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- Evaluation of the Therapeutic Effects of a Series of Treatments with Whole-Body Cryotherapy on Pain of the Cervical Spine in the Course of Degenerative Disease
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- Determination of the Hazard of Medical Waste in the Convention of the Covid-19 Pandemic
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#### **ORIGINAL ARTICLES/PRACE ORYGINALNE**

Barbara Staszewska, Radosław Szpruch, Łukasz Kikowski	
Evaluation of the Therapeutic Effects of a Series of Treatments with Whole-Body Cryotherapy	
Or ran of the Cervical Spine in the Course of Degenerative Disease Ocena woływu teraneutycznego serii zabiegów krioteranii ogólnoustrojowej na dolegliwości bólowe	
odcinka szvinego kregosłupa w przebiegu choroby zwyrodnieniowej	107
Pavel A. Dvachenko, Anatoly G. Dvachenko	
Neurological Disorders in Hospitalized Patients with Covid-19: Clinical Symptoms, Treatment and Rehabilitation	
Zaburzenia neurologiczne u hospitalizowanych pacjentów z COVID-19: objawy kliniczne, leczenie i rehabilitacja	113
Danusia M. Brezytska, Ihor V. Hushchuk, Vladyslav A. Smiianov, Oleg M. Vivsiannyk, Roman V. Safonov, Inna S. Khoronzhevska	
Determination of the Hazard of Medical Waste in the Convention of the Covid-19 Pandemic	
Określenie zagrożenia związanego z odpadami medycznymi w okresie pandemii Covid-19	118
Olha P. Litvinova-Holovan, Daria V. Vaniuk, Nadiya V. Bogdanovska, Larysa V. Bezkorovaina, Irina V. Kalonova, Cyril Yu. Boichenko, Natalia O. Nadtoch	nii
Implementation of Health-preserving Technologies in the Process of Physical Education of Condents with Type 2. Diskates in Uisbar Education Establishments	
or students with Type 2 Diabetes in Higher Education Establishments Wdrażanie technologii promujących zdrowie na zajeciąch wychowania fizycznego u uczniów szkół średnich z cukrzyca typu 2	123
Valeru K. Michchenko. Vladiclav M. Michchenko	125
Influence of Physical Rehabilitation on the Restoration of Psychoemotional	
and Cognitive Impairment in Patients Suffered Cerebral Ischemic Stroke	
Wpływ rehabilitacji fizycznej na korygowanie zaburzeń psychoemocjonalnych i poznawczych	
u pacjentów po udarze niedokrwiennym mózgu	128
Andrii A. Rebryna, Iryna Yu. Karpiuk, Tetiana K. Obeziuk, Natalia A. Lyakhova, Anastasiia I. Yefimova, Iryna S. Rastorguyeva, Svitlana I. Kara	
Features of Physical Therapy of People with Endocrine System Pathology	177
Elementy nzykoterapii osob z cnorobami endokrynologicznymi James D. Karaklas Olka D. Nakama, Liudauda J. Damastada Malada J. Maistada V. Davlas duda	155
Larysa K. Korobko, Olna B. Nanorna, Lludmyla L. Prymacnok, Mykola I. Maistruk, Vita Yu. Prokopcnuk Dance and Motor Therapy in the Physical Rehabilitation Program of Teenagers with Childhood Cerebral Palsy	
Taniec i terapia ruchowa w programie rehabilitacji fizvcznej młodzieży z mózgowym porażeniem dziecjecym	138
Viktorija V. Mishura, Yurij V. Melekhovets, Oksana K. Melekhovets, Evgen I. Kovalenko, Lufunvo F. Lihweuli, Mvkola S. Lvndin	
Comparative Analysis of 1470 nm and 1940 nm Wavelengths in Endovenous Laser Ablation	
of Large Diameter Great Saphenous Vein	
Analiza porównawcza długości fali 1470 nm i 1940 nm w wewnątrznaczyniowej ablacji laserowej żył odpiszczelowych	
o dužej šrednicy	145
Grygoriy P. Griban, Ivan M. Okhrimenko, Natalia A. Lyakhova, letiana M. Kostenko, Oleg A. Zarichanskyi, Nataliia V. Zarichanska, Olena Yu. Pop	
Innuence of the Amount of Students Motor Activity on their Health Status and Esychophysical Reddiness for Future Life Woływ aktywności ruchowej uczniów na stan zdrowia i gotowość psychofizyczna do przyszłego życia	150
Alba A. Babiak, Ivan M. Akhrimanko, Natalia A. Ivakhova, Irvna M. Orlanko, Katervna M. Pavlenko, Alena A. Solntseva	150
The Impact of Levels of Emotional Intelligence Development in High Schoolers with Intellectual Disabilities	
on Their Health Status	
Wpływ poziomu rozwoju inteligencji emocjonalnej u uczniów szkół średnich z niepełnosprawnościami intelektualnymi	
na ich stan zdrowia	155
Olha V. Kuprinenko, Kateryna A. Tymruk-Skoropad, Yuriy A. Briskin, Bohdan R. Kruk	
The Structure of Injuries and the Relevance of Physiotherapy for Prevention and Rehabilitation for Medial Tikial Stress Sundrome in Codets	
struktura urazów i znaczenie fizioterapii w prewencii i rehabilitacii przyśrodkowego zespołu stresu piszczelowego u kadetów	160
Inor D. Duzhvi Halvna P. Oleshchenko. Leonid A. Bondarenko. Serghii M. Kobyletskvi	
Familial Tuberculosis and its Prevention in Terms of Health Care Restructuring	
Gruźlica rodzinna i jej zapobieganie w aspekcie restrukturyzacji opieki zdrowotnej	166

171
178
183
187
192
197

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## Evaluation of the Therapeutic Effects of a Series of Treatments with Whole-Body Cryotherapy on Pain of the Cervical Spine in the Course of Degenerative Disease

Ocena wpływu terapeutycznego serii zabiegów krioterapii ogólnoustrojowej na dolegliwości bólowe odcinka szyjnego kręgosłupa w przebiegu choroby zwyrodnieniowej

DOI: 10.36740/ABAL202202101

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#### SUMMARY

Aim: To evaluate the therapeutic effect of a series of 10 treatments of whole-body cryotherapy combined with kinesitherapy on the cervical spine pain in the course of degenerative disease. Evaluation of the adverse effects occurrence during stay in a cryogenic chamber in patients of different ages.

Materials and Methods: For the study, based on the inclusion and exclusion criteria, 29 patients were qualified out of 231 patients who underwent the procedure of whole-body cryotherapy combined with kinesitherapy during the period of observation. The following data were used in the study: data from medical records, a sociodemographic questionnaire, standardized methods – the VAS scale and a modified questionnaire of pain indicators according to Laitinen.

**Results:** In the VAS scale in about 93.1%, and based on the modified questionnaire of pain indicators according to Laitinen, in as many as 96.5% of patients, a reduction in the intensity of pain of the cervical spine after 10 sessions of whole-body cryotherapy combined with kinesitherapy was observed. On average, pain symptoms decreased by 2.9 points on the VAS scale and the average score according to modified questionnaire of pain indices according to Laitinen was by 2.8.

**Conclusions:** A series of 10 procedures of whole-body cryotherapy combined with kinesitherapy reduces the intensity of pain in the cervical spine in the course of degenerative spine disease. Cryogenic chamber treatment is safe and well tolerated, regardless of the age.

Key words: degenerative disease, cervical spine pain syndrome, whole-body cryotherapy

Słowa klucze: choroba zwyrodnieniowa, zespół bólowy odcinka szyjnego kręgosłupa, krioterapia ogólnoustrojowa

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#### INTRODUCTION

Cervical spine pain syndromes occur in approximately 10-15% of the of the population. Although diagnosed two times less frequently than in the lumbosacral region, in 33% of cases they cause greater loss of function [1]. It is estimated that each year 30-50% of the world population suffers from pain in the cervical spine. Approximately 11-14% of the working population will experience reduced activity over a 12-month period due to cervical spine pain within 12 months, and in about 65% of people these symptoms will occur at least once in their lives [2, 3]. In Poland, this problem affects approximately 2 million individuals, of

which as many as 80% are professionally active people aged 30-59 [4].

Treating patients with spinal pain syndrome generates up to 38% of total societal costs [5], and one of their causes is the degenerative disease, which is a side effect of an increased standard of living. Its development is influenced by: sedentary lifestyle, reduced or limited physical activity, being overweight, obesity, etc. Spinal pain syndromes are the 2nd cause of physical disability and absenteeism at work [6], this generating large social costs.

Static and dynamic overloads, injuries and repeated micro-traumas lead to damage of the osteoarticular and

ligamentous-muscular system muscles. Degenerative changes are irreversible and, as a result, they cause pain and reduced mobility of spinal joints. About 50% of the 55 billion nonsteroidal anti-inflammatory drugs are taken by the group of people diagnosed with osteoarthritis [7].

One of the forms of treating the aforementioned pain is the whole-body cryotherapy treatment, which consists in cooling the whole body using low temperatures of a stimulus nature, causing reversible adaptive reactions [8,9]. The treatment takes place in a cryochamber with temperatures between -170°C and -110°C, lasts from 1 to 4 minutes and can be performed 2 times a day, and the number of treatments in a series is usually 10-15 [8].

The literature on cryogenic temperature therapy in pain syndromes of the cervical spine in the course of degenerative diseases is still insufficient, hence the interest in this area.

#### AIM

To evaluate the therapeutic effect of a series of 10 treatments of whole-body cryotherapy combined with kinesitherapy on cervical spine pain in the course of degenerative disease.

Evaluation of the occurrence of adverse effects during a stay in a cryogenic chamber in people of different ages.

#### MATERIALS AND METHODS

Based on the inclusion and exclusion criteria, 29 patients were qualified for the study out of 231 individuals who underwent a series of 10 treatments in a cryogenic chamber combined with kinesitherapy in the Prophylaxis and Rehabilitation Center NZOZ Creator Sp. z o.o. in Lodz during the observation period.

The inclusion criterion for the study was chronic pain syndrome of the cervical spine in the course of degenerative disease.

Exclusion criteria: use of whole-body cryotherapy treatments in the last 6 months prior to the study, use of other physiotherapeutic treatments during the observation period, use of any analgesics during the study, occurrence of pain syndromes of origin other than degenerative spine disease.

The research procedures were performed in accordance with the Helsinki Declaration of Human Rights of 1975, modified in 1983. All patients gave informed, voluntary and written consent to participate in the research project. They were informed about the course of the study and of their right to withdraw at any stage, without giving any reason or suffering any consequences.

The procedures took place in a cryogenic chamber of the Wrocław type, manufactured by Creator Sp. z o.o., where the cooling agent was liquid nitrogen, in the temperature range from -130°C to -120°C. The 3-minute stay in the cryochamber was followed by 30-minute kinesitherapy consisting of general fitness exercises and exercises with the use of devices (steppers, cycloergometers).

In addition to data from medical records, the study also used sociodemographic questionnaire and standardized methods – VAS scale and a modified questionnaire of pain indicators according to Laitinen. The socio-demographic questionnaire of our own authorship included basic data, such as gender, age, place of residence.

The Visual Analogue Scale (VAS) is a method, which due to its simplicity and universal applicability, is one of the most commonly used for measuring pain. The technique relies on a figure with vertical or horizontal 10-cm scale (scaled from 0 to 10), on which the examined person marks the point corresponding to their current pain, where 0 is no pain, and 10 is the maximum pain [10]. The VAS scale allows to assign a value to the subjective clinical symptom, which pain is [11].

The modified questionnaire of pain indicators according to Laitinen enables to assess the effectiveness of analgesic treatment with the use of the patient's subjective evaluation of pain [12]. It takes into account 4 indicators: pain intensity, frequency of pain, use of analgesics, limitation of motor activity. The lowest score of 0 indicates no pain; the maximum score of 16 indicates pain of considerable intensity, limiting the patient's activity and work.

The study was conducted at 2 target points – before and after the physiotherapy programme, and the surveys were coded so that they could be compared before and after the series of treatments.

Due to the popularity of presenting results of surveys using mean values, the results of this study are presented accordingly. Data were analysed using Microsoft Excel 2021 computer program.

#### RESULTS

A group of 29 subjects between 44 and 77 years was enrolled in the study. The mean age for women was 63.2 and for men 63.0; the mean for the whole group was 63.1.

There were 24 women in the group, that is about 82.76% of the subjects, and 5 men – that is about 17.24% of the group examined.

The analysis of the structure index shows that more than 86% of the patients were inhabitants of Lodz, The remaining 14% were residents of the Lodz agglomeration.

According to the VAS scale (Figure 1), before the 10-day cycle of whole-body cryotherapy, the mean patients' indication of pain was 5.7 points. After the series of treatments, the score reached 2.8 points, indicating an average pain reduction of 2.9 points. This result means that there was a significant subjective reduction in pain in all subjects, regardless of gender.

On the basis of the modified questionnaire of the pain index according to Laitinen (Figure 2), before the conducted physiotherapy in all tested patients, the average pain intensity oscillated at the level of 6 points, after the series of treatments at the level of 3.2 points; the score decreased on average by 2.8 points. The obtained result, similarly to the VAS scale, means that there was a significant subjective reduction of pain in all patients, irrespective of gender.

#### DISCUSSION

The whole-body cryotherapy procedure is considered a physiotherapeutic method of recognised efficiency in the



Figure 1. Mean pain scores using the VAS scale in study patients

treatment of many diseases, particularly those affecting the locomotor system [13]. Over several dozen years in Poland, whole-body cryotherapy has become an increasingly valued and popular treatment and is currently regarded as one of the most important physical therapy methods [14]. In the Prophylaxis and Rehabilitation Centre NZOZ Creator Sp. z o.o. in Łódź, where the research for the present study was carried out, the procedure is used every day by over 200 people and there are several cryochambers in operation in the city mentioned above.

Numerous scientific studies confirming the effectiveness of whole-body cryotherapy contributed to its inclusion 20 years ago in the list of medical procedures reimbursed by the National Health Fund and thus, it has become a standard of treatment in many branches of medicine [14,15].

The basic indications for treatment with cryogenic temperatures include, among others: musculoskeletal diseases, diseases of the central and and peripheral nervous system, diseases of immunological and autoimmune origin as well as biological regeneration and sports medicine [16-19]. Whole-body cryotherapy has also been shown to be effective in other areas of medicine, such as dermatology [20] or psychiatry [21-24], and the high effectiveness of this method encourages further development of knowledge, searching for new possibilities of application and improvement of cryogenic techniques [12].

The aim of this study was to expand the knowledge on the use of whole-body cryotherapy in the treatment of pain syndromes of the cervical spine in the course of degenerative disease.

From the analysis of the available literature, it appears that there are many scientific studies of the impact cryogenic temperatures have on pain syndromes, however, most of them concern the lumbar and sacral spine. Reports on the effectiveness of whole-body cryotherapy in pain syndromes of the the cervical spine in the course of degenerative disease are still scarce, hence the interest in this topic.

This study compares the severity of pain in patients with pain syndrome before and after a series of 10 treatments of whole-body cryotherapy combined with kinesitherapy. To standardise the study group, the inclusion criterion was cervical spine pain syndrome caused by degenerative disease.



Figure 2. Mean pain scores using the modified questionnaire of pain indicators according to Laitinen in the studied patients

In order not to falsify the results, the study included patients who did not receive cryogenic chamber treatments in the last 6 months The patients were not subjected to any other physiotherapeutic procedures during the treatment period or to any analgesic pharmacological treatment during the observation period.

According to the VAS scale, 93.1% of patients, and 96.5% of patients according to the modified questionnaire of pain indicators according to Laitinen, experienced a decrease in cervical spine pain after 10 whole-body cryotherapy treatments combined with kinesitherapy. Pain symptoms on the VAS scale were reduced on average by 2.9 points, while the average score assessed on the basis of a modified questionnaire of pain indicators according to Laitinen was 2.8.

The results obtained in our study confirm the effectiveness of this method. The analgesic effect of therapy using cryogenic temperatures is associated with functional exclusion of sensory receptors and their connections with proprioceptors and the release of conduction in sensory fibres, the increase in betaendorphin secretion, the decrease in histamine and lactate concentrations in inflamed tissues [13, 25].

The findings of the present study are consistent with reports available in the literature [26-32].

The aim of the study by Daniszewska at all [26] was to evaluate the effects of whole-body cryotherapy in patients with pain syndrome of the cervical spine resulting from degenerative disease. The following patients were qualified for the study: 49 patients aged 28-75 years who underwent a series of 10 treatments in a cryochamber, where the temperature was between -130°C and -120°C. Each medical procedure lasted 3 minutes and was followed by 30 minutes of kinesiotherapy. A numerical scale and a modified questionnaire of pain indicators according to Laitinen were used in the study, and the mobility of the cervical spine was measured in the sagittal, frontal and transverse planes with a measuring orthopaedic tape. After the therapy a statistically significant reduction of pain and increased range of motion of the cervical spine were observed.

Skrzek at all [27] conducted an observational study in 37 patients diagnosed with degenerative-discopathic changes of the spine. The subjects underwent a series of 10-30 whole-

body cryotherapy treatments at temperatures ranging from -150°C to -110°C lasting from 1 to 3 minutes, and then they participated in 45-minute kinesitherapy. In 97% of patients, a decrease in the intensity of pain was observed, on average from 6 to 3 points on the VAS scale.

In the study by Michalik at all [28] a group of 496 patients underwent a series of 20-30 treatments lasting from 2 to 3 minutes in whole-body cryotherapy at a temperature of approximately -130°C, combined with 15-30-minute kinesiotherapy. The subjects, aged 18-82, were diagnosed with musculoskeletal disorders of various aetiologies, the most common being degenerative changes of the spine and peripheral joints. After 1 month from the end of physiotherapy, pain on the VAS scale was reduced by 54.8% on average.

The beneficial effect of whole-body cryotherapy was also seen in studies of Cholewka and Drzazga [29, 30], in which an attempt was made to compare the effectiveness of treatments performed using a 2-stage cryochamber and with cold retention. The study involved 46 patients with back pain syndromes in the course of degenerative changes, who underwent a series of 10 whole-body cryotherapy treatments lasting from 2 to 3 minutes followed by kinesitherapy. The temperature in the main part of the 2-stage cryochamber ranged from -107°C to -68°C, and in the cryogenic chamber with cold retention from -125°C to -67°C. A reduction in pain was observed in 54.6% of patients, and in 83.3% of patients after the next 10 medical procedures.

Also Sieroń and Cieślar [18] in their study demonstrated positive effects of whole-body cryotherapy procedures. 40 patients with spinal pain syndrome based on discopathic lesions underwent therapy at the temperature of approx. -130°C. In 50% of patients, 1-10 treatments were performed, while in the remaining 50%, 11-20 treatments were performed. The 2-minute cryotherapy was immediately followed by 60minute kinesitherapy. The degree of improvement was assessed on a 3-point scale (no improvement, slight improvement, significant improvement). In the group that received 1-10 treatments, 45% of patients reported significant improvement, another 45% reported little improvement, and 10% reported no improvement. In the group that received 11-20 treatments, up to 100% of patients reported a reduction in pain intensity, however, the therapeutic effect was proportional to the number of medical procedures used.

Śliwiński at all [31] conducted a study on 20 patients with spinal overload syndrome. After a series of 20 whole-body cryotherapy treatments, lasting 3 minutes, combined with kinesitherapy, palpable pain of pelvic ligaments was reduced by 20% and increased pelvic muscle tension by 30%.

Miller [32] attempted to compare the effectiveness of local and whole-body cryotherapy. In 16 patients with chronic pain resulting from degenerative multi-joint lesions, a series of 20 treatments was carried out. Eight patients received whole-body cryotherapy and eight patients received local cryotherapy for all joints affected by degenerative changes. The therapy was followed by appropriate kinesitherapy. Pain severity was assessed 3 times during follow-up and was done using a 0-10 scale, where 0 is no pain, 1-2 minimal pain, 3-4 slight pain, 5-6 moderate pain, 7-8 severe pain, 9 excruciating pain, and 10 is unbearable pain. A reduction in pain was observed in all patients, however, those who received wholebody cryotherapy, had significantly better results. Before therapy, patients in this group rated the severity of pain at 6.9 points, after the series at 2 points, and 2 weeks after the end of treatment at 2.3 points. In the group receiving local cryotherapy these values were, respectively: before therapy 6.5, after therapy 3.8, and after 2 weeks 1.4 points.

In the first version of the study, in addition to evaluating the therapeutic effect of a series of 10 treatments of wholebody cryotherapy combined with kinesiotherapy on pain complaints, a study of cervical spine mobility was to be assessed. Unfortunately, the pandemic made most of the group of 29 unwilling to participate for fear of contracting COVID-19.

It is difficult to determine unequivocally how much of the reduction in pain was due to the series of 10 treatments in the cryochamber versus kinesiotherapy. Whole-body cryotherapy uses physiological and systemic responses to cold to support primary treatment and to facilitate treatment of the musculoskeletal system, and immediately following the treatment is kinesitherapy, the performance of which is a prerequisite for the entire medical procedure to have the desired therapeutic effect [18].

Many of the subjects would not have been able to perform the recommended exercises without prior treatment in the cryogenic chamber. Whole-body cryotherapy alone does not increase motor function and therefore intensive kinesiotherapy is necessary to improve or regain the function of patients.

The results of the present study indicate that whole-body cryotherapy is a safe and well-tolerated method for patients of all ages provided that they are properly qualified and safety rules are followed. None of the respondents abandoned the procedures or reported any complications. This may be due to the fact that all of them had used whole-body cryotherapy before.

According to the study by Soltys and Elwart [33], no symptoms were ever observed that could in any way threaten the lives of patients, and the benefits of the procedure and the satisfaction of the patients' needs were also noted. The benefits brought by the procedure and the satisfaction of the patients overall, indicate its positive impact.

The aim of the study by Pietrzak at all [34] was, inter alia, to assess the occurrence of adverse effects during treatment in a cryogenic chamber. The study included 40 patients with pain syndrome between 24 and 73 years of age divided into 2 groups: I (younger) up to 55 years of age, II (older) above 55 years of age. The study concluded that a stay in a cryochamber may be associated with the occurrence of adverse effects, which are relatively rare, disappear quickly and do not threaten the life or health of patients, and the age of patients has no significant influence on their occurrence.

Appropriate patient qualification, adherence to procedures and proper cooperation between medical personnel and the patient is a guarantee of safety and lack of significant complications [7, 33]. Literature data [14, 33] indicate that whole-body cryotherapy is well tolerated by patients, including children and elderly patients.

The findings of the present study seem to provide arguments for the use of whole-body cryotherapy combined with kinesitherapy in the treatment of pain syndromes of the cervical spine based on degenerative disease.

It is worth adding that all the patients have been the patients of the Centre for Prophylaxis and Rehabilitation NZOZ Creator Sp. z o.o. in Lodz for several years. Each of them participates in a series of 10 treatments of whole-body cryotherapy combined with kinesitherapy twice a year, on average every 6 months, thus one of the exclusion criteria was the use of whole-body cryotherapy treatments during the last 6 months prior to the observation. According to the subjects, the cryogenic chamber treatment is permanent and, on average, they do not need to use pharmacotherapy or other physical therapy for 6 months to reduce the severity of pain.

This paper does not fully address the issues discussed. However, due to the scarcity of literature on the use of wholebody cryotherapy in in cervical spine pain syndromes, it is an attempt to provide more data and to confirm other scientific reports.

#### CONCLUSIONS

A series of 10 treatments of whole-body cryotherapy combined with kinesitherapy reduces the severity of cervical spine pain in the course of degenerative spine disease.

Cryogenic chamber treatment is a safe and well-tolerated method, regardless of age.

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#### **Conflict of interest:**

The Authors declare no conflict of interest

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A – Research concept and design, B – Collection and/or assembly of data, C – Data analysis and interpretation, D – Writing the article, E – Critical revision of the article, F – Final approval of article

Info



POPE JOHN PAUL II STATE SCHOOL OF HIGHER EDUCATION IN BIAŁA PODLASKA has the honour to invite to The Third International Scientific Conference CHALLENGES AND DILEMMAS IN PHYSIOTHERAPY 19-20 May 2022

The aim of the conference is to exchange views and experiences on contemporary challenges and dilemmas of physiotherapy over population health with special focus on postural defects and scoliosis.

Thematic sessions:

- 1. Body structure and posture of children, adolescents and adults (epidemiology and etiology of postural defects).
- 2. Physiotherapy in the diagnosis and treatment of postural defects.
- 3. Specific physiotherapy and its effectiveness in the treatment of scoliosis.
- 4. Varia.

#### Workshops

The conference will include workshops on the FITS method (Functional Individual Therapy of Scoliosis). The workshop will be conducted by Andrzej M'hango, the co-author of the method.

The papers will be presented in Polish, Russian or English in thematic sessions and the poster session. The presentation time in each session is 15 minutes. The application with an abstract should be sent via e-mail by 31 March 2022. The abstract written in Polish and English should be between 150 and 250 words and should include: the aim of the research, materials and methods, results, conclusions, and key words.

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## Neurological Disorders in Hospitalized Patients with Covid-19: Clinical Symptoms, Treatment and Rehabilitation

Zaburzenia neurologiczne u hospitalizowanych pacjentów z COVID-19: objawy kliniczne, leczenie i rehabilitacja

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#### SUMMARY

Aim: To establish the spectrum of neurologic disorders in patients with coronavirus disease 2019, and to clarify what are their clinical peculiarities?

**Materials and Methods:** We analyzed retrospectively the clinical, radiological, and neuropathological findings of the patients who entered our clinics between October 2020 and the end of March 2021. Neurological syndromes developing during or after the disease, which were likely to be associated with COVID-19 on clinical and laboratory grounds, were included in the group of interest. Cases for which a more likely alternative pathology was found were excluded.

**Results:** In a case series of 515 patients with Covid-19, neurologic symptoms were observed in 173 (33.6%) patients and were more common in patients with severe infection (47.8%) according to their respiratory status, which included acute cerebrovascular events, impaired consciousness, and muscle injury. Encephalopathy (29/16.7), and neuropathy 36 (20.8) dominated among neurological syndromes.

**Conclusions:** Neurologic symptoms manifest in a significant part of patients with Covid-19. The most common were fever, fatigue, dyspnoea, and muscle-join pains.

Key words: SARS-CoV-2, COVID-19, Neurological Disorders

Słowa kluczowe: SARS-CoV-2, COVID-19, zaburzenia neurologiczne

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#### INTRODUCTION

In December 2019, a new infection, named Severe Acute Respiratory Syndrome (SARS)-CoV-2 causing severe acute respiratory syndrome, began in Wuhan, Hubei Province, China, and quickly spread around the world [1, 2]. SARS-CoV-2 virus is a novel, single-stranded RNA virus which was declared as the causative agent of coronavirus disease 2019 (COVID-19) in February 2020 and was recognized as a global concern (pandemic) by the World Health Organization (WHO) [3]. Preliminary data suggest that bats are the most probable initial source of the current coronavirus disease-19 (COVID-19), however worldwide spreading was apparently occurred from a "wet market" [1]. The COVID-19 pandemic represents the greatest global public health challenge since the pandemic influenza outbreak of 1918. According to currently available evidence, SARS-CoV-2 is transmitted to humans via respiratory droplets and aerosols [4, 5]. The most common

signs and symptoms of COVID-19 are considered to be fever (temperature  $\geq$  37.8°C), cough, dyspnea (breathing difficulty), myalgia and fatigue, nasal congestion, smell and taste impairments (loss) [6]. Many of these symptoms and some others persist for a long time during and after acute COVID-19 [7]. The spike (S) protein of SARS-CoV-2 had a high affinity to angiotensin I-converting enzyme 2 (ACE2), which is responsible for the virus invasion. ACE2 is expressed in many types of the cells including nasal epithelial cells, as well as the blood vessel endothelial cells. Although the respiratory system involvement is the most common and life threatening in coronavirus disease 19 (COVID-19), there are increasing reports concerning neurological complications during and after disease. These neurological complications can affect both central, including encephalopathy [8], meningo-encephalitis [9], ischaemic stroke [10], acute necrotizing encephalopathy [11], and peripheral nervous system (Guillain-Barre'syndrome (GBS)

[12]. One of the most dramatic consequences of infectious diseases like severe acute respiratory syndrome and COVID-19 are respiratory muscle weakness and low exercise capacity that observed 1-4 month' and more after the initial infection. These SARS-CoV-2 experience has revealed the need for a multidisciplinary rehabilitation approach, especially for elderly patients with comorbidities, and organ failure. The International European Respiratory Society (ERS) and the American Thoracic Society (ATS) Task Force developed and implemented for COVID-19 survivors a comprehensive pulmonary rehabilitation (PR) program [13]. PR involves exercise training especially the inspiratory muscle training (IMT), and psychological support.

#### AIM

To study the detailed emerging spectrum of neurological disorders encountered in 173 patients admitted to the Center of Infectious Disorders of the Nervous System (CIDNS, Kyiv, Ukraine) and Sumy regional hospital because of acute respiratory distress syndrome (ARDS) due to Covid-19, and the frequency and severity of certain symptoms. We also intend to determine the proportion of COVID-19 survivors with a need for various rehabilitative intervention programs following hospital discharge.

