutrition and nutrition care were generally positively correlated with the provision of nutrition counseling in their daily practice. However, some research suggested that, despite having positive attitudes, medical specialists did not always provide nutrition counseling to all of their patients in need. Furthermore, there were reports of frequent provision of nutrition counseling by specialists who expressed fewer positive attitudes towards nutrition as a determinant of health. **Conclusions:** In order to make the provision of nutrition counseling in medical specialists' offices more consistent, health policy creators should work to improve medical specialists' attitudes towards nutrition and nutrition care to better their patients' health outcomes.

**Keywords:** nutrition care; attitude; counseling; specialists

## 18. THE DIFFERENCES IN EATING HABITS OF STUDENTS BEFORE AND DURING THE COVID-19 PANDEMIC

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**Objectives:** The aim of the research was to analyze the differences in eating habits of students of the Faculty of Medical Sciences, University of Kragujevac, before and during the COVID-19 pandemic. **Methods:** This research was designed as a cross-sectional study. The data were collected through the online version of the questionnaire created using Google Forms, and were processed using the IBM SPSS Statistic 22 program. **Results:** Before the pandemic, 23% of respondents had more than three meals a day, and during the pandemic, 35% ( $p=0.000$ ). Consumption of fish and seafood increased, from 12% before the pandemic to 21% during pandemic ( $p=0.020$ ). Before the pandemic 8% of respondents used nuts daily, and during the pandemic 17% ( $p=0.000$ ). Before the pandemic, fruit was consumed almost every day by 34% of respondents, and during the pandemic by 47% ( $p=0.001$ ), and vegetables by 46% before and during the pandemic by 57% ( $p=0.001$ ). The consumption of coffee and tea daily increased by 44% before the pandemic by 54% during the pandemic ( $p=0.000$ ). **Conclusion:** The number of meals increased significantly during the pandemic, as well as that the respondents used a significantly higher percentage of fish and seafood, but also fruits, vegetables and nuts.

**Keywords:** eating habits, students, COVID-19 pandemic

## **19. PUPILS HABITS AND KNOWLEDGE RELATED TO PROPER DIET**

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**Objectives:** Taking into account data from previous researches on the percentage of malnourished children, a this research was planned to determine the habits and knowledge of pupils about the principles of proper nutrition.

**Methods:** The research was conducted during 2019 and 2020 in four elementary schools in the municipality of Novi Sad. The data collected were based on a questionnaire created for the purposes of this research, on a sample of 118 first grade students.

**Results:** Analyzed survey data showed that a significant percentage of students do not have sufficient knowledge about the principles of proper nutrition, as well as its importance for health maintenance and disease prevention. More important, the students' answers related to eating habits point to the fact that milk, fresh fruits and vegetables are insufficiently included in their daily diet, while, on the other hand, snacks, sweets and, especially carbonated drinks, are present in the diet almost every day.

**Conclusion:** Inadequate habits and insufficient knowledge of students lead to the need for systemic problem solving, primarily by involving parents and schools, as well as local communities.

**Keywords:** diet, nutrition, schoolchildren, habits, knowledge

**20. SLEEP AND ENERGY DRINK CONSUMPTION AMONG ADOLESCENTS IN SERBIA**

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Many adolescents worldwide are facing the problem of achieving recommended night sleep hours. The causes of sleep disturbance are multiple, but lately, scientific interest has been put on food's effect on sleep. Objectives: In this study, we investigated the connection between regular energy drink (ED) intake (weekly or more frequently) and sufficient sleep (SS) in adolescents ( $\geq 8$  hours). Additional objectives were to examine the relationship between health-related behaviors and SS, stratified by gender. Methods: A population-based cross-sectional study was conducted during the 2019/2020 school year in 12 schools in Belgrade. 1287 students aged 15 to 19 took part in this research (37.4% male). A modified version of the food frequency questionnaire, adapted for Serbian adolescents was used. Results: Logistic regression revealed that regular ED consumption was an independent risk factor, negatively correlated to SS in both sexes. Also, daily vegetable and water intake ( $\geq 21$ ) showed a positive correlation with SS in boys while, the odds of SS realization decreased with statements of sedative use in girl population. Conclusion: We show that EDs intake is negatively associated with SS in both sexes; daily vegetable and water intake ( $\geq 21$ ) may raise the odds for SS in boys, while sedative use may decrease the chances for SS in girls.

**Keywords:** energy drinks; sleep; adolescents; mental health; diet

## 21. THE IMPACT OF INTERNET USE ON CHILDREN'S ACTIVITIES AND PHYSICAL DEVELOPMENT

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**Objectives:** Children dedicate more and more time to internet content, which inevitably leads to an increase in their sedentary way of life and obesity. This study aimed to investigate the effect of Internet use (IU) on children's physical development. **Material and Methods:** In the cross-sectional study, the Screen time-based sedentary behaviour questionnaire was used among primary school students in the Braničevo district. The data were processed using SPSS Statistics for Windows, Version 20.0. **Results:** 836 primary school students from urban (62.2%) and rural (37.8%) areas participated in the study. The average age of the respondents was  $13.4 \pm 1.2$  years. Time spent at computer/smart devices was  $236 \pm 156$  minutes per day/student, and the total sedentary score was  $422 \pm 184$  minutes per day/student. There is no statistically significant correlation between the IU and vision problems (shortsightedness, farsightedness, astigmatism, strabismus), incorrect body posture or spine deformities. This study shows that the prevalence of obesity among respondents was 6.9%. Obesity among respondents was associated with time spent at a computer ( $p=0.001$ ) and total sedentary score ( $p=0.01$ ). **Conclusion:** There should be an association between obesity among primary school students and the IU.

**Keywords:** student, internet use, sedentary behavior, sedentary score, obesity

## **22. PREVENTION OF INTERNET ADDICTION- A RISK FACTOR FOR OVERWEIGHT IN ADOLESCENTS**

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**Objectives:** Today adolescents spend a lot of time using internet. As a consequence internet addiction and overweight may occur. The objective of this study was to examine ways of internet addiction prevention. **Materials and methods:** Data were obtained by searching the results of the studies in the PubMed database. **Results:** Many studies reported that obese adolescents are more often addicted to the internet and that there is a positive relationship between internet addiction and body mass index. Preventive measures should be primarily focused on adolescents, but also on their parents, peers and persons in their surrounding. Adolescents and their families should be aware that problem exists. Weaning from the internet addiction should be gradual. Time spent on the internet should be shortened every next day by half an hour or an hour until reaching the limit when internet user does not neglect other life activities. A key preventive factor is parental supervision. **Conclusion:** Having in mind the negative effects of internet addiction, significant attention should be paid to its prevention. Since parents have a crucial role, they should talk to their children and explain to them all the disadvantages of excessive internet use.

**Keywords:** prevention, internet addiction, overweight, adolescents

### **23. NUMBER OF PERSONAL PHOTOS ON THE FACEBOOK IN RELATION TO GENDER AND NUTRITIONAL STATUS OF HIGH SCHOOL STUDENTS**

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**Objectives:** The number of social networks is ever-increasing and the Facebook is probably the most popular one. We test a hypothesis that underweight or overweight may negatively affect the willingness to place a personal photo on the Facebook. **Materials and methods:** The study was conducted on a sample of 204 high school students (69 boys and 135 girls), aged from 18 to 19 years. The number of personal photos on the Facebook, gender, age, body weight and body height were obtained with a questionnaire. Body mass index (BMI) was calculated as body weight in kilograms divided by squared body height in meters. According to the WHO recommendations, the subjects were classified into three categories: underweight (BMI<18.5), normal body weight (BMI=18.5-24.9) and overweight (BMI≥25.0)

**Results:** The average number of personal photos on Facebook was 204±406 with a similar distribution in relation to gender (boys 230±590, girls 191±271, p = 0.526). Students with normal body weight had a higher average number of personal photos on the Facebook (220±461), compared to underweight and overweight students (161±187 and 163 ± 262, respectively). However, these differences were not statistically significant. **Conclusion:** We show that there is no significant relationship between the number of personal photos on Facebook and gender and the nutritional status of high school students.

**Keywords:** nutritional level, gender, photos, facebook

## **24. A DRAMATIC INCREASE IN THE PREVALENCE OF THE OBESE PEOPLE IS STILL EXPECTED, IF WE DON'T ACT TOGETHER TO PREVENT IT**

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Health Center Novi Sad, Serbia

**Objectives:** Obesity is an epidemic disease which global prevalence is growing since 1975. Obese shortens life, through direct connection with cardiovascular and cerebrovascular disease, diabetes, malignant disease. Unfortunately, as a disease it is not recognized, not accepted or stigmatized. **Methods.** The study was included 100 of 525 examined patients whose BMI exceeded  $30\text{kg/m}^2$ , in the Public Health Center of Novi Sad, from June 15-30. 2022. Retrospective analysis implies distribution according to analysis age, sex, Body Mass Index, waist circumference and analysis results of eating habits and physical activity. **Results.** The results show that 19.05% of 525 patients are obese, 48.95% have overweight, 32% have normal body mass. The average BMI of obese men was  $34, 59 \pm 4, 86$ , obese women  $33, 83 \pm 4, 86$ . Women had smaller average waist circumference as its statistically significant ( $t= 5, 482$ ;  $DF=98$ ;  $p= 0, 000$ ). The most common comorbidity was hypertension 72% and every fifth has diabetes 21%. Almost half eats food quickly 48%, half eat when they are nervous 51% and in free time there have no physical activity 73%. **Conclusion.** We are fit into the increased trend of obesity in the world. Two third are overweight, and that is our target group for education. The most unfavorable factor is physical inactivity.

**Keywords:** obesity, habits, illness

**SESSION: MICROBIOLOGY TODAY****INVITED LECTURES:****1. IMPLEMENTATION OF ESCMID AND IDSA TREATMENT GUIDELINES FOR MDR ENTEROBACTERALES, ACINETOBACTER BAUMANNII AND DTR PSEUDOMONAS AERUGINOSA INFECTIONS IN CLINICAL PRACTICE – ROLE OF CLINICAL MICROBIOLOGIST**

Ivana Ćirković

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Decisions about antimicrobial therapy are frequently challenging. Some specific situations are particularly frequent and difficult, but the evidence supporting the decisions in such circumstances may not be solid enough or available at all. The aims of this work are to raise the challenges faced in real life, to provide some recommendations for such situations based on the available evidence or rationale, and to delineate the priority areas for future research.

Multiple novel  $\beta$ -lactam/ $\beta$ -lactamase inhibitors have been introduced in the last few years, such as ceftolozane / tazobactam, ceftazidime / avibactam, imipenem / relebactam or meropenem/vaborbactam, and several others are in development, intended for the treatment of MDR Gram-negative infections. Such compounds are leading to the emergence, both *in vitro* and *in vivo*, of a plethora of novel resistance mechanisms that determine a major diagnostic and therapeutic challenge.

As highlighted by the recent IDSA 2020 guidance and ESCMID 2021 guidelines, there is often uncertainty about the precise role of novel  $\beta$ -lactam/ $\beta$ -lactamase inhibitor agents in clinical practice and the selection of antibiotic therapy for infections caused by Carbapenem-resistant (CR) *Enterobacterales*, CR *Acinetobacter baumannii* and Difficult-to-Treat Resistance (DTR) *Pseudomonas aeruginosa*. To support the practicing clinician, we have to tackle with some of the hard questions related to the real-life management of resistant Gram-negative infections. With the dynamic and rapidly evolving challenges of AMR, it will also provide pragmatic and up-to-date expert advice for difficult clinical situations. Selecting empiric therapy is becoming increasingly difficult and often leads to over or under-treatment. Either can negatively impact patient outcomes, with a possible increase of mortality and AMR in the long term. Yet, there is still a common reluctance to change initial regimen. In an era of ever faster technology, a critical review of the current practices is necessary before considering how the new breakthrough diagnostic solutions (faster pathogen ID and AST) will finally enable us to tackle these challenges.

Culture-independent diagnostics are charting a new albeit much needed course in managing patients impacted by sepsis by aiding in early identification of pathogens and resistance genes to improve patient outcomes and strengthen existing stewardship programs. The clinical impact of novel culture-independent diagnostics on patients impacted by COVID-19, sepsis, and resistant bacterial pathogens are of particular interest for clinical microbiologist with the goal to understand and evolve beyond the existing gold-standard diagnostic methods that remain limited by their sensitivity and extended time to identification.

**Keywords:** AMR, treatment guidelines, beta-lactam/beta-lactamase inhibitors, Gram-negatives

## **2. THE ROLE OF IPC IN REDUCING AMR BURDEN-WHO GUIDELINES ON CORE COMPONENTS OF IPC PROGRAMMES AT THE NATIONAL AND HEALTHCARE FACILITY LEVEL**

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Infection Prevention and Control (IPC) best practices are extremely important to combat AMR: they reduce occurrence of infection by preventing bacterial transmission, antibiotics use and therefore AMR. They limit the spread of MDR microorganisms. The objectives of the WHO Guidelines on core components of IPC programmes at national and acute health care facility (HCF) level are: to provide evidence-based recommendations on the core components of IPC programmes, to prevent HAI, to combat AMR. With focus on: multimodal behavior change approaches and bundles; WASH-IPC integration environment and human factors; AMR, IHR and IPC interface. Renewed focus on the *International Health Regulations (IHR)* which position IPC as a key strategy for dealing with public health threats of international concern. The Core components of IPC at National level includes: the IPC Programme; guidelines; education and training; HAI infection surveillance; multimodal strategies; monitoring, audit, feedback. The WHO Interim Practical manual support countries and HCFs with the stepwise approach of implementation: preparing for action; baseline assessment; developing and executing an action plan; evaluating impact; sustaining the programme over the long term. The National IPC assessment tool 2 (IPCAT) and IPC Self Assessment Framework (IPCAF) support implementation through effective baseline assessment and evaluation. BAPIC BulNoso coordinates the HCFs participation in the WHO Global survey on IPC and Hand Hygiene to support them to strengthen or build reliable, resilient, effective IPC programmes.

**Keywords:** IPC, AMR, IPCAT, IPCAF

### **3. BUNDLES: INNOVATIVE APPROACH FOR INFECTION PREVENTION IN INTENSIVE CARE**

Nina Gatcheva – Bulgarian Association of IPC BulNoso, Sofia, Bulgaria

**Objectives:** Patients in ICUs are at the greatest risk of acquiring nosocomial infections, both because of their serious underlying disease, and by exposure to life-saving invasive procedures.

To present bundles as an innovative approach for infection prevention and control in ICUs.

**Methods:** Based on the review of related literature sources definition of bundles approach, their structure and types is derived.

**Results:** Care Bundle is defined as a collection of interventions (usually 3-5) well known to be the best practice but frequently their application in routine care is inconsistent. The basic types of bundles in intensive care were presented and the results of their implementation were discussed.

**Conclusions:** Bundle approach is a means to ensure that the application of all the evidence-based interventions is consistent for all patients at all times, thereby improving outcomes.

Keywords: bundles, infection prevention, intensive care

**ORAL PRESENTATIONS:****1. NATURAL PRODUCTS AGAINST *HELICOBACTER PYLORI***

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**Objectives:** *Helicobacter pylori* is the primary etiologic agent responsible for gastroduodenal diseases in humans. Therefore, it is necessary to develop alternative natural and safe methods for controlling infections of the human body. A variety of plant species is capable of synthesizing many substances which show antibacterial activity.

**Methods:** The antibacterial activity of *Berberis vulgaris* extracts, alkaloid berberine, three essential oils (EOs), 12 naturally occurring monoterpene hydrocarbons, and selected antibiotics were investigated by the broth microdilution method in combination with chemometric methods.

**Results:** Extracts of *B. vulgaris* exhibited *in vitro* activity against *H. pylori*, but the activities were lower than those of berberine. Essential oils, phenolic monoterpenes and two antibiotics were classified in the same sub-cluster within agglomerative hierarchical clustering analyses. The natural compound that was the most active against *H. pylori* was carvacrol.

**Conclusion:** EOs of *Thymus glabrescens* and *Satureja kitaibelii* can be used to treat infections caused by *H. pylori*, as a potentially effective, cheap and safe natural products.

**Keywords:** *Helicobacter pylori*, *Berberis vulgaris*, carvacrol, Essential oil, Chemometrics.

## 2. EFFECT OF MATURATION ON THE ANTIMICROBIAL ACTIVITY OF *SATUREJA KITAIBELII* ESSENTIAL OILS

Dimitrijević Marija<sup>1</sup>, Mihajlov Krstev T.,<sup>2</sup> Đorđević V.<sup>1,2</sup>, Ćirić V.<sup>1,3</sup>, Miladinović D<sup>1</sup>.

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**Objectives:** Essential oils (EOs) are mainly secondary metabolites of plants and have been reported to have various biological activities such as antibacterial, antifungal, anticancer, anti-inflammatory, etc. Biological activity studies have shown that *Satureja kitaibelii* EO has significant antibacterial and antifungal activity. The aim of the present study was antimicrobial study of essential oil from natural populations *S. kitaibelii*, during different stages of development.

**Methods:** The antimicrobial activity was investigated by the broth microdilution method in combination with chemometric methods.

**Results:** The lowest values of bacteriostatic and bactericidal activity were recorded for the essential oil isolated in November. EO from November, and geraniol, a dominant component of EO were classified in the same sub-cluster within agglomerative hierarchical clustering analyses.

**Conclusion:** The obtained results lead to the conclusion that essential oil isolated from the plant in one month should not be used to evaluate antimicrobial activity. We suggest that antimicrobial studies of essential oils are based on monitoring the composition of essential oils during plant development, at least in three stages of vegetation cycle.

**Keywords:** *Satureja kitaibelii*, Essential oil, Antimicrobial activity, Maturation, Chemometrics.

### 3. SIMULTANEOUS DETECTION AND GENOTYPING OF HPV BY REAL-TIME RT-PCR METHOD

Hristina Gospodinović,<sup>1</sup> Jovana Ivanović,<sup>1</sup> Milica Ivanović,<sup>1</sup> Nataša Simić,<sup>1</sup> Maja Čabrilo,<sup>1</sup> Danica Kalinić,<sup>1</sup> Edita Grego<sup>1</sup>

<sup>1</sup>Institute of Public Health of Serbia "Dr Milan Jovanović Batut" Beograd, Serbia

**Objectives:** High-risk human papillomavirus (hr-HPV) testing has become the leading method in primary cervical cancer screening. This study aimed to determine the genotype distribution of hr-HPV among a small group of young women.

**Methods:** The performance of the High-Risk Human Papillomavirus DNA (Genotype) Diagnostic Kit (PCR-Fluorescence Probing) (*Sansure Biotech Inc.*) was evaluated in the samples obtained from 41 females 19 to 25 years of age. The test simultaneously provides results on the 15 high-risk genotypes (HPV 16, 18, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68).

**Results:** Out of the 41 samples, HPV DNA was detected in 17 (41%). The most frequent out of 13 identified HPV genotypes were types 31 (17%) and 16 (14%) while HPV types 18 and 52 were not detected in any of the analyzed samples. 11 other HPV types were detected with a frequency less than 10%.

**Conclusion:** Although this very specific test has been used to analyze the distribution of genotypes in a small number of samples, obtained results showed the high importance of hr-HPV RT-PCR genotyping among population in Serbia.

**Keywords:** HPV, genotyping, RT-PCR

#### 4. RETESTING OF BORDERLINE RESULTS IN COVID-19 DIAGNOSTICS OBTAINED WITH RT PCR

Jovana Ivanović,<sup>1</sup> Hristina Gospodinović,<sup>1</sup> Maja Čabrilo,<sup>1</sup> Milica Ivanović,<sup>1</sup> Danica Kalinić,<sup>1</sup> Nataša Simić,<sup>1</sup> Edita Grego<sup>1</sup>

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**Objectives:** RT-PCR tests for SARS-CoV-2 are occasionally repeated when suspect false-positive or negative results according to the value of Ct.

**Methods:** Of the 157998 samples analyzed by the RT-PCR method using 2019-nCov tests, 22337 were unambiguously positive, while 614 borderlines positive ( $40 \leq Ct \leq 42$  for N gene) samples were retested using xpert xpress SARS-CoV-2 tests, and same 2019-nCoV test, after using nucleic acid (DNA/RNA) extraction and purification kit (Sansure Biotech), to resolve any dilemmas arising from interpretation of the borderline values.

**Results:** Out of the total of 614 samples processed using the reagent sample release reagent in which one of the target genes had been detected, 299 borderline samples were retested with xpert xpress SARS-CoV-2 test, and 315 samples with 2019-nCoV test used. After complete retesting 614 samples with borderline values, we obtained 340 positive results ( 55.37%).

**Conclusion:** In the retest process, when there is a possibility for that, the use of tests of different characteristics is very import. This would benefit the healthcare community and potentially avoid risk of virus transmission in population without patient isolation, contact tracing, and outbreak declaration.

**Keywords:** SARS-CoV-2, RT-PCR, retesting

**POSTER PRESENTATIONS:****1. RAPID DETECTION OF SARS-CoV-2 AND OTHER RESPIRATORY VIRUSES WITH MULTIPLEX PCR ASSAY**Sanja Zornic<sup>1</sup>, Ivana Petrovic<sup>1</sup>, Bojana Lukovic<sup>2</sup><sup>1</sup>University Clinical Center Kragujevac, Department of Microbiology, Kragujevac, Serbia<sup>2</sup>Academy of Applied Studies Belgrade, College of Health Sciences, Belgrade, Serbia

**Objectives:** During the COVID-19 pandemic, it was extremely important to differentiate SARS-CoV-2 from other viruses, so the efficacy of *the multiplex PCR test*, BioFire Respiratory Panel 2.1 plus (RP2.1 plus), which can detect nucleic acids of 19 viruses, was examined.

**Materials and methods:** A total of 646 nasopharyngeal swabs were analyzed at the University Clinical Center Kragujevac from January to June 2022. The RP2.1 plus was performed according to the manufacturer's instructions.

**Results:** At least one virus was detected in 79.10% (511/646) of samples. Two viruses simultaneously were detected in 10.8% of samples, while SARS-CoV-2 and influenza A/H3 were found together in six samples (1.2%).

Rhinovirus (21.33%), influenza A/H3 (19.96%), SARS-CoV-2 (15.85%), and respiratory syncytial virus (12.52%) were the most frequently detected, followed by adenovirus (8.41%), parainfluenza virus type 3 (6.65%), and metapneumovirus (6.46%), respectively. Other viruses were less commonly detected.

The high frequency of SARS-CoV-2 detection in January (44/152; 28.95%) and February (19/63; 30.16%) coincided with the winter pandemic wave. The influenza A/H3 virus was most prevalent in March (39/111; 35.14%), while parainfluenza 3 was most prevalent in May (20/71; 28.17%).

**Conclusion:** The RP2.1 plus was very useful in detecting various respiratory viruses.

**Keywords:** respiratory viruses, SARS-CoV-2, multiplex PCR test

## 2. THE SCREENING OF GBS IN THE PREGNANT WOMEN FROM GYNAECOLOGY-OBSTETRICS CLINIC “NARODNI FRONT” BELGRADE

Marina Stojković<sup>1</sup>, Zlatica Čakić<sup>2</sup>,

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<sup>2</sup>Gynaecology– obstetrics clinic „Narodni front“ Belgrade, Serbia

**Objectives:** Group B streptococcus (GBS) is, in addition to *Escherichia coli*, the leading cause of early neonatal sepsis. About 10-30% of pregnant women are colonized with GBS in the vaginal and rectal region. Screening of GBS in all pregnant women between 36 to 38. weeks' gestation, for possibility of being carriers of the disease.

Use of intrapartum antibiotic prophylaxis in pregnant women with positive finding.

**Methods:** In 2011, the GAK Narodni Front will start screening for GBS in all pregnant women who follow the pregnancy in GAK Narodni Front. Smears are taken from pregnant women at the lower vagina and rectum . The swabs are inoculated into selective LIM broth.

In pregnant women with positive finding of GBS during delivery, an antibiotic prophylaxis (IAP) with ampicillin is introduced and in case of an allergy to penicillin, with clindamicine.

**Results:** In the period of 05.07.2011. to 31.12.2020. a screening was made with 18 267 pregnant women between 35 and 38 weeks' gestation.. In 2 148 pregnant women, GBS is isolated (≈12%).

**Conclusion:** The use of intrapartum antibiotic prophylaxis in the GAK “Narodni front” within this 10 years long period has given results, which means that the children, born by mothers, who got a prophylaxis, did not develop early-onset disease newborns.

**Keywords:** prenatal group b streptococcal screening, intrapartum antibiotic prophylaxis, early-onset disease newborns

### 3. ANTI-CUTIBACTERIUM ACNES EFFECT OF DIFFERENT HYDROLATES

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<sup>4</sup>Promontis, Gadžin Han, Srbija

**Objectives:** The use of plants for medicinal purposes has a long tradition. In particular, the interest in natural products obtained from aromatic plant distillation (essential oils and hydrolates) has been growing in recent years. Increasing antibiotic resistance is leading to increased investigation of herbal products with potential antimicrobial effects.

**Methods:** The aim of this study was to test the antimicrobial activity of six hydrolates (obtained after hydrodistillation of *Melissae officinalis herba*, *Daucus carotae semen*, *Thymi vulgaris herba*, *Lavandulae officinalis flos*, *Hyssopi officinalis herba*, and *Chamomillae romanae flos*) towards *Cutibacterium acnes*. Four dilutions of each sample were tested in microdilution assay and the results were expressed as minimal inhibitory concentrations (v/v%).

**Results:** Our results indicate that all tested hydrolates possess antimicrobial activity. The MIC values were 50 (v/v%) for hydrolates of *Thymi vulgaris herba*, *Lavandulae officinalis flos*, and *Chamomillae romanae flos* and 100 (v/v%) for hydrolates of *Melissae officinalis herba*, *Daucus carotae semen*, and *Hyssopi officinalis herba*.

**Conclusion:** According to our results, all studied hydrolates are potential antimicrobial agents; some show activity against *Cutibacterium acnes* even when double diluted.

**Keywords:** hydrolates, *Cutibacterium acnes*, antibacterial activity

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#### 4. A SYNERGISTIC ANTIBIOFILM ACTIVITY OF TEA TREE AND LEMON EUCALYPTUS ESSENTIAL OILS ON *LEGIONELLA PNEUMOPHILA*

Martina Oder<sup>1</sup>, Rok Fink<sup>1</sup>, Kaća Piletić<sup>2</sup>, Zvonimir Marijanović<sup>3</sup>, Romana Krištof<sup>1</sup>, Lucija Bićanić<sup>2</sup>, Ivana Gobin<sup>2</sup>.

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<sup>3</sup>Department of Food Technology and Biotechnology, Faculty of Chemistry and Technology, University of Split, Croatia

**Objectives:** In recent years several natural compounds, like essential oils (EO's), were tested against *L. pneumophila* for their biocidal characteristics. The aim of this research was to test the potential use of tea tree (*Melaleuca linariifolia* var. *al-ternifolia*) and lemon eucalyptus (*Eucalyptus citriodora* Hook) EO's from Australian native plants on *L. pneumophila* adhesion and biofilm formation.

**Methods:** For the characterization of the constitutes compounds of selected EO's gas chromatography and mass spectrometry (GC-MS) analyses was applied. *L. pneumophila* sg 1, ATCC BAA-74 was used in this study. For testing the potential interaction effect of tea tree and lemon eucalyptus tree EO's on *L. pneumophila*, the checkerboard synergy method was used.

Results of antiadhesion and antibiofilm properties of TT EO showed a dose-response for both tested EO's. Several combinations of EO's show the synergistic and additive antiadhesion and antibiofilm effect at a significantly lower dose compared to MIC concentration.

**Conclusion:** Our study has proved the antibiofilm effect of EO's and synergistic effect of the combination of tea tree and lemon eucalyptus EO's towards *L. pneumophila*. It seems that *L. pneumophila* is especially sensitive to various biomolecules from EO's even in the form of biofilm.

**Keywords:** essential oils, *L. pneumophila*, adhesion, antibiofilm effect;

## **5. FALSE-POSITIVE BLOOD CULTURE IN A PATIENT WITH ACUTE LEUKEMIA – CASE REPORT**

Nevena Milosavljević, Vesna Kovačević Jovanović

General hospital Medigroup, Central laboratory, Belgrade, Serbia

**Objectives:** In this report, we aimed to identify factors which may cause false positive result in automated blood culture system and to point out the importance of correctly interpreting results.

**Materials and methods:** A 86 year woman was hospitalized due to high temperature, cough, nausea and malaise. Clinically all systems were normal and the chest was bilaterally clear. Laboratory investigations showed leukocytosis and elevated value of CRP. Urine and blood culture was obtained, and she was started empirical antibiotic therapy. Her further lab tests revealed acute myeloblastic leukemia (WBC count =  $91.2 \times 10^9/L$ ). Fully automated system Bact/Alert 3D (BioMérieux, France) was used as the blood culture method.

**Results:** Positive growth signal was detected within 24 hours of incubation in the aerobic bottle. The microscopic preparation and appropriate subcultures did not show the presence of microorganisms. CO<sub>2</sub> plot of positive blood cultures was linear (in contrast to the exponential rise of CO<sub>2</sub> in true-positive cultures). In the anaerobic bottle signal was negative after five days.

**Conclusion:** Physicians and laboratory personnel should be aware that prompt recognition of false-positive blood culture signal can prevent misinterpretation errors avoiding inappropriate and unnecessary antibiotics use. The fast time to positivity and the CO<sub>2</sub> plot could be useful for early identification of such cases.

**Keywords:** false-positive, blood culture, leukocytosis

## 6. MATERNAL-NEONATAL LISTERIOSIS-CASE REPORT

Jelena Savić, Vesna Kovačević Jovanović

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**Objectives:** Listeriosis is a rare foodborn infection caused by *Listeria monocytogenes*. Pregnant woman are prone to this infection and fetal infection is a serious condition, entailing premature birth, abortion, sepsis, CNS involvement or even death. We report a case of listeriosis detected from routine control of samples immediately after birth, which contributed to quick recognition and adequate therapy of the disease.

**Materials and methodes:** In 33-year-old woman during 37th-week pregnancy worsening of the fetal condition (asphyxia fetus imminens) was observed during regular monitoring. She underwent an emergency caesarean section, when the uterine swab and nasopharyngeal aspirate of the newborn were sent for routine laboratory examination. In the laboratory investigation of mother and newborn, a leukocytosis and elevated level of CRP was found, after which an empirical antibiotics treatment with ampicillin and amikacin was started.

**Results:** Tested samples showed the growth of catalase positive, oxidase negative colonies with narrow zone of  $\beta$ -hemolysis on blood sheep agar after 24h of incubation under microaerofile conditions. Gram stained smears showed Gram positive rods. Based on clinical examination and microbiological findings, initial diagnosis of *listeriosis* was made. Final identification was done by VITEK® 2 COMPACT automated ID/AST instrument within 36h after child birth.

**Conclusion:** Although is *L. monocytogenes* a rare pathogen, must not be forgotten especially during pregnancy. We emphasize the great importance of laboratory diagnostics, especially the routine examination of the newborn nasopharyngeal aspirate for detecting the early onset of the disease.

## **7. DISTRIBUTION OF MRSA IN WOUND SWABS IN THE PERIOD FROM MARCH 2016 TO MARCH 2022 IN THE INSTITUTE OF PUBLIC HEALTH OF BELGRADE**

Suzana Živadinović Tasić, Hranislav Kačarević, Tatjana Ristić, Branislava Zlatar, Danka Purtić Kljajić, Institute of Public Health of Belgrade, Serbia

**Objective:** Our objective is to show the distribution of MRSA in *Staphylococcus aureus* isolates from wound swabs in annual periods, starting from 01.03. 2016 to 28.02. 2022, with special reference to the period of the pandemic caused by the SARS- CoV -2 virus.

**Materials and methods:** *Staphylococcus aureus* was isolated from wound swabs using standard microbiological methods. The identification findings were confirmed using Maldi-TOF technology. We conducted susceptibility testing using the disc diffusion method on a Muller Hinton plates and by determining MIC values using VITEK 2 compact device. Susceptibility testing was performed using the EUCAST standard.

**Results:** *Staphylococcus aureus* isolates revealed an overall annual MRSA prevalence of 3.18% in 2016, 12.02% in 2017, 9.46% in 2018, 12.06% in 2019, 15, 29% in 2020, 15.21% in 2021.

**Conclusion:** In the years of the SARS-CoV-2 virus the prevalence of MRSA isolates is about 15% and shows an increase compared to the annual periods before the pandemic.

**Keywords:** *Staphylococcus aureus*, MRSA, SARS-CoV-2

## 8. BACTERIAL ISOLATED FROM CEREBROSPINAL FLUID OBTAINED FROM THE PATIENTS OF CLINICAL CENTER NIS IN THE PERIOD OF 10 YEARS (2011-2021).

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Bacterial meningitis is the life threatening disease and there is a high risk for development of permanent sequelae. The outcome depends on adequate empirical therapy. Etiology of community-acquired and hospital-acquired bacterial meningitis is different.