#### MATERIALS AND METHODS

#### STUDY DESIGN, PATIENTS AND SITES

This prospective, observational study was carried out at 2 centers (Center of Infectious Disorders of the Nervous System, Kyiv, and Sumy Regional Infectious Hospital, Ukraine) which among others clinics were assigned by the government to treat patients with Covid-19. We analyzed consecutive patients from October 2020 until the end of March 2021, who had been diagnosed as having Covid-19, according to WHO interim guidance [14]: (i) definite (SARS-CoV-2 RNA PCR positive from nasopharyngeal swab, CSF or pathological specimen); (ii) probable (clinical and laboratory features highly suggestive of COVID-19: lymphopenia, raised D-dimer, suggestive chest radiology in the absence of PCR evidence) [6]; and (iii) possible, in whom temporal or laboratory features indicate an association but another cause was also found. Patients were admitted to our clinics if they have clinical or laboratory evidence of a Covid-19 infection: fever >38 °C, dry cough, headache, chest pain, general weakness, taste or smell impairment.

#### CLINICAL DIAGNOSIS AND FINAL DECISION

The final conclusion for the etiology of infection and recruiting the patient into the study was mainly based on the detection of SARS-viral RNA in nasopharyngeal swabs, however neuroimaging data and characteristic clinical signs also were taken into account. The diagnosis was considered to be Definite (confirmed) when the viral RNA was found by RT-PCR in the nasopharyngeal swab; Probable – when IgG/IgM antibody synthesis against specific viral proteins in blood were detected with the simultaneous presence of radiological or neurological symptoms; Possible (suspected) – when only antibodies against viral proteins were found in the blood [15].

#### INCLUSION/EXCLUSION CRITERIA

Patients below 18 years were not included in the study, since children with CNS infections are managed in other specialized centers. Patients with any neurological manifestations (confusion, altered mental status, seizures, focal deficiency, etc.) registered upon admission or developed during their hospital stay, as well as those who have been found to have cerebrospinal fluid (CSF) abnormalities (>four white blood cells per mm<sup>3</sup> or CSF proteins >0.4 g/L) were included in the study. Cases for which a more likely alternative pathology was found were excluded. Noninfectious CNS disease (cerebral tumor, cerebral abscess, and neurosurgery within the previous two-four months), and meningitis without clinical manifestation of brain involvement were also excluded.

Consequently, 515 patients were enrolled into the study. Written inform consent was obtained from all patients or from close relatives. Patients were managed by hospital physicians following routine clinical practice i.e. history, physical examination, hematology, biochemistry, blood culture, and radiology. Cerebrospinal fluid (CSF) examination was carried out when indications were present only. After lumbar punctures (LP) CSF samples were collected and immediately sent to lab for analysis.

The research was approved by Ethics Commission of Sumy State University University, according to the European bioethics and bio-rights, Helsinki Declaration of the World Medical Association.

#### STATISTICAL ANALYSIS

For statistical analysis continuous data were compared with Mann-Whitney U test. Proportions were analyzed by Fisher's exact test. A p value of  $\leq 0.05$  was considered statistically significant.

#### RESULTS

#### DEMOGRAPHY

Basic demographic information was collected from all patients using case report forms. Of all 515 Covid-19 infectious patients, 173 had the definite signs of NS disorders and consisted the group of interest. Their mean (SD) age was 54.9 (14.8) years, with ages ranging from 18 to 86 years, and 98 were men (56.6%), and 75 women (43.4%) (male/female 1.3). Of this patients, 71 (41%) had one or more of the following underlying disorders: cardiac or cerebrovascular disease including hypertension (65/37.5%), diabetes (19/11%), and overweight (37/21.4%). Seven patients had had previous neurologic disorders, including transient ischemic attack, partial epilepsy, and mild cognitive impairment.

#### **CLINICAL FEATURES**

According to patients, the incubation period (the time from the initial infection to the onset of the first symptoms) averaged 7-8 days (from 1 to 20 days). Although all humans are susceptible to infection, susceptibility to the virus appears to be largely determined by age, immune status, underlying medical conditions, etc. Apparently, people of mature and old age have an increased susceptibility to SARS-Cov-2infection. Preadmission period of illnesses lasted from 6 to 28 days, with an average of 21 days.

Clinical profiles observed among the patients are characterized by extreme diversity and a combination of several symptoms and signs. Most patients present with mild to moderate symptoms at onset of disease. Hospitalization has always been associated with a sharp deterioration. Almost all patients on admission had fever (≥38°C), dry cough and general weakness. Headache (93/53.7%) and cochleavestibular impairments (dizziness) (88/40.8%) were recorded also. Headache and dizziness have been also reported as two of the most common initial presentations in many patients with COVID-19 as well as others neurological pathologies such as encephalitis, meningitis, and vasculitis [16, 17]. Clinical symptoms were sometimes extremely intense, for example, weakness may be such that the patient cannot move independently. Over time, fatigue and dispnoea become the most common symptoms. Minority of the patients (10/1.9%) presented on admission the symptoms of "enteric" COVID only: abdominal pain, and diarrhea which spontaneously resolved.

As well as the symptoms, the severity of the COVID-19 disease varied from mild to critical. Mild disease accompanied usually by no pneumonia or mild pneumonia, severe disease with dyspnoea and hypoxia required oxygen supply, and critical disease accompanied by sharply decreased blood saturation with oxygen, septic shock or multi-organ failure. In a number of cases, the transition from mild to critical form occurred extremely quickly, sometimes within 24 hours the saturation dropped by tens of percent which forced the patient to be immediately transferred to the ICU. The patients presented with a wide range of CNS and PNS features including neuroinflammatory diseases and stroke from 3 days before and up to 19 days following the onset of the COVID-19 symptoms. CNS related symptoms included dizziness, headache, impaired consciousness, acute cerebrovascular disease, ataxia, and seizure, taste and smell impairment, audible and vision impairment (Table 1).

Vegetative dysfunction (45/26%), mental confusion (13/7.5%), pyramidal insufficiencies (38/21.9%), convulsions (32/18.5%), scattered neurological symptoms (29/16.7%), pelvic disorders (16/5.3%), reduced hearing (16/5.3%) were reported less frequently. Profound hearing loss was not detected. More severe neurological findings include stroke, impairment of consciousness, coma, seizures, neuropathy, and encephalopathy. In turn, impaired consciousness includes the change of consciousness level (somnolence, stupor, and coma) and consciousness content (confusion and delirium). Symptoms related to skeletal muscle injury as well as neuromuscular junction (NMJ) disorder also met quite often (31/17.9). Therefore, the correct diagnosis of neurological disorders strongly depends on the subjective assessment of the existing neurological symptoms and constant monitoring their changes during the course of the disease. Nevertheless, the dominant syndromes should be considered encephalopathy (29/16.7), and neuropathy 36 (20.8). Encephalomyelitis (11/6.3), and GBS (5/2.8) have also been reported.

Table 1. CNS rel	ated symptoms
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<b>Clinical signs</b>	<b>n</b> %
fever	169 (97.7)
headache	170 (98.2)
weakness	173 (100)
meningism (stiff neck)	14 (8)
seizures	8 (4.6)
focal neurological sings	17 (9.8)
speech disorders	12 (6.9)
cranial nerve palsy	15 (8.6)
ataxia	19 (11)
sensory disorders	34 (19.6)
sleep disorders	18 (10.4 %)
diarrhea, abdominal pain	3 (1.7)
decline of consciousness/confusion	22 (12.7)
agitation/aggressiveness	25 (14.4)
apathy	30 (17.3)
hallucination	2 (≤1)

#### IMAGING

An important diagnostic and prognostic value has also neurovascular changes in the structure of the brain. Focal changes in the brain were observed more often – in 19 (51.3%) cases against 13 (35.1%) for diffuse disorders. In 5 patients (13.5%) no changes in MRI were detected. Findings include focal and diffuse changes of the limbic system around bilateral, temporal, occipital, and frontal areas. Signs develop gradually, but they are somewhat delayed as compared to the clinical symptoms. Encephalitis often involves the cortex, hippocampal, and extra hippocampal structures affecting the amygdala, tentorial cortex, thalamus, hypothalamus and deep forebrain structures, cerebellum, and brain stem. Edema, necrosis, and sclerosis are frequently found. These typical findings are subsequently resolved and brain atrophy is observed in the convalescent period.

#### TREATMENT

Treatment was essentially supportive and symptomatic since at this time there is no approved treatment for Covid-19. The first aim is to ensure adequate isolation to prevent transmission to healthcare workers. The main principles were controlling fever and blood oxygenation. In hypoxic patients, provision of oxygen through nasal prongs, face mask, high flow nasal cannula or non-invasive ventilation is indicated and was commonly used. Mechanical ventilation of the lungs was tried to be avoided due to the frequent complications. Routine use of antibiotics was mandatory in confirmed case of pneumonia due the high probability of bacterial co-infections.

In 15% of cases, when, against the background of prolonged use of antibacterial drugs (for 12-14 days or more), a high temperature, insufficient oxygenation, clinical signs of pneumonia persisted, a fungal co-infection (Candida albicans) was detected, which required the appointment of specific therapy. The Covid-19 Treatment Guidelines Panel

recommends now using dexamethasone alone either in combination with remdesivir for the treatment of Covid-19 in hospitalized patients on high-flow oxygen or noninvasive ventilation who have evidence of clinical progression or increased markers of inflammation [18]. Even before the start of this study, we were convinced of the complete uselessness of remdesivir and therefore avoided use it. So, we focused our efforts on maintaining oxygenation by any means, preventing coagulation and reducing excessive inflammatory response. Of 515 hospitalized patients with Covid-19 infection, oxygen was given to 71%, non-invasive ventilation in 15%, mechanical ventilation in 3%, antibiotics in 71%, antifungals in 15%, glucocorticoids in 29% and intravenous immunoglobulin therapy in 27%. The duration of non-invasive ventilation was 4–22 d [median 9 d].

#### OUTCOMES AND POST-COVID CONSEQUENCES

The mean duration of hospital stay was 19.7±15.3 days (range: 7-39). As a result of the treatment, 65 patients had a good outcome and after discharge they returned home. The condition of 55 patients improved significantly (a decrease of some neurologic symptoms, but with preservation of some manifestations of cerebrosthenic, vestibulo-atactic syndromes, pyramidal insufficiency). These patients were transferred to a convalescence facility. 46 patients, which condition worsened against the background of the therapy (dysfunction of the stem and cortical structures increased), were moved to ICU for further treatment. 13 patients died. It is necessary to emphasize complete recovery was observed only in a few of those who had been discharged. Poorly expressed dysexecutive syndrome consisting of inattention, disorientation, or erratic movements in response to a command was registered in almost 20% of them. Regular headaches, paresthesia with tingling in the arms and legs, constricted muscles, lack of smells and tastes persist for a long time after discharge. The main longterm complication of the previous illness, which almost all people face, is panic attacks which are a consequence of the transferred stress - lack of the oxygen.

#### REHABILITATION

Discharge from the hospital after treatment of COVID-19 does not mean complete recovery. Some of the symptoms especially late-onset ones may persist for a long time [19]. Among the long-term consequences of COVID-19 respiratory muscle weakness, low exercise capacity, and panic attacks were registered [20]. So, almost all surviving patients need for a long and multy-disciplinary rehabilitation approach, which should be started 3-4 weeks after discharge.

#### DISCUSSION

Potential Mechanisms of Neuroinvasion and Neuroinjury. Although SARS-CoV-2 is typically associated with respiratory tract disease, this virus, like others coronaviruses in this group (HCoV-229E, HCoV-OC43, and SARS-CoV-1), can probably infect neurons. Moreover, there are some reports of neurological complications in patients with COVID-19, which removes all doubts if SARS-CoV-2 is neurotropic in humans. The virus can enter the brain by several routes,

including transsynaptic transfer across infected neurons, entry via the olfactory nerve, infection of vascular endothelium, or leukocyte migration across the blood-brain barrier (BBB) [21]. The dominant opinion was that human and nonhuman coronaviruses invade peripheral nerve terminals, spread retrograde along nerve synapses, and gain access to the CNS [22, 23]. However, a group of researchers in the brains of SARS-CoV-2-infected patients recently found an increase in string vessels, empty basement membrane tubes [24]. Their appearance is associated with the death of endothelial cells and leads, in turn, to damage to the BBB and cerebral ischemia. Authors postulate that death of brain endothelial cells in COVID-19 is secondary to their SARS-CoV-2 infection. Despite lack of ACE2 expression in certain cell types including brain endothelial cells others receptors primarily NRP1 and possibly BSG facilitates SARS-CoV-2 cell entry cells. After infection Mpro (main protease) cleaves host cell NEMO protein taking the central role in immunity. NEMO supports the survival of some but all cell types. The loss of NEMO induces an apoptosis of endothelial cells with following microvascular pathology. Subsequently, patchy hypoxia developed in the brain and the BBB became leaky.

#### CONCLUSIONS

To date, SARS-CoV-2 has infected millions and affected billions of lives. The understanding of neurologic disease in patients with Covid-19 is evolving, and clinicians should continue to monitor patients closely for neurological disease. Early detection of neurological deficits may lead to improved clinical outcomes and better treatment algorithms. Further laboratory and clinical data, including tests of CSF, brain imaging, and tests of CNS tissue, will be essential in elucidating the pathophysiology and potential for CNS injury. Lastly, longitudinal neurological assessments of patients after recovery will be crucial in understanding the natural history of Covid-19 in the CNS and monitoring for potential neurologic sequelae.

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#### Info

On behalf of the Editorial Board and the Publisher of Acta Balneologica - the official journal of the Polish Society of Balneology and Physical Medicine (published since 1905), we cordially invite you to the new website www.actabalneologica.eu where, among others, we publish open access articles. We would like to remind you that Acta Balneologica is indexed in the Web of Science (ESCI) as well as EBSCO databases, has 20 MENiSzW points, and has the permanent patronage of the Rehabilitation Committee of the Polish Academy of Sciences. At the same time, we encourage you to visit and like the Acta Balneologica profile on Facebook. facebook.com/actabalneologica. There, we place posts in the field of health resort medicine. And we will share information about treatment methods available in health resort stations. A natural consequence of our activities in the field of health resort medicine has been the establishment of the Polish Society of Health Resort Patients in 2019. You can find out more about the goals, tasks, and methods of operation of this Society on the website www.uzdrowiskowi.pl. You can also download the membership declaration here.

### Determination of the Hazard of Medical Waste in the Convention of the Covid-19 Pandemic

## Określenie zagrożenia związanego z odpadami medycznymi w okresie pandemii Covid-19

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#### SUMMARY

**Aim:** To determine the infectious danger of medical waste from patients with COVID-19, by examining them for the presence of coronavirus SARS-CoV-2.

**Materials and Methods:** Regulatory – legal acts, foreign editions, results of the laboratory researches that we received served as materials for carrying out research. While researching such methods were used: descriptive, bibliographic, analytical, epidemiological, laboratory diagnostics, statistical.

**Results:** The study confirmed the presence of RNA of the coronavirus SARS-CoV-2 in 5 selected samples from protective masks of patients with COVID-19 (8.9%) by polymerase chain reaction (PCR). SARS-CoV-2 coronavirus was not detected in samples taken from medical masks. Separate studies of wastewater from the infectious disease hospital of Ostroh General Hospital and from the city sewer network for the presence of coronavirus SARS-CoV-2 were conducted. SARS-CoV-2 coronavirus was not detected in the selected samples by PCR. **Conclusions:** The results of the study confirm the infectious potential of medical waste, mostly wrong treatment.

Key words: medical waste, COVID-19, risks, management, pandemic

Słowa kluczowe: odpady medyczne, COVID-19, zagrożenia, zarządzanie, pandemia

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#### INTRODUCTION

The problem of environmental pollution by waste, including hazardous waste, which includes medical waste, is a global threat to the entire population of our planet. Research in recent years has found a large number of medical and veterinary drugs in many ecosystems around the globe. More than half of the drugs consumed are excreted from the body in a biologically active form. The study has found that in small doses, in the United States, certain drugs are contained in tap water in almost all settlements. More than 180 of the 3,000 permitted active substances have already been detected in German waters, including antibiotics, psychotropic drugs, and hormonal drugs [1].

Today, the WHO plays a leading role in preventing the risks posed by hazardous medical waste. It has issued

several policy documents to support countries to improve their health management system, which provides statistics, various regulations and solutions that are recommended for implementation and are already in use in many countries. These are programs such as "Medical waste management" in 2011 and "Safe management of wastes from health-care activities", published in 2013 and supplemented in 2014, where medical waste also included waste of medical origin generated at home. WHO also released a 2015 handbook, Status of Health Care Waste Management in Selected Countries of the Western Pacific Region, 2008-2013, which provides an example of Western Pacific countries' experiences in medical waste management, where they have been guided by WHO guidelines. and what impact this had on the region [2-5]. This article is the result of the 3rd stage of research work on the study of the peculiarities of medical waste management in the context of the COVID-19 pandemic in Ukraine, both from medical institutions and from the population. The results of a study on the detection of coronavirus SARS-CoV-2 RNA in rinses from used protective masks of patients with COVID-19 and medical workers who provide medical care to such patients are described. Searching for the presence of SARS-CoV-2 coronavirus and enterovirus group wastewater was also investigated. Thus, suggestions are made for the safe management of medical waste in a pandemic.

According to the State Statistics Service of Ukraine, the total accumulation of hazardous waste is 5 billion tons [6]. A significant share of hazardous waste is medical waste, which is a factor in both direct and indirect risk of environmental pollution, as well as the occurrence of infectious and noninfectious diseases among the population. According to the International Charitable Organization "Ecology-Law-Human", Ukraine produces about 400 thousand tons of medical waste annually. They are accumulated by medical institutions, pharmaceutical companies, ordinary citizens etc. [7].

The main requirements for the treatment of medical waste (collection, transportation, storage, sorting, treatment (processing), disposal, removal, disinfection, disposal, destruction) in health care facilities are defined by the order of the Ministry of Health of Ukraine from 08.06.2015 № 325 "On approval of the State sanitary and anti-epidemic rules and norms on medical waste management". However, this document does not apply to the procedure of medical waste generated at people's homes. Pharmacies and the public act at their own discretion and often dump such waste in landfills or dump it in the sewers [7].

With the development of the medical industry, the amount of medical waste that poses an environmental and infectious threat to the population is also increasing. Medical waste has different degrees of epidemiological and environmental hazard depending on its composition and the degree of contamination by biological, chemical and radioactive agents. Waste and by-products can cause injuries and damage to the environment.

Problems with medical waste management have existed for a long time. However, recently, with the onset of the COVID-19 pandemic, this issue has become particularly efficient. After all, the burden on the medical sphere has increased – the number of hospitalizations has increased, which has led to an increase in manipulations, the use of tools, medical supplies. And the population uses a huge number of personal protective equipment (masks, respirators, gloves) every day, which are not properly disposed of. And the current legislation classifies such waste as hazardous medical waste.

If the issue of medical waste from medical institutions is legally settled in some way, then medical waste generated in the home is ignored, so the population throws it to the general container for solid waste or landfills. Citizens are not always adequately informed about the dangers of mishandling medical waste, do not have information on possible methods of disposal of poor quality and expired medicines at home, and most importantly, the conditions for receiving medical waste generated at home are not created in order to further transfer them to the relevant structures that have licenses to carry out operations in the field of hazardous waste management [8].

Thus, it is very important to know how dangerous such waste is. As the global SARS-CoV-2 coronavirus pandemic continues, it was interesting to learn about the resistance of the virus to the environment. After analyzing a large number of publications, we processed data on the resistance of the coronavirus to environmental factors, chemical and physical ones. However, no information was found on actual time of its storage and for how long it stays on the used protective masks. Therefore, conducting research in this area is so relevant.

#### AIM

Determining the infectious hazard of medical waste from patients with COVID-19, by examining them for the presence of coronavirus SARS-CoV-2 and providing suggestions for the safe management of this category of waste.

#### MATERIALS AND METHODS

Regulatory - legal acts, foreign editions, results of the laboratory researches that we received served as materials for carrying out research. Such methods as: descriptive, bibliographic, analytical, epidemiological, laboratory diagnostics, statistical were used. Collection of materials for the study was carried out on the basis of "Ostroh General Hospital" of Rivne Regional Council. The research took place in the specialized virusological laboratory of the Rivne Regional Laboratory Center of the Ministry of Health of Ukraine. In the course of the work, a virusological study of samples taken from used medical masks and wastewater was performed by polymerase chain reaction (PCR) to detect RNA of the coronavirus SARS-CoV-2. Conditions of research: t. 20°C, atm. pressure - 750 mm of mercury, relative humidity - 67%. PCR was performed on a special equipment - an automatic station for the extraction of ribonucleic acid Auto-Pure96 (AllSheng, China). Statistical processing of the obtained materials was performed using the statistical package "MedStat", which is widely used for the analysis of biomedical information (Y.E. Lyakh et al., 2006). Absolute risks (AR) were calculated with 95% probable intervals (95% PI).

These methods meet ethical standards and fully disclose the objectives. The research was approved by the Commission on Bioethics of the National University «Ostroh Academy» in accordance with the European bioethics and bio-rights, Helsinki Declaration of the World Medical Association.

#### RESULTS

While planning and conducting this work, we confirmed the information about the significant accumulation of used personal protective equipment (hereinafter – PPE) in medical institutions from medical staff and patients. At the same time, we have established that there is currently no objective information on the volume/number of PPE from the population. The main task in accordance with the set goal is to determine how dangerous PPE is and whether they pose an epidemiological threat to the population and may be a source of coronavirus spread in the future.

For this purpose, rinses from the masks of patients with COVID-19 were selected; rinses from masks of medical workers providing care to patients with COVID-19. The following were used for sampling: distilled water, silicone applicators for sampling and sterile cryotubes with a capacity of 2.5 ml. A total of 56 samples were taken.

Samples were taken three times for the study (Table 1). At the first selection – rinses were taken from the used protective masks: 1) patients with coronavirus disease, confirmed by PCR with severe clinical manifestations, who were hospitalized in the infectious department, in the amount of 30 samples; the rinses were removed from the inside of the masks using silicone applicators soaked in distilled water, after which they were placed in cryotubes (2.5 ml) filled with distilled water to the mark of 1.5 ml.; 2) medical workers who provide medical care to patients with covid-19, in the amount of 12 samples; rinses were taken from the outside and inside of the masks by the same method as rinses from the masks of patients.

The selection was carried out in compliance with hygienic and epidemiological safety measures. After the selection, the test tubes with the material were placed in a tripod and frozen at a temperature of -18°C, where they were stored for seven days.

On the day of the study, the samples were placed in a thermo-bag with cold cells and delivered to the laboratory for testing. As a result of the study, RNA of coronavirus SARS-CoV-2 was implemented in sample №1, which corresponded to washing from the mask of a patient with COVID-19. The other samples have not implemented the coronavirus. We assume that such a low detection rate of SARS-CoV-2 was obtained due to freezing of the samples. From the masks used by the medical staff, all the results were negative.

In the second selection, rinses from protective masks with COVID-19 in the amount of 5 samples were taken. The rinses were removed from the inside of the masks, which are in direct contact with the patient, using silicone applicators soaked in distilled water, and then placed in cryotubes (2.5 ml) filled with distilled water to the mark of 1.5 ml. After collection, the tubes were placed in a thermo-bag with cold cells and delivered to the virusological laboratory for tests that were performed on the day of collection. As a result, the coronavirus SARS-CoV-2 was detected in samples №1, №2, №5. Such an indicator points out on the reliability of the study. And if we compare it with the results of the first collection, where RNA of coronavirus was detected in one sample, we can assume that freezing of samples negatively affects the reliability of the results, and low temperatures contribute to the disruption of the RNA of coronavirus SARS-CoV-2.

At the third selection, 9 samples taken from protective masks of patients with COVID-19 were examined in the same way as in previous studies. The samples, placed in a thermo bag with cold cells, were delivered to the virology laboratory, where they were frozen. The study was conducted two days later. As a result, the coronavirus SARS-CoV-2 was detected in the sample Nº4. This study confirmed our assumptions about the negative effects of low temperatures on the RNA structure of the coronavirus.

It should also be noted that the absence of coronavirus SARS-CoV-2 on the masks used by medical workers who had direct contact with patients with coronavirus disease. This result indicates a high level of protection, by the usual surgical mask, against coronavirus infection, when used properly.

#### DISCUSSION

The results of the study show that PCR confirmed the presence of RNA of the coronavirus SARS-CoV-2 in 5 samples (Figure 1), where there were rinses from the masks of patients with coronavirus disease. The positive result at the first sampling

Type of samples	Quantity of samples	Positive results	Risk assessment	Negative results	
Rinses from masks of patients with COVID-19	30	1(3,3%)	AP=3,3% 0,0 <ap<13,1% p=0,05</ap<13,1% 	29	1 <sup>st</sup> selection
Rinses from masks of patients with COVID-19	5	3(60%)	AP=60% 6,9 <ap<99,6% p=0,05</ap<99,6% 	2	2 <sup>nd</sup> selection
Rinses from masks of patients with COVID-19	9	1(11,1%)	AP=11,1% 0,0 <ap<43,9% p=0,05</ap<43,9% 	8	3d selection
Rinses from protective masks of medical workers providing care to patients with COVID-19	12	0		0	1 <sup>st</sup> selection

Table 1. The results of sanita	ry-microbiological	examination for	coronavirus SARS-O	CoV-2
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was 3.3%, and 95% probable risk interval of detection of the pathogen on used medical masks from patients ranges from zero to 13.1%; at the second sampling, the risk of detecting coronavirus was 60%, and the probable risk ranged from 6.9 to 99.6%; at the third sampling - a positive result was in 11.1% of the samples taken with a probable interval in the range from zero to 43.9%. No coronavirus SARS-CoV-2 was detected in other RNA samples, but the results were questionable, which could not completely exclude the presence of the virus on the protective masks used. Low detection rates of SARS-CoV-2 coronavirus on the first and third samples may indicate that low temperatures contribute to damage to the RNA structure of SARS-CoV-2 coronavirus, so it was impossible to detect. We can even assume that the coronavirus mutates during freezing, but these are only assumptions that can be the basis for further research.

According to the study, medical waste, in particular personal protective equipment used, can be a potential source of infection in coronavirus disease and contribute to its prevalence among the population and in the environment. In addition, we must not forget about the negative impact of such waste on environmental safety. Therefore, appropriate recommendations should be developed at the state level on the safe handling of personal protective equipment used not only by medical institutions, but also by the population. Because a large number of patients are treated on an outpatient basis or generally transmit the disease asymptomatically, but are a source of infection. After preliminary laboratory tests, it was decided to examine the wastewater for the presence of coronavirus SARS-CoV-2. The collection was carried out three times from the sewage of the infectious diseases department, where inpatient care was provided to patients with COVID-19 and from the general sewerage network of the city. Two samples were taken in sterile, airtight glass containers (500 ml) from each site. After collection, the samples were delivered to the virusological laboratory. Virusological examination was performed by PCR test. As a result, SARS-CoV-2 coronavirus RNA was not detected. Such results may be due to wastewater disinfection and a small number of samples taken. However, we believe that it makes sense to conduct further research.

After studying a large number of materials on the methods of medical waste disposal, we came to the conclusion that the most effective method of disposal of hazardous medical waste is burning in incinerator furnaces. This is the method recommended by the World Health Organization. Enterprises with a license to conduct operations in the field of hazardous waste management and the ones that have the appropriate certified equipment must carry out neutralization. Unfortunately, there are very few such enterprises in Ukraine, so the best solution to this problem would be the introduction of mobile incinerators, which would serve a number of medical institutions in a separate area, and could accept medical waste from the population.

The main tasks currently emerging in medical waste management:

• create a basis for the introduction of proven methods and technologies for medical waste management (MWM);



Figure 1. An example of a positive test result for coronavirus SARS-CoV-2, by PCR

• to develop a national disposal network for effective control of all infectious and other hazardous medical waste, and thus: to prevent further use of landfills for medical waste disposal; improve waste management standards to reduce pollution [9].

Until now, much of the medical waste falls into unauthorized landfills. Elimination of such landfills is a major challenge for Ukraine.

The management of many medical institutions is not aware of their responsibility for the environmentally sound disposal of generated waste. And the limited financial resources of medical institutions are the biggest problem on the way to improving the management of medical waste.

Thus, the most pressing problem in the field of medical waste management is that most of the current regulations are not fully implemented, are not implemented in practice, sometimes contradict each other. In addition, the management of medical waste from the population is not regulated, so the special attention should be given to this problem and it should be regulated by law.

Nowadays, the only way to overcome these problems is to implement the "National Waste Management Strategy in Ukraine until 2030" at all governmental levels [10].

Also, an important role is played by sanitary and educational work among the population. So we can recommend: before getting rid of used masks or gloves – disinfect them or soak them in soap solution, pack in airtight packaging; to require from their local governments to organize hazardous waste collection systems as part of solid waste, placing special marked containers for this purpose; carefully collect and disinfect waste from infected patients and pack them in airtight containers; disinfect liquid waste from patients with COVID-19 or other infectious diseases before discharging it into both local and public sewer systems.

#### CONCLUSIONS

In the course of the study we found out that with the development of medicine the amount of medical waste that poses an infectious threat to the population increases. With the onset of the COVID-19 pandemic, this issue has become even more relevant. Therefore, there is a need to study the hazards of medical waste generated by patients with COVID-19.

As a result of the study, PCR confirmed the presence of RNA of the coronavirus SARS-CoV-2 in 5 samples taken from the masks of patients with coronavirus disease.

SARS-CoV-2 coronavirus was not detected on samples taken from medical workers' masks. This result indicates a sufficient level of protection against coronavirus infection, which gives the usual surgical mask when used properly.

The hypothesis of a negative effect of low temperatures on the coronavirus structure of

SARS-CoV-2. This issue is an important basis for further research.

It is confirmed that surgical masks can be a source of infection in coronavirus disease and contribute to its prevalence among the population and in the environment.

It is stated that the most effective method of disposal of hazardous medical waste, in particular used protective masks, is burning in incinerator furnaces.

The development of appropriate recommendations at the state level for the safe disposal of medical waste not only from medical institutions but also from the public, will be one of the effective methods of preventing the spread of coronavirus SARS-CoV-2.

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## Implementation of Health-preserving Technologies in the Process of Physical Education of Students with Type 2 Diabetes in Higher Education Establishments

## Wdrażanie technologii promujących zdrowie na zajęciach wychowania fizycznego u uczniów szkół średnich z cukrzycą typu 2

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#### SUMMARY

Aim: To identify, select the methods and to apply technologies to preserve the health of students with type 2 diabetes in the process of physical education in higher educational establishments.

Materials and Methods: 1-2 year students of Zaporizhzhia National University of different specialties took part in the research. The main criterion for selecting the study participants was the presence of "type 2 diabetes" diagnosis. The study involved 9 people (6 females, 3 males). The assessment of physical condition and level of physical development of study participants was conducted at the beginning and the end of the study.

**Results:** The main factors influencing health, general physical condition, level of development of physical qualities of students with a diabetes mellitus of 2 types are defined, namely: a mode and a diet of a improving food of patients with a diabetes mellitus of 2 types, a mode and volume of liquid consumption, regular, dosed exercise. The main principles of physical activity selection for students with type 2 diabetes mellitus (individuality, regularity, gradualness) and physical activity tasks are clarified, such as: increasing glucose utilization, improving the work of endocrine glands, ensuring oxidative-enzymatic processes that occur under the influence of physical activity, increasing the level of physical qualities, improving the functional state of the muscular, respiratory, cardiovascular systems, preventing the development of micro-and macroangiopathy.

**Conclusions:** Reliable results of the use of health technologies in the process of physical education of students with type 2 diabetes, which had a positive effect on such indicators as: fasting blood sugar, weight loss of overweight students, the level of development of physical qualities. Prospects for further research in this area are identified, which are to find ways to increase motivation for practical training in physical education and implementation of recommendations for health nutrition of students with type 2 diabetes.

Key words: health, health-improving nutrition, physical activity, development of physical qualities

Słowa kluczowe: zdrowie, żywienie prozdrowotne, aktywność fizyczna, rozwój cech fizycznych

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#### INTRODUCTION

Modern educational practice of higher education institutions is aimed at solving the problem of professional teaching activity of the academic teaching staff, which should ensure the preservation and development of the student's health, prevent the negative effects of the educational process.

Therefore, the leading universities of Ukraine have accumulated some experience in organizing and methodological support of a new section-lesson form of the educational process in physical education [1]. Zaporizhzhya National University, on the bases of the Bologna Process regulations and requirements, has issued the necessary regulations for the implementation of physical education in a new, improved to the European level, educational process for bachelors of all specialties as a recreational subject to restore the organism after students' mental and physical activity with the aim to improve their health.

One of the main elements of any pedagogical technology is health-protection technologies. Health-protection technologies are a system of activities that contains the interrelation and interaction of all educational environment factors, aimed at maintaining the health of participants in the educational process at all stages of their studying and development [2]. In the context of students' physical education in terms of health, the educational process is regulated in the way as not to afflict damage on its participants.

Implementation of health-protection technologies into the educational process of students, taking into consideration the age, state of health and development of physical activity during physical education classes, is aimed at preventing physical and mental fatigue, improving indicators of physical development and general well-being [3].

In terms of prevalence among student youth, diseases and metabolic disorders are becoming more common.

Every year the number of students, diagnosed with type 2 diabetes, increases, which results in such complications as: micro- and macroangiopathy (impaired vascular permeability, increased angiasthenia, increased susceptibility to thrombosis, to the development of atherosclerosis), diabetic foot syndrome, diabetic arthropathy joint pain, "crunch", limited mobility, decreasing of synovial fluid and increasing of its viscosity, nephropathy (kidney damage with the appearance of protides and hemocytes in the urine, and in severe cases with the development of glomerulosclerosis and renal failure), polyneuropathy (polyneuritis of peripheral nerves, pain along the nerve trunks, paresis and paralysis), etc., which are the causes of mortality and disablement of people of working age [4].

According to the official statistics of the Ministry of Health of Ukraine, there are about 1.3 million patients with diabetes in the country and about 100 thousand new cases are registered annually [5].

According to A. R.Bikmullina, diabetes mellitus – a disease caused by absolute or relative insufficiency of insulin hormone production in the organism and is characterized by impaired carbohydrate metabolism [6]. That is, diabetes occurs due to the malfunctioning of pancreas, which produces insulin, which in turn provides the carbohydrate cleavage and the synthesis of glycogen in the muscles and liver. In this case, the issue is type 1 diabetes (insulin-dependent); there is also another type 2 diabetes (non-insulin-dependent). Type 2 diabetes is in most cases associated with dysfunction of other endocrine glands that produce hormones with constrictive properties and most often occurs in the cases of hepatic disorders and obesity [6].

Furthermore, scientists and doctors around the world point out that patients with diabetes are more vulnerable to the new coronavirus SARS COV-2 (COVID-19) due to the peculiarities of their immune status and immune response to the virus [7].

Unfortunately, in today's world diabetes is incurable.

Thus, the abovementioned confirms the relevance of our study and necessitates the development of instructional guidelines for dosed exercise and health-improving nutrition.

#### AIM

The purpose of the study is to identify, select the methods and to apply technologies to preserve the health of students with type 2 diabetes in the process of physical education in higher educational establishments.

#### **MATERIALS AND METHODS**

The study was being conducted in the second semester of the 2020-2021 academic year for three months (March-May: March - selection of contingent and methods of work; April - application of selected methods; May - application of selected methods, processing of the results). In our opinion, this term is long enough to obtain lasting positive changes in the physical condition of study participants on such indicators as: fasting blood glucose, excess weight reducing, the level of physical qualities development. 1-2 year students of Zaporizhzhia National University of different specialities took part in the research. The main criteria for selection of study participants were: the presence of a diagnosis of "type 2 diabetes"; consent to participate in the study. The study involved 9 people (6 females, 3 males). The assessment of physical condition and level of physical development of study participants was conducted at the beginning and the end of the study.

The study was approved by the ethics committee of the Zaporizhzhia National University, in accordance with the requirements of the Tokyo Declaration of the World Medical Association and the International Recommendations of the Helsinki Declaration of Human Rights.

#### RESULTS

Scientists from different countries have contributed a lot to the study of diabetes, namely: O. Bakmulin (2019), B. Skachko (2012), A. Chernobrov (2008), I. Shchegol' (2019) and others.

According to scientists, physical activity, especially effective exercise plays a significant role in the treatment of diabetes, especially of type 2 diabetes. At the early cases of the disease, almost all treatment consists of diet and moderate exercise. This combination of diet and exercise helps to improve and reduces the risk of complications [8].

Dosed exercises are recommended for patients with all forms of diabetes, but in the absence of contraindications such as:

- The course of the disease is complicated by signs of decompensation.
- 2. Physical performance is low.
- 3. The level of glucose (glycemia) is constantly changing during physical exercise; there are sharp changes.
- 4. II or III degree of blood flow interference.
- 5. Ischemic heart disease (III-IV functional classes).
- 6. The presence of ketones in the urine.
- 7. Hypertensive disease of II or III degree [9].

The objectives of physical activity in the treatment of diabetes are:

- increasing of glucose utilization;
- improving the work of the glands of the endocrine system;
- providing oxidative-enzymatic processes that occur under the influence of physical activity;
- increasing of physical qualities level;
- improving the muscular, respiratory and cardiovascular systems functional state;
- preventing of micro- and macroangiopathy development [10].

The use of dosed exercise for patients with type 2 diabetes reduces the number of hyperglycemia cases (increase in blood glucose to 16.6 mmol/l (300 mg%) or more) and glucosuria (the appearance of glucose residues in the urine). Regular exercise improves the production of glycogen in the liver and muscles, which enhances the process of glucogenesis and glycogenolysis, and thus enabling the patient to overcome muscle weakness as well [11].

Therefore, to determine the effectiveness of the methods of improving physical development and maintaining the health of students with type 2 diabetes, we have selected the following:

- 1. Anthropometric data (height, weight).
- 2. Fasting blood sugar (each of the research participants did the appropriate analysis in a family medical institution).
- 3. Level of physical qualities development (strength of abdominal muscles, strength of arm muscles, strength of leg muscles, flexibility).

Determining the levels of physical qualities development was done with the help of physical development tests, such as: test 1 (lifting the torso from a lying position to a sitting position, hands behind the head (sit-ups); the number of repetitions is indicated); test 2 (floor push-ups (boys) and knee push-up (girls); number of repetitions is indicated); test 3 (squats; number of repetitions is indicated); test 4 (tilting the torso forward from a sitting position, the number of centimeters from the heels is indicated) (Table 1).

To maintain confidentiality, in tables 1 and 3, research participants are marked with a serial number.

Table 1 shows that all participants are overweight and have high fasting blood sugar.

Dosing of physical activity of students with type 2 diabetes occurs by selecting the type of physical activity, exercise, number of sets and repetitions, amplitude of movements, the complexity degree of the exercise and the tempo of its performing [12].

The main principles of physical activity selection for patients with diabetes are:

- the principle of individuality (to determine the intensity, tempo and level of physical exercises complexity by gender and level of physical qualities development);
- the principle of regularity (irregular exercises do not contribute to a steady increase in the level of physical qualities development);

- the principle of gradualness (gradual increase in the duration of classes and in the number and intensity of physical exercises) [13].

In our study, we used an aerobic type of exercise that involves large muscle groups, increases respiratory rate and heart rate. To determine the required heart rate during the exercise, we used the formula: maximum heart rate = 220-age, i.e. 65-80% of maximum heart rate – aerobic rhythm. The classes were held 3 times a week for 40-50 minutes, about 5 minutes of which were assigned to general organizing exercises; 3-4 minutes – combined-developing exercises; 12-15 minutes – dance exercises in aerobic mode: 12-15 minutes – strength exercises for different muscle groups; 7-8 minutes – stretching exercises (development of flexibility).

Since the absorption of glucose by muscles remains high for 48 hours after exercise, alternative exercise during holidays or weekends, when it is not possible to conduct classes with a teacher to students with type 2 diabetes in the gym, it was suggested to take walks in the fresh air at a brisk pace for 25-30 minutes to increase insulin sensitivity.

Each attended physical education class was registered by a physical education teacher.

According to the Chief Freelance Specialist of the Ministry of Health of Ukraine in the specialty "Dietology", Director of the "State Research Centre of Food Hygiene Issues of the Ministry of Health of Ukraine", Doctor of Medical Science. I. Shchegol: "Type 2 diabetes is a disease, the origin and progression of which is associated with an unhealthy lifestyle, in particular with an unhealthy diet. That is why, a balanced healthy diet, which will simultaneously contribute to the normalization of the patient's body weight, is an indispensable component of comprehensive treatment to diabetes management and prevent the development of its complications" [14].

Taking into consideration the abovementioned information, we also developed recommendations for healthy nutrition of students with type 2 diabetes, which were implemented by students as part of individual work (Table 2).

The main recommendations for healthy eating in diabetes were as follows:

Food and fluid intake (based on the observance of certain intervals between meals to reduce fluctuations and avoid blood sugar increase).

<b>Table 1.</b> Indicators of students'	physical	condition at the	beginning	g of the stud	y
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№ Research participant	Height	Weight	Gender	Age	Fasting blood sugar (mmol /kg)	Test 1	Test 2	Test 3	Test 4
Participant 1	157	63	female	17	7.2	39	11	44	7
Participant 2	163	74	female	17	8.6	37	13	46	10
Participant 3	159	69	female	18	7.4	32	8	39	6
Participant 4	172	84	female	18	8.1	29	13	45	8
Participant 5	159	57	female	17	7.5	44	15	48	11
Participant 6	167	75	female	17	7.6	42	11	42	16
Participant 7	178	81	male	18	8.3	35	24	40	3
Participant 8	172	85	male	18	6.5	42	26	50	6
Participant 9	180	94	male	18	8.9	28	15	39	0

#### Table 2. Healthy diet for type 2 diabetes

Time	Meals					
In the morning on an empty stomach	A glass of clean water					
20 minutes later	Breakfast (can consist of eggs and vegetables dishes or cereals with fresh vegetables or fruits).					
	During the entire period between breakfast and snack, the student must drink clean drinking water on request.					
3 hours after breakfast Snack (may consist of fruits or berries with a low glycemic index or fermented milk products or hot drinks with m (cocoa, coffee with milk, tea with milk without adding sugar))						
	During the entire period between breakfast and snack, the student must drink clean drinking water on request.					
3 hours after snack	Lunch (may consist of first courses (soups to taste except soups with cream) or porridge to taste with fresh vegetables and meat or fish to taste).					
	During the entire period between breakfast and snack, the student must drink clean drinking water on request. It is allowed to replace one portion of water with dried fruit compote to one's taste or berry juice (mors) or tea to one's taste without sugar.					
4 hours after lunch	Dinner (may consist of fresh, baked or stewed vegetables and meat or fish to taste)					
After dinner, it is allowed to drink clean water or herbal tea (mint, chamomile, wild rose).						

Selection of products (based on reduction or exclusion of products from the group of simple carbohydrates, giving priority to vegetables and fruits with low glycemic index, exclusion of products with added sugar, semi-finished products and processed meat).

Balanced nutrition as for macronutrients (proteins not less than 1 g/kg, fats – 0.8-1 g/kg, carbohydrates – 2-2.5 g/kg).

Sufficient amount of liquid (30 ml/kg in the warm seasons and 20 ml/kg in the cold seasons, 75% of which is clean water without the addition of any ingredients).

Refusal to drink alcoholic beverages.

The diet offered to students was advisory in nature. At the end of the research, the final test and fasting blood sugar test were carried out (Table 3).

#### DISCUSSION

Exercises have been considered one of the most effective treatments for type 2 diabetes for many years. Such therapy (diet and exercise) was defined as an effective one and was widely used by physicians in the nineteenth century [1, 15]. Therefore, with the development of new opportunities and technologies, it has become obvious that dosed exercises can be a therapeutic tool for the treatment of patients with

diabetes in combination with healthy nutrition and medical support [16]. There are studies that show that with lifestyle changing (weight loss, regular moderate dosed exercises) the development of diabetes can be stopped or removed in people with impaired glucose tolerance [3, 16].

The duration of the basic therapeutic methods and factors influence aimed at changing of physical condition indicators in positive dynamics plays an important role in choosing of certain therapy, a technique or the period of treatment. For this purpose, for our study, we have chosen both indicators that respond quickly to lifestyle changes (fasting blood sugar, body weight) and indicators that give long-term results (levels of physical development).

The final test of the physical condition of students with type 2 diabetes proved the effectiveness of the selected methods of physical training, development of physical qualities and healthy nutrition. Almost all participants experienced a significant weight loss (due to the exclusion of foods with high glycemic index from the diet, keeping to the diet and fluid intake) and increased levels of physical development (due to regular dosed exercise in aerobic mode). The changes in fasting blood sugar (Table 3) in students – participants in the study can be explained by the fact that endocrine glands improved and

Nº Research participant	Height	Weight	Gender	Age	Fasting blood sugar (mmol /kg)	Test 1	Test 2	Test 3	Test 4
Participant 1	157	60	female	17	6.6	42	12	47	9
Participant 2	163	68	female	17	6.0	44	13	48	12
Participant 3	159	65	female	18	5.9	42	10	45	10
Participant 4	172	83	female	18	7.9	31	13	46	9
Participant 5	159	55.6	female	17	5.8	46	15	48	14
Participant 6	167	74	female	17	7.1	43	11	45	16
Participant 7	178	78	male	18	6.9	39	28	45	5
Participant 8	172	81.2	male	18	5.7	46	30	50	7
Participant 9	180	92.8	male	18	8.2	31	16	42	0

Table 3. Indicators of the students' physical condition at the end of the research

glucose utilization increased due to regular dosed exercise; students' keeping to dietary recommendations provided a reduction of fluctuations in the level blood sugar during the day. Regarding the participants, whose indicators almost did not change (participants № 4 and №9), it was found out that these participants did not follow the proposed regime and recommendations for healthy nutrition. That is why their weight almost did not decrease, which negatively affected the ability to perform physical activity [17].

#### CONCLUSIONS

The aim of our study was to identify, select the methods and apply technologies to preserve the health of students with type 2 diabetes in the process of physical education in higher educational establishments.

Thus, in order to achieve this goal, we have analysed the professional literature, which is dedicated to the specifying the role of physical activity for students with type 2 diabetes during the educational process in higher educational establishments; we have determined the optimal type, intensity and complexity of exercises. It has been found out that the safest effect on lowering blood glucose, reducing the amount of excess weight and the level of physical qualities development in students with type 2 diabetes has an aerobic type of exercises that involves large muscle groups, increases respiratory rate and heart rate. It has been proved that these positive changes are possible only due to regular dosed exercise, as well as compliance with the regime and recommendations for healthy nutrition.

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#### **Conflict of interest:**

The Authors declare no conflict of interest

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## Influence of Physical Rehabilitation on the Restoration of Psychoemotional and Cognitive Impairment in Patients Suffered Cerebral Ischemic Stroke

Wpływ rehabilitacji fizycznej na korygowanie zaburzeń psychoemocjonalnych i poznawczych u pacjentów po udarze niedokrwiennym mózgu

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#### SUMMARY

**Aim:** To investigate the influence of physical rehabilitation on psycho-emotional and cognitive impairment in patients in a restoration period (3-6 months from the moment of disease) of a cerebral ischemic stroke.

**Materials and Methods:** Research was conducted on the basis of the department of vascular pathology and rehabilitation of the State Institution "Institute of Neurology, Psychiatry and Narcology of the National Academy of Medical Sciences of Ukraine".

Observations were carried out in 84 patients in a restorative period of cerebral ischemic stroke. Patients were divided into two groups. The main group included 43 patients who underwent a course of rehabilitation treatment and received drug therapy within secondary prevention. The comparison group included 41 patients who received only drug therapy for secondary prevention.

**Results:** In the course of the study, it was found that patients who underwent a course of restorative treatment with the use of drug therapy and physical rehabilitation programs received statistically significant improvement in the indicators of cognitive functions by the MMSE, MoCA scales, reduction of manifestations of psycho-emotional disorders that were confirmed by Beck and Spielberger-Khanin scales.

**Conclusions:** Physical rehabilitation of patients in the restorative period of cerebral stroke by ischemic type reduces the degree of expressivness of neurological manifestations, positively affects cognitive functions, contributes to reducing manifestations of depressive and anxiety symptoms, increases the functional capacity of the patient.

Key words: cerebral ischemic stroke, physical rehabilitation, cognitive impairment, psycho-emotional disorders

Słowa kluczowe: udar niedokrwienny mózgu, rehabilitacja fizyczna, zaburzenia poznawcze, zaburzenia psychoemocjonalne

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#### INTRODUCTION

Every year more than 17 million new cases of cerebral stroke (CS) is registered. According to WHO in the world, more than 62 million people with CS in anamnesis live. In many countries, a stroke ranks second among the causes of mortality from non-infectious diseases and second place among the causes of disability of the population [1-3].

Data from various studies indicate that only 10-20% of patients after CS can restore their efficiency and return to the usual lifestyle [4,5]. The most often causes of disabling persons who have suffered CS are language, psycho-emotional disorders and cognitive impairment [6]. Up to 71% of patients with consequences of SC suffer from cognitive impairment [7, 8].

Impairment of cognitive functions can take place in various periods, but most often this occurs in the first six months from the moment of the disease [9].

Psycho-emotional disorders that arise in these patients extremely negative impact on their adaptation to new living conditions and in general reduce the quality of life [10].

A.Maas and co-authors assert that physical activity is capable of influencing the regulation of neurotrophic growth factors, including a neurotrophic brain factor (brain-derived neurotrophic factor- BDNF). Consequently, it can be assumed that physical rehabilitation is capable of improving the state of cognitive functions and contribute to reducing psychoemotional disorders [11, 12].

#### AIM

The aim to investigate the influence of physical rehabilitation on psycho-emotional and cognitive impairment in patients in a restorative period (3-6 months from the moment of disease) of a cerebral ischemic stroke.

#### MATERIALS AND METHODS

84 patients (44 maleds and 40 females) aged 59 to 73 years old who suffered CS by ischemic type were included in the study. The study participants were treated in the department of vascular pathology of the brain and rehabilitation of the state institution "Institute of Neurology, Psychiatry and Narcology of the National Academy of Medical Sciences of Ukraine". In the process of observation, patients were divided into two groups depending on the type of treatment. The main group consisted of 43 patients who during the entire observation process underwent a course of physical rehabilitation and received drug therapy for secondary prevention of CS (antihypertensive, hypocholesterolemic, antithrombotic, sugar-reducing, etc.). The rehabilitation program consisted of kinesotherapy, ergotherapy, logotherapy. Classes took place 5 times a week, each of 3 hours duration. The general course of treatment was 21 days. For each patient, an individual rehabilitation program was developed taking into account his/her somatic state and the degree of manifestation of a neurological deficit.

The comparison group included 41 patients who received only drug therapy for the purpose of secondary prophylaxis of CS.

In order to solve the goal we used the following methods of research: clinical and neurological, psychodiagnostic and statistical.

The assessment of patients's health was taken twice: before and after completing the course of inpatient treatment.

The assessment of motor disturbance of patients was carried out using the medical research scales (Research Council Scale). The degree of functional activity of patients in everyday life by the Barthel (Barthel ADL Index, BI) was determined.

The assessment of the status of cognitive functions of patients was performed using the following scales: a mini mental state estimation scale (MMSE), Montreal Cognitive

Assessment, MoCA) scale. The study of psycho-emotional disorders was carried out using the following tests: State-Trait Anxiety Inventory (STAI), Hospital Anxiety and Depression Scale (HADS), Beck's scale (Beck Depression Inventory). To represent the measure of the central trend of sampling, we selected the median (Me) and the interquartile range [Q25%; Q75%]. The effectiveness of rehabilitation measures for the restoration of motor disorders was evaluated using  $\chi^2$ McNemar test with the Yates' (the difference was considered significant at p<0.05). The data of psychodiagnostic studies were treated by the method of variation statistics with the calculation of the average arithmetic and its error, and the reliability of the received results were determined using the Student criterion (the difference was considered reliable at p<0.05). Statistical analysis of the results was carried out using the Statistica 13.0 SO Ware (TIBCO, USA) program.

It is known that significant anxiety-depressed disorders can lead to temporary disorders of human cognitive functions. Taking into account this fact, patients with significant levels of anxiety and depression were not involved in order to accurately obtain data to the program.

The following patient selection criteria were applied:

- 1. An early recovery period of a cerebral stroke by ischemic type (from 3 to 6 months from the moment of a vascular accident);
- 2. The presence of one ischemic focus with localization in the right or left hemisphere of the brain, in the middle cerebral artery basin, which is confirmed by the data of clinical and neuroisualization studies;
- 3. Disorder of motor functions (hemiparesis);
- 4. Score by MoCA scale of  $\geq$  20 points;
- 5. Score by MMSE scale  $\geq$  24 points;
- Lack of significant manifestations of anxiety and/or depression by HADS scale (anxiety ≤ 10 points, depression ≤ 10 points).

The research was approved by Ethics Commission of Kharkiv Medical Academy of Postgraduate Education, according to the European bioethics and bio-rights, Helsinki Declaration of the World Medical Association.

#### RESULTS

Two studied groups of patients were comparable by gender, age, degree of functional activity (BI), degree of cognitive impairment (by the MMSE scale) and levels of anxiety and depression (by the HADS scale) (Table 1).

Indicator	Main group n=43	Comparison group n=41
Gender (males / females)	23/20	21/20
Age, years	65 [61;70]	66 [62;71]
Average score by Bartel index	50 [20;60]	55 [20;60]
Average score by MMSE scale	25 [24;26]	25 [24;27]
Average score of anxiety level by HADS scale	9 [8;9]	9 [7;9]
Average score of depression level by HADS scale	9 [8;10]	9 [8;9]

Indicator	Main group n=43				Comparison group n=41			
	before treatment		after treatmant		before treatment		after treatment	
	abs. number	%	abs. number	%	abs. number	%	abs. number	%
Expressed hemiparesis	15	34,9	8	18,6*	14	34.1	13	31,7
Moderate hemiparesis	25	58,1	28	65,1	24	58,6	25	61
Mild hemiparesis	3	7	7	16.3	3	7.3	3	7,3

Note: \* - p<0.05

Table 3. Indicators of activity level in everyday life (by Barthel index) in patients under study

Indicator	Main group n=43				Comparison group n=41			
	before treatment		after treatment		before treatment		after treatment	
	abs. number	%	abs. number	%	abs. number	%	abs. number	%
Full dependence on the environment	14	32,6	8	18,6*	12	29,2	11	26,8
Pronounced dependence on the environment	25	58,1	20	46,5*	25	61	24	58,5
Moderate dependence on the environment	3	7	11	25,6*	2	4,9	4	9,8
Mild dependence on the environment	1	2,3	4	9,3	2	4,9	2	4,9
Noto: * n < 0.05								

Note: \* – p < 0,05

Clinical manifestations of stroke in patients who participated in the study fully corresponded to localization of the lesion. Among patients of both groups persons who had motor disorders in the form of a moderate degree of expressiveness prevailed (58% of patients in the main group and 58.6% of the comparison group) in accordance with the Research Council Scale, 1984) (Table 2).

Prior to the course of inpatient treatment, 32.6% of patients in the main group and 29.2% of the comparison group were fully dependent on the environment; the pronounced dependence was in 58.1% and 61% of individuals respectively. At the end of the study it was established that reliable positive dynamics in the form of the decrease in dependence on the environment, was observed only in persons of the main group (p < 0.05) (Table 3). This was mainly due to the improvement of the state of motor functions (reduction of manifestations of paresis). Under the influence of rehabilitation treatment in the main group, the number of people who had pronounced hemiparesis (p < 0.05) was significantly reduced.

In the structure of changes in cognitive functions, among the people of both groups at the beginning of the study disorders of verbal memory and difficulties in calculating operations prevailed. There were problems with orientation, which were predominantly associated with amntic disorders. Most patients could not correctly call the day of the week and the date, much less often – a month and a year. At the end of the study, significant (p < 0.05) improvement of the state of cognitive functions was observed in patients who did course of physical rehabilitation. Positive dynamics was observed in the form of direct and deferred memorization, an increase in indicators of orientation and calculating operations (Table 4).

Taking into account the fact that the MMSE test may be «insufficiently sensitive" in the diagnosis of small (mild and moderate) disorders of cognitive functions in patients with past SC additionally the MoCA scale was used [13,14]. With the help of the MoCA test it was found that in the patients of both groups disorders of the visual-constructive activity of orientation and abstract thinking, manifestations of decrease in attention prevailed.

Upon completion of the study, the general score among the patients of the comparison group significantly has not increased (p>0.05), but in the patients of this group, there has been a significant improvement in the orientation function (p<0.05). After the completion of the rehabilitation course in patients of the main group there was a significant increase in the total average score by the MoCA scale – from 21.7±0.9 points to 24.4±0.7 points (p<0.05). A positive dynamics in such indicators as: executive skills, attention, orientation, deferred memorization and naming was noted (Table 5).