In the Center for microbiology, Public Health Institute Niš, in a period of 10 years we examined 2216 samples of cerebrospinal fluid (CSF) obtained from patients hospitalized in Clinical center Niš with community-acquired and hospital-acquired meningitis. Isolation and identification of bacteria was performed by use standard microbiological methods and VITEK2 system. Bacterial isolates were detected in the 15, 39% of all CSF samples ( 9, 3% in 2018.; 23, 68% in 2016.). In the period of 10 years we isolated 1 isolate of *Haemophilus influenzae*, 3 isolates of *Neisseria meningitidis*, 33 isolates of *Streptococcus pneumoniae* and 11 isolates of *Listeria monocytogenes*. All isolates of *Haemophilus influenzae* and *Neisseria meningitidis* obtained from CSF sample of children under one year old. The most isolates of *Streptococcus pneumoniae* obtained from adult patients, only 8 from children and 3 were under one year old. From samples obtained from neurosurgical patients Gram positive were isolated from 54 samples of which 45 were *S.epidermidis*; from 58 Gram negative isolates the most common was *Acinetobacter* spp. (26), followed by *P.aeruginosa* (10) and *K.pneumoniae* (10).

Exept *Streptococcus pneumoniae*, *Listeria monocytogenes* was common isolate from CSF of adult patients. From CSF of neurosurgical patients the most common Gram negative isolates were multiresistant bacteria.

**Keywords:** bacterial meningitis, isolates.

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**SESSION: CURRENT PARASITOSIS AND FUNGAL INFECTIONS****INVITED LECTURES:****1. BLASTOCYSTIS: CONTROVERSIES AND PERSPECTIVE**

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*Blastocystis* (*B.*) is a single-celled protozoan which colonizes human and/or animal gastrointestinal tract (GIT). In fact, the spectrum of possible hosts is rather diverse and involves primates, other mammals, birds, reptiles, amphibians and insects. Further, the presence of this parasite has been established in the environment as well, although the number of studies about that is insufficient [1]. It is estimated that over a billion of people worldwide are colonized by this microorganism [2]. In humans, any isolated species has been designated as *B. hominis* [3], but due to genetic diversity the term has been replaced with *B. species* or *Blastocystis* [4]. Molecular methods have made possible the establishment of a high degree of genetic diversity within the genus. Based on the gene analysis in a small ribosomal subunit of ribonucleic acid (SSU rRNA), the isolates from mammals and birds have been classified into 28 confirmed subtypes (STs) constituting separate species, and perhaps even genera [5]. In humans, ST1-ST9 and ST12 have been found and most of the isolates of human origin are ST1–4 (around 95%). The most common subtype in Europe is ST3, followed by ST4 and ST1, while in the rest of the world ST3 is also prevailing, followed by ST1 and ST2 [6]. Less common subtypes in humans are more commonly present in other hosts and they can cause zoonoses. ST5 subtype is usually found in pigs [7-9], ST6 and ST7 in birds, and so on [5, 6].

There are numerous controversies about this still insufficiently studied organism. Because of the presence of *Blastocystis* in the GIT of many healthy people there still persists the dilemma about the pathogenic potentials and clinical relevance of this protozoan. Although it is an ubiquitous parasite, its geographical distribution varies not only among different regions and countries, but also among particular population groups within a country and/or region. Poor hygiene, contaminated water and food, as well as contacts with animals, are the most frequent risk factors for feco-oral infection with the protozoan. The countries with weaker economy have a higher prevalence of blastocytosis – *Blastocystis* infection but economically stronger countries are not spared either. In developed countries, the prevalence is estimated at 10-15%, while in developing countries the proportion is 30-50% [8].

*Blastocystis* is characterized by a number of its morphological forms (vacuolar, granular, ameboid, cystic). In asymptomatic carriers vacuolar form is the one most common, while in persons with symptoms and signs of blastocytosis ameboid form of the parasite predominates [10, 11]. Although blastocytosis is usually associated with individuals with GIT complaints (abdominal pain, nausea, bloating, diarrhea), the scarce literature data suggest that it is more common in persons with other clinical manifestations (irritable bowel syndrome - IBS, nonspecific colitis, chronic inflammatory bowel disease – HIBD, urticaria). *Blastocystis* is non-invasive and does not possess any cytophagocytic capacities. Hypothetically, specific subtypes or strains within *Blastocystis* subtypes can be associated with the development of certain clinical manifestations, while others are not [12].

The studies of *Blastocystis* which utilized different *in vitro* systems and experimental models on rodents [13], similar as the reports of clinical cases [14], have demonstrated the virulence of particular isolates and their harmful effect on the host bowel epithelium. Virulent isolates are able to induce apoptosis and degradation of target cells, resulting in increased bowel permeability. On the other hand, recent investigations have shown that bowel colonization by *Blastocystis* in humans is associated with changes in bowel microbiome composition and increased number of bacteria [15-17]. The results of studies on a mouse model have demonstrated that *Blastocystis* is able to reduce the number of certain useful bacteria in the GIT, leading to dysbiosis [18]. Metagenomics data from the population of asymptomatic individuals, collected by independent research teams from all over the world have revealed that *Blastocystis* is associated with specific bacterial profiles. This fact suggests that *Blastocystis* is a potential „ecosystem engineer“, which questions the

traditional dogma that it is a pathogen. This could incite various innovative research solutions for the use of *Blastocystis*, which would impact the composition of bowel flora [15-18].

The guidelines for faecal microbiotransplantation (FMT) usually involve the list of potential pathogens which should not be present in donor stool, *Blastocystis* being one of them. However, recent data have shown that FMT recipients show a greater degree of clinical improvement if the stool contains *Blastocystis*, in contrast to those who receive *Blastocystis*-negative stool from the donor. Future studies should clarify whether this controversial parasite would make possible better comprehension of the composition and ecological consequences of „healthy“ bowel microbiome, i.e. whether it can be used as an indicant and/or modulator of bowel microbiome [15-18].

In the first study of *Blastocystis* in Serbia, the subtypes in animals (pigs) and humans were identified using SSUrDNK sequencing [19]. By way of filogenetic analysis, three subtypes were identified (ST3, ST5 and ST6). In all pig stool samples ST5 was found, and in human stool samples ST3 and ST6 were detected. This last subtype is relatively unusual in Europe and is very well adapted to birds as hosts (the possibility of sporadic transmission of a zoonosis to humans).

Although the number of studies of this parasite is growing worldwide, numerous dilemmas about *Blastocystis* still persist. Since *Blastocystis* is isolated in numerous samples originating from living organisms and from the environment, a collaborative, multisectorial and transdisciplinary approach known as One Health has been suggested and adopted at the end of May this year for a future study of *Blastocystis*. The One Health approach is required to study *Blastocystis* by integrating new advances in medical, veterinary, public, and environmental health research.

**Keywords:** *Blastocystis*, subtype, prevalence, virulence, One Health

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**ORAL PRESENTATIONS:****1. CHARACTERIZATION OF THE HUMORAL AND CELLULAR IMMUNE RESPONSE TO TRICHINELLA AND SARS-COV-2 ANTIGENS IN PATIENTS INVOLVED IN TRICHINELLOSIS OUTBREAK IN SERBIA IN MARCH 2022**

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**Objectives:** Trichinellosis outbreak appeared in Branicevo district, eastern Serbia, in March 2022. The source of infection was the traditional meat product kulen infected with *Trichinella spiralis*. In addition to the humoral and cellular immune response to *Trichinella*, this study examined for the first time the immune response to the SARS-CoV-2 virus in trichinellosis patients who were previously vaccinated and/or recovered from Covid-19 infection.

**Methods:** Fifteen out of 28 patients with trichinellosis participated in the study. Anti-*Trichinella* and antiviral antibodies were determined using tests produced by Inep, Serbia, namely: FITC *Trichinella spiralis* Antibody Detection Kit and ELISA SARS-CoV-2 IgG (RBD-S protein). Lymphocytes reactivity on antigen stimulation was determined by *in vitro* cultivation and Flow Cytometry.

**Results:** There were no inpatients due to the mild clinical picture and lack of complications. Anti-*Trichinella* antibodies were accompanied by the presence of anti-RBD SARS-CoV-2 antibodies. T and B lymphocytes specific for *T. spiralis* as well as for SARS-CoV-2 virus were detected.

**Conclusion:** The obtained results indicated that viral infection and/or vaccination did not affect the capacity of the immune system to respond adequately to *T. spiralis* antigens and vice versa.

**Keywords:** *Trichinella*, Covid-19, immune response

**POSTER PRESENTATIONS****1. CHALLENGES IN THE DIAGNOSIS AND TREATMENT OF VULVOVAGINAL CANDIDIASIS**

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**Objective:** determine the frequency of vulvovaginal candidiasis and determine the presence of *Candida albicans* and *Candida non albicans* species in the female genital tract.

**Material and methods:** In the period from February 2, 2022 to April 30, 2022. year, genital swabs of 2044 patients were processed by the standard method of yeast cultivation. All patients were sent from the Health Center in the city of Belgrade. A germination test was also performed. Germ tube positive species were identified as *C. albicans*.

**Results:** *Candida* spp. in large amounts was isolated in 288 (14.1%). Then, a germination test was performed, so that out of 288 isolates of *Candida albicans* 188 (65.2%) and *Candida non albicans* were 100 (34.8%).  
**Conclusion:** *C. albicans* is the most common causative agent but there is a steady increase in the prevalence of NAC species infections due to the increasing use of antifungal agents and the sensitive patient population. Most NACs respond poorly to fluconazole, *Pichia kudriavzevii* (formerly *Candida krusei*) is resistant to fluconazole. Common therapy for VVC leading to treatment failure and the need for alternative therapies. VVC cases are of the utmost importance to ensure the appropriate and effective use of antifungal agents.

**Keywords:** *Candida albicans*, *Candida non albicans* (NAC), vulvovaginal candidiasis

**SESSION: THEORETICAL AND PRACTICAL PROBLEMS OF COMMUNICABLE DISEASES****INVITED LECTURES:****1. PANDEMIC COVID-19, EPIDEMIOLOGY EVENT OF THE CENTURY**

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Every pandemic or epidemic is not only a medical problem but also a social, psychological, economic and political one.

Corona viruses (CoV) are a family of causes of various diseases, from a mild cold to a severe form of the disease, i.e. severe acute respiratory syndrome (SARS-CoV-1) or Middle East respiratory syndrome (MERS-CoV). Corona viruses cause diseases in animals, and for now, it is known that 7 types of viruses can cause human diseases, and only some (SARS-CoV-1 and MERS-CoV) have been proven to spread between humans. The new corona virus SARS-CoV-2 was a completely new strain of the virus that had not been identified in the human population until then. According to its genetic structure, it is similar to SARS-CoV (SARS-1). In the last hundred years, no microbe, not even a virus, has shown such a great mutation potential and with such serious consequences for the human population on the planet.

In December 2019, cases of pneumonia of unknown etiology appeared in China, and on January 7 it was confirmed that SARS-CoV-2 (COVID 19) is the cause of the disease.

In March 2020, the WHO declared this disease a pandemic.

The disease can be asymptomatic, or it can manifest itself as a mild, moderate or severe disease with cough, shortness of breath, difficulty breathing,

fever, as well as other symptoms and signs (sudden loss of smell, taste or change in taste, headache, chills, muscle pain, fatigue, vomiting and/or diarrhea). In more severe cases, the infection can cause pneumonia, severe acute respiratory syndrome, kidney failure, and even death.

In the first year of the pandemic, many laboratory, clinical, immunological and virological works and findings indicated that SARS COV-2 binds to ACE-2 receptors in type II (probably also type I) pneumocytes, which participate in the formation of the blood-lung barrier and gas exchange), which are located in the lower respiratory tract. The frequent occurrence of diarrhea, much more often than the Chinese studies showed, was explained by the existence of these receptors on the enterocytes (main cells of the small and large intestine). However, as a result of new mutational forms or substrains, it became clearer that this is a disease of a systemic nature with predominant vascular (thrombotic) characteristics. This was normally followed by a change and harmonization of therapeutic protocols. The appearance of new and more successful drugs of the type virostatic with assumption and virocytic, especially given in the first 5 days of infection, gave serious hope solution to this severe infection.

Preventive measures were aimed at general prevention measures for all respiratory infections. However, the pandemic was developing outside of all known epidemiological rules and world experience. This was especially true for frequent mutations in short time intervals. Requirements for harmonizing therapy forced clinicians to now, they already constitute 14 different treatment protocols. The frequency of mutations of this type of virus has not been recorded in medical history until now, which puts this disease in the rank of the most severe, like "Spanish fever".

With the beginning of vaccination, possible solutions have been reached, but there are still many unknowns and a constant need for the implementation of measures to prevent and suppress this vicious disease. Regardless of the greatest, so far, recorded anti-vaxxer pressure, the countries that reached a higher vaccination coverage of 80%, were closer to a possible solution. However, any abandonment of persistence in the consistent implementation of preventive measures gave negative results in the control of this disease.

It is likely that a balance and equilibrium will be established between the macroorganisms (man) and microorganism (the virus that causes COVID 19) and lead to the endemism of the disease, that is, the seasonality that we know about the flu.

According to the available WHO data, the USA, India and Brazil have had the most deaths so far, and in Europe Germany, France and Italy. However, according to the mortality rate, many countries with a much smaller population but also with economic and health organizational resources have suffered more severe blows to the health of their population. .

Philip Leuman from Cornell University and a number of scientists from the fields of medicine and economics claimed that the complete closure (lock down) applied by many countries, especially in the first half of the pandemic, did not produce noticeable and demonstrable successful results. pay multisectoral attention because the pandemic is still ongoing.

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The variant is thought to be a combination of the Omicron BA.1 and BA.2 subvariants, the Health Ministry reported on Wednesday morning.  
By Shira Silkoff, Published: MARCH 16, 2022 13:42, Updated: MARCH 16, 2022

## COVID-19 and vaccination

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### Abstract

**Introduction:** Vaccines against COVID-19 are effectiveness in order to decrease incidence and mortality rates, as well as reduced the case fatality ratio caused by SARS-CoV-2. However, there were different reasons for delaying in acceptance or refusal of COVID-19 vaccines despite their availability.

**Material and Methods:** A cross-sectional survey was carried out between 1<sup>st</sup> September and 31<sup>st</sup> October, 2021. Data were collected using an electronic questionnaire. Google forms® platform with a snowball sampling strategy was used. Participants aged  $\geq 15$  years across the Serbia were included.

**Results:** There a total of 1418 participant were included, and 1065 (75.1%) of whom were vaccinated with least one dose of COVID-19 vaccine. Persons who beliefs that in our country there were not registered life-threatening reactions after immunization against COVID-19, or those who do not believe that vaccines against COVID-19 can provoke autoimmune disease or infertility, and those who believe that adverse events after immunization against COVID-19 vaccine are not severe were more likely ( $<0.001$ ) to receive vaccine against COVID-19. In addition, participants who believed that vaccines against COVID-19 can protect against severe clinical forms of disease and lethal outcome or that vaccines against COVID-19 available in Serbia are safe were 37 and 52 respectively times more likely vaccinated against COVID-19 than those who did not believe. The dominant reason (31%) for not vaccinated against COVID-19 was belief that vaccine against COVID-19 are not safe, while every fifth unvaccinated participant did not receive COVID-19 due to previously SARS-CoV-2 infection or due to delaying (“not prepare now”) to get COVID-19 vaccine. For the one-half of vaccinated person, the main source which influencing to getting COVID-19 vaccine, was the opinion of ours respectable experts.

**Conclusion:** The main predictor of receiving of COVID-19 vaccine is the belief that “vaccines against COVID-19 available in Serbia are safe”. Those who were not believe that vaccine are safe rejected or delayed vaccination against COVID-19. There are need an appropriate public health messages for those who were not vaccinated with a focus on reducing concern about vaccine side effects as well as eliminating conspiracies related to COVID-19 vaccines.

**Key words:** Immunisation, COVID-19, vaccination decisions, acceptance, hesitancy, Serbia

### Introduction

The global pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome corona-virus 2 (SARS-CoV-2) is still ongoing. In combating with COVID-19, many different measures (e.g. travel bans, partial/full lockdown, contact tracing, and social/physical distancing) were implemented [1]. Despite this, there is an unequivocal evidence that vaccination is the crucial to limit the pandemic spread of SARS-CoV-2/COVID-19, particularly in densely populated territories [2, 3].

The main role of COVID-19 vaccines is significantly decrease incidence and mortality rates, as well as the reduction of case fatality ratio caused by SARS-CoV-2 [2].

Despite the all abovementioned advantages, the success of vaccination campaign can be threatened by vaccine hesitancy worldwide [3]. Already before COVID-19 pandemic, vaccine hesitancy was designed as one of the ten challenges to global health, and, unfortunately, this problem has grown throughout the ongoing COVID-19 pandemic [2, 4].

Vaccine hesitancy is complex and context specific, and it is influenced by various factors such as complacency, convenience and confidence [5]. On the other hand, acceptance of vaccine depends on territories of interest. For example, in developed countries, 15%– 20% of the population have expressed unwillingness to receive the COVID-19 vaccine, while in developing countries hesitancy can be as high as 63.2% [3].

In Serbia, the COVID-19 vaccination campaign started on December 24, 2020, and it is still ongoing. Recommended immunization programme was implemented and all COVID-19 vaccines were offered “free of charge”. Serbian Medicines Agency approved five vaccines for use in countrywide vaccination, namely Pfizer-BioNTech BNT162b2 (Comirnaty®), Gamaleya Research Institute Gam-COVID-Vac (Sputnik V®),

Sinopharm BBIBP-CorV (Vero Cell®), Oxford/AstraZeneca ChAdOx1-S/nCoV-19 AZD1222 (Vaxzevria®), and Moderna mRNA-1273 (Spikevax®) [6].

Coverage of the least one dose COVID-19 vaccines in adult Serbian population of Serbia until October 30, 2021 (close to finishing this research) was 49.7% i.e. in the Autonomous Province of Vojvodina (APV) was 47.5% [7].

Although there are many published studies that evaluated the willingness to vaccinate against SARS-CoV-2 infection before starting of COVID-19 immunization, limited data are available in the international literature regarding the reasons for receive vaccination vs. reject vaccination when COVID-19 vaccines became available in a certain territory. We aimed to evaluate the main reasons for receiving or rejection/delaying of COVID-19 vaccines among population in Serbia – nine months after countrywide vaccination gets started. Results of this study may help to implement vaccine rejection countermeasures in order to achievement of better success of vaccination program against the SARS-CoV-2 infection.

### **Materials and methods**

Using an electronic questionnaire, we conducted a cross-sectional survey between 1<sup>st</sup> September and 31<sup>st</sup> October, 2021. This cross-sectional survey was designed using Google forms® platform with a snowball sampling strategy. We involved only participants aged  $\geq 15$  years across the Serbia, including major cities (Belgrade-capital city of Serbia, and Novi Sad-main administrative Centre of APV-North Province of Serbia), and other minor cities across Serbia. The study investigators shared the survey link in social media (Twitter, Instagram, Facebook), on the website of the Institute of Public Health of Vojvodina, Novi Sad, and through emails to their primary social contacts.

There an anonymous, structured questionnaire was used, which was developed after a detailed consult a literature review and researches [8-12]. The draft questionnaire was pilot tested in 200 participants. The participants were in detail instructed to select one or more given option from the list of responses.

All analyses were performed using SPSS software tool (version 22) MedCalc for Windows, version 12.3.0 (MedCalcSoftware, Mariakerke, Belgium). A two-tailed p-value  $< 0.05$  was considered statistically significant.

### **Ethical consideration**

This investigation was considered as a public health surveillance, and no clearance by Ethics Committee for this response was required in Serbia. Personal and confidential information were removed, except for sociodemographic, attitudes, beliefs and perception towards COVID-19, and participants' vaccination status, and the data were anonymized before we accessed it.

### **Results**

During the study period, there a total of 1418 participant were included, and there 1065 (75.1%) were vaccinated with least one dose of COVID-19 vaccine. Mean age of vaccinated and unvaccinated persons was 46 years and 39.3 years, respectively.

Comparing the education level of participants and their attitudes and beliefs with vaccination status, we found that participants with primary education level only information that they planed the vaccination against influenza in the future ( $p= 0.0029$ ) or if they think that vaccines against COVID-19 cannot provoke infertility ( $p= 0.0002$ ) or that vaccines against COVID-19 can protect against severe clinical forms of disease and lethal outcome ( $p= 0.0142$ ), significantly associated with receiving of the COVID-19 vaccine. For respondents with other education levels (secondary, higher education level, graduate or post-graduate) there was a mainly significant positive association between attitudes/believes and vaccination status. Post-graduate participants were equally vaccinated regardless of the fact whether or not their family members affected by COVID-19. Participants with higher secondary or post-graduate were equally vaccinated regardless of existing any chronic disease. In addition, among respondents with secondary or higher secondary or post-graduate education level was not significant association between receiving of vaccines in a childhood and vaccination with COVID-19 vaccines (**Table 1**).

Participants who believed that in our country there were not registered life-threatening reactions after immunization against COVID-19 [OR (95% CI): 8.49 (6.38-11.29)] or those who did not believe that vaccines against COVID-19 can provoke autoimmune disease [OR (95% CI): 6.82 (5.14-9.04)] or infertility [OR (95% CI): 8.37 (6.21-11.27)], those who believed that adverse events after immunization against COVID-19 vaccine

are not severe [OR (95% CI): 14.3 (9.33-21.99)] were more likely to receive vaccine against COVID-19. Those believing that vaccines against COVID-19 can protect against severe clinical forms of disease and lethal outcome or that vaccines against COVID-19 available in Serbia are safe were 37 [OR (95% CI): 36.57 (24.99-53.51)] and 52 [OR (95% CI): 52.47 (33.80-81.45)] respectively times more likely vaccinated for COVID-19 than those who did not believe. We calculated the ROC curve for the ability of significant predictors in predicting the vaccine acceptance, and the highest values of accuracy were determined for belief that vaccines against COVID-19 available in Serbia are safe (AUC = 0.872, 95% CI: 0.857–0.885), and also for belief that vaccines against COVID-19 can protect against severe clinical forms of disease and lethal outcome (AUC = 0.872, 95% CI: 0.855–0.888) (**Fig 1**).

In regard to dominant reason for not vaccinated among 353 persons, the main reason (31%) was belief that vaccine against COVID-19 are not safe, while every fifth unvaccinated participant was did not receive COVID-19 due to previously SARS-CoV-2 infection or due to delaying (“not prepare now”) to get COVID-19 vaccine (**Fig 2**).

Two third of unvaccinated respondents did not answer about the dominant source of decision to be unvaccinated, but 15% of them stated that this decision done after communication with their close friends/family members. Unfortunately, 7% of unvaccinated persons had advice for this from health care workers (HCWs) (**Fig 3**).

Among 1065 vaccinated respondents, the dominant reason (90%) for getting the COVID-19 vaccine was personal protection (“Protect myself”) against COVID-19, while all other reasons computed with 10% (**Fig 4**).

Regarding the main source which influencing to getting COVID-19 vaccine, one half of vaccinated person stated the opinion of ours respectable experts, and every third vaccinated subject this decision made after communication with vaccinated friends/family members (**Fig 5**).

Regarding the type of COVID-19 vaccine (Moderna mRNA-1273 vaccine was not considered due to it was became available after the study period), we found that Pfizer-BioNTech BNT162b2 vaccine was predominate given vaccine among included participants in the City of Novi Sad and other regions of Serbia, while Sinopharm BBIBP-CorV vaccine was more frequently used among respondents from Belgrade and other cities in Vojvodina (**Fig 6**).

## Discussion

This study was conducted during the largest (fifth) wave of COVID-19 outbreak during 2021, and research was finished ten months after introducing of recommended immunization against COVID-19 in Serbia. There, we showed the main predictors for receiving any of the vaccines against COVID-19 in Serbian population aged  $\geq 15$  years.

Results of least three different reviews [2, 13, 14], that covered 125 studies conducted form different territories, strongly indicate that the most recognized factors influencing public attitudes towards COVID-19 vaccines were beliefs, knowledge, and health literacy. In addition, there were also perceived susceptibility, threats and benefits, social, religious, and political views, previous receiving the flu vaccines, and lack of trust in the governments and companies producing the vaccines.

We found that the main reason (31%) for not receiving COVID-19 vaccine among unvaccinated people was the belief that COVID-19 vaccines are not safe, and every fifth unvaccinated respondents were unvaccinated due to previous confirmed COVID-19 or delaying of giving vaccines against COVID-19. Interestingly, only 7% of included subject were unvaccinated because of potentially adverse effects of the vaccines. On the other hand, 90% of participants who were vaccinated with at least one dose of COVID-19 vaccines decided to receive vaccine due to protect themselves. Amongst our unvaccinated respondents, two third of them were not answered about the source for their decision for COVID-19 vaccination, while 15% of them this decision made in communication with their family members or friends.

It is a known fact that HCWs are considered as a trusted source of information about vaccination and their recommendation mostly presents a key driver of routine immunisation uptake [15, 16, 17-19]. Unfortunately, we found that some (7%) of unvaccinated people, this decision made after communication or advice given by HCWs. Although it was not possible to determine whether this phenomenon appear as results of true or false contraindication for immunization, still, there were unvaccinated persons due to advices of HCWs. In line

with this, it is important to mention that vaccine hesitancy also recognized and amongst HCWs [20, 21]. On the other hand, half of vaccinated persons answered that the main source for their decision to getting COVID-19 vaccine were opinions of respectable experts (health care workers) i.e their useful advice in the public media. In addition, support of family and friends play an important role in uptake of vaccines [2, 16]. We found that every third vaccinated respondents stated that their decision was the result of communication with previously vaccinated family members or friends. Our results showed that only 5% of vaccinated subjects made their decision due to the advice from their personal doctor. The small prevalence of personal doctors in the total sources from our study may be potentially explain by the fact that during current COVID-19 pandemic many of health care doctors at primary health care level were removed from their primary work position to working in the “COVID health care system”.

The present study demonstrated that HCWs, teachers at the faculty, and employed in the government sector were more likely vaccinated than their counterparts. Considering that HCWs perceived a greater risk to get infected, it is expectable that they were more likely to be vaccinated than others [20, 22]. Indeed, we found that 83% out of enrolled HCWs were vaccinated with least one dose of COVID-19 vaccines.

Regarding different behaviour, beliefs and attitudes, we found that probability of vaccination against COVID-19 was significantly associated with following predictors: belief that “Vaccines against COVID-19 available in Serbia are safe” or that “There were not registered life-threatening reactions after immunization against COVID-19”, or that “Vaccines against COVID-19 cannot provoke autoimmune disease” or that “Vaccines against COVID-19 cannot provoke infertility” or that “Adverse events after vaccination against COVID-19 are most commonly local and transient” as well as the believe that “Vaccines against COVID-19 can protect you against severe clinical forms of disease and lethal outcome”. Of notable importance, our data represent that beliefs “Vaccines against COVID-19 available in Serbia are safe“ and „Vaccines against COVID-19 can protect against severe clinical forms of disease and lethal outcome“ were the main independent variables to vaccinated against COVID-19. In line with this, several previous published studies [23, 24-26] underlined that the factors associated with more vaccination acceptance included self-efficacy, high perceived benefits, previous exposure to flu or other vaccines, positive subjective norms and attitudes towards vaccination in general and COVID-19 vaccination in particular.

On the other hand, several factors contribute to concerns about the vaccine. Regarding available literate data, it seems that concern about vaccine safety was one of the most commonly cited reasons for being unsure about accepting vaccination [24, 27-30]. In the same vein, concerns about rapidly developing and not enough properly tested a new vaccine may endanger public confidence in scientific achievements and consequently delay the willingness to accept the COVID-19 vaccine [20, 29].

Evidence obtained from our study were not published before in our country although it is a known fact how it is important to understand beforehand the public’s intention to be vaccinated for COVID-19 [31]. Indeed, it is a known facts that the spread of the SARS-CoV-2 virus is the perfect storm for the growth of conspiracies, and that the situation has significantly worsened since the COVID-19 pandemic included lockdowns [32]. Hence, only after a carefully estimation of the public intention for vaccination against COVID-19, the public health officials or policymakers and media platforms have the time to design and implement targeted interventions as well as design and deliver appropriate public health messages in order to raise the awareness of general population about the importance of vaccination [2, 31, 32-34]. This is especially important considering the inadequate knowledge towards COVID-19 vaccination in particular as well as existing of the anti-vaccination movement in our region with their noticeable negative influence and destructive messages towards vaccination in general [35].

The main strength of our study include a large, cross-section of the adult Serbian population. However, our study also has limitations. First, our study was a cross sectional, and therefore our results reflects a picture of the public response at the point of this research. Second, we collected the data using online self-administered questionnaire, so it should be mentioned that this may lead to biases due to limited the participation of some members of the community such as illiterate and those from rural settlements who did not have access to the internet. Third, although our online questionnaire was available on a voluntary basis across Serbia, our recruited sample was not statistically representative of the entire Serbian population.

In conclusion, the main predictor of receiving of COVID-19 vaccine is the belief that “vaccines against COVID-19 available in Serbia are safe” It is should be bearing in mind throughout implementation the appropriate public health messages for those who are less ready to get vaccinated may need to focus more on reducing concern about vaccine side effects [17].