One of the tasks of the research was to study the features of psycho-emotional disorders in examined patients. At the beginning of the study in patients of both groups,

Main n=	group 43	Comparison group n=41		
before treatment	after treatment	before treatment	after treatment	
8,1 ± 0,2	8,8±0,1*	8,5 ± 0,3	8.7 ± 0,2	
4,8 ± 0,1	5,5 ± 0,3 *	5,1±0,1	5,4±0,2	
3,8±0,2	4,3 ± 0,1*	3.8 ± 0,1	3,9±0,2	
7,9 ± 0,2	8,3 ± 0,1	8,2 ± 0,2	8,3 ± 0,1	
24,6±0,3	26,9 ± 0,4*	25,6 ± 0,3	26,3 ± 0,3	
	Main ( n= before treatment 8,1 ± 0,2 4,8 ± 0,1 3,8 ± 0,2 7,9 ± 0,2 24,6 ± 0,3	$\before treatment after treatment \\ \hline before treatment after treatment \\ \hline 8,1 \pm 0,2 & 8,8 \pm 0,1^* \\ \hline 4,8 \pm 0,1 & 5,5 \pm 0,3^* \\ \hline 3,8 \pm 0,2 & 4,3 \pm 0,1^* \\ \hline 7,9 \pm 0,2 & 8,3 \pm 0,1 \\ \hline 24,6 \pm 0,3 & 26,9 \pm 0,4^* \\ \hline \end{tabular}$	$\before treatment after treatment before treatment \\ \hline $k,1 \pm 0,2$ $k,8 \pm 0,1^*$ before treatment \\ \hline $k,1 \pm 0,2$ $k,8 \pm 0,1^*$ $k,5 \pm 0,3$ \\ \hline $4,8 \pm 0,1$ $5,5 \pm 0,3 *$ $5,1 \pm 0,1$ \\ \hline $3,8 \pm 0,2$ $4,3 \pm 0,1^*$ $3.8 \pm 0,1$ \\ \hline $7,9 \pm 0,2$ $k,3 \pm 0,1$ $k,2 \pm 0,2$ \\ \hline $24,6 \pm 0,3$ $26,9 \pm 0,4^*$ $25,6 \pm 0,3$ \\ \end{tabular}$	

#### Table 4. Indicators of productivity of cognitive functions by the MMSE scale in patients under study

Note: \*-p <0,05

**Table 5.** Indicators of productivity of cognitive functions by the MoCA scale in patients under study

Indicator	Main <u>e</u> n=	group 43	Compariosn group n=41		
	before treatment	after treatment	before treatment	after treatment	
Executive skills	3,8 ± 0,2	4,4 ± 0,2 *	3,7 ± 0,2	3.9 ± 0,1	
Naming	2,5±0,1	2,8 ± 0,1 *	2,6 ± 0,2	2,8±0,3	
Attention	4,2±0,2	4,8 ± 0,2 *	4,2 ± 0,1	4,3±0,3	
Speaking	1,9±0,3	2,2 ± 0,2	2,1±0,2	2,2 ±0,2	
Abstract thinking	1,8±0,1	1,9 ± 0,2	1,6 ±0,2	1,8 ± 0,1	
Deferred memorization	3,6±0,1	4,0 ± 0,1 *	4,1±0,1	4,3 ± 0,1	
Orientation	3,9±0,2	4,4±0,1*	4,1±0,1	4,5 ±0,1*	
Total score, points	21,7 ± 0,9	24,4 ± 0,7 *	22,4±0,8	23,8±0,5	

*Note:* \* - *p* < 0,05

#### **Table 6.** Indicators of pathopsychological studies in the patients examined

Indicator	Main n=	group 43	Comparison group n=41		
	before treatment	after treatment	before treatment	after treatment	
Reactive anxiety (Spielberger-Khanin scale)	31,2±0,9	28,8±0,8*	32,3±0,8	30,5±0,6	
Personal anxiety (Spielberger-Khanin scale)	32,6±0,9	29,7±1,1*	32,9±1,1	30,8±0,9	
Depression (Beck's scale)	16,5±0,7	14,2±0,9*	17,1±0,8	16,2±0,7	

*Note:* \* − *p* < 0,05

the manifestations of reactive and personal anxiety were observed, which according to the Spielberger-Khanin scale corresponded to a moderate level of expressiveness (Table 6). In the end of the study in patients of the main group there was a decrease in the average score of reactive anxiety – from  $31.2\pm0.9$  to  $28.8\pm0.8$  (p<0.05), as well as average score of personal anxiety – from  $32.6\pm0.9$  to  $29.7\pm1.1$  (*p*<0.05). Upon completion of the study, patients of the main group had a low level of anxiety. In patients of the comparison group a reliable improvement in the form of decrease in anxiety level has not occurred (*p*>0.05).

A pathopsychological assessment of depressive disorders by the Beck's scale was carried out. At the beginning of the study, all patients had signs of depressive manifestations. The average score by the Beck's scale in the patients of both groups corresponded to the manifestations of moderate degree depression. Upon completion of the study, there was a significant reduction in the manifestations of depression to the level of a mild one only in patients who did course of physical rehabilitation.

#### DISCUSSION

The problem of CS is a socially meaningful. This is due not only to a high mortality rate from stroke, but also a significant level of disability of these patients. Today, the search for new methods of treatment of CS and methods of restoration of impaired functions continues.

The effectiveness of the use of methods of physical rehabilitation for the restoration of motor disorders in patients with the consequences of stroke is proved. At the same time, there are contradictory data regarding the positive effect of physical rehabilitation for the restoration of cognitive and psycho-emotional disorders that require further study.

In our opinion, regular physical activity can positively influence the processes of neuroplasticity, especially in the first six months since the vascular accident [15]. The results of studies of the neurotrophic factor BDNF - one of the biomarkers of neuroplasticity testify to in favor of it [11, 12]. Under the influence of regular physical loads there is a normalization of the BDNF level and thereby improving the state of cognitive functions and reduction of manifestations of psycho-emotional disorders.

The results of our study testify to the positive effect of physical rehabilitation for the restoration of moderate cognitive and psycho-emotional disorders in patients with consequences of CS.

#### CONCLUSIONS

- 1. It is established that the obligatory signs of the restorative period of ischemic cerebral stroke are a wide range of neurological disorders that include motor, cognitive, psycho-emotional disorders, which require their early detection and treatment.
- 2. The use of drug and non-drug (physical rehabilitation) treatment methods is optimal for the effective restoration of motor, cognitive and psycho-emotional disorders.
- 3. Physical rehabilitation in the restorative period of CS reduces the degree of severity of neurological manifestations, causes a positive impact on all major cognitive functions, contributes to the reduction of depressive and disturbing symptoms, increases the functional capacity of the patient.

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#### **Conflict of interest:**

The Authors declare no conflict of interest

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A – Research concept and design, B – Collection and/or assembly of data, C – Data analysis and interpretation, D – Writing the article, E – Critical revision of the article, F – Final approval of article

## Features of Physical Therapy of People with Endocrine System Pathology

### Elementy fizykoterapii osób z chorobami endokrynologicznymi

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#### SUMMARY

Aim: To check the effectiveness of the program of physical therapy of patients with type 1 diabetes.

**Materials and Methods:** The study involved 30 people (25-35-year-old women) with type 1 diabetes of moderate severity of the disease in the subcompensation stage, who were at the sanatorium stage of treatment. Patients, along with following a diet and insulin therapy, were engaged in physical exercises according to the author's program based on the Nordic Walking. Assessment of the impact of physical rehabilitation was performed on blood sugar level, heart rate, blood pressure.

**Results:** It is established that at the end of the experiment the blood sugar level of the EG patients significantly ( $p \le 0.05$ ) decreased by 0.8 mmol/l (7.54%), in contrast to CG, where the difference is 0.3 mmol/l (2.75%) and is unreliable ( $p \ge 0.05$ ). This indicates the effectiveness of the developed program of physical therapy for diabetic patients based on Nordic Walking classes in combination with traditional methods of treatment.

**Conclusions:** Nordic Walking classes for patients with type 1 diabetes help to increase insulin sensitivity, stabilize blood pressure, reduce the risk of developing coronary heart disease, increase immunity, expand the functional capabilities of the body, improve the well-being and psychoemotional state of patients.

Key words: physical therapy, diabetes, physical exercises, Nordic Walking

Słowa kluczowe: fizjoterapia, cukrzyca, ćwiczenia fizyczne, Nordic Walking

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#### INTRODUCTION

Type 1 diabetes mellitus or insulin-dependent diabetes is an endocrine pathology that most often occurs among under 30-40-year-old people. Type 1 diabetes is a severe somatic disease, the treatment of which requires strict diet, regular insulin therapy, exercise and mandatory medical supervision [1, 2]. Diabetes mellitus leads to early disability, mortality due to vascular complications, myocardial infarction, stroke, gangrene of the lower extremities and other complications [3].

The statistics show that more than 100 million people suffer from diabetes worldwide and in the future, despite the achievements of diabetology, scientists predict an increase of the incidence of diabetes. On average the number of patients doubles every 15 years [4]. Research [5, 6] show that in economically developed countries, the incidence of diabetes is 1.5-4% among the population. With age, the incidence of the disease increases, reaching 7-8% among people over 55 years old. Diabetes among obese people is 6-10 times more common than among people with normal body weight [7]. As of 1.01.2015, the number of registered patients with diabetes in Ukraine reached 1.221.300 people, which is 2.667.6 per 100 thousand of population. There is an increase in the prevalence of diabetes in Ukraine by 22% from 2010 to 2015. There is also a significant increase in the number of new registered cases of diabetes among the population of Ukraine: by 23.7% over the past 5 years [8].

Physical therapy is of great importance in the treatment of this disease. Specialists [9] define three main areas of physical therapy for diseases: motor activity, diet and insulin therapy. According to scientists [10] combining insulin with exercise leads to a more effective reduction in blood sugar levels. Therapeutic physical culture has a beneficial effect on the body of a person suffering from diabetes. With proper training and constant monitoring by a doctor, you can get rid of not only the side effects of the disease (metabolic disorders, obesity, etc.), but also normalize blood sugar. Also, physical therapy for diabetes stimulates tissue and muscle metabolism, reduces body weight, improves digestion, increases the absorption and consumption of sugar by muscles, increases the activity of enzymes responsible for the formation of energy from glucose, normalizes the acid-base balance [11, 12]. All this helps to reduce blood sugar and increase the body's tolerance to carbohydrates.

#### AIM

The aim is to check the effectiveness of the program of physical therapy of patients with type 1 diabetes.

#### MATERIALS AND METHODS

The study involved 30 people (25-35-year-old women) with 1 type diabetes of moderate severity of the disease in the subcompensation stage, who were at the sanatorium stage of treatment. The study participants were divided into two equal groups - experimental (EG) and control (CG), including 15 women each. The research was conducted on the basis of the sanatorium "Berezovyi Hai" (Khmilnyky, Ukraine) in 2020. The results were processed at the Department of Biology, Human Health and Physical Rehabilitation of Berdyansk State Pedagogical University (Berdyansk, Ukraine). Patients of CG were treated with strict adherence to the developed diet and regular insulin therapy without performing physical exercises according to the traditional program of a health-improving institution. Patients of EG, in addition to the listed methods of treatment, were engaged in physical exercises according to the program based on Nordic Walking (the duration of each class is 40 minutes). The number of classes per week is 5. The duration of the course of physical rehabilitation is 3 weeks. Assessment of the impact of physical rehabilitation means was carried out according to the following indicators: blood sugar level, heart rate, blood pressure. The results of previous studies of patients of EG and CG showed that each of the patients had a significant increase in blood sugar levels, heart rate and blood pressure fluctuated within the normal range. There were no significant differences in blood sugar, heart rate and blood pressure among patients in both groups.

The research methods: theoretical (analysis and generalization of literature (22 sources from the databases Scopus, PubMed, Web of Science Core Collection were analyzed), sociological methods (study of case histories), medical and biological methods (determination of blood sugar level), pedagogical observations, experiment, methods of mathematical statistics (statistical analysis was performed using Student's t-test). This study followed the regulations of the World Medical Association Declaration of Helsinki – ethical principles for medical research involving human subjects. Informed consent was received from all individuals who took part in this research.

#### RESULTS

Analysis of existing physical therapy programs for patients with type 1 diabetes showed that the aim of physical therapy is to reduce blood sugar level and improve the quality of life, but traditional means of physical rehabilitation do not effectively affect the compensation of the disease, so we developed a physical therapy program in which, in addition to traditional means of therapeutic physical culture, Nordic Walking was used. Nordic Walking is very easy to perform, and improving overall well-being, increasing muscle performance helps to avoid complications, increase performance, while not causing physical overload. The objectives of the author's program have been defined as: achieving compensation for diabetes (reducing the use of insulin dose); increasing muscle tone and performance; normalization of body weight; prevention of acute and chronic complications in diabetes mellitus; improving the psychoemotional state; improving the activity of the central nervous system; activating blood and lymph circulation in the extremities, redox and metabolic processes; stimulating the functions of the cardiovascular, respiratory and digestive systems; stimulating the functions of the pancreas, activating metabolism; increasing body tone and muscle performance.

The author's program included morning hygienic gymnastics and Nordic Walking. Morning exercises were performed after sleeping in the open air, with musical accompaniment. The main tasks of morning exercises were: waking up the body after sleep, raising the overall tone of the patient, bringing the body to a cheerful state. Complexes of morning hygienic gymnastics consisted of general development exercises, exercises with objects (Nordic sticks). Duration is 15 min. One of the advantages of Nordic Walking is the simple and natural technique of its implementation and unpretentiousness to the place and conditions of holding. The back is straight, the shoulders are straight and free. The movements are the same as with normal walking: the right leg and left arm work simultaneously, and vice versa. It must be remembered that hands with sticks in Nordic walking are not a support, but engines. Focusing on the stick and pushing it makes walking more rhythmic and energetic. The hand should be squeezed around the stick when the hand goes forward, and unclenched when the hand goes back; the foot should be lowered first on the heel, then on the toe.

The results of the study of blood sugar, heart rate and blood pressure (systolic and diastolic) indicators among patients with EG and CG during the experiment period are presented in Table 1.

The blood sugar level among patients with both EG and CG before rehabilitation measures was higher than normal among each of the patients, and the average value at the beginning of the study was 10.9 mmol/l in CG and 10.6 mmol/l in EG. Upon repeated examination, this indicator decreased unreliably in CG by 0.3 mmol/l (2.75%, p≥0.05), and in EG – reliably by 0.8 mmol/l (7.54%, p≤0.05). That is, after carrying out rehabilitation measures in accordance with the program of the health-improving institution, there were

n								
P								
≤0.05								
≥0.05								
≥0.05								
≥0.05								
≥0.05								
≥0.05								
Blood pressure diastolic, mm Hg								
≥0.05								
≥0.05								

Table 1. Dyna	amics of indicators of	patients with type 1	diabetes before and after rehabilitation measures (	Mean±SD,	n = 30	)
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Legend: Mean – arithmetical average; SD - standard deviation; p – the significance of difference between the indicators of EG and CG due to the Student's t-test

no significant changes in blood glucose levels in the CG, and sugar levels in the EG significantly decreased, which indicates the effectiveness of Nordic Walking classes according to author's program. Moreover, Nordic Walking did not worsen the well-being of EG patients, which indicates that heart rate and blood pressure indicators remained within the normal range. The results of repeated testing of patients with EG and CG at the end of the experiment showed that minor changes in heart rate and blood pressure occurred in both groups, but in EG, unlike CG, they were more pronounced. So, the author's program had a more positive effect on reducing blood sugar on the functional parameters of the cardiovascular system and contributes to improving the level of health and well-being of women with type 1 diabetes.

#### DISCUSSION

The XXI century has raised the problem of diabetes mellitus not only as a general biological problem, but also as a social one. This is due to the fact that this pathology ranks third (after atherosclerosis and cancer) among diseases that are the most common cause of disability and mortality [13]. In Ukraine, diabetes ranks second in the structure of endocrine diseases (31.88 %) after pathology of thyroid gland (46.67%) [8].

Scientists note that diabetes mellitus is an endocrine disease characterized by chronic hyperglycemia associated with absolute or relative insulin deficiency and develops due to the influence of various endocrine, immune, exogenous (stress, infection, smoking) factors or a combination of them [14]. This disorder is caused by a decrease in the production of the pancreatic hormone insulin. When this hormone is insufficient, the formation of glycogen decreases and the blood sugar content becomes higher than normal (hyperglycemia), and its utilization by tissues decreases and it begins to pass through the kidneys and is excreted in the urine. Among the main causes that lead to diabetes, scientists [2, 6, 7] distinguish: heredity, improper nutrition, obesity, chronic diseases, excessive alcohol consumption,

smoking, sedentary lifestyle, stress. Improper nutrition leads to the appearance of many diseases due to a decrease in the protective properties of the body, disrupts metabolic processes, leads to premature aging, reduced performance, weakens the body that is sensitive to negative influences [9]. Obesity is excessive deposition of fat, weight gain due to adipose tissue. According to the scientists [3, 5] the risk of developing diabetes due to obesity among women is much higher than among men, which is associated with the deposition of fat mass in the abdomen, waist, thighs.

The treatment of diabetes mellitus include the use of diet therapy to reduce carbohydrate intake. Diet therapy is an auxiliary measure and has an effective effect only in combination with insulin therapy. Diets and nutrition regime should be observed for all forms of diabetes mellitus and methods of its treatment [4, 8].

Therapeutic physical culture is a mandatory component of complex therapy in the treatment of diabetes mellitus. Dosed physical activity helps to regulate the mode of work and rest, which ensures a reduction of body weight to the optimal for an individual and control of energy consumption and energy expenditure [16]. Exercises stimulate skeletal muscle cells to apply more glucose from the blood, improves the state of the cardiovascular system, reduces the risk of disease, and also improves sleep, helps relieve depression and stress. Comparing physical activity with an additional dose of insulin, the scientists [17] note that physical exercises stimulate tissue and muscle metabolism, improve digestion; prevent the progression of atherosclerosis, maintain optimal blood circulation and respiration, normalize the emotional and mental sphere of the patient. The amount of physical activity plays an important role. It also matters at what indications of glucose in the blood the patient begins to exercise, what and how much he ate before, what is the body's readiness for exercise [18]. Experts believe that physical exercises involving large muscle groups at a slow and medium pace and with a significant number of repetitions cause an increase in oxidative processes in the muscles, so that not only glycogen is

consumed, but also glucose is consumed in the blood [10, 11]. Our program offered a combination of traditional methods of treating diabetes (diet and insulin therapy) and performing physical exercises based on Nordic Walking [19]. Nordic Walking, performed outdoors in forest and park areas, refers to active climate therapy. Active inhalation of clean fresh air saturated with phytoncides is provided, as a result of which the function of external respiration improves, and respiratory movements become deeper. The respiratory volume increases, and ventilation of the lungs improves. The respiratory act is rebuilt and becomes more effective. As a result, the oxygen pressure in the alveolar air increases and the blood saturation with it increases, which is called "oxygenation of the body" [20]. Unlike normal walking or running, the muscles of not only the legs and lower torso are involved, but also the muscles of the arms and upper torso, that is, almost all the muscles of the body, which leads to maximum activation of the so-called "muscle pump of the body", which reduces the load on the heart. A sufficiently large amount of muscle activity combined with its low intensity allows you to effectively train the cardiovascular system, as a result of which heart function improves, heart rate stabilizes. Nordic Walking works 90% of the muscles, because it is known that physical activity increases the absorption of glucose by working muscles, reduces the level of glycemia and the need for insulin. It consumes 50% more calories than with normal walking, which effectively affects the reduction and stabilization of body weight, as well as prevention of obesity. In addition, Nordic Walking is easy to use and does not require special facilities, so diabetic patients can practice it independently in parks, streets, squares, etc. [20].

#### CONCLUSIONS

- The author's program of physical therapy for patients with type 1 diabetes was developed, in which, in addition to traditional means of therapeutic physical culture, Nordic Walking was used. The main tasks of the author's program were to achieve compensation for diabetes (reducing the use of insulin doses); normalize body weight; improve psychoemotional state; stimulate the functions of the cardiovascular, respiratory and digestive systems; activate metabolism; increase body tone and muscle performance. The duration of the course of physical rehabilitation is 3 weeks, the duration of each lesson is 40 minutes, the number of classes per week is 5.
- 2. The effectiveness of the developed program was tested and it was found that Nordic Walking classes in combination with traditional methods of treatment had a positive effect on reducing blood sugar levels among patients of EG. At the end of the experiment this indicator significantly improved among EG by 0.8 mmol/l (7.54%, p≤0.05), in contrast to CG – the difference is 0.3 mmol/l (2.75%) and is unreliable (p≥0.05).
- 3. It was found that Nordic Walking classes among patients with type I diabetes mellitus are manifested by an increase in insulin sensitivity, stabilization of blood pressure, in-

creased blood flow in the coronary vessels of the heart, a decrease in the risk of developing coronary heart disease, increased immunity, expansion of the body's functional capabilities, improvement of well-being and psychoemotional state.

Prospects for further research encompass evaluation of the effectiveness of the author's program for physical therapy of older people (over 40 years old) with diabetes.

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#### **Conflict of interest:**

The Authors declare no conflict of interest

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Info

#### **INFORMATION FOR DOCTORS**



Viofor – The first, non-pharmacological medical device with a clinically proven immunocorrective action. The topic which served as the inspiration to perform the clinical assessment
 in the field of improving the immune system was the appeal of the European Commission (2020) to intensify the search for direct or indirect treatment methods for patients suffering from COVID-19. The therapeutic factor is the low-frequency and low-induction pulsed magnetic field, shaped as signals forming a multi-peak frequency spectrum in the Viofor JPS System.

Mechanism of action. The immuno-corrective effect occurs by stimulating the thymus-dependent maturation process of regulatory T cells and supplementing deficiencies of this cell population in the immune system, as well as by lowering the concentration of pro-inflammatory factors (interleukin 1beta, IL-1β) and increasing anti-inflammatory factors (interleukin 10, IL-10), improving defensive performance of the immune system.

Immunological tests included the following parameters: proinflammatory cytokine concentration, anti-inflammatory and immunoregulatory cytokine concentration, immunological competence parameters of T lymphocytes (number and activity level of regulatory T lymphocytes), immunogenic activity of monocytes and selected cytokines, level of melatonin after surgery.

Viofor is the first medical device with effect immunocorrective effect and a non-pharmacological method of improving the immunity. Viofor's magnetic field of low frequency stimulates the thymus-dependent maturation process of T lymphocytes, decreases the concentration of pro-inflammatory factors (interleukin 1beta, IL-1β) and increases the anti-inflammatory factors (interleukin 10, IL-10) improving the defensive efficiency of the immune system. An important confirmation of the immunocorrective mechanism of Viofor JPS magnetostimulation is the immunotropic interaction not only "in vivo" in relation to the whole organism, but also "in vitro" in relation to immune cells isolated from blood. Viofor's Magnetic field of magnetostimulation exerts an immunocorrective effect by improving the defensive functions of the immune system thus supporting the functioning of the immune system.

Based on the obtained results, it was found that the magnetic field stimulation of the Viofor JPS System improves thymus-dependent maturation process of regulatory T cells and supplements deficiencies of the cell population in the immune system, as well as by reducing the concentration of proinflammatory factors (interleukin 1beta, IL-1β) and an increase in anti-inflammatory factors (interleukin 10, IL-10), improving the defensive efficiency of the immune system.

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# Dance and Motor Therapy in the Physical Rehabilitation Program of Teenagers with Childhood Cerebral Palsy

Taniec i terapia ruchowa w programie rehabilitacji fizycznej młodzieży z mózgowym porażeniem dziecięcym

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#### SUMMARY

**Aim:** The purpose of the study was to prove the effectiveness of dance and movement therapy in the program of physical rehabilitation of teenagers having cerebral palsy and level III-IV of motor development.

**Materials and Methods:** The following research methods were used during the study: theoretical analysis and generalization of scientific and methodological sources as to the research topic, pedagogical methods (pedagogical observation), clinical research methods: gross motor functions classification system (GMFCS), manual ability classification system (MACS), which is classification system of child's ability to manipulate objects in everyday activities, muscle tone assessment scale – a modified Ashworth scale, synthesis of examination cards and dynamics of basic motor functions development of teenagers with cerebral palsy, and survey.

**Results:** Research and implementation of dance and movement therapy method was taking place on the basis of the Rivne Training and Rehabilitation Center "Special Child" for two years. The study involved 5 children aged 12-14 years: four girls and one boy. The children studied according to auxiliary educational program of 4-6 years of study. All of the children were diagnosed with cerebral palsy, spastic tetraparesis, having level III-IV of motor development according to gross motor functions classification system (GMFCS), having level IV (the child performs a limited number of exercises in adaptive conditions) according to manual ability classification system (MACS). The basis for the formation of the goal of our rehabilitation program was the biopsychosocial model of rehabilitation, which is the basis of the International Classification of Functioning. The program of physical rehabilitation involved dance and movement therapy and provided two vectors: physical and social ones.

**Conclusions:** The use of dance and movement therapy in the rehabilitation program contributed to the solution of the main tasks that ensured the formation of a harmonious, positive personality of teenagers with disabilities of level III-IV according to their motor development. The participation of the dance group in the cultural events of the school and the town contributed to the socialization of children with disabilities and the readiness of society to accept such persons as its important and necessary part. Parents were ready to cooperate as partners to achieve a positive result. Dance and movement therapy has improved the effectiveness of the physical therapy program as to all of the components of the International Classification of Functioning. This approach has created favorable conditions for a significant life quality improvement for both children and members of their families.

Key words: psychomotor disorders, limited mobility of joints, self-esteem, socialization, International Classification of Functioning

Słowa kluczowe: zaburzenia psychomotoryczne, ograniczona ruchomość stawów, samoocena, socjalizacja, Międzynarodowa Klasyfikacja Funkcjonowania

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# INTRODUCTION

One of the modern challenges is the need for maximum development of creative, physical, and intellectual potential of people with disabilities. The goal of every society is to create the most favorable conditions for the personal growth for people with disabilities. To achieve this goal, it is necessary to solve a number of problems: to provide an economic basis, to regulate the legislative basis, to provide educational services of high quality, to promote personal development for this category of the population. And, of course, it is necessary to promote the effective involvement of such people as equal members of society [1]. The basic task of rehabilitation of persons with the consequences of cerebral palsy involves the formation of vital competencies that in future will help them to have a high living standard.

A number of scientific researches, educational and methodical works cover effective methods of physical therapy, quality criteria of rehabilitation programs, means of rehabilitation, clinical guidelines of supervision, innovative technologies and therapies of children with cerebral palsy of early age, preschool age, and primary school age [2, 3]. All of these approaches involve, first of all, the treatment of motor deficit of children in this category. Therefore, the problem of people in puberty with motility disorders has not been studied enough. Puberty refers to critical periods of personality development [4]. During adolescence, physiological changes occur, the work of the hormonal system is activated, a person perceives himself as an independent part of society, seeks selfaffirmation in different ways [4]. In this case, the criterion of effectiveness is the formation of skills of capacity, independence, mobility and independence of the individual within the limits defined by the underlying disease. Teenagers with disabilities, accompanied by motor disorders, are significantly limited in participation in social activities, their involvement in various forms of life tasks is reduced. It is difficult for them to choose and implement the direction of development of their inborn abilities. This happens due to many factors: architectural, communication barriers, unwillingness of both normative members of society and people with limited mobility to interact in partnership and equality. It was studied [4] that age determines the greater severity of symptoms, according to the form of cerebral palsy, as well as complications of the basic nosology. Taking into account the classification system of large motor functions, children aged from 6 to 12 years, having level III-IV of motor development remain mainly at the level reached up to 6 years and move with the help of a wheelchair [5]. It becomes obvious that children with severe motor disorders, having the level III-IV of motor development and low intellectual abilities are significantly limited in the possibility of self-realization and self-improvement in the social environment.

Thus, the constant search for new methods and areas of physical rehabilitation of teenagers with motor disorders is an important and urgent task of a physical therapist.

#### AIM

Research hypothesis is to analyze the effectiveness of dance and movement therapy in the program of physical rehabilitation of teenagers with cerebral palsy, having level III-IV of motor development.

Objectives of the study:

- To study scientific and methodical resources on the research topic.
- 2. To analyze the methodology of dance and motor therapy of persons, having level III-IV of motor development.
- 3. To substantiate the need for dance and movement therapy in the program of physical rehabilitation of teenagers with cerebral palsy.

4. To investigate the influence of dance and motor therapy on the psychomotor development of teenagers with cerebral palsy, having level III-IV of motor development.

Expected results: the members of the dance group will improve the bilateral functioning of the hands, which will help them to master certain skills of life activities, in particular partial self-movement on a wheelchair and the use of hands during daily life tasks; the potential natural abilities of teenagers will be revealed to a greater extent to realize the secondary needs of the individual (according to Maslow's pyramid of needs); parents of adolescents will join the rehabilitation process as active participants of the project; the preconditions of mutual communication relations such as "personality with disability-social community" will be formed.

# MATERIALS AND METHODS

The following research methods were used during the study: theoretical analysis and generalization of scientific and methodological sources on the research topic, pedagogical methods (pedagogical observation), clinical research methods: gross motor functions classification system (GMFCS), manual ability classification system (MACS), which is classification system of child's ability to manipulate objects in everyday activities, muscle tone assessment scale – a modified Ashworth scale, synthesis of examination cards and dynamics of basic motor functions development of adolescents with cerebral palsy, and survey.

According to the conclusions of the ethics commission of the municipal institution of higher education Rivne Medical Academy, all research methods and their application comply with scientific, ethical, and clinical principles.