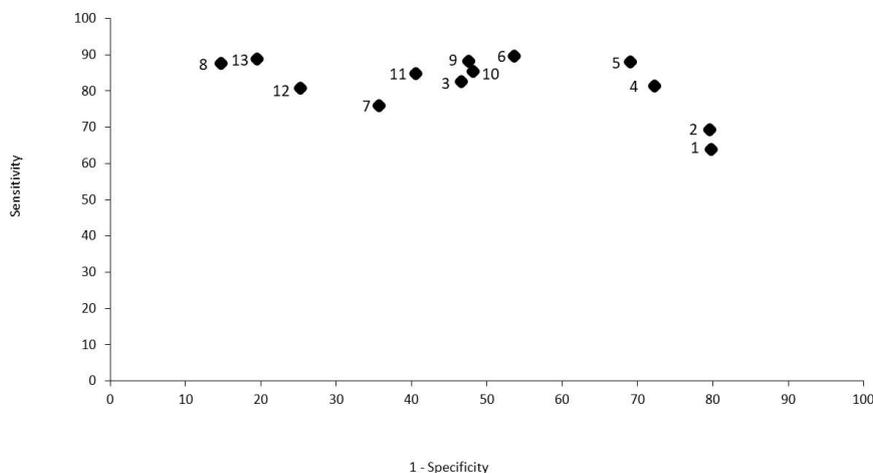
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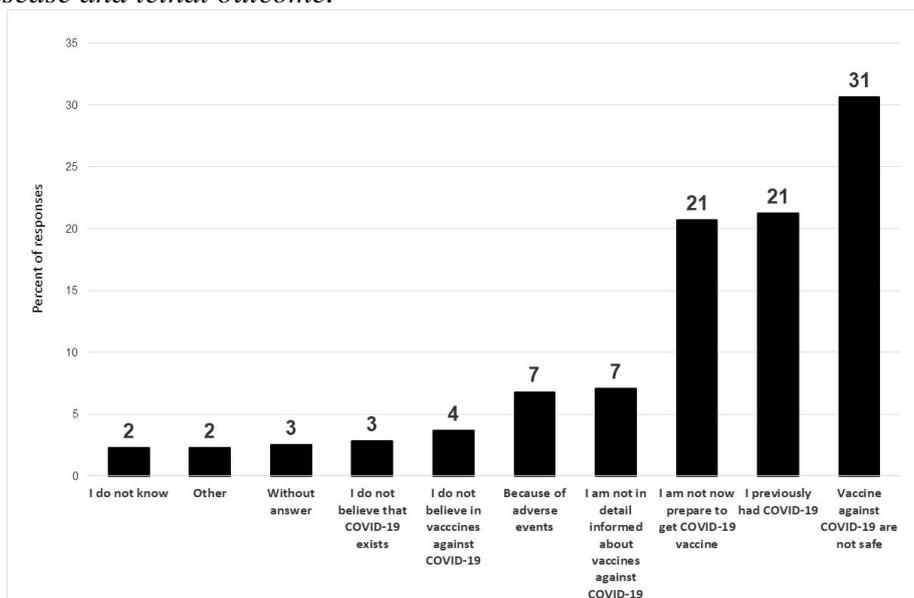
**Table 1. Level of education regarding behaviour, attitudes and beliefs of participants stratified by COVID-19 vaccination status**

Variables	Primary education						Secondary or equivalent						Higher secondary or equivalent						Graduate						Post-Graduate					
	Total		Vaccinated		Unvaccinated		p value	Total		Vaccinated		Unvaccinated		p value	Total		Vaccinated		Unvaccinated		p value	Total		Vaccinated		Unvaccinated		p value		
	(N=38)	(N=9)	(N=29)	(N=298)	(N=206)	(N=92)		(N=168)	(N=112)	(N=56)	(N=644)	(N=516)	(N=128)		(N=770)	(N=222)	(N=48)													
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%				
Did you previously have laboratory-confirmed COVID-19?																														
No	19	6	31.58	13	68.42	0.4470	212	157	74.06	55	25.94	0.0038	114	83	72.81	31	27.19	0.0142	456	381	83.55	75	16.45	0.0007	196	169	86.22	27	13.78	0.0051
Yes	19	3	15.79	16	84.21		86	49	56.98	37	43.02		54	29	53.70	25	46.30		188	135	71.81	53	28.19		74	53	71.62	21	28.38	
Were any of your family members affected by COVID-19?																														
No	14	4	28.57	10	71.43	0.6995	173	129	74.57	44	25.43	0.0168	94	69	73.40	25	26.60	0.0368	358	297	82.96	61	17.04	0.0436	159	136	85.53	23	14.47	0.0884
Yes	24	5	20.83	19	79.17		125	77	61.60	48	38.40		74	43	58.11	31	41.89		286	219	76.57	67	23.43		111	86	77.48	25	22.52	
Were any of your family members/close friends or others died due to COVID-19?																														
No	14	1	7.14	13	92.86	0.1566	87	40	45.98	47	54.02	<0.001	33	9	27.27	24	72.73	<0.001	123	67	54.47	56	45.53	<0.001	39	21	53.85	18	46.15	<0.001
Yes, family member/close friend	4	1	25.00	3	75.00		53	37	69.81	16	30.19		36	28	77.78	8	22.22		146	131	89.73	15	10.27		75	65	86.67	10	13.33	
Yes, other	20	7	35.00	13	65.00		158	129	81.65	29	18.35		99	75	75.76	24	24.24		375	318	84.80	57	15.20		156	136	87.18	20	12.82	
Do you have any chronic disease (e.g. DM, HTN, CKD, COPD, CLD, or any other chronic diseases)?																														
No	35	9	25.71	26	74.29	1.0000	195	122	62.56	73	37.44	0.0007	114	74	64.91	40	35.09	0.4835	437	340	77.80	97	22.20	0.0320	191	157	82.20	34	17.80	1.0000
Yes	3	0	0.00	3	100.00		103	84	81.55	19	18.45		54	38	70.37	16	29.63		207	176	85.02	31	14.98		79	65	82.28	14	17.72	
Did you ever get the seasonal flu vaccine?																														
No	24	4	16.67	20	83.33	0.2452	224	142	63.39	82	36.61	0.0002	109	62	56.88	47	43.12	0.0003	464	353	76.08	111	23.92	<0.001	145	106	73.10	39	26.90	<0.001
Yes	14	5	35.71	9	64.29		74	64	86.49	10	13.51		59	50	84.75	9	15.25		180	163	90.56	17	9.44		125	116	92.80	9	7.20	
Do you plan to get seasonal flu vaccine in the future?																														
No	12	0	0.00	12	100.00	0.0029	143	66	46.15	77	53.85	<0.001	72	27	37.50	45	62.50	<0.001	260	160	61.54	100	38.46	<0.001	86	54	62.79	32	37.21	<0.001
Yes	10	6	60.00	4	40.00		72	68	94.44	4	5.56		57	52	91.23	5	8.77		199	187	93.97	12	6.03		104	95	91.35	9	8.65	
Unsure	16	3	18.75	13	81.25		83	72	86.75	11	13.25		39	33	84.62	6	15.38		185	169	91.35	16	8.65		80	73	91.25	7	8.75	
Did you get all vaccines in a childhood?																														
No	0	0	0.00	0	0.00	1.0000	12	6	50.00	6	50.00	0.1431	4	2	50.00	2	50.00	0.6014	10	1	10.00	9	90.00	<0.001	2	1	50.00	1	50.00	0.3245
Yes	38	9	23.68	29	76.32		286	200	69.93	86	30.07		164	110	67.07	54	32.93		634	515	81.23	119	18.77		268	221	82.46	47	17.54	
Vaccines against COVID-19 available in Serbia are safe																														
No	8	0	0.00	8	100.00	0.0624	68	12	17.65	56	82.35	<0.001	52	7	13.46	45	86.54	<0.001	84	10	11.90	74	88.10	<0.001	32	7	21.88	25	78.13	<0.001
Yes	17	7	41.18	10	58.82		190	173	91.05	17	8.95		99	93	93.94	6	6.06		479	453	94.57	26	5.43		208	195	93.75	13	6.25	
Don't Know	13	2	15.38	11	84.62		40	21	52.50	19	47.50		17	12	70.59	5	29.41		81	53	65.43	28	34.57		30	20	66.67	10	33.33	
It is true that in our country there were not registered life-threatening reactions after immunization against COVID-19																														
No	17	2	11.76	15	88.24	0.1475	109	45	41.28	64	58.72	<0.001	70	22	31.43	48	68.57	<0.001	193	109	56.48	84	43.52	<0.001	71	41	57.75	30	42.25	<0.001
Yes	6	3	50.00	3	50.00		126	115	91.27	11	8.73		72	65	90.28	7	9.72		295	276	93.56	19	6.44		129	119	92.25	10	7.75	
Don't Know	15	4	26.67	11	73.33		63	46	73.02	17	26.98		26	25	96.15	1	3.85		156	131	83.97	25	16.03		70	62	88.57	8	11.43	
Do you think that vaccines against COVID-19 can not provoke autoimmune disease?																														
No	7	1	14.29	6	85.71	1.0000	96	39	40.63	57	59.38	<0.001	62	21	33.87	41	66.13	<0.001	162	85	52.47	77	47.53	<0.001	65	43	66.15	22	33.85	0.0003
Yes	12	3	25.00	9	75.00		126	114	90.48	12	9.52		80	69	86.25	11	13.75		308	287	93.18	21	6.82		142	127	89.44	15	10.56	
Don't Know	19	5	26.32	14	73.68		76	53	69.74	23	30.26		26	22	84.62	4	15.38		174	144	82.76	30	17.24		63	52	82.54	11	17.46	
Do you think that vaccines against COVID-19 can provoke infertility?																														
No	5	5	100.00	0	0.00	0.0002	151	140	92.72	11	7.28	<0.001	98	83	84.69	15	15.31	<0.001	394	354	89.85	40	10.15	<0.001	175	162	92.57	13	7.43	<0.001
Yes	14	1	7.14	13	92.86		89	29	32.58	60	67.42		48	12	25.00	36	75.00		120	68	56.67	52	43.33		37	15	40.54	22	59.46	
Don't Know	19	3	15.79	16	84.21		58	37	63.79	21	36.21		22	17	77.27	5	22.73		130	94	72.31	36	27.69		58	45	77.59	13	22.41	
Adverse events after vaccination against COVID-19 are most commonly local (i.e. pain, swelling, redness)																														
No	2	0	0.00	2	100.00	1.0000	40	9	22.50	31	77.50	<0.001	25	5	20.00	20	80.00	<0.001	52	13	25.00	39	75.00	<0.001	24	9	37.50	15	62.50	<0.001
Yes	26	7	26.92	19	73.08		230	187	81.30	43	18.70		133	101	75.94	32	24.06		542	474	87.45	68	12.55		233	207	88.84	26	11.16	
Don't Know	10	2	20.00	8	80.00		28	10	35.71	18	64.29		10	6	60.00	4	40.00		50	29	58.00	21	42.00		13	6	46.15	7	53.85	
Vaccines against COVID-19 can protect you against severe clinical forms of disease and lethal outcome																														
No	10	0	0.00	10	100.00	0.0142	81	15	18.52	66	81.48	<0.001	51	7	13.73	44	86.27	<0.001	104	24	23.08	80	76.92	<0.001	36	9	25.00	27	75.00	<0.001
Yes	14	7	50.00	7	50.00		189	178	94.18	11	5.82		106	96	90.57	10	9.43		481	451	93.76	30	6.24		215	201	93.49	14	6.51	
Don't Know	14	2	14.29	12	85.71		28	13	46.43	15	53.57		11	9	81.82	2	18.18		59	41	69.49	18	30.51		19	12	63.16	7	36.84	

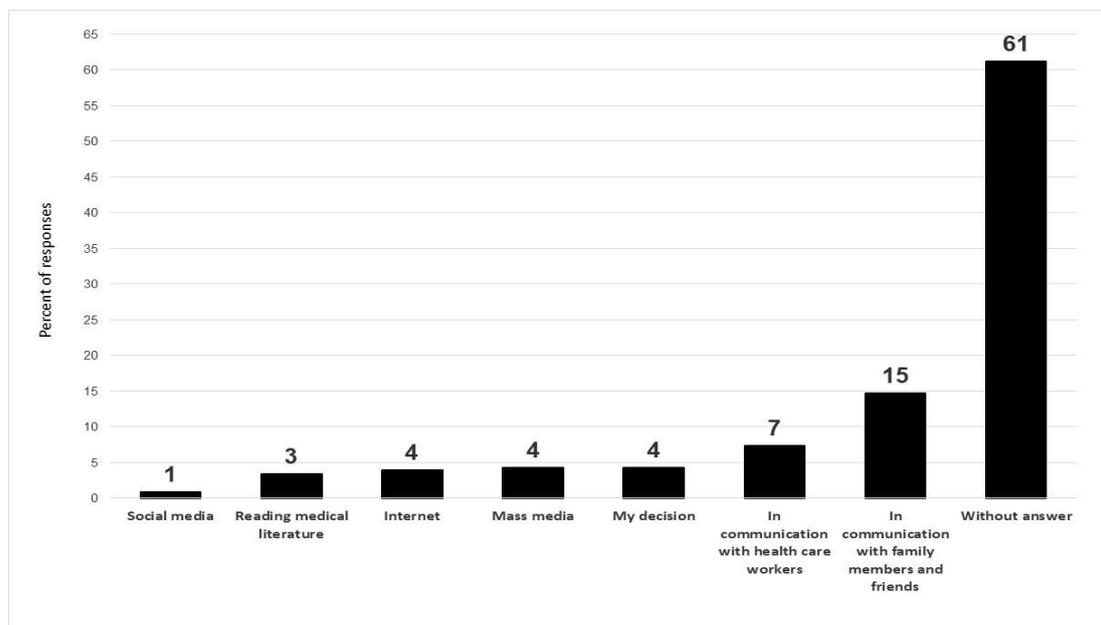


**Fig 1. ROC curve of predictors for vaccination against COVID-19.**

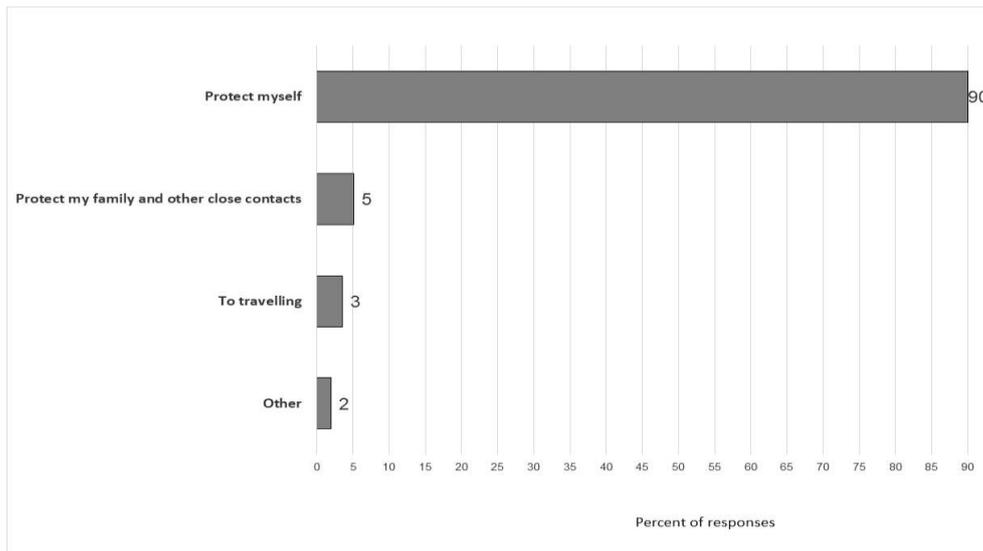
**Legend:** 1. Previous laboratory confirmation of COVID-19; 2. Any of family members affected by COVID-19; 3. Any of family members/close friends or others died due to COVID-19; 4. Exist of any chronic disease; 5. Ever receiving the seasonal flu vaccine; 6. Accept or unsure to vaccinate with the seasonal flu vaccine in the future; 7. Receiving all vaccines in a childhood; 8. Vaccines against COVID-19 available in Serbia are safe; 9. There were not registered life-threatening reactions after immunization against COVID-19; 10. Beliefs that vaccines against COVID-19 cannot provoke autoimmune disease; 11. Beliefs that vaccines against COVID-19 cannot provoke infertility; 12. Beliefs that adverse events after vaccination against COVID-19 are most commonly local (i.e. pain, swelling, redness) and transient; 13. Beliefs that vaccines against COVID-19 can protect against severe clinical forms of disease and lethal outcome.



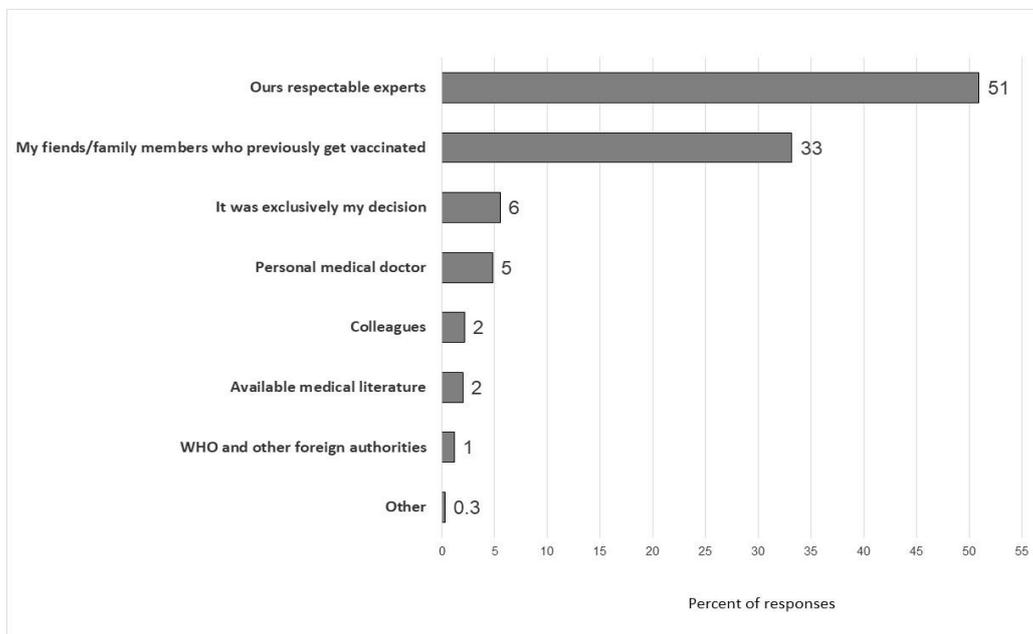
**Fig 2. Reasons for not receiving COVID-19 vaccine**



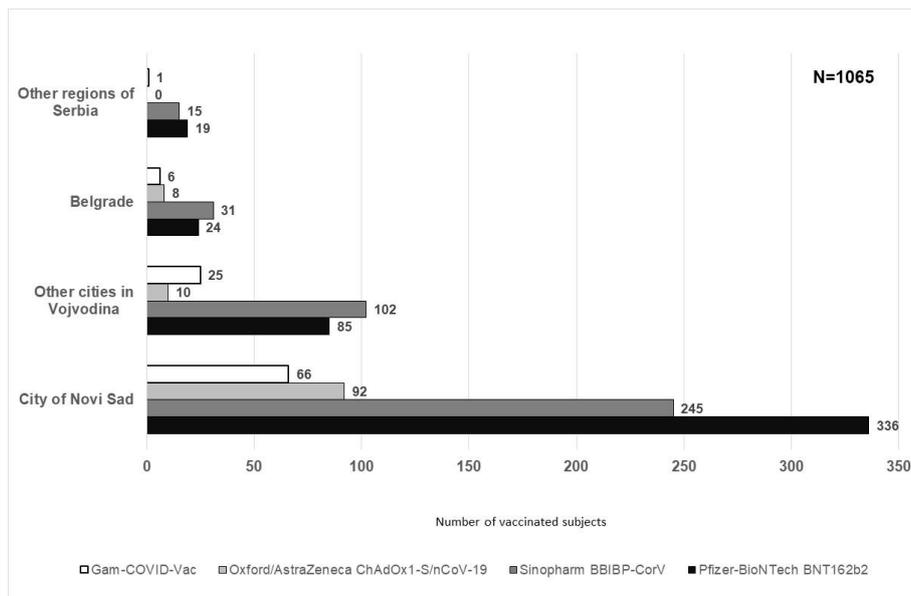
**Fig 3. Dominant source for decision to not receiving COVID-19 vaccine.**



**Fig 4. Reasons for getting COVID-19 vaccine.**



**Fig 5. Dominant source for decision to getting COVID-19 vaccine.**



**Fig 6. Distribution of COVID-19 vaccines by four respondent settlements.**

### 3. THE IMPACT OF COVID-19 ON THE INCIDENCE OF HEALTHCARE-ASSOCIATED INFECTIONS

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**Introduction:** The COVID-19 pandemic has raised concerns about the increased risk of healthcare-associated infections (HAI), both due to numerous invasive procedures and the reduced ability to implement all necessary prevention and control measures.

**Aim:** The aim of the work is to determine the impact of the COVID-19 pandemic on the frequency of HAIs.

**Method of work:** A systematic literature review was conducted. Papers from the PubMed database, which were published from January 2021 to July 2022, were included. A combination of keywords was used to search for papers. Included are cohort studies, case and control studies, observational descriptive studies, point-prevalence studies, and due to the small number of papers, a review/systematic review.

**Results:** The initial search included 3952 papers. After a detailed analysis of the papers and excluding studies that did not meet the inclusion criteria, 57 papers were included in this analysis. By reading the papers in their entirety, 27 papers met the criteria for inclusion in the study, of which 12 were cohort, nine observational descriptive, three review, one systematic review, one case-control and one point-prevalence study. The studies were very heterogeneous, so it was not possible to perform a meta-analysis.

**Conclusion:** Although the included studies were very heterogeneous, they unequivocally indicated that the COVID-19 pandemic represented a significant risk factor for the increase in the frequency of hospital infections, as well as the need for continuous and enhanced implementation of measures to control and prevent hospital infections during the pandemic.

**Keywords:** COVID-19, SARS-CoV-2, health-care associated infections

#### **Introduction:**

The COVID-19 pandemic has affected the health of the population worldwide, both due to acute infections and long-term consequences. As of August 12, 585,950,085 cases of COVID-19 have been confirmed worldwide, of which 6,425,422 people have died (1). The true impact of the COVID-19 pandemic on the health of the population has yet to be seen in the future through the chronic complications that accompany COVID-19, such as cardiovascular, neurological, mental and other health disorders.

In recent years, many studies have investigated the potential of COVID-19 for intrahospital transmission, so that measures can be taken to prevent and suppress intrahospital transmission. According to the findings of Taufer et al., of the total number of confirmed SARS-CoV-2 infections at the University Hospital of São Paulo, 8.6% were transmitted in hospital settings. Although preventive measures were taken, intrahospital transmission occurred, so the authors suggested that, when transmission in the community reaches its peak, preventive measures should be intensified in hospitals (2).

Many patients who acquire SARS-CoV-2 in hospitals are at high risk for severe outcomes and subsequent mortality (3). Quantifying nosocomial transmission of SARS-CoV-2 is therefore important both for prioritizing control efforts and for understanding the contribution of hospitals to sustaining a community outbreak, which was the subject of research by Knight et al. in England. Because of the delay from infection to the onset of symptoms, nosocomial transmission of SARS-CoV-2 may be missed according to common definitions of nosocomial infection. They estimated that almost 20% of symptomatic COVID-19 patients in hospitals in England in the first wave acquired the infection in a hospital setting. Although this is likely to have contributed little to the total number of infections in England, the vulnerability of the hospital community means it is an important area for further focus. Increased awareness and

testing, especially of discharged patients, as is now the norm, is needed to prevent hospitals from becoming vehicles for SARS-CoV-2 transmission (4).

However, not a small number of studies also examined the impact of the COVID-19 pandemic on healthcare systems and healthcare-related infections. The full impact of the pandemic on healthcare-related infections will be seen only in the coming period (5).

**Aim:**

The aim of this paper was to systematize the evidence on the impact of the COVID-19 pandemic on the occurrence of health care-related infections.

**Materials and Methods:**

We conducted a systematic review of the literature on the impact of the COVID-19 pandemic on the occurrence of health care-related infections. Included are works in their entirety that dealt with the impact of the pandemic on the occurrence of all healthcare-related infections, or on the occurrence of some type of these infections. All types of studies were taken into account, and due to the small number of papers, literature reviews and systematic literature reviews were also taken into account.

We reviewed papers from the PubMed database and included papers published from January 2021 to July 2022. By combining keywords, we obtained 3, 952 papers. Through further selection of papers according to the set criteria, we included 57 papers in the search. However, by reading the papers in their entirety, 27 papers met the criteria for inclusion in the study.

**Results:**

In this systematic literature review, we included a total of 28 studies, of which 12 were cohort, nine observational descriptive studies, three reviews, one systematic review, one case-control study and one point-prevalence study.

The studies were very heterogeneous and conducted in almost all parts of the world, both in developed and underdeveloped countries.

Table 1 shows the characteristics of the included studies.

Table 1. Characteristics of examined studies

Author	Country	Year	Type of study	Ref
Bardi	Spain	2021 March	Case-control	11
Su	China	2021 July	Descriptive	6
Bentivegna	Italy	2021 May	Retrospective descriptive	9
Lo	Taiwan	2021 March	Retrospectiv descriptive	7
Knight	England	2022 June	Prospective cohort	4
Tauffer	Brazil	2021 December	Retrospective cohort	2
De Bruyn	Belgium	2022 March	Retrospective cohort	12
Gago	USA	2022 June	Retrospective cohort	15
Cojocariu	Romania	2021 November	Prospective descriptive	8
Rovina	Greece	2022 April	Reviw	23
Casalini	Italy	2021 November	Review	24
Giannitsioti	Greece	2022 July	Prospective cohort	19
Bonazzetti	Italy	2022 June	Prospective cohort	21
Vacheron	France	2022 March	Prospective cohort	18
DeVoe	California	2021 September	Retrospective cohort	16
Maki	USA	2022 May	Retrospective cohort	19
Sturm	USA	2022 March	Retrospective cohort	22
Yasmin	India	2021 December	Systematic review	25
Ghali	India	2021 January	Retrospective descriptive	5
Tham	Australia	2022 April	Retrospective cohort	26
Russo	Italy	2022 May	Review	17
Voona	England	2022 February	Retrospective descriptive	10
Polemis	Greece	2021 October	Retrospective descriptive	28
Papst	Slovenia	2022 February	Point-Prevalence study	29
Ramos	Spain	2021 November	Retrospective descriptive	13
Rakiro	Kenya	2021 December	Retrospective cohort	14
Diaz Pollan	Spain	2022 April	Retrospective descriptive	27

Table 2 shows the results of the included studies. (Table 2.)

Table 2. Study findings

Author	Study findings	Ref
Bardi	Bacterial and fungal nosocomial infection is a common complication of ICU admission in patients with COVID-19.	11
Su	The prevention and control measures for the COVID-19 pandemic have reduced the nosocomial infection in almost all departments, except the ICU, mainly regarding respiratory, gastrointestinal, and oral infections, while catheter-related infections did not show any differences.	6
Bentivegna	Autors found that, during the pandemic (2020) HA-CDI incidence was significantly lower with respect to the previous years.	9
Lo	A collateral benefit of the COVID-19 prevention measures on the incidence density of MDRO was observed in a hospital in Taiwan where the incidence of COVID-19 was low.	7

Knights	Transmission of SARS-CoV-2 to hospitalised patients likely caused approximately a fifth of identified cases of hospitalised COVID-19 in the "first wave" in England, but less than 1% of all infections in England	4
Tauffer	Despite the preventive measures taken, nosocomial transmission of SARS-CoV-2 occurred throughout our hospital	2
De Bruyn	Study confirms that the incidence of secondary bacterial infections is very high in critically ill COVID-19 patients. These patients are at highest risk of developing secondary pneumonia.	12
Gago	Nosocomial bloodstream infections (NBSIs) occurred almost exclusively among patients who were severely ill with COVID-19 at hospital admission	15
Cojocariu	<i>Clostridium difficile</i> infection (CDI) risk is unrelated to history of SARS-CoV-2 infection. However, previous COVID-19 may necessitate higher doses of vancomycin for CDI.	8
Rovina	Patients with severe COVID-19 belong to a population at high risk of invasive fungal infections (IFIs), with a reported incidence of IFIs in critically ill COVID-19 patients ranging between 5% and 26.7%	23
Casalini	Invasive fungal infections (IFIs) can complicate the clinical course of COVID-19 and are associated with a significant increase in mortality, especially in critically ill patients admitted to an intensive care unit	24
Giannitsioti	Bloodstream infections (BSI) complicates unvaccinated patients with severe SARS-CoV-2 pneumonia and increases mortality. BSI pathogens and resistance profiles differ among COVID-19/non-COVID-19 departments, suggesting various routes of pathogen acquisition.	20
Bonazzetti	A high SOFA score and a high Charlson score resulted associated with BSI's development. Conversely, immunosuppressive therapy like steroids and tocilizumab, has no role in increasing the risk of bacteremia.	21
Vacheron	There was a higher incidence of ventilator-associated pneumonia occurring among coronavirus disease 2019 patient compared with the general ICU population, with a similar microbiological ecology and resistance pattern.	18
DeVoe	COVID-19 is associated with an increased risk of infection-related ventilator-associated complications (IVAC), probable ventilator-associated pneumonia (PVAP), and Enterococcus Bloodstream infections) BSI compared with hospitalized controls, which is not fully explained by factors such as immunosuppressive treatments and duration of mechanical ventilation. The mechanism underlying increased rates of Enterococcus BSI in COVID-19 patients requires further investigation	16
Maki	Mortality was high in seniors during COVID-19 and low oxygen saturation on admission was a risk factor for mortality. Corticosteroid therapy and anticoagulation were protective factors.	19
Sturm	The COVID-19 pandemic period was associated with substantial increases in Hospital onset bloodstream infection (HOBSI) and largely attributed to COVID-19 infected patients.	22
Yasmin	There is increasing evidence of mucormycosis co-infection in COVID-19 patients, during or post-treatment.	25
Ghali	Contrary to what was expected, we noticed an increase in the HAIs rates despite the preventive measures put in place to control the COVID-19 pandemic. This was partly explained by the vulnerability of hospitalized patients during this period.	5

Tham	Increased infection prevention and control measures did not affect the incidence of hospital acquired infection in surgical patients in our institution.	26
Russo	<i>P. aeruginosa</i> , <i>Enterobacteriales</i> , and <i>S. aureus</i> are more frequently involved as etiology of VAP; (ii) obesity is an important risk factor for the development of VAP	17
Voona	Total combined community and hospital-based quarterly rates of <i>Clostridium difficile</i> infection (CDI) decreased during the pandemic compared to the pre-pandemic period.	10
Polemis	Changes in hospitals' daily practice due to COVID-19 pandemic may have an impact on antimicrobial resistance (AMR).	28
Papst	The majority of antibiotics prescribed (69.9%) belonged to the "Watch" group of the World Health Organization AWaRe classification. The pattern of antimicrobial use differed across hospitals. The data show that early empiric use of broad-spectrum antibiotics is common in COVID-19 patients, and that the pattern of antimicrobial use varies across hospitals. Judicious use of antimicrobials is warranted to prevent an increase in AMR.	29
Ramos	Superinfections in ICU patients are frequent in late course of admission. Corticosteroids, tocilizumab, and previous broad-spectrum antibiotics are identified as risk factors for its development	13
Rakiro	Added infections in critically ill COVID-19 patients were relatively uncommon but, where present, were associated with higher mortality. Empiric use of broad-spectrum antimicrobials was common, and may have led to the selection of multidrug-resistant organisms	14
Diaz Pollan	UTIs are infrequent in hospitalized COVID-19 patients however, when they emerge, they can condition the prognosis	27

## Discussion

Healthcare-associated infections (HAI) represent an important cause of mortality. Concerns about the HAI problem have increased during the COVID-19 pandemic. On the other hand, there is increasing evidence that the incidence of HAIs can be reduced by effective prevention and control measures. Measures to prevent and control COVID-19 in hospitals can have a significant impact on reducing the frequency of HAIs. To test the impact of measures introduced during the COVID-19 pandemic on the occurrence of HAIs, Su et al analyzed the prevalence of HAIs before and during the six-month pandemic at the Children's Hospital of Sočov University. They concluded that the prevention and control measures of the COVID-19 pandemic reduced the frequency of HAIs in almost all departments, except intensive care. A decrease was registered in respiratory, gastrointestinal infections, while catheter-related infections did not show any differences (6). The Taiwanese authors were guided by a similar assumption, so they examined the impact of the prevention and control measures of COVID-19 on the occurrence of healthcare associated infections. They compared the use of personal preventive measures and the incidence of HAI as well as multidrug-resistant organisms (MDRO). They concluded that the incidence of HAI was not significantly different from the rate at baseline. They also observed that the incidence of MDRO was significantly lower in 2020, especially for carbapenem-resistant *Acinetobacter baumani* and vancomycin-resistant *Enterococcus*. However, the research covered only the first few months of the pandemic, so the results can be taken with a grain of salt (7).

The prevalence of HAI caused by the bacterium *Clostridium difficile* has increased in recent years. With the COVID-19 pandemic, the use of antibiotics has increased and most patients with severe acute respiratory syndrome received antibiotics during hospitalization, which may

influence the increase in the frequency of *Clostridium difficile* infections (CDI). For this reason, Cojocariu et al. analyzed the risk factors for the occurrence of CDI after infection with the SARS-CoV-2 virus. They conducted a prospective observational study. They concluded that the risk of CDI was not associated with a history of COVID-19. However, the findings of their study indicate that prior COVID-19 infection may require higher doses of vancomycin for the treatment of CDI (8).

A similar study was conducted by Bentivegna et al. They concluded that the HAI CDI rate was significantly lower during the pandemic compared to earlier years (9).

Because of serious concern about a possible increase in the incidence of CDI during the COVID-19 pandemic, Voona et al conducted a retrospective, single-center observational study. They found that the overall combined quarterly rates of CDI in both the community and the hospital decreased during the pandemic compared to the pre-pandemic period. There are several potential reasons for this observation. First, it is likely that reductions in patient mobility, as well as reductions in overall testing, may have underestimated the true burden of CDI in the community. Despite the widespread use of antibiotics, the overall burden of CDI may have been suppressed by aggressively strengthening infection control measures such as frequent hand washing, enhanced environmental cleaning regimens, universal personal protective equipment, social distancing, and limited visits and patient movement. All of the above may have indirectly limited the nosocomial spread of *C. difficile*. Furthermore, the enforced reduction in hospital consultations and surgical procedures may have contributed to a reduction in the possibility of *C. difficile* being introduced into the hospital from the community (10).

Bacterial and fungal HAIs are a common complication of ICU admission in patients with COVID-19. It usually manifests itself as a severe form of infection, and is associated with high mortality and a longer stay in intensive care. Thus, Bardi et al indicated that 40.7% of patients with COVID-19, who were treated in intensive care, developed a bacterial or fungal infection. Infections occurred after a median of 9 days and were significantly associated with APACHE II score ( $p = 0.02$ ). There were 91 episodes of infection: primary (31%) and catheter-related (25%) bloodstream infections were the most frequent, followed by pneumonia (23%), tracheobronchitis (10%), and urinary tract infection (8%) that were produced by a wide spectrum of Gram-positive (55%) and Gram-negative bacteria (30%) as well as fungi (15%). Overall ICU mortality was 36% (51/140). Infection was significantly associated with death (OR 2.7, 95% CI 1.2-5.9,  $p = 0.015$ ) and longer stay in intensive care ( $p < 0.001$ ) (11).

Bruyn et al. examined the incidence and risk factors for secondary infections in patients with COVID-19 in intensive care through a retrospective cohort study. Their findings indicate that almost two-thirds of patients (65.96%) developed secondary pneumonia, while 29.79% developed bacteremia of unknown origin. Due to the combination of immunosuppression caused by the virus and drugs, critically ill patients with COVID-19 may have a higher risk for secondary infections (12). A similar study was conducted by Ramos et al. and indicated that superinfections in intensive care patients are common in the late course of admission. Corticosteroids, tocilizumab and previous broad-spectrum antibiotics have been identified as risk factors for its development (13).

Also, Rakiro et al. in a retrospective cohort study in Kenya indicated the importance of additional infections in patients with COVID-19 in intensive care. They pointed out that these infections were rare, but, if present, were accompanied by high mortality (14).

A larger number of studies dealt with the epidemiology of hospital acquired bloodstream infections (HABSI). Gago et al examined risk factors for HABSI and the association between HABSI and mortality in two hospitals in New York. They observed that HABSI almost exclusively occurred in patients with a severe form of COVID-19 and were associated with high mortality (15).

Some of the studies in this review looked at nosocomial lung infections. De Voe et al reported in their retrospective cohort study that patients with COVID-19 are at high risk for infection-related ventilator-associated complications (IVACs), ventilator-associated pneumonia (PVAP) and Enterococcus bloodstream infections (BSI) compared with hospitalized controls, which is not fully explained by factors such as immunosuppressive treatments and duration of mechanical ventilation (16). Russo et al also dealt with infection-related ventilator-associated infections and concluded: *P. aeruginosa*, Enterobacterales, and *S. aureus* are more frequently involved as etiology of VAP; obesity is an important risk factor for the development of VAP (17).

The epidemiology of secondary infections in patients with malignant diseases and COVID-19 was dealt with by Maki et al. They indicated that these patients had a high rate of bacterial infection. As the severity of COVID-19 increased, so did the percentage of patients diagnosed with a bacterial infection and given antibiotics (18).

The epidemiology of Hospital acquired bloodstream infections (HABSI) was also dealt with by Giannitsioti et al., concluding that HABSI complicates unvaccinated patients with severe SARS-CoV-2 pneumonia and increases mortality. They also observed differences in the resistance of the HABSI pathogen between COVID-19 and non-COVID-19 patients (20). Similar results were obtained by Bonazzetti and colleagues (21), as well as by Sturm and colleagues (22).