# RESULTS

If we consider the symptoms and stages of cerebral palsy, this complex of symptoms combines motor disorders of varying severity and localization, muscle tone, dysarthria as a form of speech disorders, cognitive disorders, ranging from mental retardation to profound mental disorders [6, 7]. Since the motivational component and the level of harassment in children with motor disorders is also reduced [8], there is no need for them to use the acquired skills in everyday life. Specialists [9] draw attention to the need to correct the psychological and emotional state of the parents of a child with special needs. Social deprivation is experienced by family members, because of the formation of a set of problems for a child with disorders, there is a number of problems for parents, and their quality of life is reduced [9].

However, a number of scientists and clinicians note the need of sensory enrichment of the space for persons with cerebral palsy for greater efficiency of the rehabilitation process [10-13].

Research and implementation of dance and movement therapy method was taking place on the basis of the Rivne Training and Rehabilitation Center "Special Child" for two years. The study involved 5 children aged 12-14 years: four girls and one boy. The children studied according to auxiliary educational program of 4-6 years of study. All children were diagnosed with cerebral palsy, spastic tetraparesis, having level III-IV of motor development according to gross motor functions classification system (GMFCS), having level III-IV (the child performs a limited number of exercises in adaptive conditions) according to manual ability classification system (MACS).

The selection criteria for participation in dance team were: the desire of children, their psychological and emotional capacity, readiness of parents to take teenagers to the lessons and performances. The children readily agreed to attend creative dance lessons as movement therapy. The parents of the children agreed to support these classes, to adhere to the class schedule and to take the children to the performances. Teachers and rehabilitation specialists of the "Special Child" center were their partners at dance, lessons because all of the teenagers moved on wheelchairs.

The basis for the formation of the goal of our rehabilitation program was the biopsychosocial model, which is the basis of the International Classification of Functioning (ICF). This strategy allowed to decide if it is possible to form or to compensate motor functions, how is it possible to modify the environment to maximize the independence of a child, to increase the content of leisure activities and to realize a favorite hobby, to determine which members of the interdisciplinary team will provide the best restoration of bodily functions.

Table 1 presents the results of initial rehabilitation examination of teenagers having cerebral palsy due to the components of ICF.

Our program of physical rehabilitation with the introduction of dance and movement therapy included two vectors: physical and social ones. The content of the physical component contributed to the improvement of mobility of body joints, improvement of hand functions, including accuracy, bilateral movements coordination, upper extremities coordination, visual and motor coordination, muscular tension reduction, own body awareness development, and training the ability how to control it, realizing bodily restrictions and resources, opportunities of its use, creating a positive "self" image. The social direction included children's participation in school activities, integration into urban cultural and artistic activities, self-esteem strengthening, positive self-esteem development, the level of harassment increasing, communication skills development, group work experience, achieving common goals through interaction, social communications development and improvement, own personality importance awareness.

The methodology of introducing dance and movement therapy was as follows: the learning process was divided into three nominal stages: initial – the acquaintance with the musical composition, general structure and idea of future dance, learning separate movements of dance exercises; basic – profound study of dance elements, their combination with music, this stage was filled with various movements, which were easy to make for participants having a motor deficit, intergroup interaction training; final – consolidation and improvement of dance performance. Frequency of lessons was twice a week; lesson duration was 30-40 minutes. Lessons were conducted both as individual and group ones. Compositions by P.I. Chaikovskyi, J.B. Strauss and A.L. Vivaldi were used as musical accompaniment.

Each dance lesson and movement therapy were based on a generally accepted structure, which included initial, basic, and final parts.

The task of the initial part, which lasted up to 15% of the total time of the lesson, was to prepare the child's body for further movements. For this purpose, there were used exercises for groups of small muscles, and there were exercises with gymnastic objects (stick, ball, hoop). The main part of the lesson lasted from 70 to 85% of the total time of the lesson. This part provided the formation and improvement of motor skills and abilities planned according to the dance composition, performing exercises accompanied by music. The following points were important: accuracy, smoothness of movements and their compliance with the musical rhythm, coordination of hands and head movements, group movements synchronicity. The duration of the final part of the lesson was from 3 to 7% of the total time of the lesson; it provided a gradual reduction of physical and emotional activities, a gradual calming down of all participants. Exercises were used to relax muscles and to regulate breathing.

Table 2 presents the results of a control rehabilitation examination of teenagers, having cerebral palsy due to the components of ICF. The analysis of these results shows positive changes for teenagers as to all components of International Classification of Functioning.

To assess the function of the hand, including its dexterity, the dominant hand determination, visual and motor coordination, accuracy of movements, we used the "The Box and Block Test", which is simple, fast, reliable, and valid. The goal of the test is to determine the number of wooden blocks that the patient can transfer upon a partition from one half of the box to the other in one minute. Table 3 presents a consolidated monitoring of hand function results after dance and movement therapy implementation. The results of testing show, that during the control examination it was recorded that teenagers' hand functions were much better at the end of the therapy than at the beginning.

To identify the formation of the ability to move independently with the help of rehabilitative and assistive devices (RAD) and this function improvement dynamics, we used a 10meter walk test (10MWT). The 10-meter walk test allows to measure the maximum gait speed in meters per second for a short time. Table 4 presents a summary of the effectiveness of self-motion speed testing using the rehabilitative and assistive devices. There is an obvious improvement in the ability to move, in particular, teenagers can partially use both walkers for independent walking for short distances, and a wheelchair. Although the performing of such movements requires verbal, visual, and physical aid of an assistant, the motivation of teenagers to improve these activities is obvious.

Therefore, the analysis of the effectiveness of dance and movement therapy confirms that this technique effectively affects the development of general and fine motor skills,

Participants	Structures and functions	Activity and participation	Environmental factors	Emotional sphere
Girl, 12 years old, Anastasiia	According to the Gross Motor Function Classification, 2007 – level IV of motor development; violation of postural control; arm muscle tone – 3 points. MACS – level IV, the function of gra- sping objects by both hands is limited; frequent diseases of the respiratory system.	The NRC attendant, she is present at the lessons, she is a passive observer of scho- ol events. Productive functioning of hands only by "hand in hand" method. The skills of daily activity are not formed.	She is in a wheelchair and needs an assistant.	According to the psychologist's examination, the level of claims and emotional and volitional sphere is reduced.
Girl, 12 years old, Kateryna	According to the Gross Motor Function Classification, 2007 — level III of motor development; arm muscle tone — 2 points. MACS — level III.	The NRC attendant, she is present at the lessons, she is a passive observer of scho- ol events. Functioning of hands is limited, skills of daily activity are formed partially – eats herself using a spoon.	She walks with the help of walkers within the classroom, she needs the support of an assistant. To go for long distances she requires a wheelchair, and an assistant accompaniment.	According to the psychologist's examination, the level of claims and emotional and volitional sphere is reduced.
Girl, 14 years old, Yevheniia	According to the Gross Motor Function Classification, 2007 – level IV of motor development; violation of postural control; arm muscle tone – 3 points. MACS – level IV, the function of grasping objects by both hands is limited.	The NRC attendant, she is present at the lessons, she is a passive observer of scho- ol events. Productive functioning of hands only by "hand in hand" method. The skills of daily activity are not formed.	She is in a wheelchair and needs an assistant.	According to the psychologist's examination, the level of claims and emotional and volitional sphere is reduced.
Girl, 13 years old, Hanna	According to the Gross Motor Function Classification, 2007 — level III of motor development; arm muscle tone — 2 points. MACS — level III, the function of grasping objects by left hand is limited.	The NRC attendant, she is present at the lessons, she is a passive observer of school events. Productive functioning of hands only by "hand in hand" method. The skills of daily activity are not formed.	She walks with the help of walkers within the classroom, she needs the support of an assistant. To go for long distances she requires a wheelchair, and an assistant accompaniment.	According to the psychologist's examination, the level of claims and emotional and volitional sphere is reduced.
Boy, 13 years old, Maksym	According to the Gross Motor Function Classification, 2007 – level IV of motor development; violation of postural control; arm muscle tone – 3 points. MACS – level IV, the function of gra- sping objects by both hands is limited; hand tremor.	The NRC attendant, she is present at the lessons, she is a passive observer of scho- ol events. Productive functioning of hands only by "hand in hand" method. The skills of daily activity are not formed.	She walks with the help of walkers within the classroom, she needs the support of an assistant. To go for long distances she requires a wheelchair, and an assistant accompaniment.	According to the psychologist's examination, the level of claims and emotional and volitional sphere is reduced.

Table 1. Primary rehabilitation examination of teenagers with cerebral palsy due to the components of ICF

socialization of rehabilitators, and the development of positive personality traits.

It is also important to form the therapy quality criteria, to improve the methodology of intervention, to increase the number of participants in the presented project activities to identify statistical reliability.

# DISCUSSION

If we consider the effectiveness of the rehabilitation program with the use of dance and movement therapy, it is worth noting the results we have achieved: the formation of a stable emotional sphere, the development of personal qualities, the integration into the social environment, a movement optimization, the development of creative potential, and inborn abilities and predispositions. The teenagers, experiencing unusual forms of movements, began better to understand their limitations and resources.

However, the research of dance and movement therapy effectiveness as a means of physical rehabilitation requires more routine and duration, systematization of techniques and variations, as well as more rehabilitators involved.

# CONCLUSIONS

Analyzing the scientific and methodological sources as to the rehabilitation of people, having cerebral palsy, we can argue the fact, that the physical rehabilitation of children with the consequences of this pathology, is fully presented. However, there are not enough publications about the formation of

Participants	Structures and functions	Activity and participation	<b>Environmental factors</b>	Emotional sphere
Girl, 14 years old, Anastasiia	According to the Gross Motor Function Classification, 2007 – level IV of motor develop- ment; violation of postural control; arm muscle tone – 3 points. MACS – level IV, the function of grasping objects by both hands is limited; frequent diseases of the respiratory system.	Participation in school concerts, the All-Ukrainian festival "Together we can do more", the town holiday "Museum feasts", events of the charity organization "On the wings of faith", the international festival "Theater of a special actor", creative team "Step". There was form an ability to drink from a cup by herself and to use a spoon while eating.	Within the classroom and the building she mo- ves in a wheelchair by herself, on the street-road area she needs the support of an assistant.	She insists on visiting a hairdresser, she expresses a desire to use cosmetics. Teachers note the development of initiative, a sense of community, mutual assistance and diligence.
Girl, 14 years old, Kateryna	According to the Gross Motor Function Classification, 2007 – level III of motor develop- ment; arm muscle tone – 2 points. MACS – level III.	Participation in school concerts, the All-Ukrainian festival "Together we can do more", the town holiday "Museum feasts", events of the charity organization "On the wings of faith", the international festival "Theater of a special actor", creative team "Step". There was form an ability to drink from a cup by herself and to use a spoon while eating.	She walks with the help of walkers within the classroom. To go for long distances she requires a wheelchair and moves by herself.	She constantly visits the hairdresser. Teachers note the development of initiative, diligence.
Girl, 16 years old, Yevheniia	According to the Gross Motor Function Classification, 2007 – level IV of motor develop- ment; violation of postural control; arm muscle tone – 3 points. MACS – level IV, the function of grasping objects by both hands is limited.	Participation in school concerts, the All-Ukrainian festival "Together we can do more", the town holiday "Museum feasts", events of the charity organization "On the wings of faith", the international festival "Theater of a special actor", creative team "Step". She attends "Euro-art" club, where she is engaged in art.	Within the classroom and the building she mo- ves in a wheelchair by herself, on the street-road area she needs the support of an assistant.	She asks to visit a hairdresser, a manicurist, she began to use cosmetics. Teachers and parents note the development of a sense of self- importance, the need to help others, diligence.
Girl, 15 years old, Hanna	According to the Gross Motor Function Classification, 2007 – level III of motor development; arm muscle tone – 2 points. MACS – level III, the function of grasping objects by left hand is limited.	Participation in school concerts, the All-Ukrainian festival "Together we can do more", the town holiday "Museum feasts", events of the charity organization "On the wings of faith", the international festival "Theater of a special actor".	She walks with the help of walkers within the classroom and the building. She needs an assistant in the yard. She needs a wheelchair to travel long distances.	She constantly visits the hairdresser, she expressed a desire to use cosmetics. Teachers note the development of initiative, a sense of community, mutual assistance and diligence.
Boy, 15 years old, Maksym	According to the Gross Motor Function Classification, 2007 – level IV of motor development; violation of postural control; arm muscle tone – 3 points. MACS – level IV, the function of grasping objects by both hands is limited; hand tremor.	Participation in school concerts, the All-Ukrainian festival "Together we can do more", the town holiday "Museum feasts", events of the charity or- ganization "On the wings of faith", the international festival "Theater of a special actor".	She walks with the help of walkers within the building, she needs the support of an assistant. She needs a wheelchair to travel long distances.	Teachers note the development of initiative, self-confidence, a sense of community, diligence. Parents draw attention to the importance of expected performances and care for his own health.

Participants	The number of blocks at t	the beginning of therapy	The number of blocks at the end of therapy	
	Dominant hand	Auxiliary hand	Dominant hand	Auxiliary hand
Girl Anastasiia	14/min	6/min	18/min	12/min
Girl Kateryna	12/min	7/min	20/min	17/min
Girl Yevheniia	9/min	2/min	16/min	10/min
Girl Hanna	12/min	2/min	22/min	12/min
Boy Maksym	11/min	7/min	20/min	17/min

#### Table 3. Evaluation of "Box and Block Test" results

**Table 4.** Evaluation of "10-meter walk test" results

Participants	Speed of self-motion at the beginning of therapy	Speed of self-motion at the end of therapy
Girl Anastasiia	3 min with both hands – on a wheelchair	1 min with both hands – on a wheelchair
Girl Kateryna	2 min with both hands – on a wheelchair	1 min with both hands – on a wheelchair; 2 min – with the help of walkers. Requires support of an assistant.
Girl Yevheniia	Self-motion is impossible	3 min with both hands – on a wheelchair;
Girl Hanna	5 min with right hand — on a wheelchair	1 min with both hands — on a wheelchair; 2,5 min. — with the help of walkers. Requires support of an assistant.
Boy Maksym	2 min with both hands – on a wheelchair	0,5 min. with both hands - on a wheelchair; 1 min – with the help of walkers.

motor potential, content of leisure and hobbies development for teenagers, having level III-IV of motor deficit. It is obvious that the primary life needs for children and teenagers, having motor disorders, are satisfied. For the realization of secondary needs, which are considered by the specialists as social ones, there is not always such opportunities and activities in which people with motor deficit will be able to achieve certain successes.

The use of dance and movement therapy in the program of physical rehabilitation served to solve such basic tasks as: creating optimal conditions for reducing orthopedic complications of cerebral palsy, and the frequency of respiratory diseases, psychomotor qualities improvement; coordination, visual and motor abilities improvement, creative potential preconditions development, society integration.

The participation of the dance group in the cultural events of the school and the town contributed to the socialization of children, having disabilities, and the readiness of society to accept such persons as an important and necessary part of society. Parents were ready to work together as partners to achieve a positive result that is relevant for their family and children, and they have become experts and co-authors in the development of dance therapy programs. All these components ensured the personality formation of teenagers, having level III-IV of motor development disabilities.

This technique allowed to improve the effectiveness of the physical therapy program due to all components of International Classification of Functioning: structure and function, activity and participation in everyday life, environmental factors. This has created favorable conditions for a significant improvement of life quality for both children and members of their families.

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Research and implementation of the method of dance and movement therapy took place on the basis of Rivne Training and Rehabilitation Center «Special Child».

# Conflict of interest:

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Info

# POLISH ASSOCIATION OF HEALTH RESORT PATIENTS

On the initiative of Professor Irena Ponikowska, the Polish Association of Health Resort Patients was established in 2019. The Association aims to integrate patients using health resort treatment, increase the availability of health resort treatment for subjects in need, improve the quality of services provided in the health resort treatment sector, cooperate with doctors and health resort treatment facilities, and involve in patient education.

Each member of the Association will be able to benefit from discounts in fees for stay and treatment, during commercial stays in selected health resort treatment facilities, and take part in conferences, workshops, and consultations organized by the Association.

Natural and legal persons may be members of the Association. Membership in the Association for natural persons is free, whereas legal persons may become supporting members.

We invite both patients and companies operating in the field of health resort medicine to work together.

Please visit the website of the Association udrowiskowi.eu where you will find more information as well as a declaration of joining the Association.

The Board of the Polish Association of Health Resort Patients

# Comparative Analysis of 1470 nm and 1940 nm Wavelengths in Endovenous Laser Ablation of Large Diameter Great Saphenous Vein

Analiza porównawcza długości fali 1470 nm i 1940 nm w wewnątrznaczyniowej ablacji laserowej żył odpiszczelowych o dużej średnicy

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#### SUMMARY

Aim: To compare pathomorphological changes in the venous wall of large diameter great saphenous veins (GSV) after endovenous laser ablation (EVLA) using wavelengths of 1470 nm and 1940 nm.

**Materials and Methods:** We studied 120 specimens of great saphenous veins from 30 patients with chronic venous disease with largediameter (>1 cm). Patients were randomly divided into two groups. The 1<sup>st</sup> group received EVLA using wavelengths of 1470 nm, the 2<sup>nd</sup> group received EVLA using wavelengths of 1940 nm. Four specimens were taken at the level of the lower third of the thigh after laser coagulation in each patient. Vein specimens were processed for histological studies. Both qualitative and quantitative analyses were performed to assess the degree of wall changes.

**Results:** The share of satisfactory results when using 1470 nm laser wavelengths is 83.3%, while when using 1940 nm laser wavelengths this result is 93.3%. When using both wavelengths of laser irradiation with a GSV diameter of more than 1 cm, no unsatisfactory results are observed.

**Conclusions:** Obtained in our study data confirmed efficacy of the 1470 and 1940 nm endovenous laser ablation in the treatment of the large size GSV (more than 10 mm). Histological exams show preferability in the 1940 nm EVLA versa 1470 nm, considering the excellent result in the uniformity of distribution and safety in the deepness of the thermal injury.

Key words: endovenous laser ablation, chronic venous disease, large diameter great saphenous veins, 1470 and 1940 nm wavelengths, laser thermal injury

Słowa kluczowe: wewnątrzżylna ablacja laserowa, przewlekła choroba żylna, żyły odpiszczelowe o dużej średnicy, długość fali 1470 i 1940 nm, laserowe uszkodzenie termiczne

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# INTRODUCTION

Introduction of the endovenous laser ablation (EVLA) in the surgery practice leads to improvement of the clinical outcomes in treatment of chronic venous disease [1-3]. During the COVID-19 pandemic mortality rates due to venous thrombosis tended to grow [4].

There are retrospective cohort studies reporting that the risk of developing deep vein thrombosis was significantly increased among adults with chronic venous disease [5]. Similarly, Wu N.C. et al. [6] population-based study showed that the presence of chronic venous disease is a risk factor for venous thromboembolism and correlates with an increased risk of mortality in patients. Venous thromboembolism is the main disease burden worldwide, with an estimated 10 000 000 cases per year [7].

Considering the existence of a direct relationship between thrombosis and great saphenous veins (GSV) morphology and sizes, accessibility for the non-invasive outpatients' surgery approach becomes more significant [8, 9].

The advantages of this technique include high efficiency, ease of execution, minimal surgical trauma, rapid medical and social rehabilitation [1-3]. The use of the EVLA on large diameter veins (more than 10 mm) is especially relevant. In the postoperative period of treatment of large diameter GSV, patients are disturbed by large painful cords along the coagulated veins, paravenous infiltrates, risks of recanalization of welded veins. Literary wavelengths indicate that EVLA is less effective in GSV with a diameter of more than 10 mm. There is no generally accepted standard, so randomized clinical trials and deeper analysis of the effects of different wavelengths in the treatment of large veins are needed [10, 11].

#### AIM

The aim of this study is to compare pathomorphological changes in the venous wall of large diameter GSV after endovenous laser ablation using wavelengths of 1470 and 1940 nm.

# MATERIALS AND METHODS

All patients included in the study received informed consent to participate in accordance with the World Medical Association's Declaration of Helsinki (WMA Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects 2013). The study was approved by the Bioethics Commission of the Academic and Research Medical Institute of Sumy State University.

The study included 30 patients with chronic veins disease. The criterion for inclusion in the study was that the diameter of GSV>10 mm. It was determined at the level of the lower third of thigh using ultrasound the SonoScape S6 apparatus with an L741 linear probe (frequency range of 7-13 MHz) in the gray-scale B-mode.

The exclusion criteria were pregnancy or lactation, deep vein thrombosis, connective tissue diseases, oncology, and severe concomitant diseases.

The age of the patients ranged from 30 to 65 years, in average 50 ( $50,65\pm11,08$ ), women accounted for 86,7% (26). The duration of the disease varied from 7 to 20 years. Written consent was obtained from each patient after a full explanation of the purpose and nature of all procedures used. Patients were randomly divided into two groups according to the treatment

options: the  $1^{st}$  group (n=15) – EVLA with 1470 nm wavelength; the  $2^{nd}$  group (n=15) – EVLA with 1940 nm. The groups were formed in parallel in time and matched by age, sex and clinical CEAP classes (Table 1).

For EVLA, universal laser coagulators "Lika-surgeon" manufactured by OOO "Photonica Plus" (Cherkasy, Ukraine) with  $\lambda$ =1470 nm and  $\lambda$ =1940 nm were used. The irradiation power of 10 W and the fluence of 50 J/cm<sup>2</sup> were the same in both groups.

Puncture of the GSV was performed with a Vasofix Braun 14 G needle distal to the lower reflux limit, which was determined by preliminary ultrasound mapping. Under ultrasound control a light fibre with radial optics was passed in the antegrade direction to saphenofemoral junction (SFJ) up to the point of the first tributary vein discharge into the GSV. Local tumescent anesthesia was applied with Klein's solution with a calculated dosage (0.1% solution of lidocaine and sodium bicarbonate 5-10 ml per 1 cm of a vein length). The fibre was tractioned mechanically at an average speed of 1 mm/s. After the operation, the patients underwent compression therapy of the 2<sup>nd</sup> class of compression around the clock for 5 days.

For histological analysis 3 cm segment was taken just after the laser ablation at the variable levels in the thigh after the output GSV from under the superficial fascia. The segments were fixed for 24 hours with a 10% buffered formalin solution (pH = 7.0-7.2). Subsequently, the standard histological processing of the material was carried out. After dehydration, a fragment of a vein was embedded in paraffin in a carousel type "AT 1010 M". Despite of decreasing in tissue volume during fixation, the integrity of the morphological structures remained unchanged.

Histological examination was carried out on dewaxed sections 5x10 mm, with a thickness of 4 to 7 microns. 120 samples (4 sample from each vein) were stained with hematoxylin and eosin according to the standard technique. For light microscopy, a Carl Zeiss Primo Star light microscope (Germany, ZEISS Microscopy) was used.

The state of the venous wall, the nature of morphological changes, which was determined by the severity of the prevailing

	Gro		
Characteristic, units of measure	1 <sup>st</sup> group (n=15)	2 <sup>nd</sup> group (n=15)	P-value
Wavelength, nm	1470	1940	
Age, years	52.53±11.92	48.64±10.16	>0.05
Female, sex, n (%)	13(86.7)	13(86.7)	>0.05
CEAP clinical classification, n (%)			
(3	11 (73.3)	10 (66,7)	>0.05
C 4	4 (26.7)	5 (33.3)	>0.05
GSV diameter, mm	13.53±2.23	13.21±2.69	0.348
Subtotal reflux type, n (%)	6(40.0)	5(33.3)	>0.05
Common reflux type, n (%)	9(60.0)	10(66.7)	>0.05

#### Table 1. Demographic characteristics of groups

\*Values are presented as mean  $\pm$  standard deviation or number (%)

\*\*CEAP, Clinical, Etiology, Anatomy and Pathophysiology; GSV, great saphenous vein

pathological processes in the intima, media, adventitia, were assessed. The depth of pathomorphological changes in the venous wall and the length of the heat treatment perimeter were evaluated.

Statistical processing of the results was carried out using the standard package statistical programs "STATISTICA 10.0" and "MS Excel". For the obtained indicators the arithmetic mean (M) and standard error of the mean (m) were calculated. For rate the degree of significance of differences between the groups used a simple Student's t test (t).

# RESULTS

Qualitative analysis of the 120 venous wall samples from both groups showed various pathomorphological signs of a thermal damage of the vein walls.

Superficial damage to the endothelium, coagulation necrosis extending to the subendothelial layer, thermal damage to the muscle layer of the vein, microperforation, perforation with extensive zones of coagulation necrosis were examined.

Typical signs of varicose lesions were founded in the both groups: blurring of the boundaries between the membranes, myoelastosis and myoelastophibrosis, focal petrification, phenomena of elastolysis and phlebosclerosis, interfascicular fibrosis of the media, atrophy of muscle fibers and dystrophic changes or a focal absence of subendotelium.

In the 1<sup>st</sup> group, after EVLA with a wavelength of 1470 nm, histological examination revealed more profound changes in the vessel wall, including thermal injury to all layers. Significant loosening, degenerative changes in elastic and collagen fibers of the subendotelium were observed in the 10% slices. Areas of endotelium carbonization (charring) at the point of contact with the laser fiber were detected in 10% patients. In 73,3% of the slices foci of coagulation necrosis reached the media were present. 16,7% of the slices were characterised deep pronounced dystrophic-necrotic changes of all the layers (Figure 1).

Histological examination of the slices after 1940 nm laser ablation in the  $2^{nd}$  group revealed signs of varicose

vasodilation (myoelastosis and myoelastofibrosis) with continuous carbonization over the entire inner surface of the vein (Figure 2). Carbonization localized exclusively in the endothelial/subendothelial layers was detected in 8 slices (13.3%). Extension to the underlying tissues with moderate oedema, cells vacuolization, and a disorganization of elastic and collagen fibers were present in 48 slices (80.0%). Dystrophicnecrotic changes at the level of the adventitia were found in 4 slices (6.7%) (Figure 2).

No cases of tissue damages with extravasation were present in the both groups.

Quantitative histological analysis included assessment of the depth and perimeter of venous walls involving in the pathomorphological process.

The results were ranged based on injury depths and extension to evaluate the efficiency of EVLA with different wavelengths (1470 nm and 1940 nm):

Excellent, good, satisfactory, unsatisfactory – by the distribution of the pathological sings compare to the vessel perimeter (%);

Completely satisfactory, satisfactory, unsatisfactory – by the pathological sings extending into the layers of the vein wall.

The percentage of endothelium thermal injury compare to internal perimeter of the vein wall were categorized as following (Table 2):

- excellent result the range of 0,75-1,0% was founded in 60.0% of slices in the 1<sup>st</sup> group compare to 73.3% in the 2<sup>nd</sup>group;
- good result the range of 0,5-0,75% 33.3% in the 1<sup>st</sup> group (1470 nm) compare to 20.0% in the 2<sup>nd</sup> group (1940 nm);
- satisfactory result the range of 0,25-0,5% 6.7% in the 1<sup>st</sup> group (1470 nm) and 6.7% in the 2<sup>nd</sup> group (1940 nm);
- unsatisfactory result the range less than 0,25% no cases in both groups.

The depth of injury level was classified as satisfactory result if the thermal lesion is localized within the endothelium/ subendothelium, or endothelium/subendothelium and media.

Distribution of histological signs	1 <sup>st</sup> group	2 <sup>nd</sup> group	P-value
Wavelength, nm	1470	1940	
Number of slices, n	60	60	
Diameter of the GSV, mm	13.53±2.23	13.21±2.69	0.348
Perimeter, n (%)			
0,75 – 1,0	36(60.0)	44(73.3)	<0.05
0,5 - 0,75	20 (33.3)	12(20.0)	<0.05
0,25 - 0,5	4 (6.7)	4(6.7)	>0.05
<0,25	0	0	
Deepness, n (%)			
Endothelium	6 (10.0%)	8 (13.3%)	<0.05
Endothelium + media	44 (73.3%)	48 (80.0%)	<0.05
Endothelium + media+adventitia	10 (16.7%)	4 (6.7%)	<0.05
Extravasation	0	0	

Table 2. Results of the histological examinations of vein wall injures after 1470 nm and 1940 nm laser ablation

\*Values are presented as mean  $\pm$  standard deviation or number (%)

\*\* GSV, great saphenous vein



**Figure 1.** Histological examinations of the vein wall changes after 1470 nm laser ablation 1 – crater-like defect of the vessel wall, 2 – carbonization, 3 – focus of necrosis, 4 – edema, 5 – parietal thrombus. Staining with hematoxylin and eosin. Magnification: A×40, B×100, C×400



**Figure 2.** Histological examinations of the vein wall changes after 1940 nm laser ablation 1 - carbonation, 2 - edema, 3 - looseness of connective tissue fibers. Staining with hematoxylin and eosin. Magnification: A×40, B×100, C×400

If a thermal lesion was detected by all the venous layers, a result was considered as unsatisfactory.