In a review of the literature, Rovina et al indicated that patients with a severe form of COVID-19 belong to a population with a high risk of invasive fungal infections with an incidence of 5% to 26.7%. Failure of a large number of organs, immunocompromising treatments, kidney replacement therapy or extracorporeal membrane oxygenation make them susceptible to fungal infections (23), and similar results were obtained by Casalini et al (24). In a systematic review of the literature, Yasmin et al pointed out mucormycosis co-infections in patients with COVID-19 (25).

Some of the researchers were interested in whether HAIs were more common in surgical patients with COVID-19. In a retrospective cohort study, Tham et al indicated that increased infection prevention and control measures did not affect the incidence of hospital-acquired infections in surgical patients (26).

The epidemiology of hospital acquired urinary tract infections (HAUTI) was dealt with by Diaz Pollan and colleagues. UTIs are infrequent in hospitalized COVID-19 patients, however, when they emerge, they can condition the prognosis (27).

A special segment of research related to antimicrobial resistance (AMR) during the COVID-19 pandemic. Polemis et al estimated potential differences in AMR trends from routine data from the Greek Electronic System. They found significant differences in the slope of non-susceptibility trends of *Acinetobacter baumannii* blood and respiratory isolates to amikacin, tigecycline and colistin; of *Klebsiella pneumoniae* blood and respiratory isolates to meropenem and tigecycline; and of *Pseudomonas aeruginosa* respiratory isolates to imipenem, meropenem and levofloxacin. Additionally, they found significant differences in the slope of non-susceptibility trends of *Staphylococcus aureus* isolates to oxacillin and of *Enterococcus faecium* isolates to glycopeptides (28).

In a multicenter point-prevalence study of antimicrobial use in hospitalized patients with COVID-19, Papst et al. concluded that the data show that early empirical use of broad-spectrum antibiotics is common in COVID-19 patients, and that the pattern of antimicrobial use varies across hospitals. Judicious use of antimicrobials is warranted to prevent an increase in AMR (29).

**Disadvantages of the study**

Only papers found in the PubMed database are included. The studies are very heterogeneous, so it was not possible to perform a meta-analysis.

**Conclusion**

Although the included studies were very heterogeneous, they unequivocally indicated that the COVID-19 pandemic represented a significant risk factor for the increase in the frequency of hospital infections, as well as the need for continuous enhanced implementation of measures to control and prevent hospital infections during the pandemic.

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## 5. IMPORTANCE OF HIV TESTING PROMOTION DURING COVID-19 PANDEMIC

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**Introduction:** In an effort to reduce the spread of the virus and mitigate the number of COVID-19-related mortalities, governments have introduced various public health measures, including restrictions. The COVID-19 pandemic significantly impacted availability of seeking and obtaining medical services. Many of them were limited or prioritized COVID-19 activities. Health care settings were organized in a way to reduce transmission risk and to provide proper treatment of patients with COVID-19.

**Objectives:** To analyze impact of COVID-19 pandemic restrictions on HIV testing, HIV rates and risky behavior, as well as to assess possibilities for increasing efforts addressing the HIV epidemic, especially HIV testing during COVID-19 pandemic.

**Methods:** Searched relevant literature and analyzed data from Voluntary confidentially counseling and HIV testing (VCCT) service in Public Health Institute (PHI) Niš.

**Results and Discussion:** As a result of COVID-19 pandemic restrictions, HIV prevention services, such as in-person HIV testing, were decreased across the world. Reduced HIV testing was reported in Australia, China, Japan, Kenya, Uganda, Belgium and multiple other European countries.

In the first several months of the pandemic, HIV testing dropped by >50% in a Belgian hospital (1), 31% in a sexually transmitted infection (STI) Australian clinic (2), 59% across four regions in China (3). In Kenya (4,5), less HIV clinic-based testing was registered, possibly due to poor access to personal protective equipment and supplies for sanitization, reduced working hours (4) and distribution of HIV self-testing kits (5). Across Europe, reduced HIV testing was reported during the first six months of the pandemic, with HIV testing down >50% between March and May 2020 at most sites (6). In Japan, similar trends were observed (7).

The data regarding HIV positivity rates were not consistent. In Belgium, results showed a 75% reduction in diagnosed cases (1), whereas the Australia HIV rates showed no change (2). Overall, worldwide trends showed a decline in HIV testing, although these data were limited to the first 3-6 months of the pandemic, and positivity rates varied by site.

A recent observational study in United States of America (USA)(8), collected HIV testing and positivity rate clinical data from four geographically diverse USA healthcare systems in New Orleans (Louisiana), Minneapolis (Minnesota), Providence (Rhode Island) and Seattle (Washington). In outpatient settings, 68-97% reduction in the number of HIV tests per week was registered, during each state's stay-at-home order period, compared to during the pre-stay-at-home order period in early 2020.

The data regarding HIV positivity rates were not consistent: some sites reporting decreases and some reporting no change. The HIV positivity rate increased slightly at outpatient settings, except in New Orleans where it fell. Overall, USA governmental data (9) show a downward trend in HIV diagnoses through 2020 in the geographic areas that had mentioned above. Some reasons for these reductions could be poor access to the health facilities, fear of attracting infection due to COVID-19 exposure at health settings and means of transportation used to the health settings (1), reduced HIV risky behaviors during the pandemic, as well as reduced use of pre-exposure prophylaxis. Also, some patients prioritized solving their essential needs related to the pandemic (e.g., loss of jobs and income, food insecurity), instead health needs (4).

The data regarding HIV transmission risk behaviors during the pandemic among different key populations were not consistent. The results of the community-based study conducted in United Kingdom showed that, 76% of men-who-have-sex-with men (MSM) reported being sexually active outside their household, although a similar proportion reported having less partners than pre-pandemic (10). Data from the Netherlands' cohort study showed that, 73% of MSM reported a decrease in casual sex partners during the COVID-19 pandemic (11). The evidence from the USA showed trends of fewer risky sexual behaviors among MSM population in the early stages of the pandemic, by April 2020, and after that the data showed increasing trends of their sexual risk behaviors (12). Among persons who use drugs, USA data showed some stability or improvement in HIV testing during the COVID-19 pandemic, particularly in hospitals. Individuals on methadone maintenance reported no change in or access to testing (13).

From 2004 to 2021, 4224 clients were counseling and testing in PHI Niš. During COVID-19 pandemic, VCCT service in PHI Niš documented reduced HIV testing (101 clients in 2021 and 107 in 2020 vs. 405 in 2005, and 393 in 2004), and reduced HIV/AIDS cases reporting as well. The vast majority of them was men with unknown risky behaviors and the rest was MSM reported being sexually active outside their household. The majority were diagnosed at the stadium of clinical AIDS (14).

Bearing in mind goal of the Serbian Strategy on HIV and AIDS, to reduce HIV incidence for 75% by the year 2025, as well as some important factors that contributing the spread of the disease in Serbia in the pre-pandemic era (low socio-economic status of part of the population, lack of objective estimation apropos the magnitude of especially vulnerable groups as injecting drug users, sex workers and men having sex with men, deficient monitoring system for HIV infection, low public awareness of the risks of HIV transmission, high level of discrimination against the vulnerable population and Persons Living With HIV, deficient coverage of key population by preventive activities) (15), characterizing the impact of the COVID-19 pandemic on HIV testing rates will help guide public health outreach and resources to revive HIV prevention and testing efforts to address the HIV epidemic.

VCT remains the priority in preventive programme. Difficulty remains to recognize VCT as independent, comprehensive service as well as difficulty of small amount of persons tested, vulnerable individuals in particular.

Services of voluntary counseling and HIV testing should be made more attainable to beneficiaries. Regarding HIV testing, important activities should include: cooperation of VCT centres with all the key actors of community for the purpose of increasing accessibility of the service, organizing VCT activities out of facilities, on the field, make VCT accessible to marginalized population groups as well as persons with special needs, creating possibilities to integrate VCT into Citizen Association dealing with HIV/AIDS programmes, promotion of VCT significance in general population, especially vulnerable and vulnerable population groups, as well as among health workers, improving routine HIV screening in health care settings (pregnant women, patients on hemodialysis, patients with STI's, and Tuberculosis), as well as improving mandatory HIV testing (blood donations, organ, tissue donations, assisted reproduction) and diagnostic HIV testing (patients with suspect symptoms of an HIV infection, patients with immunological deficiency).

**Conclusions:** The overall impact of reduced testing could lead to delayed antiretroviral treatment initiation, poor viral suppression, increased transmission risk, and increased HIV-related deaths. As the pandemic resolves and restrictions ease, the healthcare industry should scale up testing, messaging to publicize the importance of testing, through VCT services and routine HIV screening.

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## **6. CLINICAL AND EPIDEMIOLOGICAL FEATURES OF MONKEYPOX INFECTION IN PEOPLE LIVING WITH HIV**

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### **Introduction**

Human monkeypox (MPX) is a viral disease and zoonosis and it is caused by a member of the Monkeypox virus (MPXV). The MPXV is a member of the Orthopoxvirus genus, sharing clinical features with smallpox virus. It is a large, linear, double-stranded DNA virus. Other members of this genus are vaccinia virus, smallpox virus and cowpox virus. The virus has been known since 1958. There are two genetically distinct viral clades: Central African (Congo Basin) and West African. The first humans became infected in 1970, in areas of the Democratic Republic of Congo (1).

### **Epidemiological features of monkeypox**

Rodents are suspected to be a reservoir of infection. Several animal species are prone to the infection. The primary route of infection in African outbreaks are: 1. animal to human transmission (handling and ingesting wild game animals), 2. human to human transmission through close contact with infected individuals. Predominant route of transmission between humans is spread of respiratory droplets and direct contact with skin lesions and scabs. Carriers of the infection could also play role in transmission of the virus (1).

Human-to-human transmission is the consequence of the close contact with respiratory secretions, skin lesions of an infected person or recently contaminated objects. Transmission via droplet respiratory particles requires prolonged face-to-face contact (2).

Until now, monkeypox was known as exclusively an endemic disease of West and Central Africa. As of May 2022, this disease also occurred in over 20 non-endemic countries in patients who did not travel to endemic countries. Before 2022, there was an outbreak in Nigeria in 2017/2018 in which 118 cases of MPX. Mortality was 6%. Four of the deceased patients had AIDS, but were not on antiretroviral therapy (ART). The total number of patients infected with HIV was missing. In the 2017/2018 outbreak also in Nigeria, in 40 MPX patients, 9 had HIV infection, out of which 7 had advanced HIV disease with high HIV RNA viral load and low CD4 cell counts. Patients with the advanced HIV diseases had larger monkeypox efflorescences, ulcerations on the genitals and longer duration of monkeypox (3, 4).

There was also an outbreak in the United States in 2003. The infection was passed from rodents from Ghana to prairie dogs in USA that were kept with them, and further to humans (5).

Since May 2022, the World Health Organization (WHO) has reported a global outbreak of 25000 cases of monkeypox predominantly ongoing in Europe and North America, which is predominantly affecting gay, bisexual, and other men who have sex with men (MSM) (6).

Since the start of the monkeypox outbreak and as of 1 September 2022, 18 463 confirmed cases of MPX have been reported from 29 EU/EEA countries, 35 confirmed cases from Western Balkan countries and 11 cases from Turkey, 19962 cases in USA and 1289 confirmed cases in Canada (7,8,9).

In the period from June 17, when the first case was registered in Serbia, to August 17, 2022, 31 confirmed cases of monkeypox were registered among male persons aged 21 to 44. The registered cases are from Belgrade (27), South Bačka (1), South Banat (1), Srem (1) and Nišava (1) districts. According to information from territorially competent public health institutes/institutes that conducted epidemiological research, all persons developed a typical clinical picture of the disease with the development of smallpox, fever and other symptoms and

signs of an infectious disease. Three people needed hospital treatment, while the rest were treated at home (10).

As for the period from 2022, the first 27 cases in Portugal were recorded primarily in the MSM population and had mild symptoms of the disease. In Italy, the Czech Republic and Australia, cases of monkeypox in HIV patients were also mild with genital ulcerations and rash (11,12,13,14).

Among MSM patients with monkeypox for whom HIV status is known, 28%–51% have HIV infection, according to data from the European Union, England, and the United States. Transmission occurs mostly among sexually active MSM population, dominantly through intimate skin-to-skin contact during sex (15).

### **Pathogenetic and clinical features of monkeypox**

The virus is capable of replicating in the host cytoplasm, unlike other DNA viruses that typically replicate in the nucleus. It possesses cell tropism towards dendritic cells, monocytes and macrophages, B lymphocytes and activated T lymphocytes. Due to its large size, it is difficult for the virus to replicate rapidly, and host immune system generates an immune response easily. The virus produces proteins responsible for the host's immune response modulation, that are: 1. intracellular proteins (virotransducer proteins and virostealth proteins) and extracellular protein (viromimic protein) (16).

The virus enters the host from any route (oropharynx, nasopharynx or intradermal). Then it replicates at the inoculation site and spreads to local lymph nodes. An initial viremia leads to viral spread to other organs, which coincides in time with the incubation period (7-14 days, up to the 21 days). The secondary viremia correlates with prodromal symptoms (fever, lymphadenopathy), and the patients may be contagious. Serum antibodies are detectable by the time of lesion appearance. (17).

Until May 2022, the classic clinical course of smallpox was known, consisting of 3 stages: an incubation period of 1–2 weeks, a prodrome, characterized by fever and lymphadenopathy, followed by the onset of a deep-seated vesicular or pustular rash which begins centrally and spreads to the limbs. The clinical picture of monkeypox in the current epidemic is slightly different, including the course of the disease. Prodrome or systemic symptoms occur less frequently. There is no specific order of appearance of systemic symptoms and mucocutaneous features. Genital, perianal, and oropharyngeal mucosal lesions occur in approximately 40% of cases, and may be associated with intense pain and severe inflammation (proctitis, urethritis, phimosis, balanitis, tonsillitis and epiglottitis) (15).

The clinical characteristics of the 197 patients presented in the retrospective observational monkeypox virus study, who were tested and managed through a south London HCID centre between 13 May and 1 July 2022. The median age of participants was 38 years, all 197 participants were men, 196 were identified as gay, bisexual, or other MSM. All patients had mucocutaneous lesions, most commonly on the genitals (56.3%) or in the perianal area (n=82, 41.6%). 86.3% patients had systemic illness: fever (61.9%), lymphadenopathy (57.9%), and myalgia (31.5%). Systemic features started after the onset of mucocutaneous manifestations in 38.5%. 13.7% presented with mucocutaneous manifestations without systemic features. 36.0% reported rectal pain, 16.8% sore throat, and 15.7% had penile oedema. 13.7% had oral lesions and 4.6% had tonsillar signs. 35.9% participants had concomitant HIV infection. 31.5% had a concomitant sexually transmitted infection. Rectal pain and penile oedema were the most common symptoms requiring hospital admission (1).

Patients living with HIV who have an undetectable number of HIV RNA copies and a high CD4 cells levels, are less likely to develop a serious form of monkeypox. Unlike, the number of CD4 cells below 200 copies per milliliter, the number of HIV RNA copies above 200 per milliliter, as well as clinical signs of AIDS are associated with a higher risk of severe forms of monkeypox (18).

Patients with advanced and uncontrolled HIV infection might be at higher risk for severe or prolonged monkeypox disease following infection. Patients with monkeypox and concomitant HIV infection had higher rates of secondary bacterial infection, prolonged illness, greater percentage of confluent or partially confluent rash presentation. In contrast, there were no noted death outcomes or excess hospitalization rate in European countries where most patients are successfully treated by ART. WHO has stated that a more severe disease course has not been reported in persons with HIV infection who are receiving ART and have a strong immune system (3,4,19).

### **Diagnostic approach to monkeypox**

Diseases that could resemble monkeypox are chickenpox, measles, bacterial skin infections, scabies, syphilis, and medication-associated allergies. All MSM patients with typical rash and risky sexual behaviour could be suspected monkeypox cases. Polymerase chain reaction (PCR) is the preferred laboratory test. Sampling is done from skin lesions (vesicles, pustules and dry crusts). PCR blood tests is not reliable because of the short duration of viremia. Antigen and antibody detection methods do not provide monkeypox-specific confirmation due to serological cross-reactivity of orthopoxviruses. Oropharyngeal swabs could be performed in high-risk contacts who developed systemic symptoms without rash or lesion for sampling (20).

### **The treatment of monkeypox**

There are no Food and Drug Administration (FDA)–approved treatments for monkeypox. Drugs that are thought to have activity against MPX are: tecovirimat, vaccinia immune globulin intravenous (VIGIV), cidofovir, and brincidofovir (21).

Vaccination as the only form of pre-exposure prophylaxis is currently recommended for persons at risk for occupational exposure to orthopoxviruses, such as laboratory personnel performing diagnostic testing for MPX and members of health care worker response teams designated by appropriate public health and antiterror authorities. Routine immunization of all health care workers against smallpox or monkeypox is not currently recommended. Early administration of smallpox vaccines as postexposure prophylaxis ( $\leq 4$  days after exposure) might prevent monkeypox, and later use (5–14 days after exposure) might decrease the severity of monkeypox if it comes to infection. JYNNEOS (a live virus vaccine that uses nonreplicating modified vaccinia Ankara (MVA)) and ACAM2000 (a replication-competent live vaccinia virus vaccine) are two vaccines are licensed by FDA for the prevention of orthopoxvirus infections. ACAM2000 is contraindicated for persons living with HIV because of the risk for the spread of vaccinia virus (15).

### **Conclusion**

In order to reduce the risk of adverse outcomes and prevent further unwanted spread of the disease, it is necessary to quickly diagnose monkeypox and assess the immune status of HIV-positive patients.

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## ORAL PRESENTATIONS:

### 1. ANALYSIS OF COVID-19 OUTBREAK ORIGIN IN CHINA IN 2019 USING DIFFERENTIATION METHOD FOR UNUSUAL EPIDEMIOLOGICAL EVENTS

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**Objectives** – Origin of outbreaks could be natural, accidental, deliberate, and caused by a new or re-emerging bioagent. The aim of this study was the retrospective analysis of whether the COVID-19 outbreak was natural, accidental, deliberate one, or caused by a new or reemerging bioagent.

**Methods** – Analysis was performed according to the Radosavljevic–Belojevic method for outbreak scoring and differentiation. Data for the application of this method were obtained by literature review in the Medline database for the period from 2000 to 2020.

**Results** – The analysis of the unusual COVID-19 outbreak shows that the present official assumption of its natural origin is questionable and pointed out to a probability that the pathogen could have also been accidentally introduced in the human population.

**Conclusion** – There are no conclusive pieces of evidence about the reservoir of the pathogen or the source of infection. These parameters are essential for the final clarification of the outbreak origin. This study suggests that the COVID-19 outbreak is a consequence of an accidental release of a new COVID-19 virus, probably during the technical accident and/or negligent violation of hygienic norms in the laboratory facility. Further epidemiological, microbiological, and forensic analyses are needed to clarify the COVID-19 outbreak.

**Keywords:** Outbreak, pandemic, COVID-19, outbreak origin, outbreak differentiating, SARS-CoV-2

## 2. DO WE HAVE REALISTIC EPIDEMIOLOGICAL PICTURE OF COVID 19 EPIDEMIC?

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**INTRODUCTION:** During more than two and a half years of COVID 19 pandemic, numerous scientific findings and experiences, as well as the exchange of various protocols, important epidemiological data and information, for a large number of health workers it remained unknown how data was obtained from covid clinics and from health institutions in general in our country they process and present themselves. The **AIM** is to present the experience of the Institute for Student Health Care in Belgrade, which is useful in many ways in terms of collection, analysis and presentation of epidemiological data, because during the pandemic, this Institute modified the entire process of data collection and presentation, slowly corrected it compared to the initial steps, led meaningfully, coherently and correctly.

**METHOD and DISCUSSION:** The data that were collected and sent at the request of various institutions mostly related to the cumulative number of antigen and PCR tests on a daily basis and the number of positive patients for SARS CoV2, i.e. the report tables did not have separate columns on the number of persons who worked only Ag and the number of people who did both Ag and PCR test, as well as the number and percentage of positives. Realizing that this kind of reporting is not adequate for the analysis of the epidemiological situation, doctors from ISH Belgrade presented their reports differently over time. The following examples show how important it is to correctly collect and report/present data:

Example 1 – Most often requested reporting:

Observation period	Number of tests Ag+PCR	Number of positive tests
22.02.2021. - 28.02.2021	240 Ag and 50 PCR Total 290	115Ag and 7 PCR 122 (42%)
01.03.2021. - 07.03.2021	249 Ag and 98 PCR Total 347	120 Ag and 19 PCR 139 (40%)

Based on this reporting, one gets the impression that in the week from March 1 to 7 significantly larger number of people took the test, but the percentage of positivity was lower

Example 2 – Example of correct reporting:

<b>Observation period</b>	<b>Number of persons that did Ag and PCR tests:</b>	<b>Number of positive tests</b>
22.02.2021. - 28.02.2021	<i>240 persons did Ag test and 50 did PCR test too</i> <b>Total 240 persons</b>	<i>115 Ag and 7 PCR</i> <b>122 (51%)</b>
01.03.2021. - 07.03.2021	<i>249 persons did Ag test and 98 did PCR too</i> <b>Total 249 persons</b>	<i>120 Ag and 19 PCR</i> <b>139 (56%)</b>

From example 2, we see that in the week from March 1 to 7, 2021. almost the same number of people took the test as the previous week, but the percentage of positives was higher. **CONCLUSION:** It is extremely important to collect data meaningfully and carefully and to create reporting tables with equal care. Also, it is necessary to have an understanding for the suggestions, proposals and remarks of colleagues who see omissions during a certain period of work; accept them without vanity, with the common desire to get as realistic an epidemiological picture of COVID-19 in our country as possible.

**Keywords:** COVID 19, epidemiological data, reporting

## POSTER PRESENTATIONS

### 1. INTERNATIONAL HEALTH REGULATIONS (IHR) CAPACITIES IN BALKAN COUNTRIES BEFORE AND DURING COVID-19 PANDEMIC

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**Objectives:** The aim of this study is to explore the changes in IHR core capacities in Balkan countries in 2020 in comparison to 2019.

**Methods:** In order to assess the needs for IHR training within the Joint Action on Strengthened International Health Regulations and Preparedness in the EU (SHARP JA) we analysed 13 core IHR capacities. Method was desk-based review with the analysis of available data for 12 Balkan countries from the States Parties Annual Report tool (SPAR) for the years 2019 and 2020.

**Results:** The overall IHR capacity for all 12 Balkan countries in 2020 was 69.33%, while in 2019, before the COVID-19 pandemic, the average value was lower (65, 58%). In 2019, the highest value was registered in Slovenia, 86%, and lowest in Bosnia and Herzegovina – 35%. In 2020, Turkey assessed own IHR capacities with the highest mark (88%), while the lowest was recorded in Montenegro (55%). The individual capacity with the lowest value is *Points of entry* (50% in 2019 vs. 52.22% in 2020), and the highest value in both years were registered in Surveillance (78.18% vs. 81.11%).

**Conclusion:** Countries assess own IHR capacities with higher values during the COVID-19 affected 2020 than in 2019.

Key words: IHR, SPAR, COVID-19, Balkan countries

## 2. ATTITUDES TOWARD COVID-19 VACCINES AMONG THE VACCINATED PEOPLE IN SERBIA

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**Objective:** To explore attitudes toward COVID-19 vaccines among people in Serbia.

**Method:** Participants were recruited in September and October 2021 after receiving the third vaccine dose at the Institute of Public Health of Serbia, Belgrade. Data were collected using an anonymous questionnaire based on the previously conducted qualitative study. Participants were asked how likely they would receive specific COVID-19 vaccines on a scale from "never" to "always".

**Results:** Of 366 study participants, 62.3% (228) were females. Mean age of study participants was 41.6±15.5 years (age range 18-87). The majority of people articulated that they would always receive Pfizer vaccine (221, 61.4%). Considerably less people would always receive Sinopharm (167, 45.6%), Sputnik V (131, 35.8%) and Astra Zeneca (54, 14.8%). No difference in attitudes were observed according to gender, age and risk for catching COVID-19. A higher education level correlated with a stronger positive attitude toward Sinopharm (Spearman's rho 0.148, p = 0.005) and Sputnik V (Spearman's rho 0.114, p = 0.033). Having chronic illnesses correlated with a stronger negative attitude toward Astra Zeneca (Spearman's rho -0.126, p = 0.019).

**Conclusion:** This study showed that people who were regularly vaccinated against COVID-19 had the strongest positive attitude toward Pfizer vaccine.

### **3. ANALYSIS OF THE MORTALITY RATE OF THE COVID-19 INFECTIOUS DISEASE IN BELGRADE IN THE PERIOD OF MARCH-JUNE 2020, WITH AVAILABLE DATA TO 31st OF AUGUST 2020.**

Zoran Kokić

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**Abstract:** The seriousness of every pandemic, besides mass illness, is measured through mortality and especially direct and indirect mortality. The objective of the paper: To present the available data on deaths during the epidemic of infectious disease COVID-19 in Belgrade for the period March-June 2020 and to determine whether there was an excess of general mortality and excess mortality from pneumonia compared to the average in March-June 2016-2019. Method and data: A descriptive epidemiological method was used in the paper. Data on mortality used data from the Center for Informatics and Statistics of the Institute of Public Health Belgrade from the database of deceased persons. Conclusion: After analyzing the mortality rate of the infectious disease COVID-19 in Belgrade, during the period of March-June 2020, it can be estimated that the mortality from this disease in Serbia is significant, and is higher than recorded during daily monitoring, so it is very important to be thoroughly researched. A thorough revision of mortality for the territory of the Republic of Serbia is proposed by the authors, according to the singular predetermined methodology in accordance with the WHO recommendations.

#### **4. THE IMPORTANCE OF USING INDICATORS OF THE EPIDEMIOLOGICAL SITUATION IN PLANNING AND ORGANIZING WORK, DURING THE PANDEMIC CAUSES BY SARS-COV-2 VIRUS**

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**Abstract:** In view of changes in circumstances, caused by pandemia SARS-CoV-2 virus, the health system functions in circumstances that call for more efficient planning and organizing work of health organizations, than before. The objective of the paper: To show the positive experience in using indicators of the epidemical situation in planning and organizing work in the primary health care center „Vozdovac“.

**Method and data:** They used information from the primary health care center „Vozdovac“. For information about the population were used information from the Republic Institute for Informatics and Statistics. Since the beginning of the pandemic, all serviced and organizational units of the primary health care center „Vozdovac“, worked without stopping. According to the Ministry of Health instructions, the covid ambulance was opened, where 254434 patients used the services, 85956 swabs were taken concerning the SARS-CoV-2 virus, of which 32844 were positive. On a daily basis were taken indicators of the epidemiological situation: the total number of patients, the percentage of the first visit, the number of taken swabs for SARS-CoV-2 virus, the percentage of positive swabs for SARS-CoV-2 virus, morbidity rate for the SARS-CoV-2 infection, and the number of patient in other organizational units of health center.

**Conclusion:** Monitoring indicators of the epidemiological situation and the indicators of the burden of other organizational units of health centers, contribute to adequate and efficient planning and organizing work in the primary health care center „Vozdovac“.

**Keywords:** COVID-19; indicators of the epidemiological situation; planning and organizing work in the primary health care center

## 5. GENDER DIFFERENCES IN COVID-19 MORTALITY AMONG HEMODIALYSIS PATIENTS IN CLINICAL CENTER NIS

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**Objective:** Since the first reports of COVID-19 cases, gender differences have been reported in COVID-19 mortality. We describe these sex disparities concerning age and comorbidities among reported cases among patients in a hemodialysis (HD) unit.

**Methods:** Data on COVID-19 cases and mortality during 24 months of COVID-19 outbreak was extracted from the patients' medical records. Associations between sex and case fatality were analyzed with multivariable logistic regression. Subsequently, the male-female ratio of standardized mortality ratios and population mortality rates relative to all-cause and infectious diseases-specific mortality were computed, stratified by age.

**Results:** The male-female odds ratio for case fatality was 1.46 [95% CI 1.20-1.55] and 1.20 [95% CI 1.11-1.31] among HD patients. This remained significant after adjustment for age and comorbidities. The standardized mortality ratio was higher for males, with a male-female ratio of 1.79 [95%CI 1.65-1.86]. Male- female population mortality differences were most significant among 55-59 and further increased with older age.

**Conclusions:** Our study demonstrated that male sex is a predisposing factor for severe outcomes of COVID-19 in HD patients, independent of comorbidities and age. The underlying mechanisms are probably unique to COVID-19. More knowledge of the underlying mechanisms can help prioritize and personalize treatment and prevention.

**Key words:** hemodialysis, COVID -19, mortality, gender

## 6. COVID-19 VACCINE EFFECTIVENESS IN NURSING HOMES IN PODRAVJE HEALTH REGION

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**Objectives:** Covid-19 outbreaks in nursing homes (NH) were associated with high morbidity and mortality in pre-vaccination period. We evaluated vaccine effectiveness (VE) for NH residents against symptomatic disease during Delta and Omicron SARS-CoV-2 variant predominance.

**Methods:** in Slovenia, NH have to report an outbreak of infectious disease to the regional unit of National Institute of Public Health. We have performed a descriptive analysis of the collected data from NH outbreaks in the Podravska health region from 12.3.2020 to 30.5.2022. Residents with completed vaccination or with booster dose were included in vaccinated cohort. Residents who had not received any dose of vaccine or had not completed the initial vaccination series represent unvaccinated cohort. VE was calculated using the formula  $VE = (1-RR) * 100$ , where RR (relative risk) is the ratio of attack rate in vaccinated and attack rate in unvaccinated residents.

**Results:** In the study period, 17 covid-19 outbreaks in NH in region were reported with 2932 confirmed cases. VE among NH residents against symptomatic disease during the Delta period was 45% (95% CI: 17-63%), while during the Omicron wave vaccination was not effective in protecting against the disease.

**Conclusion:** Covid-19 vaccines were still protective at the time of Delta variant predominance, while in period of the Omicron variant, protection against symptomatic disease disappeared. Despite that, covid-19 vaccines offer good protection against severe disease and hospitalization.

**Keywords:** Covid-19 outbreak, nursing homes, vaccine effectiveness.

## 7. PREDICTORS OF DISEASE SEVERITY IN PATIENTS WITH COVID-19

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**Objectives:** To identify predictors of severe forms of COVID-19 defined as the need for assisted ventilation (non-invasive or invasive mechanical ventilation).

**Methods:** The research was conducted as a retrospective cohort study at the General hospital "Laza K. Lazarević" in Šabac for the period from 1.4.2020. to 14.11.2020. The relationship between demographic and clinical parameters of patients and the need for assisted ventilation was examined by logistic regression analysis.

**Results:** The study included 516 patients, 334 male subjects (64.7%), with the age of 60 and over (52.7%). The most commonly reported symptoms were fever (89%) and generalized weakness (68.8%). Mechanical ventilation was required by 44 patients, majority of whom were male (64.7%). The dominant comorbidities in mechanically ventilated group were hypertension (63.6%) and diabetes (22.7%). According to multivariate analysis independent risk factors for assisted ventilation were: obesity ( $p=0.022$ ), duration of illness from onset to hospital admission more than seven days ( $p=0.023$ ), oxygen saturation ( $sO_2$ ) $<90\%$  ( $p=0.002$ ), arrhythmias ( $p=0.001$ ), leukocytosis ( $p=0.034$ ), lymphopenia $<1.0 \times 10^9$  ( $p=0.022$ ) and CRP $>50$  mg/l ( $p=0.002$ ).

**Conclusion:** The risk of assisted ventilation was higher in obese patients, with  $sO_2$  $<90\%$  on admission to hospital, duration of illness from onset to hospital admission more than seven days, arrhythmias, leukocytosis, lymphopenia $<1.0 \times 10^9$  and CRP $>50$  mg/l.

**Keywords:** COVID-19, comorbidities, risk factors, severity, assisted ventilation

## **8. COVID-19 SURVEILLANCE AND LABORATORY (SWOT ANALYSIS): STRENGTHS, WEAKNESSES, OPPORTUNITIES, AND THREATS**

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**Introduction:** The covid-19 pandemic is coronavirus disease (COVID-19) pandemic - characterized with respiratory tract infection and pneumonia, that broke out in Wuhan (China) in 2019. This pandemic has led to global health and socioeconomic disruptions in the world.

**Aim:** To analyze the strengths, weaknesses, opportunities, and threats of the public health response regarding COVID 19 outbreak in Montenegro.

**Materials and method:** Qualitative observational research method was used.

**Results:** Activities that are recognized as strengths of the public health response are good cooperation between epidemiological service, sanitary inspection and police/border police (in passenger control, control of epidemiological measures, control of quarantine/isolation).

Activities that stand out as the main weaknesses are laboratory overloading, insufficient human resources in laboratory, sanitary inspection, health care institutions..

Activities that are recognized as opportunities are: strengthening of SARI surveillance (including coordinator education, visits to health care institutions, improvement of communication), strengthening and improvement of diagnostic capacities at all health care levels.

As a threats to the surveillance system the following were identified: decline in trust in official scientific sources, strengthening of the anti-vaccination lobby.

**Conclusion:** Further steps need to be taken in order to strengthen the response to public health risks should be strengthening of surveillance and laboratory capacities (in human resources, education, preparation of response plans, laboratory equipment and diagnostics, PPE...)

**Keywords:** Covid 19, Surveillance, Laboratory, Public health, Montenegro, examination method, observation method

## 9. DESCRIPTIVE EPIDEMIOLOGICAL AND CLINICAL CHARACTERISTICS OF PATIENTS ON ANTIVIRAL THERAPY

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**Introduction:** Covid-19 is a multisystem disease caused by its mutations and their variants. Covid-19 virus, pro-and inflammatory cytokines destroy infected cells. There has been a significant improvement regarding the vaccines and treatment. However, the problem of new emerging variants and subvariants is still present.

**Objectives:** Analysis of descriptive epidemiological and clinical findings of patients with COVID-19 in relation to different antiviral therapy.

**Methods:** The study enrolled 1019 patients in Covid Hospital Kruševac categorized into three groups, from June 6<sup>th</sup> to September 6<sup>th</sup> 2022. Patients were grouped according to age and number into three groups: I:35-50 (8.31%), II:51-66 (17.87%) and III:67-81 (74.41%). Epidemiological and clinical parameters, antiviral treatment and treatment outcomes were analyzed.

**Results:** Male gender was dominant (68.9%), (25.1±12.11; 37±09;71.21±11.11). Vaccination status in was: I:62.03%, II:71.55%, III:77.65%; IV:unvaccinated-31.91%. Administered antiviral drugs were: Favipiravir, molnupiravir and paxlovid: I:39%, 8%, 53%; II:46%, 30% 34%; III:51%, 21%, 29%. Hospitalization length was in group I:5-7, II:7-10, III:10-14 days. Recovery was significant in groups I and II (89.27%, 65, 7%). Comorbidities were: cardiological (69.87%), neurological (33.5%), endocrinological (31.4%), nephrological (19.9%), malignancies (15.09%).

**Conclusion:** Prevention, immunization, timely and proper therapy reduce the incidence and result in global eradication of this disease.

**Key words:** Covid-19, antiviral drugs, epidemiological and clinical characteristics, prevention.

**10. EPIDEMIOLOGICAL CHARACTERISTICS OF COVID-19 IN THE AREA OF TUZLA CANTON FOR THE PERIOD 27.03.2020-31.12.2021.**

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**Objective:** Show the course of the COVID-19 pandemic in the area of Tuzla Canton.

**Methods:** Statistical data collected in the ZZJZ of Tuzla Canton (data from records prescribed by law) and the data of the platform of COVID-19 ZZJZ FBiH were processed through retrospective analysis.

**The results:** In the period from March 27, 2020, when the first case of the disease was registered in the territory of TK, until the end of 2021, 31, 597 cases of COVID-19 were registered, with 4, 686 people requiring hospital treatment at the UKC Tuzla. The disease most often occurs in the working population aged 25-64. The lowest number of patients was registered in the age groups 0-6 and 7-14, which we attribute to the lower testing rate and milder clinical picture in children. In the analyzed period, 1, 576 deaths were recorded.

**Conclusion:** In the period March-April 2021 (the third wave of the pandemic), when the delta variant of the coronavirus was dominant, the largest number of patients who required hospital treatment since the beginning of the pandemic in TK (1, 097 patients) was reported as well as the largest number of deaths from COVID-19 (318 ). Risk factors associated with death in patients are male sex, older age (65+) and the presence of comorbidities (diabetes, hypertension, lung diseases...).

**Keywords:** pandemic, healthcare, COVID-19

## 11. EPIDEMIOLOGICAL CHARACTERISTICS OF NEUROINVASIVE CLINICAL FORM OF WEST NILE FEVER IN THE AUTONOMOUS PROVINCE OF VOJVODINA, SERBIA, IN THE PERIOD 2012-2021

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**Objective:** To analyze epidemiological characteristics of the neuroinvasive clinical form of West Nile fever (WNF) in Vojvodina Province, Serbia.

**Methods:** We investigated the epidemiological characteristics of WNF in Vojvodina. We carried out a descriptive study over a 10-year period (from 2012 to 2021) and covered 380 patients.

**Results:** During the study period, the average annual incidence rate of WNF was 2.0/100,000 inhabitants (range: 0.0-9.9/100,000) and the case fatality rate was 15% (57/380). Observed the whole 10-year period, the highest incidence rate (9.9/100,000) and the highest mortality rate (1.6/100,000) were recorded during 2018. West Nile fever was reported in all seven districts of Vojvodina, but the highest average incidence rates were registered in the South Banat (7.0/100,000) and the South Bačka (2.0/100,000). The majority of WNF cases was reported in August, followed by July and September (47%, 30%, 18%, respectively).

**Conclusion:** West Nile fever is an endemic disease in Vojvodina. Incidence and mortality rates and also geographic distribution of cases varied considerably throughout seasons. Recognition of only neuroinvasive forms of WNF contributed to the underestimation of this disease in Vojvodina. Education of physicians in the primary health care and timely detection of milder forms of the diseases should be emphasized.

**Keywords:** West Nile fever, epidemiology, Vojvodina.

## **12. EPIDEMIOLOGICAL CHARACTERISTICS OF HEMORRHAGIC FEVER WITH RENAL SYNDROME IN MONTENEGRO FROM 2011 TO 2020**

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**Objective:** To determine the epidemiological characteristics of hemorrhagic fever with renal syndrome in Montenegro from 2011-2020.

**Method:** Descriptive study, using the data of the Centres for Disease Control and Prevention of Communicable Diseases Institute for Public Health of Montenegro.

**Results:** In the observed period, 92 patients with hemorrhagic fever with renal syndrome were registered, of which 71 % were men, and 67 cases (72.8%) were from North region of country. The incidence in the observed period were range from 0, 1/100 000 inhabitants in 2011 to 6.9/100.000 inhabitants in 2014. In the observed period, 4 people died; the average case fatality rate was 4, 3% (range: 0.1-0.3%). The greatest number of HFRS cases (49 cases) occurred during the summer months. 61, 9% were adults. It is necessary to work of education on the possibilities of prevention, early detection of the disease and general raising of awareness about this disease, as well as to perform monitoring of the disease incidence and distribution.

**Keywords:** HFRS; incidence; Montenegro

### 13. CLOSTRIDIOIDES DIFFICILE INFECTION AND COVID-19 IN THE INSTITUTE FOR PULMONARY DISEASES IN VOJVODINA

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**Introduction:** Increased antibiotic consumption and higher hospitalization rates during the COVID-19 pandemic may contribute to an increased risk of *Clostridioides difficile* infection (CDI).

**Aim:** to determine hospital-acquired (HA-CDI) incidence prior (2015-2019) and during the COVID-19 period (2020-2022) and to analyze differences in CDI patient's characteristics, timelines of CDI testing, and duration of hospitalization depending on COVID-19 status.

**Methods:** The HA-CDI incidence/10, 000 patient-days for patients hospitalized in the Institute for Pulmonary Diseases of Vojvodine (IPBV) from January 2012 to July 2022 was calculated. The retrospective analysis of CDI IPBV patients' characteristics from 2020 to 2022, depending on COVID-19 status, was performed.

**Results:** The HA-CDI incidence rate increased from 4.2/10, 000 patient days in 2015 to 8.7/10, 000 patient days in 2021. During the COVID-19 period, from a total of 124 CDI patients, 63.7% were males, and 47.6% had COVID-19 infection. In addition, 91.9% of CDI patients had prior antibiotic use. Although patients with COVID-19 were older (68.19 vs 66.26 years), had a lower delay for CDI testing (1.02 vs 1.58 days) and had a shorter hospitalization (24.10 vs 30.25 days), we did not confirm a significant difference ( $p < 0.05$ ).

**Conclusion:** The HAI-CDI incidence increased during the COVID-19 pandemic in the IPBV. Gender and age distribution, as prior antibiotic consumption, were similar among CDI patients regardless of their covid-19 status. COVID-19 positivity did not influence on timing for CDI testing or the duration of hospitalization.

**Keywords:** CDI, COVID-19, antibiotics

#### **14. PERCENTAGE OF LGBT PERSONS AT THE HIV COUNSELING CENTER, INSTITUTE FOR STUDENT HEALTH CARE, BELGRADE**

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**Introduction:** Center for prevention of HIV and STI (CPHS) was established in year 1981. and voluntary, confidential counseling and testing (VCCT) on HIV has been approved from UNAIDS and World Health Organization as one of best methods in HIV prevention. At the same time VCCT provide psychosocial support to all persons who were at risk of infection or are already HIV infected.

**The main aim:** The aim was to show number of clients from LGBT population who are visiting VCCT in CPHS. The period of 30 years, from 1990 to year 2020 has been observed.

**Methods and results:** The processed data were taken from national databases and from the Center's annual reports, that are maintained by staff of CPHS. The methods of descriptive and analytical statistics were used from encrypted and depersonalized information and based on that the results were obtained in form of percentage and proportions. In observed period total of 57 542 persons had been tested and 122 591 counseling had been performed. In early nineties less than five percent of LGBT population had been included in total number of HIV tested persons and in last ten years participation of LGBT population had been reached forty percentage.

**Conclusion:** In last 30 years there is trend of increasing percentage of persons from LGBT population who are coming for VCCT. At the beginning of working CPHS the percentage of LGBT persons who was coming for testing was very low. In recent years close to 40% of persons tested in VCCT is part of LGBT population, which mostly results from friendly approach of CPHS councilors towards the LGBT population, greater trust of LGBT persons and decreased stigma about same sex orientation and HIV infections.

**Keywords:** CPHS-Center for prevention of HIV and STI, HIV Human immunodeficiency virus, LGBT Lesbian, Gay, Bisexual, Transexual, VCCT-Voluntary Confidential Counseling and Testing

## 15. EPIDEMIOLOGICAL CHARACTERISTICS OF SCABIES IN MONTENEGRO 2011-2020.

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**Introduction:** Scabies is a major dermatological and a public health concern worldwide, especially in developing country. Epidemics are occasionally registered in collective housing settings such as preschools, nursing homes, social institutions, prisons or in the form of family epidemics.

**Objective:** The aim of the study was to determine epidemiological characteristics of notified cases of scabies in Montenegro in period 2011-2020.

**Material and methods:** The analyzed data were used from the surveillance system (MG soft) and from the Reports on the movement of infectious diseases in Montenegro in the period from 2011 to 2020. A descriptive method was used for analyses of collected data. The official population census of Montenegro from 2011 was used to calculate the incidence. All data is statistically processed using Microsoft Office Excel.

**Results:** In the period 2011-2020 in Montenegro was registered 5476 cases of scabies. The average incidence rate for this period was 88, 2/ 100.000. The highest number of cases was registered in 2015 (884 cases, incidence rate 142, 6/100.000) and the lowest in 2011 (173 cases, incidence rate 27, 9/100.000). The average age-specific incidence rate in period 2011-2020 was the highest in age groups 0-4 and 5-9 (233, 5/100.000 and 229, 3/100.000, respectively) and the lowest values was registered among patients in the age group between 40-49 years (30, 4/100.000). The disease was equally represented among males (51, 3%) and females (48, 6%). Scabies was presented throughout the year but the largest number of cases were registered during the winter months (October- March).

**Conclusion:** The high average incidence rate of scabies in the observed period, both among males and females, especially among children of preschool and school age during the winter months, highlighted the need for improved monitoring in vulnerable population. Education and epidemiological surveillance of scabies needs to be improved in order to provide evidence for planning of the disease prevention and control program.

**Key words:** scabies, incidence rate, surveillance, Montenegro

## **16. EXPERIENCES FROM THE UNITED NATIONS MULTINATIONAL OPERATION IN THE CENTRAL AFRICAN REPUBLIC IN THE PREVENTION OF INFECTIOUS DISEASES FROM MARCH TO NOVEMBER 2021**

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**Objectives:** The objective of this report is to share our experiences from the United Nations multinational operation in the Central African Republic in the prevention of infectious diseases from March to November 2021.

**Methods:** Contingent of Serbian Armed Forces engaged in UN Level 2+ Hospital was consisted of 72 contingent members. There were records on applied preventive measures, questionnaires about implementation of chemoprophylaxis against malaria, records about medical examinations of contingent members and upon returning to R. Serbia they were tested for malaria and presence of the antibodies to Zika, Dengue, Chikungunya, West Nile fever, HIV and Hepatitis C viruses.

**Results:** During the reporting period, 4 persons were registered with malaria, among which one person had three episodes of the disease. In the fifth person, malaria was registered 4 months after returning from Africa and the causative agent was plasmodium ovale. Three cases of illness from COVID-19 were also recorded.

Upon returning to R. Serbia was tested for the presence of antibodies to Zika, Dengue, Chikungunya, West Nile fever, HIV and hepatitis C viruses. Antibodies to the Dengue virus were recorded in 16 persons, Chikungunya virus in five and Zika virus in two persons.

**Conclusion:** Prevention of infectious diseases and especially vector-borne diseases in conditions of high risk for transmission is a great challenge because it depends on numerous factors that influence its effectiveness.

**Key words:** Malaria, Dengue, Zika, Chikungunya, vector-borne diseases, prevention, COVID-19

## **17. EPIDEMIOLOGICAL CHARACTERISTIC OF GASTROINTESTINAL INFECTIOUS DISEASES AND FOOD POISONING EPIDEMIC IN THE ZENICA - DOBOJ CANTON**

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**Introduction:** Gastrointestinal infectious diseases are a group of frequent diseases in developing countries as a result of industrialization in food production and often consuming of the food in public places. In Bosnia and Herzegovina and in Zenica-doboj Canton these diseases are frequent. The aim of this work is to investigate epidemiological characteristics of the most often gastrointestinal infectious diseases in Canton Sarajevo (Enterocolitis acuta, Toxiinfectio alimentaris, Salmonellosis, Amoebiasis) compared in relation to the occurrence of epidemics caused by hean friction.

**Methods:** We used individual reports as well as monthly and annual bulletins about the movement of infectious diseases which are obligatory for reporting from the Epidemiology department of the Institute for health and food safety Zenica This work is a retrospective study, for the period 2012-2021. Descriptive- analytical method was used. In statistical processing we used mean, structure index and trend index.

**Results:** In Zenica-Doboj Canton, during period of 10 years ( 2012. – 2021.), 6.616 cases (8, 8 %) of acute enterocolitis, food poisoning, salmonellosis, amoebiasis and hepatitis A were registered. The most of cases was in 2014. ( 910) and the least in 2020. ( 226 ) with rate of 257/100.000 to 64/100.000. According to age distribution, most of cases were of age 25 to 49 years, 22, 4% of all cases. Within this population, there were 17, 2% enterocolitis acuta, 14% food poisoning, 12, 6% salmonellosis. Population of 0-6 years old, salmonellosis is second and acute enterocollitis is third common disease. Sporadic cases were dominant, with exception in two cases – in 2007. three epidemic with total 17 cases and 8 hospitalized patients and in 2018.god. one epidemic with 42 cases and 7 hospitalized patients. Common cause was suspected to be homemade Maionaisse and undercooked chicken and fish. Most common disease was acute enterocolitis with 4.229 or 5.6% registered cases. Acute enterocolitis and food poisoning commonly happened in period from May to October, almost doubled in number comparing to other months. Salmonelosis was quadrupled in August compared to other months. Only one case of hepatitis A was registered in 2014. and no registered cases od amebiasis at all in period of these 9 years.

**Conclusions:** Gastrointestinal infectious diseases are constantly registered in Zenica-Doboj Canton, with high rate of 208, 2/100 000. Most of cases are in working people, ages between 25 to 49, which is related to eating in public restaurants and fast foods. According to this reality, most important action to take is to continuous effort to improve hygienic and sanitary conditions and common food safety protocols.

**Keywords:** gastrointestinal infectious diseases, epidemic, food intoxications

## 18. CARDIOVASCULAR DISEASES AS COMORBIDITY AMONG COVID-19 DEATH CASES IN THE REPUBLIC OF SRPSKA, BOSNIA AND HERZEGOVINA

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### Objective

Analyses of deaths from COVID-19 worldwide show that cardiovascular diseases (CVD) are among the most significant risk factors for death from COVID-19. The purpose of this study was to analyse COVID-19 mortality and to what extent CVD are represented as a comorbidity in those who died from COVID-19 in Republic of Srpska.

### Methods

Data of all COVID-19 death cases in the Republic of Srpska between 4 March 2020 and 31 August 2022 were collected from epidemiological surveillance of the Public Health Institute of Republic of Srpska. The analysis used data from COVID-19 death reports, on the WHO reporting form. This cross-sectional analysis was carried out on a sample of 5695 COVID-19 death reports.

### Results

From the beginning of the pandemic until August 31, 2022, total of 6501 deaths from COVID-19 were reported in Republic of Srpska, of which 3866 were men (59,5%) and 2635 were women (40,5%). Cumulative mortality rate per 100.000 is 576,2. Mortality rate among men is 695,7/100.000 men and among women 460,1/100.000 ( $p < 0,001$ ). Age-specific mortality is the highest among elderly  $\geq 80$  years (4255,1). Of the total number of reported deaths, 5695 death reports were completely filled out (87.6%), of which 3377 were men (59,3%) and 2318 women (40,7%). Of this number, 4144 persons (72.7%) had CVD. Among men 69.5% had CVD, and among women 77.3% ( $p > 0,001$ ). Observed by age, the frequency of CVD was the highest in persons of an older age:  $\geq 80$  years 79.3%, 70-79 years 76.6% and 60-69 years 67.3%.

### Conclusion

CVD are the most common comorbidities in persons who died of COVID-19 in the Republic of Srpska. The frequency of CVD was higher among women and people older than 70 years.

**Keywords:** COVID-19, mortality, cardiovascular diseases, comorbidity

**SESSION: THEORETICAL AND PRACTICAL PROBLEMS OF NON-COMMUNICABLE DISEASES****INVITED LECTURES:****1. QUALITY OF LIFE AMONG PATIENTS WITH HIGH-RISK SKIN MELANOMA**

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Melanoma is a malignant tumor originating from the melanocytes. Due to its severity, melanoma has an impact on the patients' quality of life. The quality of life of people diagnosed with high-risk cutaneous melanoma (stages IIC and III) may change over time, depending on the recurrence and/or progression of the disease. People with high-risk cutaneous melanoma, have an increased risk of loco-regional relapse and/or developing distant metastases as well as a higher risk of dying due to the disease progression after primary surgical treatment.

The diagnosis of melanoma has a long-term effect on the patient's psychosocial status and overall quality of life, taking into account the higher survival rate in the early stages of the disease, as well as the increased risk of recurrence and metastasis. Many factors have an impact on the patient's reaction to the presence of melanoma, starting with sociodemographic characteristics, personality, the way he deals with stress and the perception of the disease itself. Stage of the melanoma, the need for further therapies, and the presence of comorbidities are also important. The social relations and support that the patient has from his environment, primarily from his family, should not be neglected either. Knowing that they suffer from melanoma causes a feeling of anxiety, fear, uncertainty and depression in affected persons. As might be expected, persons diagnosed with advanced disease, but also those with melanoma localized on exposed parts of the body such as the face or extremities, have a higher level of psychological reaction. On the other hand, chronic stress has been linked to melanoma progression. A higher degree of depression is significantly associated with a worse quality of life. A large proportion of melanoma survivors reported ongoing quality of life deficits, fear of cancer recurrence, as well as unmet information needs up to 5 years after diagnosis.

With the introduction of new generation drugs, such as target and immunotherapy, into systematic and adjuvant therapy, measuring the quality of life of melanoma patients is of increasing importance. Multiple factors have been identified that may have an impact on quality of life, however, results between studies have been inconsistent. Various generic and specific instruments – questionnaires are applied in studies examining the quality of life of melanoma patients.

In the Finnish study during follow-up the quality of life of those treated for melanoma was not worse compared to the general population. A German group of authors states that the quality of life of surgically treated melanoma patients, without signs of disease recurrence during two years of follow-up, is comparable to the general population, concluding that the diagnosis and surgical treatment of melanoma do not have to significantly worsen the quality of life. In the MelBase cohort, the quality of life among patients with melanoma seems to be fairly stable over the whole disease course, although a small but significant decrease at time therapy is changed is observed.

A strong association between the occurrence of metastases and decline in the quality of life has been confirmed. An array of predictors of change in quality of life was identified after 6-12 months of follow-up in Serbian melanoma patients, including depressive symptoms, serum vitamin D and CRP levels, and the tumor classification according to TNM-T. The subscales of the Serbian version of the Functional Assessment Cancer Therapy—Melanoma (FACT-M) questionnaire have good internal consistency.

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## 2. CANCER-CAUSING INFECTIONS

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### Introduction

Malignant disease rates have reached enormous proportions globally and are considered a modern epidemic. They occupy the second position as cause of premature morbidity and premature mortality worldwide (1). During 20<sup>th</sup> century it has been recognized that infections with certain viruses, bacteria, and parasites as risk factors for several types of cancer in humans (2). It is assessed that some infections are linked to 15% to 20% of cancers, worldwide (3). Unsurprisingly, this percentage is higher in low- and in middle developed countries, and it is lower in the United States of America (USA) and other developed countries (4). There are several infectious agents which cause cancers mostly viruses, such as Epstein-Barr Virus, Human Papillomaviruses (HPV), Human Immunodeficiency Virus (HIV), Hepatitis Virus B (HVB), Hepatitis Virus C (HVC), Human Adult T-cell Leukemia Virus Type 1 (HTLV-1), *Helicobacter pylori* (*H pylori*) bacteria and three parasites *Chistosoma haematobium*, small liver flukes - *Opisthorchis viverrini* and *Clonorchis sinensis* (5). There are more than 200 HPV genotypes among which, more than 100 HPV types have affinity for skin and others for mucosal sites and 20 genotypes are human oncogenic. According to the International Agency for Research on Cancer (IARC) HPV types 16 and 18 are the most common types in the world (6), especially HPV type 16 which is two times more prevalent than any other HPV type (6-7). Since 2006, the bivalent (2vHPV) for girls, the HPV vaccine for boys was licensed later in 2009, it was a quadrivalent vaccine (4vHPV) and the nine valent HPV vaccine (9vHPV) were licensed both for girls and boys in 2014 (8). All three HPV vaccines do not provide complete protection against all oncogenic HPV types, and immunity is not lifelong, that is why the cervical cancer screening is an important preventive measure regardless of vaccine status. The main recommendation is that children should be routinely vaccinated between the ages from 9 to 14 years of age because these vaccines are highly effective only before exposure to HPV which is usually happened during the first sexual intercourse (9). In the Republic of Serbia, vaccination against HPV infection is not part of the mandatory national immunization program. It's recommended for children from nine years before the first sexual intercourse, and primarily for children in the seventh grade of primary school (13 years of age) (12). The 9vHPV contains (6, 11, 16, 18, 31, 33, 45, 52, 58) and it is indicated for the active immunization of both females and males from the age of 9 up to 45 years. It gives effective prevention of some premalignant lesions and cancers of cervix, vulva, vagina and anus caused by vaccine HPV types and genital warts (*Condyloma acuminata*) caused by specific HPV types (13). The 9vHPV vaccine does not contain HPV 35, 56 or 59, which are detected in the Serbian female population so there is a need to develop an HPV vaccine that will be specific for these HPV types (14). Besides primary prophylactic measures there are effective measures of secondary prevention such as screening and early detection of cancer. There is the well-known Pap smear screening method which is widely available, cheap and has good specificity for the detection of precancerous lesions with a proven impact on reducing cervical cancer prevalence and mortality rates. Also, the viral DNA of the high-risk strains HPV viruses can be easily detected in exfoliated cervical cells using commercially available tests. The HP-DNA test represents a convenient, highly sensitive screening tool and has a tendency of becoming the main screening method. But, it has an important flaw and that is its lower specificity (15-16). The majority of individuals infected perinatally with hepatitis B virus (HBV) develop a persistent infection, where the immune responses fail, leading to future tissue damage and eventual potential for life-threatening

complications such as liver cirrhosis and adenocarcinoma of the liver. This fact underpins the importance of the availability and affordability of effective vaccines and innovative approaches, particularly in low-income and middle-income countries. In the Democratic Republic of the Congo, combining HBV screening and treatment for pregnant women, as well as infant birth-dose immunization, with existing platforms for prevention of mother-to-child transmission of HIV, has proven practical and been widely accepted. Vaccines are critical for the hepatitis C virus (HCV) infections. Efforts to develop a hepatitis C vaccine started more than 30 years ago, when the hepatitis C virus was identified. Since then, researchers have studied several potential vaccines in animals. Some of these vaccines, developed mainly in the past decade, have undergone limited testing in people. Despite remarkable progress in HCV, about 60 subtypes have been identified, therapeutics with the development of direct-acting antivirals (DAAs), new infections continue to outpace cures, highlighting the need for an HCV vaccine. Beyond the enormous diversity of HCV, which has thwarted vaccine design efforts, the challenges of carrying out a study to assess the efficacy of an HCV vaccine candidate are formidable. Although the top-line results from the first human HCV vaccine trial, published in 2021, were disappointing.

**Conclusion:** For preserving and improving the health of the whole population as well as in groups with higher individuals at risk health measures of primary and secondary prevention are important as well as education and promotion of healthy behavior styles are also important.

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### **3. SELF-ASSESSMENT OF THE HEALTH CONDITION AMONG PATIENTS WITH EPILEPSY**

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Epilepsy is a chronic neurological disorder characterized by recurrent seizure episodes involving part of the body or the entire body. Seizure episodes are due to the release of excessive electrical discharges from a group of brain cells.

Around 50 million people worldwide have epilepsy with 2.4 million of new cases appearing each year making it the most common neurological disorder, according to the World Health Organization (WHO). Many factors including stroke, brain tumor, head injury, central nervous system infections, and genetically inherited defects are believed to be the cause of epilepsy.

Epilepsy is a major public health problem. It is common and can have serious physical and psychological consequences, including premature death, traumatic injury, and mental health disorders. Patients with epilepsy have greater difficulties dealing with schooling, limitation in employment, independence, and social activities and are widely stigmatized. These experience may therefore affect the lifestyle and quality of life of the people with epilepsy. Because of that, the aim of this study was to assess the quality of life and its associated factors among epileptic patients globally and in Serbia and to recommend some preventive measures to improve the quality of life for people with epilepsy.

Quality of life (QOL) is a broad concept and includes a person's physical health, mental health, level of independence, social health, personal beliefs and their relationship with each other and with the outside environment. QOL is a vital outcome measure in people living with epilepsy. Various instruments with good psychometric properties have been developed to assess QOL of patients with epilepsy. The main purpose of utilizing these instruments in clinical practice is to plan patients' care toward improving their life satisfaction and general well-being rather than mere symptoms alleviation.

Health-related quality of life is measured based on the total score of the Quality of Life in Epilepsy Inventory (QOLIE-31) instrument. QOLIE-31 is one of the most accepted tools, which is used especially in adults 18 and older. This tool, in fact, is derived from QOLIE-89. QOLIE-31 is a questionnaire that consists of 31 items and 7 subscales. They are emotional well-being, seizure worry, overall QOL, social function, medication effects, cognitive function, and energy/fatigue.

Studies show that social and economic deprivation increases the prevalence and incidence of epilepsy. Epileptic patients have lower education, income, and health conditions.

In many study, Seizure frequency was a stronger predictor of poor quality of life, because it is associated with excess fear, unable to work, stigmatization, diminishing hope and future life, impairment in social function, and psychological impairment. Individuals with frequent epileptic seizures will always be in discomfort, and they do not know when the next seizure will happen, as a result they take care and impose restrictions from driving, cooking, and doing risky jobs to avoid having seizure episodes at inappropriate times, places, or social events.

Level of education is sociodemographic parameter that has shown a significant variation in means score of QOLIE-31 in many study, whereby level of education was one of the predictor of quality of life in patients with epilepsy. This could be due to the influence of education on individual perception of their disease condition and adherence to their medications.

Our results showed that seizures frequency and long polypharmacy were predictors of poorer quality of life in people with epilepsy. Younger people had significantly higher quality of life among patients with epilepsy, but other sociodemographic factors such as gender, level of education and employment were not significantly predictors of quality of life.

The results of most studies suggest that seizure frequency and level of education were found significant predictors of QOL showing the necessity of seizure control and patient education for improving quality of life in patients with epilepsy.

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#### 4. THE FIRST RESULTS OF THE LUNG CANCER SCREENING PROJECT IN VOJVODINA, SERBIA

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**Introduction:** Among all cancer types, lung cancer (LC) is one of the most frequently diagnosed cancers and the leading cause of cancer-related mortality in Serbia and worldwide (1-3). According to the Serbian National cancer registry data, around 6,700 new LC cases and 5,300 LC deaths were confirmed in 2019 (1). Deaths from LC account for 25% of all cancer deaths in our country, which is higher than all colorectal, breast and cervical cancer deaths (1). The morbidity and mortality LC rates in Serbia are among the highest in the world (4, 5) and, during the past decades, have been continuously rising in both genders, particularly among females (1, 2). Almost 60% of LC in Serbia are detected in stage IV of the disease (2), resulting in 5-year survival rates of approximately 5-10% (6). After smoking cessation, low-dose computed tomography (LDCT) lung cancer screening (LCS) is the best prevention method for reducing LC mortality by detecting LC in the earliest stages of disease (6-9). Alarming smoking prevalence rates and increased LC mortality rates in Serbia accelerated the planning and implementation of the first LCS program in Serbia. As a result, LCS pilot program started on 20th September 2020 in the Institute for Pulmonary Diseases of Vojvodina, organized and granted by the Provincial Secretariat for Health Care of the Autonomous Province of Vojvodina.

**Aims:** The aim of this study was to present the first results of the LCS program in Serbia and to analyze differences in socio-demographic data and LC risk of screening participants by gender.

**Material and Methods:** The screening program was implemented and carried out in the high-risk population of the South Bačka District. The assessed population eligible for screening was around 33,000. Persons aged 50-74 years, former smokers who quit smoking  $\leq 10$  years, or current smokers, with a smoking history of 30 pack-years or more, or 20 pack-years with additional risks (COPD, prior pneumonia, other malignancy, LC hereditary history or exposure to environmental carcinogens) undergone LDCT evaluation. Exclusion criteria were LC diagnosis  $\leq 5$  years, continuous use of home oxygen concentrator (DOT), and co-morbidities in an advanced stage of the underlying disease, with a low expected survival rate. All participants in LC screening signed informed consent and completed an online questionnaire. The questionnaire collected socio-demographic (age, gender, employment, education, marital status, family lung cancer history), clinical (body mass index, chronic diseases, surgical interventions, prior cancer in personal history, previous CT or chest X-ray findings), smoking habits (current or former smoker, pack-years smoking history, type of cigarettes consumed), self-risk perception for LC risk, a willingness to quit smoking). Radiological assessment performed further evaluation according to Lung-RADS score results (10, 11). Interpretation utilized structured reporting; analyzing via Lung-RADS categories (category 1 and 2 benign, category 3 probably benign, and category 4 suspicious-probably). Lung-RADS LCS score 4 results underwent review by a multidisciplinary team consisting of oncologists, thoracic surgeries and pathologists. The personal patient data were de-identified and encoded during the process of data sampling and GDPR protocol was applied (12). We retrospectively analyzed the socio-demographical and clinical data of participants included in the LCS program from 20th September 2020 to 31st May 2022. Data analysis included descriptive and inferential statistics methods. Numerical features were analyzed through mean values (arithmetic mean, median) and measures of variability (value range, standard deviation), and attributive features using frequencies and percentages. The univariate analysis included the  $\chi^2$  test for attributive features, Student's t-test and one-way analysis of variance (ANOVA) for numerical features. In addition, Pearson and Spearman correlation tests were used for the association between the

variables. The IBM SPSS Statistics 24.0 software package was used. Values at the significance level of  $p < 0.05$  were considered statistically significant.

### Results:

A total of 1644 participants met the inclusion criteria for LC screening and were included in this study (Table 1). Among current smokers, 1.4% (19/1376) of study participants accepted the offered smoking cessation in the Counseling centre.

Table 1. Demographic and clinical characteristic of individuals who attended the screening

Variable	Male	Female	Total	p-value
No. of attendees (%)	697 (42.4)	947 (57.6)	1644 (100.0)	<0.001
Age, average $\pm$ SD	62.46 $\pm$ 6.66	61.75 $\pm$ 6.67	62.05 $\pm$ 6.677	0.032
Current smokers*	546 (78.3)	830 (87.6)	1376 (83.7)	<0.001
Pack-year*	46.25 $\pm$ 20.12	36.86 $\pm$ 13.47	40.84 $\pm$ 17.19	<0.001
Cigarette type*	Regular cigarettes	806 (85.1)	1348 (82.0)	<0.001
	Hand rolled	151 (21.7)	286 (17.4)	
	e-cigarettes	4 (0.6)	10 (0.6)	
Family history of lung cancer*	247 (35.4)	408 (43.1)	655 (39.8)	0.006
Personal cancer*	3 (0.4)	33 (3.5)	36 (2.2)	<0.001
Marital status*	Married	548 (78.6)	1077 (65.5)	<0.001
	Divorced	65 (9.3)	210 (12.8)	
	Widow/-er	49 (7.0)	272 (16.5)	
	Single	35 (5.0)	85 (5.2)	
Education level*	Primary school	51 (7.3)	156 (9.5)	0.018
	High school	491 (70.4)	1119 (68.1)	
	University degree	151 (21.7)	351 (21.4)	
	Other	4 (0.6)	28 (1.1)	
Employment status	Retired	335 (48.1)	794 (48.3)	0.056
	Employed	283 (40.6)	629 (38.3)	
	Unemployed	79 (11.3)	221 (13.4)	
Concerns about the risk of lung cancer*	Often and very often	130 (18.7)	345 (21.0)	0.016
	Sometimes	251 (36.0)	617 (37.5)	
	Not concerned at all or rarely	316 (45.3)	682 (41.5)	
Consider to quit smoking	in 30 days	158 (22.7)	347 (21.1)	0.199
	in next 6 months	287 (41.2)	701 (42.6)	0.313

From September 2020 to May 2022, 2043 LDCT scans were performed; 1664 were initial, and 418 (20.3%) repeated LDCT. The distribution of screening results according to Lung-RADS score is listed in Table 2. The cancer detection rate was 1.8 (30/1644), while the detection rate of primary LC was 1.6% (26/1644). Of 26 LC diagnosed, 88.5% were detected after initial LCS, and the remaining 11.5% were detected during follow-up LCS. LC cases were significantly more common among males than females (2.4% vs 0.9%,  $p = 0.01$ ).