Signs of stable endothelium carbonization, disorganization and necrotization of collagen and elastic fibers along the entire perimeter within the endothelium or endothelium + media, categorized as completely satisfactory, were presented by 93.3% in the 2<sup>nd</sup> group and 83.3% in the 1<sup>st</sup> group.

The above characteristics, spreading into all the layers without extravasation, were categorized as unsatisfactory: in the 1<sup>st</sup> group, satisfactory results were detected by 16.7 %, in the 2<sup>nd</sup> group – 6.7 %. There were no unsatisfactory results in both groups – no cases of tissue damage with extravasation (Table 2).

Endolumenal thermal trauma led to the representing of the mixed blood clots, loose fibers of the subendothelial layer and necrotic-desquamative masses into the lumen. Postablation deformity of the inner surfaces and adhesion of the parietal parts of vessels were founded in slices of the both groups. In some slices of the 2<sup>nd</sup> group, the lumen of the vessels was not determined, due to adhesion of the opposite wall's intima.

## DISCUSSION

The purpose of EVLA is to cause irreversible damage to the vessel wall, which will ensure permanent occlusion of the incompetent vein. Laser energy, which is transmitted through a flexible light guide to the operating area, causes thermal ablation, vaporization and carbonization of the lumen compound (plasma, blood cells) and vein vessel wall, leads to a photothermal burn of the endothelium and adhesion of the vessel walls, and its degeneration over time into a fibrous cord. Laser devices with predominant liquid water absorption are more efficient than those targeting haemoglobin as a chromophore target. The non-invasive chronic vein disease treatment recently focuses on using the longest wavelengths lasers, including 1940 nm and 1470 nm [12, 13].

Now-days debates include discussion of the upper limit GSV to provide complete obliteration after EVLA. It was accepted by a number of clinicians a value of 10, 12, 14,15 mm [14-16] as the upper limit for GSV diameter in endovenous thermal ablation.

Araujo WJB, Timi JRR, Kotze LR, Vieira da Costa CR [11] compared histological and immunohistochemical changes in GSV>10 mm after EVLA and LET (50 versus 100 J/ cm). They demonstrated achieving of GSV occlusion with less thermal damage to the intima, media, adventitia and perivasal tissues using 1940 nm versus 1470 nm diode laser.

To carry out a comparative assessment of efficiency of 1470 nm and 1940 nm EVLA in large diameter GSV treatment, we considered the development of uniform stable carbonization of the endothelium, disorganization and necrotization of collagen and elastic fibers as the basis for the subsequent development of persistent fibrosis at the next stages postablative inflammation.

We analysed deepness of morphological changes in the venous wall after EVLA using the following criteria: no thermal lesion, thermal lesion within the endothelium/subendothelium, thermal lesion within the endothelium and media, thermal lesion of all the venous layers.

We determined the uniformity of carbonization by the distribution of pathohistological signs of endothelium in percentage (%) of the total intima perimeter ranged as: 0,75-1,0%; 0,5 - 0,75%; 0,25-0,5%; less than 0,25% of the perimeter.

Results of our study demonstrate significant differences in histological picture of the GSV wall after laser ablation between the groups: the excellent result in the uniformity of a distribution of the thermal injury sings compare to the vessel perimeter were obtained in 73.3% in the 2<sup>nd</sup> group (1940 nm) compare to 60% in the 1<sup>st</sup> groups (1470 nm) (p<0,05). Completely satisfactory results in a thermal injury within the endothelium/ subendothelium and media layers were obtained by 93.3% after 1940 nm laser ablation in the 2<sup>nd</sup> group and 83.3% – in the 1<sup>st</sup> group with 1470 nm laser ablation.

# CONCLUSIONS

Obtained in our study data confirmed efficacy of the 1470 and 1940 nm endovenous laser ablation in the treatment of the large size GSV (more than 10 mm). Histological exams show preferability in the 1940 nm EVLA versa 1470 nm, considering the excellent result in the uniformity of distribution and safety in the deepness of the thermal injury.

# ETHICAL ASPECTS

The study was approved by the Bioethics Commission of the Medical Institute of Sumy State University.

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# Influence of the Amount of Students' Motor Activity on their Health Status and Psychophysical Readiness for Future Life

Wpływ aktywności ruchowej uczniów na stan zdrowia i gotowość psychofizyczną do przyszłego życia

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#### SUMMARY

**Aim:** To investigate the impact of the amount of students' motor activity on their health status and psychophysical readiness for future life. **Materials and Methods:** The research was conducted in 2019-2021. The study involved 420 students and 232 graduates of different years. 57 male students took part in the experiment aimed at studying the impact of the amount of motor activity on the health of students and their psychophysical readiness: 28 students were included to the experimental group, 29 students – to the control group. Research methods: theoretical analysis, questionnaires, testing, pedagogical experiment, statistical methods.

**Results:** It was revealed that an increase in the amount of practical (academic and extracurricular) classes to 12-14 hours per week for one year positively affected the state of health of students and their psychophysical readiness for life. In EG, in contrast to CG, the results of most fitness tests significantly improved. The number of students with a high level of health in EG increased by 28.6%, and in CG – by 3.4%. The number of EG students with low level of neuropsychiatric stability decreased by 32.2%, and in CG – by 6.6%.

**Conclusions:** Increasing the level of motor activity of students requires creation of a modern system of physical education of students, which should take into account their interests, motives and personality-oriented choice of the type classes. Classes should be organized in accordance with the level of physical fitness and health status of students.

Key words: motor activity, students, psychophysical readiness, physical education, health

Słowa kluczowe: aktywność ruchowa, studenci, gotowość psychofizyczna, wychowanie fizyczne, zdrowie

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# INTRODUCTION

Difficult economic conditions, political troubles, and the war in the East of Ukraine negatively affect the social status of students, their health, physical fitness, and psychophysical readiness for future life. At the same time, the modernization of the system of physical education of students in Ukraine according to European standards led to the closure of physical education departments, reduction of hours in the discipline "Physical education" and deterioration of the material and technical base of universities. Now in Ukraine, the natural biological need of students for motor activity does not meet the nowadays requirements, does not provide students with the necessary level of health, physical fitness, working capacity, scientifically based educational and physical culture and recreational health technologies that can be used by future specialists in their professional activity. There emerged a contradiction between the needs of the students' personality in ideological, spiritual, cultural, intellectual enrichment and physical improvement [1].

In addition, during the quarantine period caused by the COVID-19 pandemic, even greater restrictions arose, which led to the temporary closure of sports halls, sports complexes,

stadiums, cancellation and postponement of sports competitions, etc. Higher education institutions (HEI) switched to distance learning, which significantly increased the deficit of motor activity of students [2].

The system of physical education in Ukrainian HEI should cover the totality of all components that form and educate the student, interact in it, and depending on how coordinated individual and joint actions of students with the department of physical education are, the level of efficiency of functioning of this system will be revealed. One of the indicators of the effectiveness of the physical education system in HEI is the level of motor activity of students [3]. Motor activity is the main factor in maintaining and promoting health, it is a universal means of preventing diseases. Motor activity has a beneficial effect on the formation and development of all functions of the central nervous system, strength, mobility and balance of nervous processes, increasing mental resistance to stress [4, 5]. However, the problematic situation with the physical education of HEI students, which has developed nowadays in Ukraine, reinforced by the pandemic, requires further scientific research.

# AIM

The aim is to investigate the impact of the amount of students' motor activity on their health status and psychophysical readiness for future life.

# MATERIALS AND METHODS

#### PARTICIPANTS

The research was conducted in 2019-2021 at Polissia National University (PNU) and Zhytomyr Ivan Franko State University (ZHSU). 420 students took part in the survey, including 258 students (127 male, 131 female) from PNU and 162 students (73 male, 89 female) from ZHSU. In addition, 232 graduates of PNU from different years took part in opinion polls. 57 male students from PNU took part in the experiment aimed at studying the impact of motor activity in the amount of 12-14 hours per week during the academic year on the level of students' health and their psychophysical readiness: 28 students were included in the experimental group (EG), 29 – in the control group (CG).

#### PROCEDURE

The content of the practical section of physical education of EG students was enriched with the means that contribute to the improvement of the main systems (cardiovascular, respiratory, musculoskeletal) of the body and meet the interests of students and do not require additional equipment, and their influence can be quickly corrected in the educational process and during self-study classes. The content of physical training of EG students provided for the achievement of a certain level of development of physical qualities, the acquisition of motor skills and abilities that meet the requirements of future professional activity, contribute to the successful combination of training with physical education classes, and allowed students to successfully adapt to future life.

The main means of the practical section were physical exercises of various types: general development, therapeutic,

recreational, preventive, professional and applied, sports, rehabilitation. Exercises were also selected depending on the predominant manifestation of certain motor skills, namely: running, jumping, acrobatic, gymnastic, game, etc. The methods of physical training of students developed by us in the educational process allowed us to use exercises based on the structure of movements (cyclic, acyclic, mixed), on the predominant influence on the development of muscle groups, on the features of the muscle mode, on the intensity of work and energy supply mechanisms. All these means were included in the program of EG classes during the 2020-2021 academic year: to physical education classes according to the schedule; to morning hygienic gymnastics; to exercises that were performed during the day; to classes in sports sections; to self-study classes in free time. The CG was engaged in the current system of physical education according to the curriculum of PNU.

Physical fitness of students was assessed by the results of running 100 m, pull-ups on the crossbar, long jumps, push-ups, shuttle running 4 x 9 m, sit-ups, bending the torso forward. The level of students' health (high, satisfactory, unsatisfactory) was determined by the results of their self-assessment by conducting a survey. Psychological indicators of students, such as neuropsychiatric stability (NPS), were determined using the "Prognosis" method [6]. The NPS became more pronounced the more points a student scored on a scale from 1 to 10 points.

#### **RESEARCH METHODS**

Theoretical analysis, questionnaires, testing, pedagogical experiment, statistical methods. During the researches the authenticity of difference between the indicators of cadets by means of Student's t-test was determined.

#### ETHICAL APPROVAL STATEMENT

This study complies with the ethical standards of the Act of Ukraine "On Higher Education" No. 1556-VII dated 01.07.2014 and the Letter from the Ministry of Education and Science of Ukraine "On the Academic Plagiarism Prevention" No. 1/11-8681 dated 15.08.2018. Informed consent was received from all individuals who took part in this research.

#### RESULTS

The main tasks of forming the motor activity of students are to provide students with knowledge and form motivation for maintaining a healthy lifestyle and a desire for selfimprovement. It is important to develop students' skills and abilities to conduct independent daily physical exercises, using various forms of classes, conduct systematic physical training with a health or sports orientation, teach students to diagnose and correct formation of posture and regulate physical activity, etc. The solution of these problems is possible if individual and differentiated approaches are applied in the process of physical education, which are determined by the different composition of students in terms of interests, motives, preferences, physical development, physical fitness, health status, etc.

Studying the students' weekly time budget revealed their overall motor activity. The average data obtained by us for

The second states to the set of the	PNU (	n=258)	ZHSU (n=162)	
Types of physical activity	1st year	2nd year	1st year	2nd year
Scheduled physical education training sessions	1.2	1.2	1.2	1.2
Classes in sports sections and recreation groups	0.9	1.2	0.9	1.2
Self-study classes	1.7	1.9	1.7	1.9
Total	3.8	4.3	3.8	4.3

**Table 1.** Motor activity of students in the weekly time budget (n=420, %)

Table 2 . Analysis of motor activity of PNU graduates after graduation (n=232,%)

		Motor activity a		
Motor activity while studying at the university	Persons engaged in physical culture and sports	Persons engaged in fishing and hunting	Persons engaged in walking and cycling	Persons working in the kitchen garden and in the field
Physical education training sessions (n=169)	4.1	8.9	17.2	46.8
Training sessions, classes in sports sections, participation in sports competitions (n=63)	31.8	14.3	42.9	52.4

the weekly time budget of students is the trend of load distribution, which is consistently repeated throughout the week (Table 1). From the data obtained, it can be seen that the weekly time budget of students of the 1st and 2nd courses is largely aimed at expanding the reserves of activity of thought processes and intellectual activity, and is not aimed at achieving the necessary level of motor activity.

The norm of motor activity for students should be 14 hours (8.33 %) per week. The data obtained show that in general, students are in a state of physical inactivity, a reduced regime of physical activity. The formation and upbringing of students by means of physical culture and sports is a complex process with stable objective and subjective social qualities that develop in the educational process of higher education institutions, as well as under the influence of the social environment. The dynamics of students' motives and interest in physical culture and sports during their studies at the HEI shows that there are no significant changes in understanding of their importance for maintaining a healthy lifestyle, work and professional activities. Therefore, future specialists after passing the exam or graduating the HEI stop practicing physical exercises. Sociological studies conducted among PNU graduates have shown that only those students who were actively engaged in sports during their studies at the HEI continue doing physical exercises and sports, and try

to lead an active lifestyle during their professional activity (Table 2). This indicates that it is necessary to expand the opportunities of HEI for introducing new most popular sports and means of physical culture and recreation activities, and actively involve students to independent motor activity.

The survey of students showed that most of them are more or less dissatisfied with the system of organization of physical education, means, methods and material and technical equipment of sports halls, forms of conducting training sessions, their content and direction, and this, in turn, negatively affects the attitude to the educational process of physical education, independent physical exercises and physical culture and recreation activities during extracurricular hours. An even larger number of students are not satisfied with the organization and conduct of physical culture, recreation and sports events (Table 3).

To increase the level of physical activity of students, it is necessary, first of all, to improve the system of physical education in the HEI what regards developing software, scientific and methodological, regulatory and legal support, bringing educational standards and regulatory documents in line with new requirements and opportunities for the development of society. The criteria and standards for evaluating students in physical education, which will be taken into account in their professional activities, should be significantly revised and justi-

able 3. Students' satisfaction with the organization of	f physical education and ph	ysical culture and recreation activities during	g their studies at the HEI (n=420, %)
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Name of the UE	Turne of a busical		Su	ıbjective assess	ment of studer	its		
(number of students)	education classes	Sati	sfied	Partially	satisfied	Not satisfied		
		male	female	male	female	male	female	
PNU (n=258)	Practical exercises	67/52.8	73/55.7	43/33.8	38/29.0	17/13.4	20/15.3	
	Classes in the section	42/33.1	38/29.0	53/41.7	52/39.7	32/25.2	41/31.3	
ZHSU (n=162)	Practical exercises	46/63.0	57/64.0	19/26.0	21/23.6	8/11.0	11/12.4	
	Classes in the section	21/28.7	36/40.5	34/46.6	39/43.8	18/24.7	14/15.7	

Tests	Groups	Before the experiment	After the experiment	Relia of the d	bility ifference
				t	р
100 m run (c)	EG	14.6±0.89	13.9±0.78	1.84	>0.05
	CG	14.3±0.67	14.2±0.68	1.29	>0.05
Dull ups on the stosshar (times)	EG	6.7±0.56	11.7±0.52	2.86	<0.01
Pull-ups off the crossbar (tilles)	CG	6.6±0.49	7.7±0.67	1.33	>0.05
I am a issue from the allow (such	EG	207.4±13.21	223±15.51	2.03	< 0.05
Long Jump from the place (cm)	CG	203.5±14.09	207.7±12.83	1.41	>0.05
Duch unc (times)	EG	18.9±0.75	31.9±0.76	2.48	< 0.05
Push-ups (umes)	CG	18.7±0.82	23.5±0.87	1.96	>0.05
	EG	10.71±0.93	9.30±0.83	1.73	>0.05
	CG	10.42±0.86	10.09±0.94	1.38	>0.05
Cit ups in 1 min (times)	EG	20.1±0.94	34.5±1.35	2.51	<0.01
Sit-ups in Thini (times)	CG	19.9±0.86	26.7±1.13	1.63	>0.05
Donding over (m)	EG	7.1±0.47	14.7±0.53	2.87	<0.01
Bending over (cm)	CG	7.2±0.43	9.9±0.41	1.56	>0.05

Table 4. Dynamics of physical fitness indicators of students (male) during the pedagogical experiment (EG, n=28; CG, n=2	29)
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fied. The system of assessment of students in physical education should be supplemented taking into account the availability of physical culture and recreation competencies. To increase physical activity, teachers should focus on attracting students to practical training and extracurricular activities in the amount of 12-14 hours per week. This motor mode contributes to a significant improvement in the level of physical fitness of EG students, which was proved during the experiment (Table 4).

The results of the study showed that EG students during one academic year were able to significantly improve their physical fitness indicators in five tests out of seven (p<0.05-0.01). At the same time, students' test performance in CG did not improve in any test (p>0.05). In addition, a survey of students was conducted on how they assess their own health status. The results of the assessment show that at the beginning of the academic year, the number of students who rated their health status as high (EG - 17.8%, CG - 20.7%), satisfactory (EG - 60.7%, CG - 55.2%) and unsatisfactory (EG - 21.5%, CG – 24.1%) in both groups was approximately the same. At the end of the experiment, the number of students with a high level of health in EG increased to 46.4% (by 28.6%), and in CG - to 24.1% (by 3.4%). The number of students with a satisfactory level of health in EG decreased to 42.8%, and in CG - to 51.8%; with an unsatisfactory level, the number of EG students decreased to 10.7%, and in CG - remained unchanged (24.1%).

The study of the dynamics of students' NPS indicators showed that at the beginning of the experiment, the EG and CG indicators were almost the same: 7.1% had a high level of NPS (items 1-3 on the NPS scale) in the EG, and 7.0% in the CG; medium level (items 4-6) in the EG 32.1%, in CG – 24.1%; low level (items 7-10) in the EG 60.8%, in CG – 68.9%. At the end of the study, the number of low-level students in EG decreased to 28.6% (the difference is 32.2%), in CG – to 62.1% (the difference is 6.6%). The number of students with a high level of NPS in EG increased to 17.8% (the difference is 10.7%), in CG – to 10.3% (the difference is 3.3%). This suggests that EG students are more prepared for unpredictable and atypical (stressful) life situations. The conducted studies indicate a positive impact of the proposed amount of motor activity on the health status of students and their psychophysical readiness for further educational and professional activity.

# DISCUSSION

Human motor activity is defined as a factor that favorably affects the growth and development of the body, as an indicator of the functional state of the body, because movement is an important biological need of a person [7]. Under the motor activity of students, we consider all body movements made by skeletal muscles, as a result of which there is a significant increase in energy consumption, which is higher than the basal metabolic rate [3, 8]. Scientists [1, 4] consider motor activity as an integral part of a person's lifestyle and behavior, which is determined by socio-economic and cultural factors, which depends on the organization of physical education, morphofunctional features of the body, the type of nervous system, the amount of free time, motivation for classes, availability of sports facilities and recreation areas for young people. Psychophysical readiness is a kind of personal trait that provides and characterizes the possibilities of continuous growth of the individual in the present and future, his attitude to the world and himself [9, 10]. Along with this, multifaceted manifestations of a person's psychophysical readiness give an idea of the mechanisms and conditions of special sequential transformations in the personality structure.

The amount of motor activity of students and the needs of their body in it depend on many physiological, socio-economic, household, psychological and other factors: age, gender, physical build, level of physical fitness, motivation for classes, lifestyle, geographical and climatic conditions, the amount of free time and its character, availability of sports facilities, etc. [2, 11]. The individual norm of motor activity is determined by the achievement of a specific physical state, which can be expressed by quantitative indicators of physical performance, physical fitness, and the functional state of the main body systems [4].

One of the most important tasks of improving the educational process is to organize the optimal level of motor activity of students, which is able to provide them with good health, physical and mental performance, a positive emotional state, active rest, and satisfy their need for movement. We offered a weekly norm of activity of 12-14 hours. As a result, at the end of the academic year, the level of physical fitness of EG significantly improved, in contrast to CG, where most indicators remained unchanged. The percentage of students with a high level of health and neuropsychiatric stability has increased significantly.

# CONCLUSIONS

1. Increasing the amount of motor activity of students requires creation of a modern system of physical education of students, which should take into account their interests, motives and personality-oriented choice of the type of classes. Classes should be organized in accordance with students' health and physical fitness. Methods, means and forms of classes should correspond to the level of formation of individual motor qualities, material and technical equipment of classes to ensure the fulfillment of tasks.

2. Analysis of the current level of motor activity of students in the weekly time budget showed that students were in a state of reduced motor activity (3.8-4.6%). It was revealed that an increase in the amount of practical (academic and extracurricular) classes to 12-14 hours per week for one year positively affected the students' health and their psychophysical readiness for life. In EG, in contrast to CG, results in pull-ups, pushups, long jump and bending over significantly improved. The number of students with a high level of health in EG increased by 28.6%, and in CG – by 3.4%. Indicators of neuropsychiatric stability of EG students at the end of the study are significantly better than in CG: in EG, the number of students with a low level decreased by 32.2%, in CG – by 6.6%; with a high level in EG, it increased by 10.7%, in CG – by 3.3%.

Prospects for further research are to study of the influence of the amount of motor activity on the functional state and health of female students.

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#### **Conflict of interest:**

The Authors declare no conflict of interest

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A – Research concept and design, B – Collection and/or assembly of data, C – Data analysis and interpretation, D – Writing the article, E – Critical revision of the article, F – Final approval of article

# The Impact of Levels of Emotional Intelligence Development in High Schoolers with Intellectual Disabilities on Their Health Status

Wpływ poziomu rozwoju inteligencji emocjonalnej u uczniów szkół średnich z niepełnosprawnościami intelektualnymi na ich stan zdrowia

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#### SUMMARY

**Aim:** To study the levels of development of emotional intelligence in high schoolers with intellectual disabilities and correlation with their health status.

**Materials and Methods:** The experimental part of the research involved the use of the valid psychodiagnostic techniques (Hall's method, the Mayer-Salovey-Caruzo Emotional Intelligence Test, "Understanding Emotional States", "Human Drawing"), as well as methods of questioning and observation. We used the rank correlation coefficient according to the two-sided Student's t-test in order to compare the results of the research. In experimental research involved 76 high schoolers in the age of 14-17 who studied in 7-9 grades. There were 45 children with intellectual disabilities and 31 high schoolers with normative development.

**Results:** The conducted diagnostic work made it possible to establish both the integrative indicator of emotional intelligence and the levels of expression of its individual components. Low and medium levels of emotional intelligence development in high schoolers with intellectual disabilities was found: a decrease in the level of perception of emotions by expression; superficial perception of expressive features, vagueness of ideas about them; insufficient differentiation of the constituent elements of the emotional standard.

**Conclusions:** It is proved that the low state of development leads to significant difficulties that arise during interaction with each other, and this primarily affects the further socialization and integration into society.

Key words: personal emotional intelligence, health status, high schoolers with intellectual disabilities

Słowa kluczowe: osobista inteligencja emocjonalna, stan zdrowia, uczniowie szkół średnich z niepełnosprawnością intelektualną

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#### INTRODUCTION

One of the important strategic tasks of reforming the educational sector of Ukraine is its focus on ensuring the harmonious development of the individual. In this context, the problem of emotional and behavioral adaptation of children is extremely acute. It is within this paradigm that great importance is attached to the mental health of an individual capable of self-improvement and self-actualization [1-4]. Given this, an urgent problem in psychological science is the formation of emotional intelligence, emotional competence in high schoolers, namely the development of such important personality traits

as sensitivity to other people, their inner turmoil, one's own emotional well-being, which reflects a holistic person's attitude to the world. The scientists' research shows that emotional intelligence is one of the main factors in the adaptation and socialization of the individual [5-9].

The study of the phenomenon of emotional intelligence is important both from the point of view of fundamental psychology, and from the standpoint of practical and special psychology, as well as medicine. Establishing psychological patterns and mechanisms for the development of emotional intelligence should contribute to a deeper understanding of the genesis and functioning of the psyche in general, because emotions and intelligence are its key components [10].

The solution of this problem is particularly relevant for children with special needs in general and with intellectual disabilities in particular, for whom educational institutions create the conditions for social adaptation during their education. One of the key determinants of the success of social adaptation of this category of children is the level of formation of their emotional intelligence, which is one of the fundamental elements for the mental development of the individual. Suppression of one's emotions prevents one from experiencing these emotions psychologically and causes negative consequences, such as behavioural disorders. Therefore, the priority is to address the issues of optimizing the formation of emotional intelligence in high schoolers with intellectual disabilities.

In particular, it concerns the disclosure of psychological mechanisms that determine the development of emotional intelligence in high schoolers with intellectual disabilities, which are complicated by many factors: insufficient formation of general ideas about the content of emotions, their integrativeness, dynamics, ambivalence, peculiarities of emotional development and more.

Thus, the study of emotional peculiarities of children and the development of emotional intelligence of high schoolers are of paramount importance. They are relevant in connection with the psychological and pedagogical approach to solving the problem of social adaptation of children in society by increasing the level of perception and understanding of another person as an individuality, and also, most importantly, solving the problem of mental health of the child.

#### ΑΙΜ

The aim is to study the levels of development of emotional intelligence in high schoolers with intellectual disabilities and correlation with their health status.

# MATERIALS AND METHODS

#### CATEGORIES OF RESPONDENTS

The vision of emotional intelligence (EI) requires a certain specificity of the experimental research organization. Thus, in order to identify the peculiarities of emotional intelligence of high schoolers with intellectual disabilities, we conducted the experimental research, which involved 76 high schoolers in the age of 14-17 who studied in 7-9 grades. There were 45 children with intellectual disabilities and 31 high schoolers with normative development among them. The difference in the age of high schoolers of 7-9 grades with normative development and with intellectual disabilities who participated in the experiment is explained by the fact that high schoolers with intellectual disabilities begin schooling 1-2 years later than their peers with normal development due to intellectual disabilities, underdevelopment of the cognitive sphere and all mental processes, which creates a pathogenic basis for the educational activities of children in this category. The research was conducted during 2020 in secondary schools in Kyiv, Ukraine.

The research was carried out in several stages according to certain criteria, which allowed to determine the indicators and levels of the peculiarities of emotional intelligence of high schoolers with intellectual disabilities (ID) (which are based on a step-by-step study of emotional intelligence). The first stage involves the diagnosis of the ability to perceive, understand and identify emotions; the second stage includes the diagnosis of the ability to assimilate emotions in thoughts, to stimulate thought processes with the help of emotions; the third stage involves the diagnosis of the ability of self-control and selfregulation of behaviour in accordance with the emotions experienced by the individual or his environment. Self-control over the emotional sphere, regulation and stimulation of thinking are possible only if the individual masters the ability to perceive, understand and identify emotions (personal and the emotions of others), so, in our opinion, the research of emotional intelligence should begin with diagnosis of these components.

#### DATA COLLECTION TOOLS

The experimental research used such methodologies as MSCEIT v.2.0 (The Mayer-Salovey-Caruzo Emotional Intelligence Test), Hall's method, "Understanding Emotional States" method, "Human Drawing" K. Mahover's projective method [11]. The conducted diagnostic work with the use of the mentioned methodologies made it possible to establish both the integrative indicator of emotional intelligence and the levels of its individual components manifestation.

Three levels of perception, understanding and identification of emotions by high schoolers were identified on the basis of the analysis of the obtained experimental data using these methodologies, such as low – the 1<sup>st</sup> level, medium – the 2<sup>nd</sup> level, high – the 3<sup>rd</sup> level. A low level of emotional intelligence is determined by a weak ability to control one's own emotions and feelings, impulsiveness, low self-control. A medium level of emotional intelligence is characterized by the ability to determine one's own feelings and emotions, not always correct ability to recognize the emotions of other people, the ability to control one's own emotional state not in all situations. A high level of emotional intelligence is characterized by the accuracy of interpretation of one's own emotions, other people's emotions, the ability to control one's own emotional state and emotions of other people.

The main criteria for the levels of emotional development formedness was the degree of skills formedness: to recognise emotions by expression; the ability to understand and identify emotions (the ability to distinguish expressive and impressive signs of emotions, the reasons for their occurrence); to verbalize emotions (accuracy of words use, the ability to characterize the perceived emotional state); to reproduce emotions (expressiveness and arbitrariness); the ability to express emotions in facial expressions, pantomime, speech.

#### STATISTICAL ANALYSIS

The data of the study were summarized as numbers, percentages, averages, and standard deviations. We used the rank correlation coefficient according to the two-sided Student's t-test to compare the results of the research.

# ETHICS COMMITTEE APPROVAL

This study was performed according to the requirements of the Regulations on Academic Honesty of Institute of Special Pedagogy and Psychology of the National Academy of Pedagogical Sciences of Ukraine and approved by the Academic Council (Protocol No. 3 of March 05, 2020). The preliminary consent to participate in the research was obtained from all respondents.

# RESULTS

# LEVEL DISTRIBUTION OF PECULIARITIES OF DEVELOPMENT OF EMOTIONAL INTELLIGENCE OF HIGH SCHOOLERS WITH IMPAIRED AND TYPICAL INTELLIGENCE

Three levels of emotional intelligence formedness were determined based on the analysis and generalization of the obtained results: low, medium, high. A low level of emotional intelligence formedness was revealed in high schoolers: 43.3 % in the group of the 7<sup>th</sup> grade children and 38.9 % in the group of the 9<sup>th</sup> grade children; 9.1 % was detected in the group of the 7<sup>th</sup> grade children with normative development (ND), and no 9<sup>th</sup> grade children had a low level (Table 1). The primitiveness of emotions, superficiality, vagueness, specificity of emotional vocabulary, inaccuracy in the use of words of emotional intelligence formedness in high schoolers with this level.