Table 2. Lung cancer screening results

Variable	Male (n=667)	Female (n=947)	Total (n=1644)	p-value	
First LDCT, n (%)	697 (80.6)	947 (79.1)	1644 (79.7)	0.415	
Repeat LDCT, n (%)	168 (19.4)	250 (20.9)	418 (20.3)		
Lung RADS score results, n (%)*	0	4 (0.6)	3 (0.3)	7 (0.4)	0.009
	1	297 (42.6)	420 (44.4)	717 (43.6)	
	2	272 (39.0)	370 (39.1)	642 (39.1)	
	3	60 (8.6)	73 (7.7)	133 (8.1)	
	4A	30 (4.3)	62 (6.5)	92 (5.6)	
	4B	9 (1.3)	2 (0.2)	11 (0.7)	
	4X	25 (3.6)	17 (1.8)	42 (2.6)	
Emphysema, n (%)*	263 (37.7)	278 (29.4)	541 (32.9)	<0.001	
Benign changes, n (%)	10 (1.4)	10 (1.1)	20 (100.0)	0.489	
Cancers, n (%)*	18 (2.6)	12 (1.3)	30 (1.8)	0.044	
Lung cancer, n (%)*	17 (2.4)	9 (0.9)	26 (1.6)	0.012	

Characteristics of participants with confirmed LC are listed in Table 3.

19 of 26 diagnosed LC patients (71.1%) were in stages I to IIIA (TNM, eighth revision) and were amenable to surgical treatment. In addition, 84.6% (22/26) of confirmed LC were NSCLC (adenocarcinoma 57.7%, squamous cell carcinoma 18.8% and NOS 6.3%) and 15.4% (4/26) were SCLC.

Table 3. Characteristics of participants with confirmed LC in screening

Variable	Male, n= 17	Female, n=9	Total, n=26	p-value	
Age, average $\pm$ SD	64.24 $\pm$ 5.93	66.66 $\pm$ 6.42	64.80 $\pm$ 6.58	0.343	
BMI, average $\pm$ SD	25.34 $\pm$ 3.44	24.75 $\pm$ 5.75	25.69 $\pm$ 4.47	0.744	
Pack-years, average $\pm$ SD	53.40 $\pm$ 21.95	44.47 $\pm$ 11.59	47.50 $\pm$ 19.41	0.269	
Lung cancer stage, n (%)	I	5 (29.4)	3 (33.3)	8 (30.8)	0.743
	II	4 (23.5)	1 (11.1)	5 (19.2)	
	III	3 (17.6)	3 (33.3)	6 (23.1)	
	IV	5 (29.4)	2 (22.2)	7 (26.9)	

## Discussion

Inclusion criteria in our study were a combination of NLST and other European LCS trials (13-18). In contrast to the NLST, MILD, NELSON and LUSI study, where the proportion of males was 51%, 66.2%, 83.5%, and 64.7%, respectively (18), the percentage of females in our study was significantly higher compared to males (58% vs 42%). Our participants' observed age was lower than other reports (62 years vs 64 years, respectively) (18-26) due to lower age limits for inclusion in our LCS program.

Data from the USA LCS program showed that the adherence to LCS among the high-risk population is still low compared to breast cancer screening (7.3% of eligible smokers in 2016 vs 70% for breast cancer screening) (17). Achieving an adherence rate of at least 40% is necessary for a screening program to be cost-effective (18). The results of LCS programs in other regions observed differences in adherence regarding gender, race, smoking and

socioeconomic status (SES) (13, 19-23). Females, the non-white population, persons with lower SES, and current smokers have lower participation rates in screening programs (13, 19-23). Prior studies reported the highest risk for LC among individuals with lower SES (25), who also have the lowest adherence rate to screening programs (24).

Concerning marital status, almost 70% of screened reported living in a marriage, while only 5% of the respondents were single. We observed significant differences ( $p < 0.001$ ) in reported marital status by gender. Life in some form of union (marriage/common-law union) influences males to participate in screening compared to females (78.6% vs 55.9%). Acceptance to participate in screening among females were not affected by marriage status. We find a significantly higher share of divorced (15.3% vs 9.3%) and widows (23.5% vs 7.0%) among females compared to males.

In contrast to the LCS results in other trials, where the percentage of current smokers ranges from 48% to 69% (18), we observed a significantly higher proportion of current smokers among both genders (84.3%), as well as a considerably higher proportion of females current smokers compared to males (88.2% vs 78.9%).

In our study, females reported a significantly higher perceived LC risk and worry about LC than males (22.7% vs 18.7%). However, personal risk perception for LC was not correlated with the education level of study participants regardless of gender, neither for males nor for females. Current smoking status among our LCS participants contributes to increased self-perception risk for LC only among females. A correlation between the higher perceived LC risk and smoking status was observed for females ( $p = 0.01$ ) but not males ( $p = 0.327$ ). Although females in our study were significantly often current smokers, they more commonly participated in a screening and also significantly often expressed a higher level of concern about their LC risk. The obtained results contrast with previous studies where adherence to screening programs among current smokers was lower due to their emotional barriers (24).

Some prior studies indicate that participation of current smokers in the LCS programs can be used as an additional motivation and education moment to quit smoking, particularly for those with suspicious or positive screening results according to Lung-RADS score (19, 26, 27). Continued smoking among persons included in the screening was associated with their younger age, lower SES, marital status (singles), lower BMI, higher intensity and longer length of previous smoking experience and exposure to secondhand smoke (27). An almost negligible share of smokers (1.2%) who decided to quit smoking in our study indicates that significant changes are needed in existing smoking cessation programs. An innovative, active approach within the quitting centres, a combination of counselling and medication support before and after receiving the screening results, could contribute to reducing the prevalence of smoking in our country (19, 27-29).

In our study, 83.1% of participants had negative Lung-RADS score results, while suspicious or very suspicious Lung-RADS score results were found in 8.9%. A similar distribution of Lung-RADS score results was reported in other studies (30). However, in this study, males had more positive screening results and a significantly higher percentage of diagnosed LC than females. Biological differences between gender, lower duration and intensity of smoking and a longer mean preclinical course for developing LC in females compared to males explain the observed differences in screening outcomes (19, 31). In addition, males are more likely to be diagnosed with more aggressive LC in the advanced stage of the disease (31).

The observed cancer detection rate of 1.8% and the LC detection rate of 1.6% are in line or somewhat lower than the results of other studies (29, 31). LC detection rate in our study was influenced by a higher proportion of females and younger ages included in our study. It is important to note that the LCS program in the IPBV started a few months before the coronavirus pandemic, and the psychological effects and influence of covid-19 on screening adherence cannot be ignored. Also, our median follow-up imaging time was limited to only

nine months, and some indolent malignant lung nodules cannot be confirmed within the reported surveillance period. These limitations may lead to an underestimation of the actual LC detection rate.

During the last decade, 65% of LC diagnosed in the IPBV were in stages IIIB and IV (32), while according to our LCS results, almost 2/3 of LC were in stages I to IIIA and were amenable to surgical treatment. Observed results emphasize the significant impact of LCS is a stage shift to potentially curable stages of disease (29).

### Conclusion

Almost 2/3 of LC detected in screening were in stages I to IIIA. The observed difference in risk perception for LC among current female smokers must be used as an additional motive for quitting. Health messages should be tailored to gender and SES, since males and females are often differently motivated to participate in screening programs. The results of this study can be used as a starting point for planning the national LCS program in the future.

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**ORAL PRESENTATIONS:****1. THE INFLUENCE OF CLINICAL AND PATHOLOGICAL CHARACTERISTICS OF INVASIVE DUCTAL CARCINOMA ON DISEASE PROGRESSION**Miodrag Đorđević<sup>1,2</sup>, Karanikolić A.<sup>1,2</sup>,<sup>1</sup>Faculty of Medicine University of Niš<sup>2</sup>Clinic of Endocrine and Breast Surgery, UCC Niš

Breast cancer is the most common malignant tumor among women, with a growing medical importance due to the constant increase in incidence and mortality as the consequences of metastatic disease development.

**Objectives:** The aim of this paper was to study the influence of the clinical and pathological characteristics of invasive ductal carcinoma on the occurrence of metastases in axillary lymph nodes and disease progression.

**Methods:** The study included 136 female patients with primary invasive ductal carcinoma, who had underwent radical mastectomy at the Clinic of Endocrine and Breast Surgery of the University Clinical Center Niš. The following clinical and pathological parameters were analyzed: age of the patients, localization and size of the tumor (T stage), histological grade of the tumor, Nottingham score, Ki-67 proliferation index (low/high), as well as the status of ER (negative/positive), PR (negative/positive), and HER2 (negative/positive) receptors.

**Results:** The mean age of the patients was 64.01±11.92 years (arithmetic mean± standard deviation). Positive axillary lymph node status, i.e. the presence of metastases in the axillary lymph nodes was found in 77 (56.6%) patients. Comparative analysis of the clinical and pathological characteristics of carcinoma with the axillary lymph node status revealed a significant association between metastases and T4 tumor stage (23.4:5.1%; Chi square test: p=0.003). Ki-67 proliferation index was significantly higher in patients with positive axillary lymph node status compared to those without metastases (31.44±16.88:26.25±13.66; Chi square test: p=0.049). In relation to other analyzed parameters, statistical significance was not found. Luminal A subtype of breast cancer was detected in 50.7% of patients, basal subtype in 26.5%, whereas HER2+ breast cancer was found in 22.8% of patients. A statistically significant correlation between molecular cancer subtype and the appearance of metastases in the axillary lymph nodes was not found. A univariate logistic regression analysis showed that an increased probability for the occurrence of metastases in the axillary lymph nodes was associated with T4 tumor stage (OR=7.200; 95% IP: 1.850-28.016; p=0.004) as well as the increased values of Ki-67 proliferation index (OR=1.022; 95% IP: 1.01-1.044; p=0.049).

**Conclusion:** Results of this paper have demonstrated that detection of breast cancer in early stage by preventive examinations can decrease the occurrence of metastases and disease progression.

**Keywords:** breast cancer, metastases, prevention.

**POSTER PRESENTATION:****1. DECADE OF ADENOCARCINOMA IN THE INSTITUTE FOR PULMONARY DISEASES OF VOJVODINA: TOBACCO ABUSE AND GENDER DIFFERENCES**

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**Objective:** to determine differences in adenocarcinoma (AC) patients by gender.

**Methods:** Retrospective analysis of lung cancer (LC) hospital registry data (age, gender, LC type, stage of disease, smoking status) was performed. The observed period was ten years (2011-2020).

**Results:** Of 4924 AC patients, 64.0% (3152/4924) were males. The percentage of females with AC increased during the observed period, from 8.4% in 2011 to 12.0% in 2018. Females were younger at the time of diagnosis than males ( $63.22 \pm 9.48$  vs  $64.19 \pm 8.77$ ,  $p < 0.00$ ). More than 80% of AC in both genders were detected in the III or IV stages of the disease. However, females were more commonly seen in I or the II stage (19.3% vs 14.4%,  $p < 0.001$ ), while males were more often found in stage IV (52.3% vs 48.2%,  $p < 0.001$ ).

According to smoking status, males, compared to females, were more common former smokers (30.3% v. 17.4%,  $p < 0.001$ ), while females more often had never smoked (25.3% vs 7.3%,  $p < 0.001$ ). The average pack years for AC patients was 47 ( $47.38 \pm 28.99$ ), without observed differences by gender ( $p = 0.961$ ).

**Conclusion:** Increasing number of females with AC have been registered. Significant differences in age, smoking habits and disease stages were observed by gender. Reducing smoking prevalence and detecting LC early in the disease is crucial to decreasing LC mortality.

**Keywords:** adenocarcinoma, gender, smoking status

## 2. MALIGNANT NEOPLASMS IN PROBISHTIP 2007-2018

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**Objective of the work:** To show the condition of the malignant neoplasms in municipality of Probishtip in the period of 2007-2018.

**Method of the work:** A descriptive-analytical method was used. Data was used from the Institute of public health- Skopje. The morbidity and mortality are shown in a scale of 1:100000 residents.

**Results:** In the given period of 2007-2018 in Probishtip there were 385 registered cases of malignant neoplasms with an average morbidity of 197/100000. When compared with the morbidity as a result of the malignant neoplasms in Republic of North Macedonia (347/100000) the morbidity in Probishtip has a lower rate. The largest number of cases were registered in 2016, 40 cases with a morbidity of 247/100000. As far as gender is concerned, in Probishtip there were more cases of women with 58%/42%, while in the Republic of North Macedonia more men got the disease than women 55%/45%. The most represented age group is the group over 70 years old. with 123 cases or 32% of the total number of cases. The most common malignant neoplasm in the given period is Ca mammae with 64 registered cases with a morbidity of 477/100000, followed by Ca colorectal with 63 registered cases and a morbidity of 469/100000, etc. The average mortality in Probishtip is 182/100000 and is higher than the average mortality in Macedonia, which is 179/100000 for the period 2009-2015.

**Conclusion:** In the given period, for all types of malignant neoplasms, Probishtip has a lower morbidity compared to Republic of North Macedonia. In Probishtip, the female gender was more affected than in the Republic of North Macedonia in which there was a higher number of male cases. The highest number of registered cases is in the age group of over 70 years. The most common localization is Ca mammae or 17% of the total number of patients. The mortality rate in Probishtip is higher than in the Republic of Macedonia in the given period.

**Keywords:** cases, malignant neoplasms, Ca mammae

### 3. FACTORS ASSOCIATED WITH THE BURNOUT SYNDROME AMONG SECURITY EMPLOYEES OF THE PRIVATE SECURITY SECTOR IN CENTRAL SERBIA

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**Background:** Burnout is a special a state of physical or emotional exhaustion that also involves a sense of reduced accomplishment and loss of personal identity. The objective of the paper was to evaluate the factors which were associated with the appearance of burnout among work staff in the private security agencies.

**Material and Method:** We performed a multicenter cross-sectional study that involved representative sample of working staff from Agencies of Private Security in Central Serbia. Burnout was assessed using Maslach Burnout Inventory- Human Services Survey (MBI-HSS). A multivariate regression analysis were applied to determine the factors associated with the burnout. The p-value below 0.05 ( $p < 0.05$ ) was considered statistically significant.

**Results:** A response rate was 80%. The total number of participants were 353 (330 men and 23 women). The prevalence of total burnout syndrome was 32.6%. Much higher number of employees developed moderate or high level of burnout symptoms in individual subscales. Especially for emotional exhaustion (EE), moderate and high levels were cumulatively present in 86.1%. The largest number of employees had high level of depersonalization (DP), 82.4%. Slightly more than one third of employees (34.5%) had low personal accomplishment (PA), about one third (32.9%) had moderate PA, 32.6%. More than 64.3% of the respondents were married; about one third did not have children 33.7%, and more than a half of the respondents had completed secondary school 54.7%. The least of the employed had a university degree 27 (7.6%). 77.3% of the respondents were in the service and about 22.7% held managing positions. 81.6% of respondents worked in shifts, 78.5% worked from 8 to 12 hours and more than 60% responded were satisfied with the working conditions. We identified that female gender, older age, working in shifts, working 8-12h a day, as well as dissatisfaction with working conditions.

**Conclusion:** Our results have shown that female sex, older age, working in shifts, long working hours, as well as dissatisfaction with working conditions were significantly associated with higher risk of total burnout and for the development of EE. Male sex and marital status were associated with DP, while female sex and higher level of education were associated with greater PA. Managerial position and higher education were protective factors in relation to the development of burnout.

**Keywords:** burnout, risk factors, security staff, MBI questionnaire

#### 4. THE VALIDITY AND RELIABILITY OF THE SERBIAN VERSION OF THE SMARTPHONE ADDICTION SCALE—SHORT VERSION

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**Objectives:** Smartphone use has been rapidly increasing worldwide. In order to identify potential smartphone addicts, several scales were developed to assess smartphone addiction. The study aimed to test the reliability and validity of the Serbian version of the Smartphone Addiction Scale Short Version (SAS-SV) and estimate smartphone addiction prevalence among medical students.

**Methods:** The study was conducted on a sample of 323 third-year medical students. The cross-cultural adaptation was performed following the well-established guidelines. Exploratory factor analysis was used to examine the structure of the questionnaire. For test–retest reliability, students completed the questionnaire twice within seven days.

**Results:** The Serbian version of the SAS-SV showed good internal consistency (Cronbach's alpha = 0.89) and excellent reliability for test–retest scores (ICC = 0.94, 95% CI = 0.92–0.96). Factor analysis supported the extraction of one factor, which explained 51.538% of the variance. The SAS-SV was correlated with time indicators of smartphone use. According to cut-off values for the SAS-SV score, 19.5% of students could be regarded as “addicted”, and often spent more time on smartphones and social networks on working days and weekends than “not addicted” students.

**Conclusions:** The Serbian version of the SAS-SV is a reliable and valid instrument for detecting smartphone addiction among university students. Further research on this issue is encouraged to enable a better understanding of this ever-increasing public health issue.

## 5. THE ROLE OF SOME RISK FACTORS IN OCCURRENCE OF LOW BACK PAIN SYNDROME

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<sup>1</sup>Institute of Epidemiology and Biostatistics with Medical Informatics, Medical Faculty, Skopje

<sup>2</sup>PHI Specialized Hospital for Geriatric and Palliative Medicine 13<sup>th</sup> November, Skopje, Republic of North Macedonia

**Aim:** The **objective** of this study is to investigate the existence of the eventual causal associations among some risk-factors with the low back pain syndrome.

**Methods:** The research was conducted as a case-control study. A total of 142 participants with low back pain and the same number of frequency-matched controls were included. The relationship of the analyzed risk-factors and the appearance of the low back pain and quantification of that relationship were made by means of non-parametric methods ( $\chi^2$  test of homogeneity with C-coefficient of contingency) and parametric methods (Linear correlation-Pearson's coefficient). The value of  $p < 0,05$  was considered for significant level.

**Results:** From the analysed data we found that professions with lifting ( $p < 0,001$ ), whole body vibration ( $p = 0,013$ ) smoking ( $p = 0,005$ ) the number of smoked cigarettes ( $p = 0,049$ ) the length of smoking ( $p = 0,016$ ), the age when started smoking ( $p = 0,13$ ) are significant risk factors for low back pain.

**Conclusion:** From the results of our study we can conclude that some of the risk factors have statistically significant influence for the low back pain. By using primary prevention measures starting from the early childhood we can reduce the incidence of the low back pain. By using the secondary prevention measures for the adult patients we can reduce the intensity, the frequency and the absenteeism from the low back pain.

**Keywords:** low back pain, risk factors, profession, smoking

## **6. THE MOST IMPORTANT EPIDEMIOLOGICAL CHARACTERISTICS OF THOSE INJURED BY ANIMALS AND THE EFFECTIVENESS OF THE VACCINATION SCHEME IN THE FIRST SIX MONTHS OF 2022 IN THE TERRITORY OF THE NIŠAVA DISTRICT**

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1 Institute for Public health Niš

2 Faculty of Medicine, University of Niš

### **Abstract**

**Introduction:** Rabies is primarily a disease of wild and domestic animals, and it is transmitted to humans through contact with an infected animal.

**The aim of the work:** To show the most important epidemiological characteristics of those injured by animals and the effectiveness of the vaccination scheme in the first six months of 2022 on the territory of the Nišava district.

**Method:** A descriptive study was applied. The data source was the protocol of the Department for Immunization and Rabies Protection Institute for Public Health Niš.

**Results:** From January 1, until June 30, 2022. a total of 348 (men 207 and women 140) reported injuries. The average number of injured per month was 58, the least injured were 48 in June and the highest 74 in April. There were 267 from urban areas and 81 from the countryside. The animal that most often caused injuries 338 was a dog, and a cat caused 8 injuries, and a fox and a rat each injured one (1). Injuries were most often localized on the left lower leg 102. Only one (1) person was hospitalized due to injuries. Anti-rabies protection applied in 12 and ten-day animal surveillance in 27 injured. All the vaccinated created a sufficient number of protective antibodies with vaccination scheme 2-1-1.

**Conclusion:** Anti-rabies protection was applied to 12 and ten-day animal surveillance was applied to 27 injured. The vaccination has been effective in post-exposure rabies prophylaxis.

**Key words:** rabies, anti-rabies protection, post-exposure protection

## **SESSION: HEALTH PROMOTION – CHALLENGES AND SOLUTIONS**

### **INVITED LECTURE**

#### **1. INTERNATIONAL PREVENTION STANDARDS - WHAT WORKS AND DOES NOT WORK IN PREVENTION AND WHY?**

Matej Košir

Institute for Research and Development »Utrip«, Slovenia

#### **Abstract**

Over the past decades, prevention science has contributed several documents. Many years of research have collected findings about what works and does not work in prevention and why. Unfortunately, practice does not follow science to a great extent since we still use ineffective or harmful approaches. The occupation of a "prevention worker" or a "prevention expert" does not exist in practice, and education and training or continuous professional development in the field of prevention is mainly left to individuals and their initiatives. By doing so, we are creating differences between target groups involved in prevention activities since existing "prevention workers" have different expectations and perceptions and use different approaches and strategies, which are sometimes not ethical or professional. Using evidence-based approaches and quality prevention programs based on existing international standards, guidelines, and recommendations, we could avoid the accidental creation of differences between target populations (e.g., health inequalities). At the same time, achieving a set of objectives of different evidence-based prevention policies and programs at national, regional, and local levels would be easier.

**Keywords:** prevention, prevention science, evidence-based prevention, standards

#### **Introduction**

Preventive science is interdisciplinary, combining insights from various other scientific disciplines. The mantra of modern prevention is multi-risk behaviors. We want to prevent many health and social problems (usually simultaneously and in the same settings). These include substance use (alcohol and tobacco), risky sexuality, underage pregnancy, violence, accidents, suicides, mental illness, delinquency, obesity, etc. Additionally, it is crucial to start as early as possible (e.g., by adopting and implementing the concept of early prevention) (CND, 2022) and focus on different dimensions of health, such as physical, social, emotional, spiritual, and intellectual health (NASEM, 2020, from O'Donnell, 2017).

Based on the experience in the past decades, which is also supported by scientific evidence today, we have learned that only talking to people about not doing something does not affect achieving the desired long-term behavioral changes. Therefore, to perform quality prevention, we must consider the factors that affect the behavior. It is also important how we do this. In the past, we have learned that the best way to prevent is to focus on positive instead of negative behavior. Recently, we have been increasingly focusing on strengthening the protective factors that help young people and adults avoid substance use and other forms of unhealthy or risky behavior. We also focus on identifying risk factors that can cause unwanted behavioral outcomes and on young people's resilience to successfully cope with the pressure and challenges of daily life. It is also vital to build and strengthen personal and social competencies and life skills, through which it will be easier for young people to break through life. We must always consider and understand the factors that affect children and adolescents and recognize their views and values. We must encourage different options and positive behavior and provide meaningful, adequate, and age-appropriate information and knowledge that young people can use to avoid risky behavior. Understanding the concept of "prevention," the goal of prevention is not focused on trying to "stop" young people from using substances but on promoting health

and healthy lifestyles and equipping young people with those information, knowledge, and skills. All this will help them respond appropriately to different challenges later in their lives. And those challenges are not only related to substance use and much other health, wellbeing, and safety-related issues.

### **Evidence-based prevention approaches and international standards**

In recent years, many documents have been published in which the findings of numerous research studies have been collected and publicly presented evidence of what works and what does not work in prevention. In 2013, the United Nations Office for Drugs and Crime (UNODC) issued the first edition of international prevention standards in the field of substance use, which is one of the essential documents in the field of prevention, and which includes information on the most successful preventive approaches based on evidence collected from all over the world. The document was updated in 2018 (UNODC, 2018).

Based on the international standards and other existing documents (UNESCO, 2017; EDPQS, 2011; Council Conclusions; 2015; Lee et al. 1, 2012) that offer insight into the findings of preventive science, we can mention the following as practical components of evidence-based prevention programs. Effective interventions are based on theories and need assessment, are age-appropriate, are carefully planned, implemented (e.g., fidelity) and evaluated, they emphasize strengthening protective and reducing risk factors that can contribute to different risk behaviors, they include personal and social skills training, positive parenting approaches, normative education, social and emotional learning, are part of multi-component approaches (covering different domains and settings at the same time), especially at the community level, are supported by evidence-based advocacy and media campaigns, etc.

However, there are still (too) many so-called "prevention" activities in practice, which we know from the scientific literature, that do not have any effects or are even harmful. For example, ineffective and/or harmful practices include only providing information approach (e.g., through leaflets and brochures), scaring children and youth with the negative consequences of alcohol consumption, smoking, or using other drugs, and lectures (testimonies) by people who used drugs in the past or used to be addicted to drugs, one-off (usually mass and peer-to-peer), non-interactive and non-structured lectures or workshops, drug testing in schools and at the University, etc.

### **Conclusion**

Unfortunately, due to non-compliance with existing standards and guidelines in the field of prevention, we are losing the time and opportunities to achieve better results, and significantly better behavioral outcomes. Interestingly, evidence-based prevention is quite unpopular among policy- and decision-makers, who want rapid and visible results as soon as possible. As a result of such a situation, the financing of evidence-based preventive programs is also impaired. According to 2017 OECD data, and the European Commission, about 97% of health expenditures are intended for treatment and only about 3% for prevention.

We are facing a major challenge: how to systematically regulate the field of prevention and assure adequate political support and sustainable funding. There are quite a few ways to achieve this goal. The most important is undoubtedly the development and systematic implementation of education and training programs in the field of prevention to increase the knowledge and skills of the prevention workforce. Furthermore, we have to invest more in monitoring and evaluation since the evaluation culture in Europe in the field of prevention is very weak (e.g., funding schemes usually do not include evaluation as a criterion for funding).

Finally, it is worth noting that prevention intervention means interfering with the lives of different target populations (e.g., children, adolescents, parents, etc.), so our action must be based on a professional basis and, of course, ethics.

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## ORAL PRESENTATIONS

### 1. HEALTH WORKERS: "ATTITUDES AND KNOWLEDGE ABOUT BREASTFEEDING SUPPORT PRACTICES "IN SERBIA

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**Objectives:** In health systems, health care providers influence and support dietary decisions at key moments before and after childbirth to maintain exclusive breastfeeding and continue breastfeeding later.

**Methods:** The online survey was conducted in May 2021 among health workers who directly participate in caring for pregnant women, midwives, and newborns. The questionnaire contained 45 questions—data processing: descriptive statistical analysis.

**Results:** 1,959 health workers of all profiles participated in the survey. The most common characteristics are nurses (47.1%) and pediatricians (15.1%), primary health centers (51%), 58.1% aged 35-54, and 66.7% with more than ten years of practice. Knowledge varies by question, and many misconceptions still exist. 93% of participants believe that health workers have a vital role and influence in a woman's choice of how to feed her newborn and infant. 96.2% believe that this topic is important for the purpose of health education. 90.4% believe that health workers need additional education regarding breastfeeding support. 41.2% believe that modern milk formulas for babies are nutritionally equivalent to mothers' milk. Every second respondent (51.9%) had education with content about the importance of breastfeeding during undergraduate or postgraduate classes.

**Conclusion:** Breastfeeding counseling provided by trained individuals is key to improving breastfeeding rates.

**Keywords:** breastfeeding support, health workers, education

## **2. INTERSECTORAL COOPERATION IN HEALTH PROMOTION EXPERIENCES OF THE PUBLIC HEALTH INSTITUTE SBK/KSB -TRAVNIK**

Amra Kalčo<sup>1</sup>, Karajko-Melić A.<sup>1</sup>, Zukić-Begić E.<sup>1</sup>

<sup>1</sup>Institute for Public Health SBK/KSB

Health promotion represents active participation in improving own health and is carried out through actions that have an impact on the spread of health messages and the implementation of certain activities. These activities include health information, health education, health education, adoption of healthy lifestyles, as well as activities aimed at the individual, family, and community.

The aim of the paper is to present an example of the promotion of physical activity in the community through the intersectoral cooperation of the Institute for Public Health of the Central Bosnia Canton and the Sports Association of the Central Bosnia Canton.

The Institute for Public Health of the Central Bosnian Canton has been cooperating for many years through various projects aimed at promoting physical activity. The traditional walk "With us on the road to health" marks World Anti-Smoking Day, during which numerous competitions are organized for the participants. The project "Open the streets to health" is related to the marking of dates related to health, and ultimately resulted in the permanent closure of the main street in Travnik. The "Small School of Healthy Eating" within the "Fun Soccer School for Girls" offers lectures on proper nutrition and anthropometric measurements. The seminar "The role of sport in preserving health" is intended for physical education teachers, and health and sports workers, with the aim of improving knowledge and practices in improving health through physical activity, but also preserving the health of those who engage in these activities.

Improvement is not and cannot be only in the domain of the health sector. The aforementioned example of intersectoral cooperation was well received by citizens. New projects intended for vulnerable groups are also being prepared.

**Keywords:** health promotion, physical activity, intersectoral cooperation

### 3. THE PREDICTORS OF RISKY BEHAVIOR RELATED TO STUDENTS' HEALTH

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<sup>2</sup>Clinical Hospital Center Kosovska Mitrovica, Blood Transfusion Service, Kosovska Mitrovica, Republic of Serbia

**Introduction:** The World Health Organization defines risk behaviors as "a specific form of behavior that has been proven to pose a risk for certain diseases, poor health or injuries".

**The aim:** The paper's main aim was to determine the frequency of risky health behaviors and the relationship between the frequency of risky health behaviors and students' basic characteristics.

**Method of work:** The research was conducted as a cross-sectional study on the representative sample of students of the Faculty of Philosophy, Faculty of Sciences, and Faculty of Medical Sciences of the University of Pristina with temporary headquarters in Kosovska Mitrovica, in January 2020. A list of students enrolled at these faculties of the University in 2019/2020, available from the administrative unit of the University seat, served as a data source for forming the sample. A questionnaire prepared as an instrument of research had also been used a standardized questionnaire from the World Health Organization was used.

**Results:** The results of our study indicate that the majority, more than half (58.0%) of the students of the Faculty of Philosophy, Faculty of Sciences, and Faculty of Medical Sciences of the University of Kosovska Mitrovica practice healthy health behavior of respondents practice healthy behaviors. Predictors of respondents' risky health behaviors are: the faculty that the student is studying (OR=0,382 95% CI: 0,208-0,703, OR=0, 435 95% CI: 0,239-0,793), year of study (OR=0,584 95% CI: 0,354-0,962).

**Conclusion:** The research findings indicate a need to implement appropriate health interventions to enable the initiation of activities to acquire healthy habits at a young age and adopt healthy lifestyles.

**Keywords:** students, health, risky behavior.

#### **4. KNOWLEDGE AND PRACTICE REGARDING THE USE OF FACE MASKS FOR COVID-19 PREVENTION AMONG MEDICAL STUDENTS**

Maja Miloradović<sup>1</sup>, Vukašinović D.<sup>1</sup>, Đurđević K.<sup>1</sup>, Jovanović A.<sup>1</sup>, Paunović K.<sup>1</sup>

<sup>1</sup>The University of Belgrade, Faculty of Medicine, Institute of Hygiene and Medical Ecology

**Objective:** The study aimed to investigate knowledge and conduct regarding using face masks for COVID-19 prevention among medical students.

**Methods:** Graduate and postgraduate students of the Medical Faculty University of Belgrade were surveyed. They were asked how regularly they wear face masks and of which type, how they position the masks, and how they maintain and dispose of them.

**Results:** The study included 351 students, 81 males, and 270 females, mostly 18-24 years of age (78.1%). Only 0.6% of medical students reported not using face masks at all. The surgical mask was most commonly used (44.2% always used surgical masks, and another 37.9% of students used surgical masks frequently;  $p=0.001$ ). FFP2, cotton, or other mask types were rarely used. N95/KN95 mask was also regularly used (occasionally 25.6% and frequently 22.5%). Adequate application covering the nose and mouth was reported by 89.4% of students ( $p=0.001$ ). However, 5.1% reported often wearing masks only under the chin. The majority of students changed masks daily (61.8%;  $p=0.001$ ). Only 6.2% of students disinfected masks before disposal, while 8% disinfected masks before or during.

**Conclusions:** Medical students generally have adequate knowledge regarding face masks for COVID-19 prevention. They also regularly and adequately use them.

**Keywords:** face masks, adequate application, COVID-19 prevention, medical students

## 5. ROLES AND CHALLENGES OF HEALTH PROFESSIONALS IN THE PUBLIC HEALTH SYSTEM

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<sup>1</sup>Institute of Public Health SBK/KSB

**Objectives:** Health care in the public health system aims to inform the population, promote healthy lifestyles and ensure early treatment of diseases. Health professionals in public health care are responsible for improving patients' health through evidence-based promotions and recommendations for healthy lifestyles and encouraging individuals to use preventive services (examinations, counseling, and tests). Through continuous education in public health, health professionals are able to move a larger group of people to active involvement in the application of healthy lifestyles.