High schoolers show instability, emotional lability, monotony of emotional expression, inadequate emotional reactions in a situation of failure, dominated by a reduced emotional mood. They do not seek to establish contact with peers of their own free will. It is difficult for them to understand the emotional state of other people. They have limited ideas about social emotions, show indifference to moral norms. Their vocabulary of emotions is poor, it is difficult for them to inform about their own emotional state, about the onset of fatigue. Amedium level of emotional intelligence formedness was found in: 50 % of the 7<sup>th</sup> grade high schoolers and 50.0 % of the 9<sup>th</sup> grade high schoolers with intellectual disabilities, 54.5 % of the 7<sup>th</sup> grade high schoolers with ND and 58.8 % of the 9<sup>th</sup> grade high schoolers with ND (Table 2).

Qualitative signs of emotional intelligence formedness of high schoolers with this level are: lack of expression of adequate emotions, narrowing their range, a higher level of differentiation of emotions by basic modalities (joy, sadness, anger, fear), instability of their expressive features, inaccurate differentiation of subtle experiences.

High schoolers demonstrate the adequacy of emotions, their relative stability, clearly depict individual emotions in facial expressions, pantomime. The range of emotional experiences is narrowed. They have adequate knowledge about social emotions, emotional attitude to them is vague. Preschoolers name emotional states well known to them, substantiate the reasons for their occurrence, the situational way of interpretation of an emotional state prevails. They show interest in joint activities, which depends on the emotional participation of the adult. The positive emotional background of mood is prevailing. A medium level of emotional intelligence formedness is determined in the high schoolers who have this level. A high level of emotional intelligence formedness was found in: 6.7 % of the 7<sup>th</sup> grade high schoolers with intellectual disabilities and 11.1 % of the 9th grade high schoolers with intellectual disabilities; 36.4 % of the 7th grade high schoolers with ND and 41.2 % of the 9th grade high schoolers with ND (Table 3). It is established that the high schoolers with a high level of emotional intelligence formedness are dominated by

Table 1. Comparison of emotional intelligence formedness at the 1<sup>st</sup> level in high schoolers with ND and ID, %

Curche	The first level of emotional intelligence formedness in percentage			
Grade	High schoolers with ND	High schoolers with ID		
7 <sup>th</sup> grade	9.1	43.3		
9 <sup>th</sup> grade	-	38.9		

Abbreviations: ND – normative development; ID – intellectual disabilities

Table 2. Comparison of emotional intelligence formedness at the 2<sup>nd</sup> level in high schoolers with ND and ID, %

Grada	The second level of emotional intelligence formedness in percentage			
Glaue —	High schoolers with ND         High schoolers with ID			
7 <sup>th</sup> grade	54.5	54.5		
9 <sup>th</sup> grade	58.8	58.8		

 $\label{eq:stability} \textit{Abbreviations: ND-normative development; ID-intellectual disabilities}$ 

Table 3. Comparison of emotional intelligence formedness at the	e 3 <sup>rd</sup> level in high schoolers with ND and IE	), %
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Curche	The third level of emotional intelligence formedness in percentage			
uraue	High schoolers with ND	High schoolers with ID		
7 <sup>th</sup> grade	36.4	6.7		
9 <sup>th</sup> grade	41.2	11.1		

Abbreviations: ND - normative development; ID - intellectual disabilities

adequate, differentiated, expressive emotions, perception of emotions is characterized by the definition of a set of expressive signs of emotions in all modalities, there is the use of emotional vocabulary in the process of verbalization, sufficient justification of the situation, phenomena, actions, which indicates an understanding of the semantic side of emotions.

High schoolers have adequate emotions; they demonstrate various emotional states, which are manifested in facial expressions, pantomime and speech. Children name emotions, explain the reasons for their occurrence. They understand social emotions and express an adequate attitude to moral norms. They can withstand entering and leaving the emotional state according to the situation. Contacts with peers and adults are emotionally coloured. High schoolers with this level have a high level of emotional intelligence formedness. Thus, the vast majority of high schoolers with intellectual disabilities showed the 1<sup>st</sup> and the 2<sup>nd</sup> levels of emotional intelligence formedness. This suggests that these children have limited ideas about emotions and ways to express them.

# SPECIFICS OF INTERNAL CONNECTIONS WITHIN THE STRUCTURE OF EMOTIONAL INTELLIGENCE OF HIGH SCHOOLERS WITH IMPAIRED AND TYPICAL INTELLIGENCE

At the same time, the high schoolers with normative development showed mainly the 2<sup>nd</sup> and the 3<sup>rd</sup> levels of emotional intelligence formedness. Children in this category mostly demonstrated high and medium levels of emotional intelligence formedness, which in turn indicates an understanding of emotions and the ability to adequately express them through facial expressions, pantomime and speech.

Differences between the groups of high schoolers who participated in the experiment, which are significantly reliable were recorded in order to ensure the adequacy of numerical indicators and determine the predicted level of probability at p≤0.05. Significant differences were revealed according to certain criteria of emotional intelligence: the groups with ID and the groups with ND – perception of expression (t=5.4 at p $\leq 0.05$ ), understanding of emotions (t=4.1 at p≤0.05), identification of emotions (t=4.7 at p≤0.05), emotional reactions (t=6.9 at  $p \le 0.05$ ). The qualitative analysis of the obtained statistics testifies that most high schoolers with intellectual disabilities show abnormalities in the development of cognitive processes, emotional and volitional sphere, difficulties in communication and behaviour, they do not form a positive emotional well-being, experience of their significance for other people, openness, etc. and this confirms the presence of trends in negative factors in the development of emotional intelligence of children in this group (Table 4).

Summarizing the results of the ascertaining research of emotional intelligence in high schoolers with intellectual disabilities, it can be determined that violations of the regulatory functions of emotional intelligence and negative social conditions of education lead to poor perception of emotional states of other people and not always adequate, undifferentiated expression of their own emotions.

## DISCUSSION

The basis of our theoretical and experimental research was the position that increased emotional competence through learning improves the level of emotional intelligence, which affects the mental health of the high schooler [10]. In the confirmation of scientists [7, 12], our research testified that high schoolers with intellectual disabilities are characterised by insufficiently developed emotional intelligence, in contrast to high schoolers with proper development. Thus, high schoolers with ID have a limited amount of emotional experience, narrowing the range of experiences and superficial knowledge about different emotional states, which is an important indicator in the process of identifying emotions. Such children face difficulties in understanding and differentiating emotions and emotional states, compared to children with normative development.

Our research complements the findings by Bucich, MacCann, Petrides, Furnham [6, 13] that the development of emotional intelligence in school age should be considered within the context of the category of learning activities, as it is developed and manifests itself in activities, in the process of communication and interaction with other people. In particular, the development of emotional intelligence in the learning process involves the use of appropriate methods of learning activities.

It should be noted that the analysis of experimental data showed emotional intelligence formedness in high schoolers with intellectual disabilities at a low level. In addition, high schoolers with intellectual disabilities show abnormalities in the development of cognitive processes, emotional and volitional spheres, difficulties in communication and behaviour.

It is worth noting that the directions of development of emotional intelligence at school age are the knowledge of one's own emotions and feelings; knowledge of other people's emotions and feelings; possession of one's own emotions and feelings; interaction and communication with other people. Purposeful increase of children's social and emotional competence underlies the growing complexity of their social relationships and emotional experiences.

Correlation analysis showed that the higher the level of emotional intelligence of schoolers with intellectual disabilities,

Table 4. Comparative analysis of differences in the levels of emotional intelligence formedness according to Student's t-test

Arithmatic maan	Student's t test	2.47	2.05
Arithmetic mean	Student's t-test	ND (9 <sup>th</sup> grade)	ID (9 <sup>th</sup> grade)
2.27	ND (7 <sup>th</sup> grade)	1.19	
1.79	ID (7 <sup>th</sup> grade)		1,28

Abbreviations: ND – normative development; ID – intellectual disabilities

the higher the level of their social activity, as it is manifested in the process of communication, interaction with other people. All these factors affect the life of schoolers and their health (r=0.6-0.7). Conversely, the low level of emotional intelligence of this category of people determines the miscalculations of social communication and changes in mental well-being (r=0.3-0.5).

# CONCLUSIONS

Thus, the analysis of the data of the experimental research gives grounds to draw a conclusion about the existing problems in the personal development and emotional intelligence of high schoolers with intellectual disabilities. They feel unprotected, have emotional anxiety and are therefore highly dependent on their surroundings. The presence of a deep originality of emotional and volitional development largely determines the low level of emotional intelligence formedness, being one of the reasons for low social activity and low level of social adaptation of children in this category.

Such conclusions encourage the study of ways of corrective work on the formation of emotional intelligence in high schoolers with intellectual disabilities, which will involve the development of skills: to recognize emotions by expression; to understand and identify emotions (to specify the expressive and impressive signs of emotions, the reasons for their occurrence); to verbalize emotions (to use words accurately, justify the perceived emotional state); to reproduce emotions (expressiveness and arbitrariness); to express emotions in facial expressions, pantomime, speech.

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# **Conflict of interest:**

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# The Structure of Injuries and the Relevance of Physiotherapy for Prevention and Rehabilitation for Medial Tibial Stress Syndrome in Cadets

Struktura urazów i znaczenie fizjoterapii w prewencji i rehabilitacji przyśrodkowego zespołu stresu piszczelowego u kadetów

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#### SUMMARY

**Aim:** The purpose of the study was to substantiate the relevance of the introduction of physiotherapy for prevention and rehabilitation for medial tibial stress syndrome in cadets by analyzing of their injuries experience.

Materials and Methods: 256 cadets took part in the retrospective study. The study was conducted in a survey form. The specially prepared questionnaire included questions about injuries and pain syndromes with an emphasis in the manifestation of symptoms of medial tibial stress syndrome.

**Results:** 59.5% of respondents reported on the occurrence of injuries and pain syndromes during training in higher military educational institutions. The first year was pointed out as the most traumatic by the cadets of all year of studying. Out of all respondents 62% of the first year cadets, 37.8% of the second years, and 32.2% of the third years pointed the first year as the most traumatic. 83.2% of respondents indicated having an experience of injuries and pain syndromes in the lower limbs during training. It was found that 13.6% of injuries and pain syndromes in cadets occur in the lower limbs; among them 62.1% have the localization of pain on the medial surface.

**Conclusions:** The highest number of injuries and pain syndromes in cadets occurs in the first year of studying. The most common are injuries and pain syndromes of the lower limbs, a third part of which are the injuries of the tibiae area. More than half of all injuries and pain syndromes of the lower limbs are localized on the medial surface, which means the risk of development of MTSS. The obtained results determine the relevance of research on the development and analysis of the effectiveness of using physiotherapy interventions to prevent and treat the MTSS in cadets

Key words: overuse injuries, exercise therapy, chronic disease, lower limb, shin splints

Słowa kluczowe: urazy przeciążeniowe, terapia ruchowa, choroba przewlekła, kończyna dolna, przyśrodkowy zespół stresu piszczelowego

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# INTRODUCTION

In the context of the eighth year of armed hostilities in Ukraine, the issue of treatment, rehabilitation and high quality training of military in the Armed Forces of Ukraine is relevant. Injuries of head and lower limbs, which equal 19.44 – 20.87% and 17.37 – 18.61%, respectively [1], prevail in the military members of the Armed Forces of Ukraine. In addition to combat injuries, a high percentage of militaries get injured during regular and mission training. However, there are no statistics of injury in Ukrainian cadets in higher military educational institutions (HMEI).

Based on the statistics of the Colchester Garrison Sports Injury and the Rehabilitation Centre British Army the most common injuries and pain syndromes in recruits are lumbar pain (22.2%) and lower limb injuries (55.8%). It is mentioned that military training, particularly, excessive physical activity, in 35.2% of cases results the described conditions [2]. Recovery after getting such injuries is usually prolonged and may lead to significant breaks in training and, as a result, decreasing of the training efficiency and force performance [3].

In Ukraine, the main focus is on the analysis of the causes and prevention of acute and severe injuries in cadets, on implementation of effective safety rules' system for organizing their educational process [4]. However, data on the quantity of injuries cumulative and/or chronic of the lower limbs that are caused by excessive physical activity, are not enough. Such injuries include compartment syndrome, stress fractures and MTSS [5]. Researchers pay great attention to the causes, ways of prevention, approaches to treatment and exercise therapy in the case of MTSS [6-8].

# AIM

Substantiation of the relevance of the physiotherapy introduction for prevention and rehabilitation for medial tibial stress syndrome in cadets by analyzing of their injuries experience.

# **MATERIALS AND METHODS**

The research was conducted on the basis of the Hetman Petro Sahaidachnyi National Army Academy (Academy) in May 2021.

256 cadets took part in the research: 79 cadets were of the first year study, 90 – second years and 87 – third years. The average age of cadets of all three years at the time of the study equaled  $19.73 \pm 2.53$  years.

The study was conducted by questioning cadets of mechanized and tank troops, whose training and professional activities in comparison with other types of the Ground Forces (in particular, cadets of rockets and artillery troops) mainly goes with more physical loading. The design of research was retrospective cohort study.

For the survey, a special questionnaire form was developed. It consisted of 3 sections containing (1) general questions, (2) questions about injuries and pain syndromes that arose in the period of studying at the academy, (3) questions about the experience of injuries and pain syndromes of the lower limbs with an emphasis on the symptoms of MTSS.

According to the requirements of European bioethics and bio-rights approved by the Helsinki Declaration of the World Medical Association (2008), all cadets were acquainted with the aim and objectives of the study, informed about their rights (in particular, the right to refuse to participate in the study). The cadets confirmed observance of the principles of respect for the autonomy and dignity of the individual in accordance with the provisions of the Constitution of Ukraine, by signing an informed consent of using the survey results in a scientific study. Processing and analysis of the results were carried out confidentialy, in accordance with the Article 32 of the Constitution of Ukraine.

# RESULTS

The survey was conducted in cadets of the Faculty of Combat Arms. From all number of first year cadets took part in the survey 59% cadets, from second year studing – 76.3% and third year – 57% cadets. Among the respondents, 20% of cadets had experience of previous military service; 63.3% indicated the presence of bad health habits (namely, smoking).

Answers to the question: "During which years and semesters did you have the most troubling pain or injury?" are presented in Table 1. Out of 256 respondents, 138 (53.9%) people indicated the time of the severest injury as their study period; 118 (46.1%) people did not answer this question.

The experience of the severest injury and the occurrence of pain syndromes during training in cadets through semesters is given in Table 2.

Most of injuries and pain syndromes in cadets occur in the first year of studying and mainly in the first semester, that is, in the first months of studying at the Academy (Figure 1).

It should be noted that 20.3% of cadets were suffering injuries, pain syndromes or their outcomes for several semesters.

Table 1. Number of responses provided by cadets of different studying year about their experience of injuries and pain syndromes

	Cadets			
Answers	1 year (n=79) n (%)	2 year (n=90) n (%)	3 year (n=87) n (%)	Total (n=256) n (%)
Presence of injury during study process	47 (59.5)	37 (41.1)	54 (62.1)	138 (53.9)
No answer	32 (40.5)	22 (58.9)	33 (37.9)	118 (46.1)

Table 2. Distribution of injury and pain syndromes experience in cadets by semesters of studying

	Total	1 year		2 year		3 year	
Semester distribution	(n=138) n (%)	Cadets (n=47) n (%)	Number of answers	Cadets (n=37) n (%)	Number of answers	Cadets (n=54) n (%)	Number of answers
l semester	70 (50.7)	35 (74.5)	40	15 (40.5)	_	20 (37)	
ll semester	41 (29.7)	14 (29.8)	49	19 (51.4)	- 40	8 (14.8)	_
III semester	25 (18.1)			9 (24.3)	49	16 (29.6)	(0
IV semester	12 (8.7)			6 (16.2)		6 (11.1)	00
V semester	13 (9.4)					13 (24.1)	_
VI semester	5 (3.6)					5 (9.3)	-
Total number of cadets, who mentioned 2 or more semesters	28 (20.3)	2 (4.3)		12 (32.4)		14 (25.9)	



Figure 1. Indexes of injuries` or pain syndromes` occurring in cadets, depending on studying years

The most typical localization of injuries and pain syndromes of lower limbs in cadets was assessed by the following question: «During the whole period of training, did you have complaints of pain or injury in the indicated parts of the lower limbs?» The injured parts of lower limbs were then shown by cadets on the picture, to demonstrate the required parts. In general, 83.2% of respondents indicated the presence of injuries and pain syndromes experience in the lower limbs during training (Table 3); only 16.8% of cadets did not give an affirmative answer to this question.

Table 4 represents the distribution of the number of injuries and pain syndromes in different parts of lower limbs in cadets during training.

The occurrence of injuries and/or pain syndromes indicated in 13.6% of cadets; from whom 37.9% complained of pain symptoms in both tibiae, 34.5% – only in the right, and 27.6% – only in the left one (Table 5).

From the total number of injuries and/or pain syndromes in the tibiae 62.1% are of the medial surface (Table 6). The injuries of the medial part of the lower limbs were mainly indicated by cadets of the first year of studying; 31% of the total number of respondents indicated the localization of injury and/or pain syndrome in different parts of the tibiae.

A total of 28.5% among all respondents answered the question: "Did you have any complain of pain in the lower limbs during the recent month of training?" affirmatively (Table 7).

Table 3. Distribution of cadets' answers about the experience of injuries and pain syndromes of the lower limbs

	Year of studying			
Answers	Total (n=256) n (%)	1 year (n=79) n (%)	2 year (n=90) n (%)	3 year (n=87) n (%)
Mentioned the injury during period of training/studying	213 (83,2)	72 (91,1)	68 (75,6)	73 (83,9)
No answer	43 (16,8)	7 (8,9)	22 (24,4)	14 (16,1)

Table 4. Distribution of of injuries` and pain syndromes` numbrer in different parts of lower limbs in cadets during training

	Year of studying			
Injuries/pain syndromes of lowers limbs` parts	Total (n=213) n (%)	1 year (n=72) n (%)	2 year (n=68) n (%)	3 year (n=73) n (%)
Coxofemoral joint, femur	9 (4,2)	4 (5,6)	0 (0)	5 (6,9)
Knee joint	62 (29,1)	21 (29,2)	19 (27,9)	22 (30,1)
Tibia	29 (13,6)	14 (19,4)	7 (10,3)	8 (11)
Tibial joint, foot	42 (19,7)	16 (22,2)	12 (17,7)	14 (19,2)
No complaints	96 (45,1)	27 (37,5)	35 (51,5)	34 (46,6)
Number of respondents, who chose $\ge 2$ variants	25 (11,7)	10 (13,9)	5 (7,4)	10 (13,7)

Table 5. Distribution of tibial injuries and pain syndromes in cadets

	Cadets			
Injury/pain syndrome localization	Total (n=29) n (%)	1 year (n=14) n (%)	2 year (n=7) n (%)	3 year (n=8) n (%)
Right tibia	10 (34,5)	6 (42,9)	1 (14,3)	3 (37,5)
Left tibia	8 (27,6)	4 (28,6)	2 (28,6)	2 (25)
Both left and right	11 (37,9)	4 (28,6)	4 (57,1)	3 (37,5)

#### Table 6. Tibial injury/pain syndrome localization in cadets

	Year of studying				
Tibial part	Total (n=29) n (%)	1 year (n=14)	2 year (n=7)	3 year (n=8)	
Anterior surface	5 (17,2)	-	2	3	
Posterior surface	8 (27,6)	1	3	4	
Lateral surface	7 (24,1)	4	1	2	
Medial surface	18 (62,1)	11	4	3	
More than one variant	9 (31)	2	3	4	

Table 7. Number of complaints of pain in lower limbs in cadets during recent month of training

		Year of study	ing/training	
Answers	Total (n=256) n (%)	1 year (n=79) n (%)	2 year (n=90) n (%)	3 year (n=87) n (%)
Have complaints of pain in lower limbs	73 (28,5%)	31 (39%)	23 (26%)	19 (22%)
Have no complaint of pain	183 (81,%)	48 (18,8%)	67 (74,4%)	68 (78,2)

Table 8. Distribution of lower limbs` pain intensity in cadets during recent month of studying

		Cac	lets	
Pain intensity	Total (n=73) n (%)	1 year (n=31) n (%)	2 year (n=23) n (%)	3 year (n=19) n (%)
Mild	12 (16%)	-	8 (35%)	4 (21%)
Moderate	44 (60%)	22 (71%)	11 (48%)	11 (59%)
Severe	10 (15%)	6 (19%)	3 (13%)	1 (5%)
Intense	6 (8%)	3 (10%)	1 (4%)	2 (10%)
Intolerable	1 (1%)	-	-	1 (5%)

In 60% of cases, cadets, while answering the questions about the intensity of pain in the lower limbs that occured during recent month of training, characterized it as "moderate" (Table 8).

# DISCUSSION

The study of the prevalence of injuries and pain syndromes in HMEI cadets due to physical oversuse during training and professional activity is a basis for numerous publications of foreign scientists [9]. In particular, it has been demonstrated that injuries of the musculoskeletal system are a serious burden in the UK armed forces [10].

Special attention is given to injuries that can be prevented by taking into account the risk factors of their occurrence [11]; by an appropriate planning of physical exercises and their progression [12]; by implementing a physical therapy [13]. The injuries described before also include medial tibia stress syndrome. At the same time, in Ukraine there are not such statistical data available and, accordingly, any attention is paid to the prevention and rehabilitation after MTSS in cadets.

The retrospective study of the injuries and pain syndromes of the lower limbs experience in cadets enabled to obtain data on spreading of this kind of injury for the first time. It also allowed to justify the relevance of introduction of physical therapy for its prevention and rehabilitation in Ukraine.

In particular, 59.5% of respondents mentioned the occurrence of any types of injuries and/or pain syndromes during their studies at the HMEI. This index is significantly higher than the detected level of injuries in English cadets, studied by J. Sharma (2013), which equaled 48.65%. In these cadets, overuse injuries were most typical than acute and chronical [10].

The first year of studying Ukrainian cadets mentioned as the most traumatic: from the total number of respondents, 62% first year cadets, 37.8% - second years, and 32.2% third years had answered this question affirmatively. In addition, 74.5% of first year cadets noted the first semester as the period of highest risk of injury and occurrence of pain syndromes; almost 40.5% of second years and 37% of third years also indicated the first semester as the most traumatic. This equaled 50.7% of all respondents. Such data are agreed with foreign studies that indicate that most of the overuse injuries of the lower limbs occurred in the first 13 weeks of training/studying [10]. It should be noted that the tendency of decreasing the number of injuries and pain syndromes is observed in each following semester of training. 29.7% of respondents indicated the second semester as the most traumatic period of studying; 18% of cadets named it as the third, 8.7% chose the fourth, 9.4% - the fifth and only 3.6% mentioned the sixth semester as the most traumatic.

Injuries and/or pain syndromes of the lower limbs occurred in 83.2% of the respondents and mostly in cadets of the 1st year (91.1%). The lowest index of MTSS and injuries was in cadets of the 2nd year (75.6%). This is exactly the same as in study of J. Sharma (2013), which indicates an injury prevalence in 82.34% of cadets [10].

It was established that the highest number of injuries and pain syndromes in cadets befall to knee joints (29%), ankle-joints, feet (19.7%) and tibiae (13.6%). Almost 12% of the total number of cadets indicated injuries and pain syndromes of different parts of the lower limbs. Among the injuries and/or pain syndromes, 62.1% of respondents indicated localization on the medial surface.

The biggest number of cadets of the first year of studying (39%) experienced pain in the lower limbs during recent month of training. The intensity of pain in 71% of cases was indicated as moderate, in 19% – severe, and 10% – intense. Cadets of the second and third years in 48% and 59% of cases, respectively, indicated the intensity of pain at moderate.

Pain in the medial part of tibia is one of the clinical signs of MTSS, which is indicated as frequent injury in cadets. Medial tibial stress syndrome (MTSS) (M76.80 according to the ICD-10) is an overuse injury of the lower limbs [14]. This pathology mostly occurs in sportsmen, in particular, athletes (from 13.6% to 20%) and military members (from 7.2% to 35%) and can significantly limit their ability to perform professional physical activities [15].

Development of MTSS has two, supposedly interdependent, yet, inconclusive final etiological theories. The first is hyperextension (under the influence of a physical overuse) of places of attachment of the tibial muscles (salens muscle, gastrocnemius muscle, plantar muscle) to the tibia, resulting in their micro-damage and overtension of their attachment places with microtraumation of the periosteum, which exceed the limits of recovery and lead to its inflammation. [16]. The second is a direct injury of the tibia, under the influence of excessive tension, which leads to bending/distortions of the tibia with the subsequent development of periostitis and pain syndrome [17].

The main clinical manifestations of MTSS is a diffuse pain in the middle and distal part of the tibia, concentrated on the posterior surface. In the case of the first manifestations of the syndrome, pain occurs and increases at the beginning of physical activity and through it; the pain may disappear without any manifestations during rest time. For a difficult course, it is typical the pain does not disappear during the entire tension/activity period, increases and maintains during rest time [16, 18].

The risk of getting the MTSS is particularly high in the military members of the first year of service, who also include the cadets from HMEI [11]. It has been determined that the course of primary military training can lead to periostitis of the tibia in 10% of cadets and 60-80% of all injury cases are associated with musculoskeletal overuse [19].

Individuals who have this syndrome are prone to relapses of the disease; without proper treatment and rehabilitation there is a risk of developing of a chronic form, which leads to limitation of functioning. MTSS can also become a trigger to a stress fracture, an injury that requires longer treatment and recovery period [6-8].

Unfortunately, the recovery time after the MTSS, as a rule, is also long. Studies demonstrate that full recovery can be achieved on average in the period from 102 to 118 days [20]. All this negatively affects the process of professional training of military members, in particular, reduces the level of their theoretical knowledge and practical skills, and also leads to significant spending for treatment and recovery.

It has been proven that MTSS can be prevented by implementing a physiotherapy [21]. Means of physiotherapy are the main intervention for the prevention and rehabilitation for MTSS among servicemen of the foreign armed forces, because they reduce the risk of its occurrence, significantly decrease the recovery period and prevent complications [12, 13].

All the above determines the relevance of using means and methods of physiotherapy in prevention and treatment of MTSS in servicemen of the Armed Forces of Ukraine.

# LIMITATION

Given the design of the study is retrospective, part of data may have been incomplete. Lack of requirements to diagnose and practice to record overuse injuries and pain syndromes in the medical service of the academy, made it impossible to carry out a statistical analysis of such data.

# CONCLUSIONS

The results of the study indicate the prevalence of injuries and pain syndromes of the lower limbs in Ukrainian cadets, that were indicated by 83.2% of people.

The biggest number of injuries occurs in the first year of training. The main part of injuries and pain syndromes that occurred in the lower limbs is registered in the first semester of training - this is the time when cadets are the least prepared for a heavy physical exertion.

Among other injuries and pain syndromes of the lower limbs, 13.6% occur in tibiae. Often, their medial surface is affected (62.1%), which means a risk of developing MTSS. The main outcomes of this injury in cadets are serious functional limitations and risk of complications, which prolongs the time of treatment and recovery, and therefore leads to decreasing in training efficiency and level of force performance.

Thus, research on finding ways to introduce physiotherapy for the prevention and rehabilitation after medial tibial stress syndrome in cadets is relevant.

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Organizational and theoretical-methodological basics of physiotherapy for prevention and rehabilitation for restrictions on the functioning of military personnel.

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# Familial Tuberculosis and its Prevention in Terms of Health Care Restructuring

# Gruźlica rodzinna i jej zapobieganie w aspekcie restrukturyzacji opieki zdrowotnej

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#### SUMMARY

Aim: To study the peculiarities of the course of familial tuberculosis, which includes tuberculosis revealed in someone in the family if there is a source of this infection.

**Materials and methods:** We studied 199 families. One member of each family contracted pulmonary tuberculosis and later became a source of the disease for contactees. The examination was performed with standard clinical techniques using radiological, bacteriological, and immunological examination techniques.

**Results:** We found that in 12-24 months, 207 people were diseased in these families. We also revealed the shift toward a younger age among the diseased contactees. Special emphasis should be paid to the disease of children under 18–52 people, while there was only one patient among the sources of tuberculosis. There were more cases of familial tuberculosis in urban than in rural areas. Females were more likely to suffer from these forms of tuberculosis.

**Conclusions:** Considering the above, we believe that the development of familial tuberculosis occurs due to closer contact of TB source patients with family members, which is facilitated by bad habits of source patients and lack of isolation of contactees from sources and ill-considered reform of health care in general and tuberculosis particularly.