**Materials and methods:** Review and search of recent literature in electronic and paper form (descriptive method).

**Results:** The entire health care system, and especially public health care, is one of the most complex organizational systems, which aims to provide comprehensively necessary, accessible, integrated, and, above all, quality health care. Health professionals are faced with a whole series of social, educational, and educational challenges in order to be ready to respond to the needs of modern society, including activities of health improvement and promotion, disease prevention, promotion and implementation of health care, and improvement of the environment, scientific research work, and active participation in the creation of health policy in the country.

**Conclusion:** Improvement of health, separation, treatment, and mitigation of diseases, i.e. easier overcoming of everyday challenges, can be achieved by health professionals through the promotion and application of health education, which is a health measure that develops the development of healthy and changes harmful health behavior, and by teaching and spreading information about healthy procedures. . achieves the above.

**Keywords:** promotion, prevention, public health, health education

## **POSTER PRESENTATIONS**

### **1. PREVENTIVE-PROMOTIONAL ACTIVITIES, HALLMARK OF THE "DOM ZDRAVLJA NIS"**

Simovic Nevena, Jovanovic N., Randjelovic S., Premovic V.  
Dom zdravlja Nis

**Introduction:** "Dom zdravlja Nis", on the initiative of the Ministry of Health of the Republic of Serbia, organizes the "Open Doors" campaign intended for the implementation of preventive examinations and screening programs. The Center for Preventive Health Services and all services of the "Dom zdravlja Nis" individually participate and organize their activities and promote preventive work.

**Work Goal:** To show the importance of preventive work, team, and multidisciplinary cooperation to eliminate risk factors for chronic noncommunicable diseases.

**Method of work:** The research includes all persons aged 19-65 and older who visited the event from 07.10.2021. until 04.09.2022. years. The data was obtained through the review and retrospective analysis of the "Dom zdravlja Nis" medical records.

**Work results:** In this period, 126.880 services were provided. 9.299 diabetes screenings, 6.797 cardiovascular disease screenings, 6.442 colorectal cancer screenings, 10.371 depression screenings, 7.436 cervical cancer screenings, and 5.024 breast cancer screenings were performed. 21.719 blood pressure measurements, 22.005 blood glucose measurements, 3.861 lipid status measurements, and 4.243 blood tests were performed. 3.528 breast ultrasounds, 4.269 abdominal ultrasounds, 2.052 thyroid gland ultrasounds, 339 EKGs, 303 ophthalmological examinations, 304 audiometric hearing tests, 536 dental preventive examinations, 303 internist examinations, 396 dermatovenerology examinations, 223 psychiatrist examinations, 2.052 psychologist examinations and 16.911 educations for breast self-examination.

**Conclusion:** Any disease detected at an early stage is a success. We continue with preventive and promotional activities as our main task.

**Keywords:** Prevention, screening, promotion.

## 2. HEALTH PROMOTION DURING THE COVID EPIDEMIC

Ivan Cukic<sup>1</sup>, Obradovic M.<sup>1</sup>, Tomašević M.<sup>1</sup>

<sup>1</sup>Institute for Student's Health of Belgrade University, Serbia

**Introduction:** In early month of August 2022, there were detected more than 590 million Coronavirus cases with nearly 7 million deaths (1). In Serbia, more than 2 million cases were registered from the beginning of pandemic with virus SARS-CoV-2 (2). First case in European region was reported from World Health Organization on the January 27th 2020 (3). Epidemiological measures in last two years connected to prevent disease transmission included complete lockdown, restricted movement of people in public, wearing face masks, forcing people to stay at home and working online, prohibiting visits to retirement homes, social distancing, online education of young people, etc. During this time of COVID-19 pandemic crisis, health promotion becomes more important than ever to support the health and wellbeing of people in our communities (4).

**Aim:** Promotional activities have been focused on risky behavior in younger persons mainly addressing medical misinformation and improving public health knowledge.

**Methods and results:** During the pandemic years from 2020 to 2022, numerous preventive activities have been done. Online counseling centers have been organized and included teams of doctors from general and physical medicine, dentistry, gynecology, epidemiology, and psychiatry, who have been communicating with young persons related to specific health doubts and problems. Promotion of vaccination has been done with United Nations Population Fond (UNFPA) and the Belgrade Center for Human Rights with open message "It's up to you - decrease the numbers!". The campaign included communication with young people by a special e-mail address that has been opened through which young people could ask questions about vaccines.

On the occasion of October 17th - Student Health Day – An interactive meeting has been made "Don't be a bug" in #NaTebiJe network to ensure that students of Belgrade University get verified information about vaccination.

With the goal to mark the European Testing Week (ETW) - HIV and Hepatitis C, during November and on December 1st - World AIDS Day, like every year, The Institute for Student's Health in Belgrade with the support of the Student Center, had made a series of activities in student dormitories with voluntary and confidential HIV counseling and testing. During year of 2022 promotive activities have been continued with a new podcast release in which students talk about actual health topics with health experts.

**Conclusion:** Health promotion is extremely important during the Covid -19 pandemic. Using digital platforms such as Instagram, FB, YouTube channels, Platform Stream Yard, Spotify, Zoom and different podcasts we have entered a new era of communication with young persons. However, changing behavior of young people and their perception of healthy lifestyles takes time. The health promotion messages and information should be designed in a way that is understandable to the general public (4). Working together with local communities (Student's Parliament, Student's Center, Belgrade's Right center for human rights, UNFPA, and others) and using multiple communication techniques such as social media we can achieve the main goal - education of young population about different health issues/problems and improving general health of every nation.

**Keywords:** health promotion, students, Covid

### **3. WORK OF THE “DOM ZDRAVLJA NIS” IN THE CONDITIONS OF THE PANDEMIC COVID -19**

Jovanovic Natalija<sup>1</sup>, Randjelovic S.<sup>1</sup>, Premovic V.<sup>1</sup>, Simovic N.<sup>1</sup>

<sup>1</sup>Dom zdravlja Nis

**Introduction:** "Dom zdravlja Nis" In 2020, was faced with an unexpected health problem of global proportions. A state of emergency was introduced, and the employees adjusted their work to the new situation.

**The aim of the paper:** To show the importance of treatment of patients suffering from COVID-19 infection in the "Dom zdravlja Nis".

**Method of work:** Data obtained by insight into the treatment protocols of patients suffering from COVID-19 infections.

**Results:** From 15.03.2020. until 30.06.2022. there was a total of 694.348 services rendered to patients suspected of having contracted COVID at multiple COVID clinics of "Dom zdravlja Nis". 282.088 laboratory tests were made, as well as 80.707 X-ray scans of the lungs. 12.154 patients were referred to a higher level of health care, representing 1.75% of all tests. In the COVID clinic intended exclusively for children up to 18 years of age, 40.125 checkups were performed. Based on the Professional - methodological instructions for controlling the introduction and prevention of the spread of the new coronavirus SARS-CoV-2 in the Republic of Serbia, 132.693 samples of material for PCR testing, 11.566 samples for serological testing, and 190.885 samples for antigenic tests were carried out in the Nis Health Center testing. Out of the total number of people tested, 116.860 respondents (36,11 %) had a positive result.

**Conclusion:** Treatment of patients at the Nis Health Center reduced the occurrence of complications and referrals to a higher level of health care.

**Keywords:** COVID-19 infection, examinations, sampling, serological testing.

#### 4. WORK OF THE DIABETES CENTER AT “DOM ZDRAVLJA NIS”

Jovanovic Natalija<sup>1</sup>, Randjelovic S.<sup>1</sup>, Premovic V.<sup>1</sup>, Simovic N.<sup>1</sup>

<sup>1</sup>Dom zdravlja Nis

**Introduction:** There is a worldwide trend in the rise of diabetes, and Serbia is no exception. As such, in the interest of detecting and preventing early complications related to diabetes, in 2015 "Dom zdravlja Nis" opened a clinical for diabetes.

**Objective:** Motivating patients to change their lifestyle and habits to lower the risk of diabetes.

**Methods:** Using data received by observing the work of the diabetes center in "Dom zdravlja Nis."

**Results:** From 2015 to 2022, the clinic has had 3.850 files opened for people with diabetes and 485 for pre-diabetes patients. Of the patients checked, 98% were Type 2 diabetes, and 2% were with Type 1 diabetes. 79,5% of patients were treated with oral hyperlipidemia, and 20,5% were on insulin. With 77,5% of patients, their BMI was measured at 25. There were 34,3% of patients whose HbA1C was over 6,9%. The tested patients showed evident complications: 25,3% had cardiovascular issues, and 48,7% had polyneuropathy. 15,4% had retinopathy, 4% had diabetic kidney disease, 3,6% had peripheral vascular disease, and 1,6% had a diabetic foot.

**Conclusion:** Diabetes screening tests are a powerful tool for early detection of disease risk because there are no symptoms at the beginning of the disease.

**Keywords:** Motivation, early detection, diabetes, complications.

## **5. BELIEFS AND ATTITUDES OF PHARMACISTS TOWARDS HEALTH PROMOTION AND DISEASE PREVENTION IN COMMUNITY PHARMACY**

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**Objectives:** Examination of the beliefs and attitudes of pharmacists towards health promotion and disease prevention in community pharmacies to support and improve this service.

**Methods:** Quantitative, non-experimental cross-sectional study was conducted in September 2022. Pharmacists in Serbia's community pharmacies voluntarily and anonymously filled out a dedicated questionnaire through an available online survey. The questionnaire was distributed using the snowball technique.

**Results:** The study included 74 pharmacists primarily employed in private community pharmacies (89.2%) located in a city (90.5%). Almost all respondents (91.9%) stated that they are familiar with the activities carried out within the framework of health promotion and disease prevention, while 71.6% of respondents believe that they have enough knowledge to carry out the abovementioned activities. 71.6% of respondents stated that they perform the mentioned activities. However, only 29.7% of respondents believe they are sufficiently engaged in this area. The main reason cited is the lack of time (87.8%) and motivation (46.1%) for providing these services.

**Conclusions:** To improve the public health services provided in community pharmacies, the problems faced by pharmacists must be addressed. It seems that adequate time management and additional stimulation of pharmacists would significantly improve these services.

**Keywords:** Attitude, Community pharmacy, Health Promotion, Disease Prevention, Public health

## 6. LIFESTYLE AS A PREDICTOR OF HEALTH IN THE FEMALE POPULATION IN CENTRAL SERBIA

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**Introduction/Aim:** The World Health Organization defines lifestyle as a general way of life based on the interaction between lifestyles in a broad sense and individual behavior patterns determined by sociocultural factors and personal characteristics. Risky lifestyles can contribute to morbidity and mortality in the population. To study the lifestyle habits of the population of women in Central Serbia and determine the need for preventive measures.

**Method:** Cross-sectional study was conducted using a sample of 1182 women in their reproductive period (15-49 years of age) from Central Serbia from April 2019 to November 2021. The study was conducted by teachers and students of the Faculty of Medical Sciences at the University in Kragujevac using the methodology and tools of the STEP-wise Approach to Noncommunicable Diseases Risk Factor. Surveillance of the World Health Organization (STEPS) with the support of the Ministry without portfolio charged with demographics and population policy of the Republic of Serbia. Commercial, standard SPSS software package version 18.0 (The Statistical Package for Social Sciences software (SPSS Inc, version 18.0, Chicago, IL)) was used for statistical calculations.

**Results.** Two-thirds of women (62.5%) reported daily use of tobacco products, and slightly more than two-thirds (68.5%) had drunk or consumed alcohol in the last 12 months. Vegetables are consumed daily by (43.2% of women, while 27.9% of women consume fruit daily. One in seven women believes that excessive salt consumption does not affect health. Sport, fitness, or leisure recreational activities of high intensity of at least 10 minutes, only 19.4% of women did this in their free time. Women with the highest education level and working employed exhibit more correct behavior patterns.

**Conclusion.** A healthy lifestyle contributes to physical and mental health and overall quality of life. The women in our study show inadequate behavioral patterns that should be improved through preventive health and educational intervention measures.

**Keywords:** lifestyle, women, Central Serbia

## 7. FREQUENCY AND CONSEQUENCES OF DENTAL CARIES IN SCHOOL CHILDREN

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**Introduction:** Tooth decay is damage to a tooth that can happen when decay-causing bacteria in the mouth make acids that attack the tooth's surface. This can lead to a micro hole in a tooth, called a cavity. If tooth decay is not treated, it can cause pain, infection, and tooth loss.

Young children are at risk for early childhood caries, called "baby bottle tooth decay", which is severe tooth decay in baby teeth. That can cause serious dental issues. Early promotion of good dental hygiene is necessary to prevent serious dental health problems later in life.

**Objective:** To determine the prevalence of tooth decay in school children ages 6-11 in Tuzla canton in 2019-2021.

**Methods:** Retrospective analysis of data obtained from the dental examination of school children.

**Results:** The total number of children in the research was 1674, and 0.47% had utterly healthy teeth. 61.5% of children had 5 or more teeth affected by tooth decay. The number of children with a tooth extracted due to tooth decay was 30.5%. The number of children who have a tooth extracted for another reason was 50.4%. The average KAP index is 2,53, which is higher than the EU average (<1,5).

**Conclusion:** Organized screening programs and early intervention make it possible to diagnose early signs of dental diseases, reduce treatment costs, and improve the quality of general dental health.

**Keywords:** dental health, tooth decay, cavity

## **SESSION: PREVENTIVE ASPECT OF A HEALTHCARE ORGANIZATION**

### **INVITED LECTURES**

#### **1. COVID 19 - IMPORTANCE OF PUBLIC HEALTH INITIATIVES**

Roberta Markovic

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The year 2020 will be evoked for the COVID-19 outbreak, which on 30 January was acknowledged by WHO as a public health emergency of international concern (PHEIC), and on 11 March it was characterized as a pandemic (1). In the Republic of Serbia, the first case of COVID-19 was confirmed on 6 March 2020. The spread rate of COVID-19 and the unexpectedly high number of deaths in some countries were an alarm-bell for public health experts globally to take a proactive role in raising readiness and to provide fast, well-timed dissemination of information and instructions for action in the crisis situation. According to WHO, “The overarching goal for all countries was to control COVID-19 by slowing down transmission of the virus and preventing associated illness and death” (2), and the expectation was that “In response to COVID-19, every country should be implementing a comprehensive set of measures, calibrated to the local context and epidemiology of the disease”(2).

Beside these WHO recognized and suggested that good strategy to control COVID 19 will be based on public health initiatives – on public measures, public health measures that will involve individuals, institutions, communities, local and national governments, media, NGOs and other bodies in communities (3). Distinctly, if we expect Public Health and social measures to be effective and efficient, all members of society should be involved. As well it is expected Public Health measures to provide a toolkit of interventions that could be applied in respect to local context (4).

The Public Health Institute Niš, Serbia, as the leader Public Health institution on South East Serbia led activities relying primarily on WHO guidance and knowledge gained at the April 2019 WHO “Emergency Risk Communication training and plan-writing workshop” held in Belgrade/Serbia, recommendations of Ministry of Health of RS, as well CDC and ECDS. As well previous experiences related to public health initiatives were of great help (5, 6, 7). The Public Health Institute Nis, activated all mechanisms to prevent the spread of COVID-19 in the districts that it is responsible for. One of the activities was to get Public Health messages out, widely and as promptly as possible, through trusted and easily reached channels. Very important goal was to implement this as a community-based program in order to reach adequate society response. Previous experiences highlighted that initiatives from the community were welcome as a backbone for the development of strategies and action plans (8).

The local Public Health network of partners, developed over the last ten years, has now been our strength and advantage. And the initiative for needed public health activities started from our partners. The members of the network were *not only health care institutions (primarily primary health care), but also local self-government, schools, colleges, youth organizations, social institutions, cultural institutions, sports organizations, citizens' associations, the Red Cross nongovernmental organizations (NGOs), and the media* (9). Digital communication methods such as Zoom and Skype importantly enabled communication of information among the members of the Public Health Network, and the solving of issues as they arose. Besides, public health initiatives were directed to IPH Nis mostly through partners from the network.

Results of our common activities made us satisfied in such crisis:

- More than 20 education materials, in electronic form have been developed promptly, made available on PHI Nis’s site, and sent to different local and regional organisations,

and MEDIA&REFORM CENTAR Nis, key NGO which had organized further distribution of education material through different kind of media.

- 5 video clips were developed and emitted through local media, as well.
- Materials have been developed for high-risk groups as well as for the Roma population, in the Roma language. Work was organized in Roma neighborhoods, through Roma mediators.
- Educational material in the form of a poster intended for elementary school pupils was created and printed within 48 hours, and because of the lockdown, material in electronic form (JPG format), were distributed to a network of teachers and class presidents, who further distributed it to all pupils and teachers via a Viber network.
- Materials were forwarded to the University of Niš (14 faculties with a current total of 24,667 students and more than 2 000 staff).
- 3 insta-live educations organised for student population.
- 7 ZOOM trainings on mental health protection were conducted, for children, young population, parents, teachers and population in general.
- Especially for families in risc we organised few zoom meetings in partnersheep with NGOs
- Through specialised Roma web portal we have realised 2 shows with publis health specialists on two topisc: prevention COVID 19 and vaccination.
- Regularly we have used radio to spred information on health behaviour during COVID 19 epidemic.

And following what were public initiatives on the territory of IPH Niš, in the period of COVID 19 epidemic that initiated these activities we could recognize strong role of different individuals, groups, bodies, organizations, media, institutions etc who made a great contribution in defining and implementing many measures that led to the establishment of control over the epidemic. *Local communities* were strong partners; after expressing the need for educational material for population in general, they have distributed developed material, made it available to general population, but also they had implemented proposed measures in the community and controlled application of the measures.

*The Roma population*, from the town of Nis, appealed through their representatives, mediators with a request to receive information on measures against COVID 19. Education materials have been developed for Roma in the Roma language. Education was organized in Roma neighborhoods, through Roma mediators. As well, through specialized Roma web portal 2 shows have been realized, with Public Health specialists on two topics: prevention COVID 19 and vaccination.

*MEDIA&REFORM CENTAR Nis*, respectable NGO and IZJZ Nis as common initiative have prepared several videos related to measures to protect against COVID 19 (could be seen on you tube).

*Public traffic in Nis, Airport Nis, public organizations in Nis, sport centers, markets* were expressing constant and great need for educational materials, consultations, support regarding measures and protocols that have been changing and developing in accordance with the knowledge about COVID 19 at the global level.

*Population of Students of the University of Nis* needed psychological support in the process of vaccination and initiated 3 insta-live educations organized by our medical doctors (from Centre for Health Promotion) and other professionals.

Professionals from Center for Health Promotion IZJZ Nis in communication with the representatives of organizations in network recognized *the need for psychological support* in general. 7 zoom meetings with more than 100 participants by each were organized.

It is always possible to do better and more, and the acquired experience helps in this, but as the epidemic of COVID 19 was a crisis in many ways, we can be satisfied with the response and activities that we carried out together at the community level. Nowadays, we are sure that the planning of public health interventions in crisis situations at the local level should be part of existing national action plans for emergency preparedness and response, but still, local characteristics of each community and Public Health initiatives will adjust these activities.

As advantage of our activities in the period of COVID 19 epidemic crisis we have recognized: Strong IPH Nis network, the accessibility of all stakeholders in the Public Health network and rapidity of communication. As disadvantage, the absence of providers for some specific social groups in Public Health network: the population of parents with children with autism, the elderly in the countryside, the homeless and migrants. Also there was a lack of services for psychological support to general population, especially to health workers in COVID system.

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## **2. PREVALENCE OF PRIMARY HEADACHES IN THE SERBIAN ENVIRONMENTS OF KOSOVO AND METOHIA**

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This paper will present findings from epidemiological studies on the prevalence of primary headaches in the world, as well as our the most significant findings from the first study of the prevalence of primary headaches in the adults in the Serbian areas of the southern province of Serbia, Kosovo and Metohija (1).

Despite the fact that they belong to the most common diseases of humanity, the epidemiology of headaches is only partially documented, and data is still being collected. Available knowledge indicates that half to three quarters of adults aged 18 to 65 have had a headache in the last year (2). The most common of headaches, episodic tension type headache (TTH), has been reported in over 70% of individuals in some populations (3). The average one-year frequency of episodic TTH in adults is 42%, and is slightly higher in women (4). The largest number of epidemiological studies on the prevalence of primary headaches conducted in Europe. A review of these studies shows an average one-year prevalence of migraine in adults of 14.7% (8% in men and 17.6% in women). In relation to the whole life, the prevalence of migraine is slightly higher, 16%, in women 20%, in men 11% (5). It should be taken into account that most studies included only cases with a definite diagnosis of migraine (with and without aura), and it is speculated that the inclusion of cases with probable migraine (fulfilling all but one criterion for the diagnosis of the Classification) could double the prevalence (6). As for TTH, in European countries its prevalence in adults is 62.6% with a slightly higher frequency in women (5). The prevalence of primary headaches is significantly lower in children and ranges from 5.2% in boys to 9.1% in girls for migraine, and 15.9% for TTH (5).

In a review of studies on the prevalence of primary headaches, it was determined that 4% of the European population has chronic headache, that is,  $\geq 15$  days per month with headache for at least three months (5). Chronic headache is often accompanied by excessive use of medication, which is considered the most common among secondary headaches, with a prevalence between 1-2%, affecting more women and people with a lower socioeconomic status (7,8). Studies of the prevalence of primary headaches in the United States show a consistently high prevalence of migraine and severe headache, but within the range of findings from studies in countries on other continents (9,10). In general, headaches are the fourth or fifth most common reason for going to the emergency room in America, and even the third in women (10).

Regarding the prevalence of headaches in Asian countries, they range widely from low (9.3% for migraine and 23.8% for all primary headaches) in China (11) to very high as found recently in Nepal (12) where more than 80% of the adult respondents had some primary headache, and even 7.2% had a chronic headache (more than 180 days a year). Some authors (13) believe that the reasons for large variations in prevalence should be sought among genetic, environmental or cultural influences. It seems that in African countries, the beginning of research on the prevalence of primary headaches is somewhat more recent. Studies that have recently been published indicate that the prevalence of primary headaches is also high here, in Ethiopia 44.9% (14) and Zambia 61.6% (15). As the circumstances of life change over time, stresses on the one hand and the availability of new drugs and better knowledge about the prevention of risk factors on the other, the question arises whether, and how, all this affects the frequency of primary headaches? Some studies show that apart from a small increase in the frequency of migraine, the frequency of headaches remains stable in the adult population (16). However, knowledge about the prevalence of cluster headache, which is less common than migraine and TTH, is not like that (17). Thus, two recent studies (18,19) on the prevalence of cluster headaches show a

frequency of 1.3%, which is significantly higher than 0.12% as shown by a meta-analysis of earlier studies (20). In addition, cluster headache has long been viewed as a male disease, but a study that tracked the incidence between the sexes from 1963 to 1997 showed a downward trend in male dominance. Sex ratio with 15 cluster headache before the age of 50 was 7:1. and after the age of 50, 2.3:1 to the detriment of the male sex (21). The authors believed that this could be related to the regulation of the level of sex hormones and environmental factors, while the previous explanation was a change in the lifestyle of women over the decades, primarily in terms of increased alcohol consumption and smoking (22).

Although living conditions have improved for most individuals across the globe, stress levels have also increased, while pain medication has become more readily accessible and awareness of preventative factors has improved. This prompts the question if, and how, the interplay of all these influences affects primary headache prevalence. Available evidence indicates that, despite a slight increase in migraine frequency, headache prevalence in adult population has remained relatively stable (18). Given the specific living conditions in the Autonomous Province of Kosovo and Metohija in terms of political and security factors, our study was guided by the hypothesis that these unique characteristics would influence the primary headache prevalence in areas predominantly inhabited by ethnic Serbs in this region (1). This was the first study examining primary headache prevalence among adults in Serbia.

The aim of our study was to estimate the prevalence of primary headache, migraine and TTH, diagnosed in accordance with the ICHD-3 criteria, among adults residing *in areas predominantly inhabited by ethnic Serbs in* the southern Serbian Autonomous Province of *Kosovo and Metohija* (1). This cross-sectional study involved a representative sample of participants that took part in "face-to-face" interviews guided by a questionnaire specifically designed for this purpose. The study inclusion criteria included age in the 18–65 range, Serbian mother tongue, and residence in the areas of Kosovo and Metohija predominantly inhabited by ethnic Serbs. Study participation was voluntary and all included individuals were provided a detailed explanation of the study aims and procedures, which they confirmed by signing an informed consent. A structured questionnaire was developed for the study, in line with the recommendations made by other authors (23), whereby the "HARDSHIP" questionnaire served as a guideline (24).

The our study included 1,062 adults (571 or 53.8% of whom were women) residing in one of six KiM municipalities with predominantly Serbian population. Analyses indicated 47.7% prevalence of primary headache, further revealing that in predominantly Serbian municipalities in KiM primary headaches are more prevalent among women, participants residing south of the river Ibar (in enclaves), married or cohabiting individuals, as well as among interviewees who reported feeling unsafe in KiM. In addition, annual prevalence of migraine, migraine with aura, migraine without aura, and TTH was established at 15.2%, 3.3%, 11.9%, and 32.2%, respectively.

While 3.5% of the respondents were diagnosed with chronic headache, the difference among women (5.4%) and men (1.2%) was statistically significant. Similarly, chronic headache accompanied by medicament overuse (2.9%) was statistically significantly higher among women (4.2%) compared to men (1.4%). No statistically significant differences in the chronic headache prevalence or rate of pain medication overuse among those suffering from migraine and TTH was noted, at 3% vs. 4.4% and 2.4% vs. 3.6%, respectively. Finally, in 4.9% of respondents suffering from migraine, this condition was diagnosed as chronic.

Primary headache prevalence among adults residing *in areas predominantly inhabited by ethnic Serbs in* the southern Serbian Autonomous Province of *Kosovo and Metohija* is similar to those reported for other countries, especially those in the Balkan region. However, it is noteworthy that the individuals that took part in this investigation live under unique political and security conditions that induce uncertainty and sense of unsafety, which could have

resulted in increased prevalence of primary headache, especially TTH, likely due to elevated anxiety.

New studies and new knowledge are needed, raising awareness of this significant public health problem and fighting as effectively as possible to reduce its frequency and consequences.

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## **ORAL PRESENTATIONS**

### **1. COMPARATIVE PRESENTATION OF PREVENTIVE EXAMINATIONS FOR THE EARLY DETECTION OF BREAST, CERVICAL AND COLORECTAL CARCINOMA IN THE TERRITORY OF SERBIA IN THE LAST TWENTY YEARS**

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**Objectives:** The paper aims to provide a comparative presentation of preventive examinations for the early detection of breast, cervical and colorectal cancer in the territory of Serbia in the last twenty years.

**Methods:** Periodic implementation of the national health survey of the Serbian population (2000, 2006, 2013. and in 2019) was the basis for a comparative presentation of the use of preventive examinations. In accordance with the objectives of the research, a retrospective analysis of data for the period from 2000 to 2019 was performed. Data were obtained through a questionnaire, that is, by surveying the population regarding the use of healthcare.

**Results:** According to the results of the 2019 survey, slightly more than one third of women (34.6%) in Serbia aged 50 to 69 stated that they had had a mammographic examination of their breasts during their lifetime, which is a significant increase compared to 2013, when only one quarter of women, 26.5%, performed this type of examination. The target population for early detection of cervical cancer is women aged 25 to 64. According to the results of the 2019 survey, 67.4%, or two-thirds of women of the indicated age, had a preventive examination (Papanikolau test) in the three years preceding the survey. The total number of newly diagnosed cases with colorectal cancer in 2020 is 5,989 for both sexes, of which 2,956 new cases were diagnosed with rectal cancer, and 2,947 new cases with colon cancer. According to the survey 10.9% of the population in 2019, and 7.6% in 2013, had a preventive examination, i.e. testing for occult bleeding in the stool in the last three years in the 50-74 age group.

**Conclusion:** Continuous health care activities in the Republic of Serbia include organized screening programs for breast, cervical and colorectal cancer, which are a very effective strategy for cancer control.

**Keywords:** health care, population, retrospective analysis, comparative view

## **2. ORGANIZATION AND CORE FUNCTIONS OF THE NATIONAL INSTITUTE OF PUBLIC HEALTH (NIJZ) OF SLOVENIA**

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National Institute of Public Health - regional unit Maribor, Slovenia

**Objectives:** NIJZ is the central national organization of public health in Slovenia. Established in 2014, NIJZ consists of a Central unit in Ljubljana and 9 Regional units with more than 600 employees. It's main goal is to promote community health education, monitor on relevant components of health and its determinants and also to evaluate and determine the effect of health politics due to protect and increase the level and quality of health of the slovenian population.

**Methods:** By monitoring the health system and preparing analyzes of the system's operational function and effectiveness, NIJZ recognizes and identifies key challenges and health hazards in the field of public health and suggests measures to improve the health of the slovenian citizens. Through research and cooperation with domestic and international foundations and institutes contributes to new knowledge, introducing new solutions and examples of good practice to decision-makers and politicians.

**Results:** The National Institute of Public Health performs various preventive activities to identify health threats and design measures to control, reduce or eliminate them; provides also health promotion programmes and national strategies for disease prevention in primary healthcare; prepares scientific background for national health policies; manages a great number of health databases, as well as the national eHealth platform.

**Conclusion:** As an essential partner of the healthcare system in Slovenia, NIJZ plays a central role by ensuring accessible and equal public health programmes and services to the entire slovenian population.

**Keywords:** NIJZ, public health, core functions, organization

### 3. ANALYSIS OF THE REALIZATION OF RIGHTS TO MEDICINES THAT ARE NOT IN THE DRUG LIST

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**Objectives:** Broadly defined healthcare rights<sup>1,2</sup>, in the Republic of Serbia, include the right to medicines, which is regulated by a special act (Drug List<sup>3</sup>). Exceptionally, after exhausting of all alternative options of treatment, insured persons have right to medicines outside the Drug List<sup>2</sup>. The criteria that are implemented for placing the medicine on the Drug List, do not apply to those medicines.

**Goal:** Analysis of the consumption of medicines outside the Drug List in 2021, by diagnosis.

**Method:** Comparison, based on reports from electronic invoices for years 2021 and 2020. Results: In year 2021, 29,844 insured persons received medicines outside the Drug List, which is twice as many as in 2020. The diagnoses, which these drugs are most often prescribed for, are Viral pneumonia and Acute myocardial infarction. However, the diagnoses with the largest increase in consumption on an annual basis require a deeper analysis both, for the preparation of the Healthcare Plan, and for the selection of priorities for the Drug List.

**Conclusion:** There is a need for a deeper analysis in this area, in order to assess justification of this additional opportunity to get reimbursed medicines, provided by the current regulation.

**Keywords:** Drug List, medicines, reimbursement, healthcare rights, Serbia

#### **4. ACTIVITIES AND RESULTS OF THE WORK OF THE SECTOR COUNCIL FOR HEALTH AND SOCIAL PROTECTION SECTOR OF THE GOVERNMENT OF THE REPUBLIC OF SERBIA**

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**Abstract:** Sector councils are expert and advisory bodies formed in partnership, whose basic function is to define the needs for qualifications on the labor market in the Republic of Serbia. They were established and are functioning since November 2019. The sector councils are made up of representatives of social partners such as relevant ministries and bodies, unions, employers, experts in education, labor market representatives, professional associations and chambers. The sector council for the health and social protection sector is a professional and advisory body formed in partnership, whose main function is to define the needs for qualifications on the labor market in the Republic of Serbia. A qualification is a formal recognition of acquired competences. An individual acquires a qualification when the competent authority determines that he has achieved the learning outcomes within a certain level and according to the given qualification standard, which is confirmed by a public document (diploma or certificate). Competence is an integrated set of knowledge, skills, abilities and attitudes, which enable an individual to act effectively in accordance with the qualification standard. Qualification standard serves to harmonize education policy and employment policy. The structure, elements and concept of learning outcomes are determined by the Methodology for the Development of Qualification Standards. New qualification standards were adopted in 2020: Two decisions were made on the drafting of the qualification standard proposal for physiotherapeutic and pharmaceutical technicians and four initiatives launched for modernization of qualification standards are in progress.

**Keywords:** qualification standards; sector council; health and social protection.

## 5. COPING WITH SYMPTOMS OF DEPRESSION, ANXIETY AND STRESS AMONG UNIVERSITY STUDENTS DURING PANDEMICS OF COVID-19 IN RELATION TO THEIR LIFE STYLE HABITS

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<sup>1</sup> Department of Social Medicine, Faculty of Medicine, University of Niš, Serbia

<sup>2</sup> Public Health Institute of Niš, Serbia

**Objectives:** The time of the pandemic brought great difficulties, to our everyday lives. In addition, numerous studies have shown a drastic increase in mental disorders in people around the world. Therefore, the basic idea of our study was to investigate these disorders in university students in relation to their different lifestyles.

**Methods:** The cross-sectional study was carried out at the University of Niš from October to December 2021. All of the participants were assessed by using appropriate questionnaires. The study included 1,400 randomly selected students. The statistical analysis of the data included the application of multiple regression analyses and correlation tests.

**Results:** Statistical analysis indicates that extremely severe levels of depression symptoms were reported by 232 students (16.6%). Severe and extremely severe anxiety symptoms were reported by 480 students (34.3%). Multiple linear regression analysis found that the most pronounced manifestations of depressive symptoms were the "most deserving" parameters related to the consumption of alcoholic beverages ( $\beta = 0.10$ ) and psychoactive substances ( $\beta = 0.11$ ) compared to the period before the COVID-19 pandemic. For anxiety symptoms, the main role was played by alcohol consumption ( $\beta = 0.11$ ), but also by the use of social networks, as an adequate substitute for deprived content during the pandemic ( $\beta = 0.13$ ). Alcohol consumption was the most "responsible" for elevated stress levels compared to the period before the COVID-19 pandemic ( $\beta = 0.19$ ) and use of psychoactive substances ( $\beta = 0.21$ ).

**Conclusions:** During the COVID-19 pandemic, symptoms of depression, anxiety and stress were drastically increased in the students. More frequent consumption of alcoholic beverages and psychoactive substances during the pandemic proved to be a significant predictor for the symptoms of depression, anxiety, and stress.

**Keywords:** life style habits; COVID-19; mental health.

## 6. USE OF OUTPATIENT HEALTHCARE OF THE ADULT POPULATION IN THE POST-CONFLICT AREA

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**Objective:** to show the use of outpatient care for the adult population in Serbian communities in Kosovo and Metohia (KiM) in relation to demographic and socio-economic characteristics.

**Method:** A cross-sectional study, conducted on a representative sample of the adult population in Serbian municipalities in KiM. 1067 respondents were surveyed using the questionnaire for population health surveys (*EHIS, wave II*). The collected data were statistically processed with the help of  $X^2$  and *Kruskall-Wallis* test with a significance level of 0.005.

**Results:** In the year preceding the survey, 80% of respondents visited their chosen doctor, significantly more women (68.6%), respondents over 75 years old (88%), primary and lower education (83.1%). Gynecologists' services were used by 36.1% of highly educated women (39.8%), aged 26-35. 46.4% used the services of a specialist, mostly respondents from the municipality of Gračanica. Traditional medicine was used by 6.5% and home care by 6.1% of the respondents. 26.7% of them used private practice.

**Conclusion:** In the year preceding the survey, four out of five respondents used the services of their chosen doctor, and almost every other used the services of a specialist. Women and respondents over the age of 65 used the services of chosen doctor, specialist and private practice most often. Respondents from the municipality of Kosovska Mitrovica most often used private practice.

**Keywords:** outpatient healthcare, adults, Kosovo and Metohia

## 7. OBSTACLES AND CHALLENGES IN HEALTH PROMOTION DURING EMERGENCY SITUATIONS - REVIEW OF THE COVID-19 PANDEMIC

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<sup>1</sup> Public Health Institute SBK/KSB

**Objectives:** Health promotion is defined as improving health and creating the potential for good health before health problems or threats to health occur. Through health promotion processes, the population can examine their health status with the help of various methods and act in time if a risk factor or disease symptom is detected. The COVID-19 pandemic led to the conclusion that health promotion and the prevention of other diseases were not given enough attention, that health resources were largely directed towards the diagnosis and treatment of the coronavirus only.

**Materials and methods:** Overview of existing global research with health promotion models that were applied during the COVID-19 pandemic and a review of the possibility of applying them in our health care system.

**Results:** The need for health promotion during the COVID-19 pandemic is reflected in the prevention and management of mass non-communicable chronic diseases that can be an additional risk factor for a worse outcome for patients with the corona virus and the development of complications of this disease. Special attention should be devoted to the protection of mental and reproductive health and the protection of the elderly population. Health promotion programs range from individual interventions to focused actions in the family, community, public health, media systems and various health promotion policies.

**Conclusion:** COVID-19 is not only an individual's health problem, but involves the family, community and health system. Changes in health promotion methods, strengthening programs and policies and overcoming obstacles are necessary to ensure the prevention of the occurrence and complications of other diseases, the protection of mental health and the protection of the vulnerable population, both during the COVID-19 pandemic and during future emergency situations.

**Keywords:** health promotion, vulnerable groups, emergency situations, covid-19

## POSTER PRESENTATIONS

### 1. PREVENTIVE SYSTEMATIC EXAMINATIONS OF CHILDREN IN SPECIALISTIC-CONSULTATIVE SERVICES IN PRIMARY HEALTH CARE FACILITIES IN SERBIA IN 2021. IN REPUBLIC OF SERBIA

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**Objectives:** The pandemic of SARS-CoV-2 had an influence on healthcare system organization, in order to control and suppress the COVID-19 disease. The aim is to determine the impact of the COVID-19 pandemic on the realization of planned preventive systematic examinations (PSE) of children in specialist-consultative services of primary health care in the Republic of Serbia.

**Methods:** Reports of realization of the PSE from 2019. to 2021. are used and the trend of these services in the previous three years was analyzed using a descriptive statistical method.

**Results:** During the year 2021, the providing of PSE of children is below the planned, except for examinations of 7-years-old children. The total number of PSE of children in specialist-consultative services was 134.482, which is approximately the same as in the previous, pandemic year 2020 (132.442), where there was a significant decrease in the number of ophthalmological examinations, but also an increase in the number of performed preventive examination of children in the service of physical medicine and rehabilitation. In the non-pandemic year of 2019, the total number of these PSE of children was 4.5% higher (140,895).

**Conclusion:** PSE of children are carried out regardless of the changeable epidemiological situation, but on a reduced level, compared to the pre-pandemic year of 2019, which can be attributed to the reorganization of the healthcare system, healthcare workers and parent's hesitation from conducting PSE of their children during an unfavorable epidemiological situation.

**Keywords:** primary healthcare, children healthcare, preventive examinations, COVID-19

## **2. THE ROLE OF HEALTH EDUCATION IN IMPROVING THE PSYCHO-PHYSICAL STATUS OF AN INDIVIDUAL IN MODERN SOCIETY**

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**Abstract:** In order for all social classes to regard health as a recognized value, as recommended by the World Health Organization, it is necessary to encourage and motivate the individual to show responsibility for health. Such goals are achieved through health promotion activities - health propaganda and health education, as part of the general education of the nation. Positive changes in the behavior of each individual in the living and social environment, with the aim of strengthening control over one's own health and improving it, are implied by the improvement of psycho-physical and mental capacities. The health-educational process, through health propaganda, affects the awareness, information and knowledge of the individual and through health education, it affects changing attitudes and motivations related to health. Psychological work with patients in private clinical practice indicates insufficient information of people about diagnoses and treatment options, the importance of prevention in all fields of health care, health culture and education, about opportunities for learning and acquisition of skills and behavior. The data on this enable the targeting of activities and measures, which, through planned implementation, will be reflected in raising the level of health awareness, and thus in improving the psycho-physical status of individuals in modern society.

**Keywords:** health, education, responsibility, promotion, psycho-physical status.

### 3. CHRONICAL DIALYSIS PROGRAM – AN ASPECT OF PATIENT ADHERENCE TO PRESCRIBED THERAPY

Jačović Knežević Nataša<sup>1</sup>, Atanasijević D.<sup>1</sup>

<sup>1</sup> Institut za javno zdravlje Srbije „Dr Milan Jovanović Batut”

**Introduction:** Hemodialysis treatment is lifelong and burdensome for the patient. It requires continuous adherence to the prescribed therapy which implies regular use of medicines. Irregular adherence leads to the unintended consequences (bone demineralization, pulmonary edema and metabolic disorders that often result in the development of cardiovascular disorders and possible death).

**Objectives:** Identification the proportion of patients on a chronic dialysis program who do not adhere to prescribed therapy.

**Method:** Descriptive analysis based on the part of Satisfaction survey from 2021 that refers to the adherence of dialysis patients to medicines.

**Results:** Health Insurance Fund allocated 1.24% of its resources for dialysis material in 2021. The same time, 3/5 respondents from the Survey declared that they were in situation to pay out of pocket for some medicines that were recommended by doctor. The price was reason for 15.8% of respondents to give up from that therapy, which mostly presents the second line of therapy for secondary hyperparathyroidism. Numerous of these medicines are not on the List of reimbursed medicines or even not registered.

**Conclusion:** Additional research is needed to assess the justification of additional investment in order to achieve better treatment effects.

**Keywords:** dialysis, medicines, hyperphosphatemia

## **SESSION: APPLICATION OF INFORMATION AND COMMUNICATION TOOLS IN THE HEALTH CARE SYSTEM**

### **INVITED LECTURES:**

#### **1. DATA-DRIVEN HEALTHCARE**

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With the advancement of digital technologies, data has been mass-produced in all areas of modern society. The often-used term "Big data" represents large and complex databases that traditional statistical methods cannot analyze. As a new generation of technology, big data is designed to enable the continuous and systematic collection, storage, analysis, and interpretation of the data created daily in digital society. This technology has found application in all areas of development, in technical, social, and natural sciences. It has the potential to improve the health care system itself, starting from drug testing, through personalized access, to the industrialization of the process of providing health care [1]. Adopting big data technologies will transform current health care into modern data-driven healthcare. For the healthcare system to become data-driven, the analysis of healthcare data should be redirected from reporting outcomes to discovering behavioral patterns, which would contribute to adapting workflows to new conditions, improving treatment and increasing the efficiency of the system, safer management, as well as more efficient reimbursement of treatment costs. Data-driven healthcare would advance and accelerate the integration of the activities of physicians, administrators, managers, patients, and researchers by reducing costs and risks, personalizing health care, and increasing efficiency based on the comparison of outcomes. One of the first examples of data-driven healthcare was discovering the cause of a sudden cholera outbreak in London in 1854. Despite disagreeing with his colleagues, John Snow, an obstetrician interested in various aspects of medicine, believed that polluted water was the leading cause of transmission of this disease. To prove his hypothesis, he examined each case of illness concerning different water supply methods [2]. He marked every death caused by cholera on the map and noticed they were all clustered around a water supply pump in the Soho district. However, the workers of the local brewery and workshops, which had their own water supply, were not infected. The case of two women who died of cholera and lived far from the pump did not fit, but after figuring out that they still got water from this pump every day, this assumption was confirmed. Upon further analysis, it was determined that the water used to wash the diapers of a baby suffering from cholera was spilled near the pump, thus contaminating the pump itself. The applied approach in discovering the cause of the cholera outbreak fundamentally changed the approach to analysis and visualization of data related to health at that time [3].

#### **Everything is digital, but healthcare is a little less**

The potential of data-driven healthcare is still largely untapped. We live in an era where every activity is becoming digital. After the new life circumstances resulting from the declaration of the COVID-19 pandemic, an unexpected increase in the amount of digital data production was recorded in 2020. However, less than 2% of this data has been saved for use in 2021. According to the International Data Corporation, the amount of digital data in the next few years will more than double the amount of data created since the very beginning of their storage. In order to understand the way digitalization affects the healthcare system, it is necessary to understand that the success of any healthcare institution requires accomplishing the following three goals:

1. Quality - the guarantee of treatment efficiency and improvement of patient experience;
2. Access - providing proactive care or facilitating entry into the health care system after recognizing the need for it;
3. Efficiency - improving the process of providing health care and reducing health care costs while guaranteeing quality and affordability.

The digital transformation of healthcare is key to achieving these goals, especially as the healthcare industry lags behind other sectors, such as media, financial services, and trade, which have already gained clear advantages from global digitalization. For example, in Italy, according to a report by Gilead Sciences, over 50% of the population would rather choose to go to the doctor in person than to have a consultation at a distance. Other analyzes also found a lack of contact between humans when interacting with artificial intelligence systems. Also, healthcare institutions still have a small number of digital initiatives, and a significant number of institutions do not yet introduce new digital technologies into their strategic plans [5].

### **From digital health to data-driven healthcare**

The World Health Organization (WHO) defines e-health as "the use of information and communication technologies for health", while digital health is described more broadly as a term that covers areas that include e-health, telehealth, and others. It is estimated that over the next decade, the healthcare industry will undergo a significant transformation, as many advanced technologies, including artificial intelligence, are being adopted globally during the COVID-19 pandemic. The daily clinical practice will become more agile due to the application of artificial intelligence and advanced analytics that automate decision-making processes. Considering the fundamental role of data in this automation, adopting these technologies will contribute to transforming digital health into modern data-driven healthcare [6].

The generation of big data in healthcare is a trigger for improving healthcare. New technologies generate a huge amount of data that must be processed to create additional value. Big data analysis consolidates various information and identifies behavioral patterns and changes in existing trends. For the healthcare system, the generation and analysis of large amounts of data have several important advantages, which include:

- A more accurate assessment of the need for staffing – helps hospitals estimate future admission rates.
- improvement of the process of providing health care to chronic patients - defines more efficient management of the population at risk by organizing economic procedures for the provision of standardized therapies continuously;
- reducing the rate of medication errors - identifying inconsistencies between the patient's health condition and prescribed medications and pointing out existing discrepancies.

### **Drivers of data-driven healthcare**

Focusing only on new technologies in the transformation toward data-driven healthcare is not sufficient. The method of collecting data and managing the interests of interested parties can enable or hinder the transformation. The following eight drivers of data-driven healthcare have been identified in the literature: 1. technological trends, 2. data quality and availability, 3. data security, 4. enabling ecosystem, 5. public-private partnerships, 6. patient participation, 7. change management in the healthcare industry, and 8. skills development [7].

## How Healthcare Organizations Can Become Data-Driven

**Need:** Healthcare organizations must accept the fact that the future will be driven solely by data, and various stakeholders can initiate the transformation of the healthcare system in such a way that it is data-driven. The government can promote the implementation of integrated health systems and the exchange of medical knowledge, while private institutions can provide specific analytical skills that the public sector lacks.

**Challenge:** Individuals, in some cases, are reluctant to share data if they have no benefits or, on the contrary, appropriate it for personal gain. The culture in healthcare organizations and the lack of appropriate analytical skills can be significant obstacles to the necessary changes in how data is managed.

**Recommendations:** All decision-makers in the health care system must buy into a common mission, vision, and goals before taking any data-driven initiatives. Such association requires significant teamwork, concerted efforts, and consensus at the level of health institutions to define common tasks, technologies, and ways of implementing agreed strategies. Implementation will not happen overnight, but it typically represents a multi-year mission that a shared vision must support and adopt action plans. That is why it is imperative for all decision-makers in the healthcare system to agree on a common horizon in this multi-year perspective of digitization of the healthcare system.

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## 2. INFORMATION AND COMMUNICATION TECHNOLOGY IMPORTANCE FOR HEALTH

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Everyone knows that computers have drastically changed our everyday life. We say that we live in an information society. Specialized computers are embedded in many devices that we all use, directly or indirectly, on a daily basis. For example they have become indispensable in private and business communication, finding information, using multimedia content, office business, electronic commerce and banking and so on.

Today's telecommunication systems connect the entire planet and ensure the availability of information and communication services anytime and anywhere. Telecommunications have experienced a revolution in the last 20 years with the advent of the Internet and mobile telephony. This technological revolution is not only still ongoing, but it has ambitions to completely change and automate almost all aspects of human activities in the coming years: first of all, by connecting "everything" to the Internet in the form of Internet of Things (IoT) technologies, the development of mass storage systems (Cloud), and analysis of the huge and varied amount of collected data (Big Data). The development of IoT and Cloud technologies is the basis for the development of the so-called smart systems in numerous domains of human activity. Smart cities (Smart Cities) through which you move using smart traffic (Smart Transportation), you get electricity through a smart electrical network (Smart Grid), while your health is taken care of by smart health (Smart Health). This development puts telecommunications systems at the very core of the development of future intelligent systems, making the development of IoT technologies and mobile cellular systems perhaps the most exciting segments of modern technology at the moment.

When it comes to medical practice, an increase in medical knowledge is evident, which also leads to an increase in the total amount of medical data. Health care is becoming more and more complex, the number of health professionals and their specialties is increasing, the share of new technologies in medical activity is growing, and numerous health care programs are being introduced. All the countries of the world have come to the conclusion that it is necessary to use the information system in healthcare as well as to continuously upgrade it in order to increase the quality and efficiency of the entire healthcare system. The information system intended to support the provision of health services was created with the aim of supporting medical decision-making and providing conditions for the management of complex health institutions.

Today, Medical Informatics is a basic branch of medical science. It uses previous experiences and results in order to register medical findings, when they are suitable for analysis and further use. Medical informatics is also an experimental science, it is characterized by a series of questions, for which to be answered experiments are carried out, analyzes are carried out, and the obtained results are used for the further implementation of experiments and the development of the cognitive process. Medical informatics is also a medical technology (a set of rules, procedures and equipment used in medical work) because it participates in the medical decision-making process, whether it is for disease prevention or diagnosis, application of therapy, selection of treatment or monitoring of the patient's health condition.

Modern means of communication have made a significant contribution to the development of telemedicine. Telemedicine is the use of telecommunications and IT technologies to exchange data, images, video or audio materials or other information in order to provide health services

between remote locations. Telemedicine involves the provision of health services at a distance, overcoming spatial, temporal, social and cultural barriers.

Modern communication technologies such as the Internet, e-mail, conference connection, video conference and others are an excellent prerequisite for the education for health of a large number of people. Besides being used for informing and warning, information and communication technologies can be used to schedule examinations, deliver the results of all diagnostic procedures, and also to share experiences and consultations with medical doctors.

Promotion of healthy lifestyles, consultations with appropriate medical doctors, flow of health information important for diagnosis and treatment of patients as well as other important issues significant for the health of the nation can be accessible to a large number of people. Modern telecommunication means have created the technical conditions to always be online no matter where you are.

After the implementation of the health information system, social networks also became significant. Social networks have always been created between people. They were not in electronic form, ie. they were not Facebook or similar, but social contacts were made between people since forever. Mutual visits and get-togethers were organized, but not virtual, but face-to-face, and connections between friends spread. Friends, then friends of friends, relatives, neighbors and work colleagues entered the social circle. In mutual contacts in the past, and so today through social networks, social influence was and is being achieved by transferring our experiences, positive or negative, to each other.

Online social networks are a phenomenon of today, they are the largest virtual community and an inexhaustible source of data and updated information. The population can be informed and warned every day with the help of interactive communication on social networks about many issues that are important for health. The space to influence the health of others through social networks is very large and the question is how to use it. In modern conditions, there are not enough health institutions that advise or help to positively influence health through the social network. It is probably in its infancy and the assumption is that in the days to come, that influence will strengthen daily, because there is an increasing number of users on social networks who spend more and more time on these platforms.

Researchers studying the connections between people on social media have found that the influence of other users can change attitudes and feelings and affect health, from the flu to obesity.

"People create social networks wherever they are," claims dr. Larry Miller, president of the company "Activate Networks". "New discoveries enable systematic assessment and measurement of social impact," says dr. Miller. "In the parlance of Facebook, a friend of a friend's friend - who you may not even know - influences you. This includes health-related habits such as smoking, obesity, alcohol and drug use, sleep, depression, feelings such as happiness and loneliness, and a whole range of behaviors that are analyzed."

Medical doctor and sociologist Nicholas A. Christakis, professor at Harvard University and one of the 100 most influential people in the world in 2009 according to Time magazine, emphasizes the inextricable connection between people and health. He is leading a research project on social networks and "network science" - a nascent and rapidly developing field. Before the flu epidemic in 2009, dr. Christakis and a group of researchers observed 744 students at Harvard University. First, 319 according to the random sample system, and then 425 students whom the first group designated as their friends on social networks. In this study, it was found that on average, members of interconnected groups of "friends" got the flu between 14 and 46 days earlier than others who were not part of this network.

"Google has its own approach, which is very wise. It observes how many people search the Internet under the term flu," notes dr. Miller. "That means we can get a few weeks to prevent the epidemic." Hypothetically, we could see groups of volunteers in cities taking temperatures

on a given day and health workers using those results to determine which places are susceptible to the spread of flu. "Vaccination can be organized, because you have a few weeks at your disposal," points out dr. Miller.

Now the research of the company "Activate Networks", which Christakis runs with Miller, is applied for commercial purposes. "The potentials are huge", says dr. Miller. "Active Networks" advises corporations on how to improve cooperation, innovation, management, health and relaxation. "You can monitor a relatively small group of people in the network, and based on their behavior, the behavior of all participants in the network can be predicted," says dr. Miller. His company uses a similar method to predict the use of prescriptions, or drugs.

"You can get a picture two months in advance of what will happen in the entire population. It is a significant period", he says. This way, networks of medical communities can also be established as well as the use of better techniques for, for example, the treatment of diabetes. Once the key influencers are identified, the message can be delivered face-to-face or electronically." When presented with information about their peers (online), people change their behavior. They do it intuitively", points out dr. Miller. If someone realizes that most of their colleagues have adopted more efficient or useful methods, this strongly influences behavior change.

Social influence is realized to the extent that we learn from each other - recommending a book or movie, adopting fashion trends, improving habits related to health or work. This is achieved even beyond immediate friends - over hundreds of people - and many of them we will never meet. Given that social networks can extremely strengthen certain tendencies, they are ideal for spreading important messages to a large number of people, emphasizes dr. Miller. "The influence is not only between individuals, but also between groups of people and that is one of the key observations. It's the group that matters, not just the individual". Now it's crucial to study how social influence works in a given network and determine who has the strongest influence in it.

Social networks can therefore be very useful, but there is also a negative side.

Addiction. It is common knowledge that excessive computer use can lead to a certain addiction, especially when it comes to video games, but there is not too much of a difference when using social networks. Addiction to social networks occurs because their use stimulates the pleasure centers in our brain that are activated every time someone "likes" your photo or leaves a positive comment. Communication in any form, not only on social networks, affects the pleasure center.

The stimulation of dopamine, the neurotransmitter responsible for feelings of lust such as the desire for cigarettes, reaches a whole other level when we spend time on social media.

Most of us have hundreds or even thousands of "friends" on social networks who regularly update their profiles, post photos and write statuses and in some way constantly communicate with us. In real life, you're unlikely to get fifty positive comments for a new haircut or car, no one will publicly praise you for having great taste in music or finding an awesome quote. Real, live communication requires much more effort and time than social networks and rarely involves as many participants as it does on the Internet, so we feel pretty good about communicating with people through comments and likes.

Just imagine what it would be like if 50 of your friends gathered in a coffee shop and they all commented on how great your dress is or loudly agreed with you with every sentence you said. Sounds a bit scary, doesn't it? It is precisely such praises and confirmations on social networks that bring us pleasure and can create the illusion of one's own greatness.

Because of all mentioned above and because social networks are a simple, fun and fast way of communication, addiction can develop very easily. Which is not surprising at all because you can communicate with hundreds of people at any time, hear their opinion and new information without getting up from your favorite armchair. You don't need to change clothes, put on

makeup or do your hair. Another reason why we often go to social networks is certainly boredom, because almost always when we have nothing better to do, we look at what our "friends" are doing on Facebook or Twitter, and the invasion of smartphones has made that approach even easier. This very habit can very easily turn into a classic addiction, and after a while we can't imagine life without social networks. Over time, bigger problems can develop such as lack of attention and concentration, you will notice how it becomes harder and harder to focus on one thing and how fewer things hold your attention.

Lack of concentration and attention deficit disorder. Spending too much time on social media can cause you to lose concentration as well as many other symptoms of ADHD, because social media communication requires constant switching from one topic to another, from one place to another, from reading comments, following new posts and replying to messages as well as commenting and liking.

Due to the speed of information flow, little can hold your attention for a long period of time, which can be bad when it comes to communication with real people and work. It can also affect the way you learn new things because through social networks you get information in the shortest possible form. All of this leaves a mark on your concentration and attention span. For example, people who constantly interact with others through social media will feel quite uncomfortable while reading a book because they will not receive any feedback. If you suffer from any kind of attention deficit disorder, then you should know that social media will not do you any good. On the other hand, if you haven't had such symptoms before, spending too much time on social media can cause them. Symptoms of attention deficit disorder are: lack of concentration, you always leave work or studies to check what's on social networks, you have trouble reading long texts that get boring quickly, and you feel uncomfortable when you sit for a long time and do nothing.

Decline of intellectual abilities. Honestly, everything we do on social networks, looking at other people's photos, commenting and posting short statuses, can hardly be classified as intellectual activities that ennoble in any way. For most people, social media activity has become like chewing gum for the brain. They constantly occupy our thoughts, but we do not get any concrete benefit from them. At least when it comes to intellectual pleasure.

We get used to social networks very easily, and on the other hand, you don't need special intelligence to use them and ultimately be successful on them. The number of followers, likes and comments are not authoritative whether someone is successful, funny and resourceful in real life. It's all a soap bubble that can burst very easily. Despite this, people change their real life with social networks and neglect activities such as reading books and informative texts on the Internet and this is actually their worst side. That is why there is a decline in intellectual abilities.

Increased level of stress and fatigue. Although social media may seem like it's giving you a break, it does the exact opposite, because keeping a close eye on everything that's going on literally tires your brain. He gets tired of excess information, especially that which you receive without any order and sense, quickly and in small portions. Your brain needs a certain amount of time to digest and process information in peace, and on social networks it usually doesn't arrive because in the meantime you've read another one, and another one, and another one. There is a high probability that your brain will be very tired in the evening if you have spent a lot of time on social networks during the day and have burdened it, in most cases, with completely irrelevant information. Instead of resting and sleeping, you will feel the need to have fun again with some activities. It's how information that your brain hasn't had time to process during the day affects your psyche. And so, due to the lack of rest and concentration, stress is born, which is a good start for many physical and psychological problems.

In addition to all this, the wireless technology that connects electronic devices to wireless computer networks (wireless LAN) uses electromagnetic radiation. There is practically no

space in which a person works, lives or sleeps without harmful radiation. Wireless signals, unlike TV and radio signals, are strong enough to penetrate concrete walls. Many health experts believe that wireless radiation is extremely dangerous for long-term health, especially for children and developing people.

Wireless radiation penetrates the body, affects cell membranes, and cells lose their ability to function properly over time. It disturbs the body's natural energy field, causing stress, fatigue and weakening of the immune system, it is the cause of many headaches, problems with concentration, dizziness, depression, it is often the trigger of epileptic attacks, insomnia, high blood pressure, infertility, etc.

Children are especially sensitive to wireless radiation signals because their nervous systems are still developing. The skulls are thinner and smaller so the radiation penetrates deeper into their brains. Many schools now use wireless technology, but this negatively affects children's ability to learn.

A world-renowned neurosurgeon and researcher, dr. Leif Salford, has conducted many studies on radiofrequency radiation and its effect on the brain. One of them was conducted on 32 animals when they were exposed to cell phone radiation for 8 weeks. Two percent of the neurons in all areas of their brains had shriveled and degenerated after that period.

Another example is dr. Devra Davis, who explained the science of cell phone radiation. She showed two photos of the cells; one had a cell damaged by "gamma" radiation (the kind emitted in Hiroshima) and another that was damaged by low levels of non-ionizing radiation (from a cell phone). Both cells look very damaged compared to a normal cell, but the DNA cell exposed to cell phone radiation looks worse.

In May 2011, the World Health Organization acknowledged that wireless technology is a potential carcinogen.

There are recommendations in Austria, France, Germany and Sweden, that you should not hold a mobile phone close to your body, that you should use "hands-free" to reduce radiation to the head and not use a mobile phone in a car without an external antenna.

In the US and Canada, profit has completely blocked all serious warnings and research. In America, profits from wireless communications are measured in billions of dollars, so parents are even suggested that their children are safer when they are in contact with them. Of course a mobile phone is the right thing for that. The Government of Serbia does not advertise on this issue at all, even though the occurrence of cancer in both children and adults has been on the rise in our country in recent years. If all the previously mentioned researches are to be believed, the number of cancers will increase from year to year.

But how can we imagine the modern world without wireless technology? On the other hand, there are of course large companies that make enormous profits on wireless technology and in order to increase their profits even more, they will advertise to the public that such technology cannot be harmful, of course in cooperation with some scientific institutes. The opening of funds for expensive "treatment" with chemotherapy and x-radiation will be established and filled on all sides. It will be good business. For those who survive.

Finally, we will present some data from a recent research in our country:

The basic findings of this research indicate that 76.7% of households in the Republic of Serbia own a computer, which is an increase of 2.4% compared to 2020. and 3.6% compared to 2019. The representation of computers in households varies depending on the territorial unit: in Belgrade it is 94.7%, in Vojvodina 72.2%, in Šumadija and Western Serbia 69.1% and in Southern and Eastern Serbia 70.9%

Significant differences also exist when we compare the percentage of internet connections in urban and other Serbian settlements: 85.6% versus 74.7%. Compared to 2020., a decrease of 1.5% was recorded in the urban areas of Serbia, while in other parts of Serbia the growth rate was 4.3%. As with the representation of computers in households, there is a big gap in terms

of having internet connections. When looking at the structure of households according to the amount of monthly income, internet access is mostly owned by households with a monthly income exceeding 600 euros (96.6%), while the share of households with an income of up to 300 euros is only 58.7%.

In the Republic of Serbia, 74.8% of people used a computer in the last three months, 2.1% of people used a computer more than three months ago, 5.5% more than a year ago, and 17.6% of people have never used a computer. The number of computer users increased by 2.1% compared to 2020., by 4.1% compared to 2019., and by 5.2% compared to 2018.

The research showed that 95.5% of the population uses a mobile phone, this figure for 2020. was 94.1%.

A website is owned by 84.5% of businesses, which is a 0.1% increase from 2020. and a 0.9% increase from 2019.

During 2020., 30.1% of companies in the Republic of Serbia increased the number of employees who have remote access to company's email, while 25.4% of companies increased the number of employees who have remote access to company's ICT system. The number of companies that increased the volume of online meetings, with the help of Skype, Zoom or Teams, was 37.7%.

## ORAL PRESENTATIONS

### 1. THE HEALTH INFORMATION PORTAL FOR ACCESS AND DISSEMINATION OF POPULATION HEALTH-RELATED INFORMATION IN EUROPE

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The COVID-19 pandemic has shown the need for a quick exchange of accurate information between European countries. The Population Health Information Research Infrastructure (PHIRI) Project developed the Health Information Portal, a one-stop shop facilitating discoverability and access to health and healthcare information in Europe to respond to this need.

On August 8, 2022, the Portal contained links to 220+ key national health information sources, 120+ national and European health information projects, 20+ health research infrastructures and international organizations, 350+ dissemination sources, and 80+ training in different areas of population health. The experts provide the information on the Portal within National Nodes (organizational entities, often linked to a national institution that brings together relevant health stakeholders in the country), including the public health institutes from Slovenia, Croatia, Serbia, and beyond. Such resources promote discoverability, access, and dissemination of health data allowing researchers and policymakers to benefit from the most up-to-date health evidence available in Europe.

The Portal also hosts a COVID-19 corner where policy discussions between public health institutes, Ministries of Health, research institutions, and universities on national experiences related to the management of the pandemic are posted. Such information is accompanied by an overview map where key COVID-19 policy measures implemented in Europe are displayed to further aid the countries in learning from each other experiences.

**Keywords:** COVID-19, population health, health information, public health, healthcare

## 2. THE CONTEMPORARY APPROACH TO ASSESSING THE QUALITY OF CAUSE OF DEATH DATA

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**Objectives:** Mortality data are used by national and regional authorities to determine public health policy and priority goals, and researchers, clinicians, and educational institutions use them for scientific and educational purposes. The planning of health activities relies on high-quality data on the cause of death (COD). It has been shown that the quality of death certificates is often poor, with a slight improvement in the past half-century. The poor quality of COD often comes from the garbage codes, which are uninformative for COD sets of diagnoses.

**Methods:** ANACONDA (Analysis of Causes of National Deaths for Action) is a recently developed electronic tool for assessing the plausibility of COD data. This tool classifies garbage codes into four categories based on the severity of implications on health policy. Data analysis goes through a ten-step process, calculating the vital statistics performance index of quality.

**Results:** The five main components that affect this score are the following: completeness of registration, the fraction of garbage codes in the data, amount of COD detail in the COD list used, not recorded age and sex of deceased, number of biologically implausible causes found in the data. Therefore, ANACONDA calculates the standard mortality indicator, identifies errors, makes profiles of garbage codes, and finally reclassifies garbage codes.

**Conclusion:** ANACONDA data-driven reports can be helpful in the development of death certificate training for physicians by implementing country-specific issues.

**Keywords:** public health, ANACONDA, death certificates, mortality data, health policy

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### 3. APPLICATION OF NEW ELECTRONIC TOOL IN ASSESSMENT OF QUALITY OF CAUSE OF DEATH IN SERBIA IN 2019.

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**Objective:** The Global Burden of Disease (GBD) study has developed methods to create comparative cause-specific mortality estimates. This paper evaluates the quality of death registration and underlying cause of death (UCD) in Serbia for 2019.

**Methods:** Mortality data (101 458 registered deaths) were analyzed using ANACONDA (Analysis of Causes of National Deaths for Action) software. The Vital Statistics Performance Index for Quality (VSPI(Q)) is estimated for the overall quality. Unusable or insufficiently specified UCD codes were identified.

**Results:** Sixty percent of the input data was coded with a usable UCD, 25.7% with unusable "garbage" codes, and 14.8% of deaths were insufficiently specified causes with limited impact. 14755 (14.5%) deaths were coded to an unusable code of 'very high impact' codes likely to have a severe impact on describing mortality patterns in the population. The most prevalent garbage codes were: essential hypertension (I10) and cardiac arrest (I46.9) in both sexes. The VSPI(Q) score was 70.2 %, representing high quality.

**Conclusion:** Mortality data had a high VSPI(Q) score in Serbia in 2019. Garbage codes are prevalent at all ages, contrary to expectations. Further research into practical strategies deployed in Serbia to improve data quality can inform efforts to improve death reporting systems.

**Keywords:** ANACONDA, mortality data, quality, Serbia

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