Key words: familial tuberculosis, contactees, morbidity

Słowa kluczowe: gruźlica rodzinna, osoby z kontaktu, zachorowalność

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# INTRODUCTION

Pulmonary tuberculosis remains one of the most urgent problems today, as in most cases, it is the source of the disease. In Ukraine, this is especially important given that 95-96% of TB patients are pulmonary. Despite the efforts of the medical community and governments around the world, it is not possible to significantly reduce the morbidity rate. The measures planned by WHO for the implementation in 2015 have not been accomplished. Thus, in 2020, 10 million TB patients were registered worldwide, and 1.5 million of them died. It is especially hard to perceive the high infant mortality rate. The fact is that in 2015, 210 000 children died of tuberculosis. In recent years, about 700 children die every day [1].

Peculiarities of tuberculosis in Ukraine are high morbidity, high level of mycobacteria resistance to antibacterial drugs, the spread of multidrug-resistant tuberculosis. In recent years, the incidence of tuberculosis has somewhat dropped worldwide, as well as in Ukraine. This applies to the incidence of the adult population (42,2 per 100 thousand population in 2020, compared to 60,1 per 100 thousand population in 2019) and the incidence of tuberculosis in children aged 0 to 14 from 9,0 to 5,9 and at the age of 15-17 years including – from 20,0 to 14,2 respectively [2].

However, there is an increase in the number of patients with prevalent forms of pulmonary tuberculosis, which are accompanied by destructive changes [2]. The growth of primary resistance of Mycobacterium tuberculosis, which, according to various authors, occurs in 15-35% of newly diagnosed patients is of particular concern. Moreover, secondary resistance of mycobacteria to antibacterial drugs develops within 6 months of treatment in 45-65% of patients. Besides, Ukraine is one of the 5 countries in the world with the highest rate of patients with multidrug-resistant pulmonary tuberculosis. Its treatment requires extraordinary costs, which are equal to those spent on the treatment of 5-10 patients with sensitive forms of tuberculosis. But in this case, achieving «effective treatment» is possible in about 50% of patients [2]. According to the reform of health care, the diagnosis and treatment of tuberculosis are transferred to the general health care network [3-5]. Such a situation is causing concern.

The relevance of the issue under consideration is that most newly diagnosed patients with pulmonary tuberculosis and extrapulmonary forms keep an unrestricted regimen and are not isolated from others, which is especially dangerous for family members, as pulmonary forms of tuberculosis are the main source of tuberculosis infection.

# AIM

The aim is to study the peculiarities of the development and course of familial tuberculosis to reduce the bacterial load on society, and thus – to reduce the incidence and morbidity of tuberculosis.

# MATERIALS AND METHODS

199 families were under observation. One member of each family contracted pulmonary tuberculosis and later became a source of the disease for contactees. The survey was conducted according to common methods. Besides the radiological methods, in addition to radiography, ultrasonoscopy was used when the pleural disease was suspected. In children, tuberculin testing was used. During the statistical processing of the material, the calculation of the arithmetic means M and the error of the arithmetic mean were used. Student's t-test (with normal scores) and non-parametric Wilcoxon test were used.

# RESULTS

Of the families that had members with various forms of pulmonary tuberculosis, 93 (46,7%) lived in cities and 106 (53,3%) in rural areas. Among the urban residents, there were 66 males (71,0%) and 27 females (29,0%). Male patients were predominantly 29-38 old – 21 persons (31,8%). The smallest number of patients-sources of tuberculosis were at the age of 59 and older – 7 people (10,6%). Most of the female patients were at the age of 29-38 years – 8 (29,6%) and 39-48 years – 7 people (25,9%). The smallest number of patients were 19-28 years old – 2 (7,4%).

In general, patients aged 29-38 years prevailed among urban residents – 29 (31,2%) people; there were 20 (21,5%) people aged **39-48; aged 49-58 – 18 (19,4%) people.** The lowest number of patients was under 28 years and older than 50 - 13 (14,0%) and 12 (13,0%) persons, respectively. There was only one female patient under 18.

Among rural patients-sources of familial tuberculosis, there were 90 males (84,9%) and 16 females (15,1%). Among male patients aged 29-38 years, there were 21 (23,3%) persons, aged 39-48 – 30 (33,3%) persons, and aged 49-58 – 28 (31,1%) persons. The lowest number of patients was at the age of 19-28 – 5 (5,5%), and 59 and older – 6 (6,7%). Among female rural patients, the largest number of sources of infection was at the age of 29-38 – 8 (50,0%); at the age of 39-48 – 3 (18,8%) persons, at the age of 49-58 y – 3 (18,8%) persons; at the age of 19-28 and 59 older – 1 (6,3%), each group.

It is worth emphasizing that at the age of 18, there were no male patients among the urban patients, and among female patients at this age, there was only 1 (3,7%) patient. There were no sources of tuberculosis among the rural residents under 18. Thus, there was only 1 (0,5%) person under 18 among the sources of tuberculosis infection (Table 1).

Among the contactees of urban residents, the number of patients in familial tuberculosis centers increased to 207. In cities, there were 115 (55,6%) such patients and 44,4% in rural areas. There were 63 males in the cities (54,8%) and 52 females (45,2%). In rural areas, there were 38 males (41,3%) and 54 females (58,7%).

The largest number of urban male contactees was at the age of 29-38 - 15(23,8%), the same number of sick contactees (23,8%) was at the age of 39-48. There were 9 (14,3%) and 8 (12,7%) patients aged 19-28, and 59 and older, respectively. A small number of such patients -4(6,3%) were at the age of 49-58. It should be emphasized that the largest number of sick contactees (12-19,0%) was at the age of 0-18. Although, there were no sources of infection at all.

The largest number of contactees, urban female residents, contracted tuberculosis at the age of 12 (23,1%) when there were no sources of tuberculosis infection at all (0-18 years). The same number of patients 12 (23,1%) was registered at the age of 29-38. A slightly smaller number of patients was at the age of 19-28 and 39-48 – 11 (21,2%) and 9 (17,3%),

Table 1	. Features of	f sources of	familial	tuberculos	sis by age	e, gender,	and	place of	<sup>F</sup> residence

Place of re	esidence				Gender			
		0-18 years old	19-28 years old	29-38 years old	39-48 years old	49-58 years old	0-18 years old	Total
Urban	male	-	11	21	13	14	7	66
	female	1	2	8	7	4	5	27
	total	1	13	29	20	18	12	93
Rural	male	-	5	21	30	28	6	90
	female	-	1	8	3	3	1	16
	total	-	6	29	33	31	7	106
TOTAL		1	19	58	51	49	19	199

respectively. A significantly smaller number of contact patients was at the age of 49-58, and 59 and older – 3 (5,8%) and 5 (9,6%), respectively.

Among the rural residents, there were 38 male contactees (41,3%) and 54 female contactees (58,7%). It is noteworthy that there were 1.4 times more females among familial tuberculosis contactees than males. The largest number of contactees, rural residents, was among males -11 (28,9%) aged 0-18, among whom there were no sources of tuberculosis infection. A smaller number -10 (26,3%) of male contactees were recorded at the age of 29-38 and 49-58 - 8 (21,1%). At the age of 19-28, 39-48, and 59 and older, there were 4 (10,5%), 4 (10,5%), and 1 (2,6%) patient, respectively. There were 17 (31,5%) female contactees aged 0-18, while there were no patients of this age at all among the sources of tuberculosis infection. At the age of 19-28 and 29-38, 11 (20,4%) and 13 (24,1%) female contactees were recorded, respectively. There were significantly fewer patients of other age groups (39-48, 49-58, and 59 and older) among females - 4 (7,4%), 3 (5,6%), and 6 (11,1%), respectively.

Thus, there is a higher incidence of contactees among people living in cities, which can be associated with much closer contact with the source of tuberculosis infection. At the same time, the higher incidence of contactees among the rural population among females is noteworthy, which is probably due to closer contact for the care of patients-sources of tuberculosis infection.

We should particularly emphasize the high incidence of contactees aged 0-18 in both urban and rural areas because at this age there was only 1 source of tuberculosis infection. In the cities, contactees there were 24 (20,9%) patients of both genders, and in the villages – 28 (30,4%) – p<0,05.

Among patients-sources of tuberculosis infection, there were 70 (35,2%) working people, while there were 129 (64,8%) non-working people, i.e., 1,8 times more – p<0,05. Given that most patients-sources did not work, they spent most of their time at home. Because of this, they had the opportunity to contact their roommates before the disease, as well as after the recovery, for a long time to some extent, which «facilitated» the possibility of «transmission» of an infectious agent. Thus, this group of people can be attributed to conditionally active sources of tuberculosis infection.

Besides the above-mentioned factor, 36 (18,1%) alcohol addicts and 24 (12,1%) smokers were at risk for tuberculosis. The harmfulness of smoke exposure is well known, it is almost as aggressive as active smoking. 14 (7,0%) people (patients-sources) were former prisoners, most of whom acquire bad health habits toward others. As this certainly affects the intensity of infecting contactees, the total number of «negative» active sources was 74 (37,2%) persons. Since these groups of people are not very concerned about others and they are not particularly worried about the fate of cohabitants, otherwise, they would not be drawn to this «evil» and would have long ago abandoned it, we believe that this group of sources of tuberculosis should be classified as an aggressive source. Considering the features of the sources of infection, we found unfavorable conditions in families, not

only in terms of possible infection but superinfection as well. This is especially dangerous given that 64,8% of sources did not work, so the conditions for the family contact increased. It is worth emphasizing that only 132 (66,3%) people were committed to receiving treatment for TB, and 67 (33,7%) people did not take good care of their health. Therefore, it is useless to expect a proper treatment of their cohabitants. Thus, the cohabitants of such sources of tuberculosis infection were held hostage and it was out of their control whether they will get sick or not, it is rather when it will happen. Thus, in this regard, the nature of the pulmonary process in patients-sources of infection was very important. Among such patients (199), focal tuberculosis was recorded in only 7 (3,5%). Infiltrative tuberculosis was in 123 (61,8%) patients. That is, the most aggressive form of pulmonary tuberculosis, which in the vast majority of cases was accompanied by the decay of lung tissue, and thus, the release of mycobacteria, which illustrates their combativeness as a source of infection. Disseminated tuberculosis was observed in 55 (27.6%) individuals. Fibrous-cavernous tuberculosis «accompanied» cohabitants in the center of this infection in 10 (5,0%) observed. In general, we observed the most aggressive forms of tuberculosis (infiltrative tuberculosis, disseminated tuberculosis, and fibrous-cavernous tuberculosis) in the vast majority of studied patients - 188 (94,5%).

It is worth emphasizing that the source of tuberculosis infection in 4 (2,0%) was extrapulmonary tuberculosis – tuberculous pleurisy, which most authors consider a non-life-threatening form of the disease in terms of possible contamination of others. Having considered such an experience, we applied a specific examination of such patients. The results will be discussed below.

Bacillary sources of tuberculosis were 99 (49,7%) observed. Microscopically, Mycobacteria of tuberculosis were found in 57 (57,6%) people.

Among the contactees, Mycobacteria tuberculosis were found in 94 (45,4%) patients. Microscopically, this was proved in 113 (54,6%). In the process of microbiological study, the sensitivity of Mycobacterium tuberculosis to antibacterial drugs was confirmed in 20 (20,2%) patients-sources of tuberculosis. Among familial tuberculosis contactees, susceptible mycobacteria were revealed in 26 (27,7%) individuals (p> 0,05). Multidrug resistance among patients-sources of tuberculosis was proved in 39 (39,4%) subjects, and among contactees of familial tuberculosis – in 31 (33,0%) persons (p>0,05).

In rural areas, there were 14 patients with familial tuberculosis fewer among the contactees than the sources of infection, while there were more than 22 urban contactees. Male patients predominated among the patients-contactees (11 more). However, their number was less than the in the sources of infection. Attention was drawn by a significantly higher number of contactees with newly diagnosed tuberculosis among females – 52 people – compared to the number of sources (27). The difference was 25 people (p<0,05), indicating a significantly higher risk of developing familial tuberculosis in females, which can be explained by the greater possibility of contamination at home contacting with tuberculosis patients to the level that causes the disease. We see a similar situation among rural patients. However, the number of newly diagnosed patients with familial tuberculosis in female patients was higher than among males. That is, there were 3,4 times more female contactees with familial tuberculosis (p<0,05). In contrast to the group of patientssources of tuberculosis infection among urban residents, where there was only 1 person under 18. In the group of contactees there were 28 (30,4%) among rural dwellers, and among urban residents - 24 (20,9%). These two figures draw much attention. Their total number was 52 people. Thus, the availability of tuberculosis infection sources at home leads not only to the contamination of contactees but also to the disease development. Concerning all patients with familial tuberculosis, family-type contactees under 18 count for 207 people. Such a number (25,1%) is thought-provoking and worrying. Thus, what will be the life of these children in the future when they face all the realities of life, considering negative, as well as all the risk factors.

# DISCUSSION

Considering the above-mentioned issues, we should emphasize that the maximum number of sources of tuberculosis – 158 (79,4%) people were at the age of 29-58, i.e., at the most productive age. At the same time, the vector of the maximum number of family-type patients (contactees) has shifted to rejuvenation: 19-48 years – 117 (56,5%) people. These people are still receiving education, including vocational education, and improving their professional skills. This is the cohort that the present and future of any state depend on. Unfortunately, the disease has hindered them from living active social life for many months. Moreover, the significant incidence between females and children under 18 (25,1%) should be emphasized.

Peculiarities of pulmonary tuberculosis are presented in the Table 2. It shows that the predominant form of tuberculosis between sources of infection and contactees of familial disease was infiltrative (61,8% and 57,0%, respectively – p>0,05) and disseminated tuberculosis (27,6% and 12,6%, respectively). A significant number of contactees with extrapulmonary tuberculosis is noteworthy – 26 (12,6%), which is much more difficult to diagnose as there are no specialists in extrapulmonary tuberculosis. Within the research presented in this article, we are considering their total number, everything else is the subject of a separate further study.

Bacillary cases among the sources of tuberculosis were found in 99 (49,7%) persons, and among the patients-contactees of familial tuberculosis - in 94 (45,4%) persons (p>0,05). Sensitive tuberculosis was revealed in 20 (20,2%) sources of infection, and among the contactees of familial tuberculosis - 26 (27,7%). Polyresistant tuberculosis among the sources of infection occurred in 16 (16,2%), and among the familial tuberculosis contactees - in 12,8% (p>0,05) patients. Multidrug-resistant tuberculosis was revealed in 39 (39,4%) patients, and in the familial tuberculosis contactees - 33,0% (p>0,05). Tuberculosis with extended resistance of Mycobacterium tuberculosis among was recorded in 7 (7,0%) sources of tuberculosis infection, and among the familial tuberculosis contactees - in 5 (5,3%) - p> 0,05. In general, tuberculosis with the last three types of resistance (multidrug-resistant, polyresistant, and with extended resistance), which are extremely dangerous for the patient-source of infection and contactee, as well, as the cost of treatment of these patients exceeds that of sensitive tuberculosis many times. It is incredibly difficult to achieve the abacillation of such patients. Despite the WHO's recommendations, as well as according to the order of the Cabinet of Ministers of Ukraine dated November 27, 2019 [4], which focuses on 85% sanitation of such patients, in our country, we can treat only 45-47% of such patients, which justifies the transfer of patients with multidrug-resistant tuberculosis to palliative treatment [5].

## CONCLUSIONS

Summarizing the results of the study, we can state that the availability of tuberculosis patients (199 people) in the family, who were not isolated for the entire period of treatment, led to the development of familial tuberculosis in contactees (207). The age of the diseased contactees tented to rejuvenation. Moreover, if there was only 1 patient under 18 among the sources of infection, there were 52 people among the contactees of familial tuberculosis. Extrapulmonary tuberculosis occurred in a significant number of contactees – 26

Table 2. Characteristics of contactees who fell ill from the source of familial tuberculosis by age and sex and place of residence

Place of re	esidence				Gender			
		0—18 years old	19—28 years old	29–38 years old	39—48 years old	49–58 years old	59 and older	Total
Urban	male	12	9	15	15	4	8	63
	female	12	11	12	9	3	5	52
	total	24	20	27	24	7	13	115
Rural	male	11	4	10	4	8	1	38
	female	17	11	13	4	3	6	54
	total	28	15	23	8	11	7	92
TOTAL		52	35	50	32	18	20	207

(12,6%) persons – p <0,05, compared with 4 (2,0%) patients in the group of the sources of infection, which further indicates the danger of familial tuberculosis. We consider the development of the latter is happening due to the reform of health care and the reorganization of the tuberculosis service. Favorable factors for the development of familial tuberculosis were close contact of family members with the source of infection (super-infection), which is confirmed by the higher number of patients with familial tuberculosis in the urban area (115) compared to rural areas (92) – p<0,05 and the predominant number of sick female contactees in rural areas – 54 (58,7%) compared to 38 (41,3%) males. The risk of developing tuberculosis was alcohol-addiction – 36 (18,1%), most males and only 1 female, and smoking abuse – 24 (12,1%).

Only 132 (66,3%) people among the sources of tuberculosis adhered to treatment. Unfortunately, there is no use asking other individuals in this group - 67 (33,7%) - to change their attitude to their health, and even more so to the health of others against the background of these habits, is useless. What is left to overcome this vicious circle? We think measures should be taken to overcome the second link of the epidemic process, which is breaking the chain of transmission of the infectious process. To this end, measures to isolate bacillary patients and persons with common pulmonary tuberculosis should be verified. To make it even more transparent - to stop the destruction of the tuberculosis service, as well as health care in general. We should stop and restore what is left before it is too late. We do understand that this is an incredibly difficult and problematic process, if at all possible.

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# ABOUT THE JOURNAL ACTA BALNEOLOGICA

Acta Balneologica is the scientific journal of the Polish Association of Balneology and Physical Medicine. It was created in 1905. The articles published in the bimonthly journal include peer-reviewed original papers, review papers, and case studies concerning spa medicine (balneology, bioclimatology, balneochemistry, hydrogeology) and physical medicine (physiotherapy, cryotherapy, kinesiotherapy, pressotherapy, and rehabilitation). The journal is unique for its subject matter not only in Poland, but also in Europe.

Every year, Acta Balneologica provides media patronage for many scientific medical events. The journal is addressed not only to doctors and rehabilitation and physiotherapy specialists who use knowledge from the field of balneology and physical medicine in their work, but also to heads of hospital departments, hospital directors, thermal stations and sanatorium managers, managers of public and private hospitals, clinics, and SPA and wellness centres, and specialists in other fields of medicine.

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# Medical and Social Reasoning of Improvement of Oncogynecological Diseases` Prevention System Management

Medyczne i społeczne uzasadnienie poprawy zarządzania systemem prewencji chorób onkoginekologicznych

DOI: 10.36740/ABAL202202113

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# SUMMARY

Aim: To analyze the dynamics of oncogynecological morbidity level in Sumy region and to identify barriers for prevention and early diagnosis of oncogynecological diseases in women.

**Materials and Methods:** study structure included: desk study (collection and analysis of statistical data), medical and sociological research on definition of barriers for prevention and early detection of oncogynecological diseases on the basis of primary medical level, which was conducted by questioning among women of Sumy region with an anonymous questionnaire with subsequent statistical processing of data using the license package of programs "PSQ" (processing of sociological questionnaires), a computer program of primary sociological information analysis.

**Results:** in the process of analyzing the dynamics of morbidity, mortality, annual mortality and neglect of diseases of oncopathology, a decreasing in the rate of morbidity was found with simultaneous increasing of annual mortality and neglect, which highlights a decrease in carrying out preventive examinations in women. This, in turn, worsens the possibility of diagnosis of gynecological oncopathology at the early stages and their prevention.

**Conclusions:** this requires development of a set of measures that would provide maximum coverage of regular gynecological preventive examinations in women. This mechanism can be effectively implemented through involvement the territorial communities in the process.

Key words: healthy lifestyle, quality of medical care, gynecologic oncology pathologies` prevention

Słowa kluczowe: zdrowy styl życia, jakość opieki medycznej, profilaktyka chorób ginekologiczno-onkologicznych

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#### INTRODUCTION

Cancer is second most common cause of mortality in the world following the cardiovascular diseases. In Ukraine, cancer is among five main causes of mortality. Among European countries, Ukraine ranks 2nd place in terms of cancer prevalence (with an annual increase about 3%) [1, 2]. In general ranking of mortality from the most common forms of malignant neoplasms, oncopathologies of female reproductive organs (cancer of the mammary glands, stomach, colon, rectum, ovary, cervix equal) take one of the main places and equal 57.6% [3]. The incidence of malignant neoplasms is of a great social-economic importance, since it leads to premature mortality and disability in female population, significant economic losses due to direct and indirect costs associated with this pathology [4, 5].

Taking into account the high mortality from cancer in Ukrainian women, it is considerable to implement a comprehensive approach to measures, related to the prevention and early diagnosis of oncogynecological pathology. It is proved the earlier diagnosis is made, the more successful the treatment is and the more favorable the prognosis is done. Thus, survival in case of diagnosis and treatment started at 1st clinical stage of the disease is 92%, at II – 88%, at III – 42%, at IV – 13% [2].

Cancers of female reproductive system are most common in structure of oncological morbidity (37%). As a cause of death, malignant tumors of female genitals occupy the second place; and in women of working age – the first one. These losses are

of social importance at the national level, negatively affecting the demographic situation, since women of reproductive age (15-49 years) make up almost a third of the total number of cancer patients – 27.5% [6].

The mortality rate associated with cancer in Sumy region women was: 2018 - 87.5%, 2019 - 89,1%. The number of deaths from malignant cervical neoplasm at the age of 30-59 years per 1000 women of the corresponding age in 2018 was 0.08 cases, in 2019 - 0.1 cases, in 2020 - 0.07 cases. According to the Sumy Regional Oncology Dispensary in 2020, there was a decreasing neglect during the diagnosis of uterine cancer from 2.8 to 1.2% (Ukraine – 3.9%), increasing of neglect in cervical cancer diagnosis from 11.82% to 20% (Ukraine – 25.5%) and in case of ovarian cancer diagnosis – from 11.2 to 15.4% (Ukraine – 15.8%) in region. The level of coverage of cytological examination with oncology examinations in 2020 decreased by 35.6% and equaled 31.6% of the planned index (in 2019 – 67.2%).

Most cases of cancer can be prevented by vaccination against human papillomavirus. At the same time, it should be noted that early diagnosis significantly increases chances of successful treatment.

#### AIM

The aim of the study is to analyze the dynamics of oncogynecological morbidity level in Sumy region and to identify barriers for prevention and early diagnosis of oncogynecological diseases in women.

## MATERIALS AND METHODS

Study structure included: desk study (collection and analysis of statistical data), medical and sociological research on definition of barriers for prevention and early detection of oncogynecological diseases on the basis of primary medical level. The second step was conducted by questioning among women of Sumy region with an anonymous questionnaire. There were 662 respondents aged 18 and above (error of representation with probability of 0.95: not more than 4%) with subsequent statistical processing of data using the license package of programs "PSQ" (processing of sociological questionnaires), a computer program of primary sociological information analysis. The field stage of the research was implemented between July 15 and August 20, 2021. At the first stage, a program and tools were developed, a sample was formed, and a survey methodology was developed under quarantine restrictions. At the second stage, a mass population survey was conducted with a specially designed questionnaire. At the third stage, questionnaires were selected and computer processing was carried out. The research was approved by Ethics Commission of Sumy State University University, according to the European bioethics and bio-rights, Helsinki Declaration of the World Medical Association.

#### RESULTS

The total number of patients with first made oncogynecological diagnosis in recent 5 years is 2,113 women. From them, 167 women in Sumy region have been diagnosed with uterine body cancer, 97 – with ovarian cancer in 2020 alone, and 90 women with cervical cancer (Table 1).

Dynamics of diagnoses made for the first time in 2016-2020 for cervical cancer and uterine cancer are reduced, but this cannot be considered as general morbidity decreasing.

The ratio of morbidity, neglection and mortality indexes allows to determine the real status of oncogynecology in Sumy region. In particular, during the period of 2016-2020, the incidence of cervical cancer decreased by 20.29%; however, the annual mortality increased by 20.4%, and neglection of the disease increased by 157.15% (Table 2). One of the factors in reducing of examinations` number are quarantine restrictions, due to the Covid-19 pandemic, as a result of which a significant number of cases of morbidity was not registered, and women consulted oncogynecologists already at the stage of neglected (advanced) disease.

We also observe negative dynamics regarding ovarian cancer, the rate of which increased by 4.22%, and the rate of neglect of which increased by 54% (Table 3).

Somehow more positive is dynamics of of uterine cancer incidence (Table 4).

Thus, indicators of neglection and mortality from cervical cancer and ovarian cancer are increasing despite the fact that general incidence rate is decreasing, which may show a low level of diagnosis of these diseases at early stages.

The indicator of neglection in context of age groups in 2016-2020 (Table 5) shows that the largest number of neglected cases is found in the age groups of 45-60 years and in 60 years`.

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Voor		Number of patients						
Tear	Cervical cancer	Uterine body cancer	Ovarian cancer					
2016	117	214	96					
2017	117	233	91					
2018	127	206	110					
2019	110	233	105					
2020	90	167	97					
Increase rate, 2020/2016 yrs, %	-23,08	-21,96	1,04					

The data from Table 6 demonstrate that the biggest number of women with oncogynecological pathology is recorded in over 60 age group, which may be associated with decreasing attention to their health and late searching for medical help in women of retirement age. While studying the dynamics of preventive examinations coverage, it was found that in 2020 this index has decreased, which negatively affected detection of new cases. Thus, coverage of oncological preventive examinations with cytological test in 2020, had decreased by 2.5 times, compared to 2016. Also,

# Table 2. Cervical cancer index dynamics in 2016-2020 yrs

Index (data)	2016	2017	2018	2019	2020	Increase rate, %,
Morbidity, per 100 000	20,7	19,6	22,8	19,7	16,5	-20,29
Mortality, per 100 000	8,5	7,5	8,1	10,3	7,1	-16,47
Annual lethality, %	9,8	7,7	9,3	7,9	11,8	20,41
Neglection, %	5,6	6,0	5,2	11,82	20	157,15

# Table 3. Ovarian cancer dynamics, 2016-2020 yrs

Index	2016	2017	2018	2019	2020	Increase rate, %,
Morbidity, per 100 000	16,6	16,1	20,0	19,9	17,3	4,22
Mortality, per 100 000	10,1	10,0	9,6	7,9	9,0	-10,89
Annual lethality, %	28	22,9	14,3	20,0	14,2	-49,28
Neglection, %	10,0	9,4	13,6	11,2	15,4	54,00

#### Table 4. Uterine body cancer dynamics, 2016-2020 yrs

Index	2016	2017	2018	2019	2020	Increase rate, %,
Morbidity, per 100 000	38,0	42,3	36,5	42,5	30,9	-18,68
Mortality, per 100 000	11,6	10,9	10,7	8,7	8,7	-25,00
Annual lethality, %	9,0	13,1	7,7	6,3	5,6	-37,77
Neglection, %	2,6	1,2	2,8	2,8	1,2	-53,84

# Table 5. Pathologies` neglect indexes dynamics in different age groups, 2016-2020 yrs., %

	Age group	0-15	15-30	30-45	45-60	Older 60	
	Cervical cancer	-	0	3,8	5,4	6	
2016	Uterine cancer	-	-	0	6,8	0,7	
	Ovarian cancer	-	0	20	7,9	11,1	
	Cervical cancer	-	-	6,5	6,3	5,3	
2017	Uterine cancer	-	-	0	0	1,4	
	Ovarian cancer	0	0	0	10,7	12,8	
	Cervical cancer	-	0	0	8,6	0	
2018	Uterine cancer	-	0	0	3,5	2,8	
	Ovarian cancer	-	0	7,7	7,9	20,7	
	Cervical cancer	-	0	12	19,6	2,6	
2019	Uterine cancer	-	-	7,7	4	2,1	
	Ovarian cancer	-	0	0	6,9	19,2	
2020	Cervical cancer	-	-	19	15,4	26,7	
	Uterine cancer	-	-	0	2,3	0,8	
	Ovarian cancer	-	0	0	16	18,3	
Age group	Rate of patients, (number,%)						
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	Cervical cancer	Uterine cancer	Ovarian cancer				
0–15	0	0	0				
15–30	1 (1,1%)	0	4 (4%)				
30–45	21 (22,1%)	4 (2,2%)	8 (8%)				
45–60	40 (42,1%)	46 (25,8%)	25 (25%)				
Over 60	33 (34,7%)	128 (71,9%)	63 (63%)				
Total	95 (100 %)	178 (100 %)	100 (100 %)				

#### Table 6. Number of women with oncogyneclogical diseases in different age groups, 2020 year

Table 7. Dynamics of preventive examinations vs number of patients in 2016-2020 yrs

Index	2016	2017	2018	2019	2020	Increase rate,%, 2020/2016
Total of oncological patients diagnosed during examinations	186	178	202	212	169	-9,14
Total of oncological patients with first time diagnosed cancer	427	441	443	448	354	-17,10
Number of preventive examinations (cytological test)	417857	403564	384060	341644	159338	-61,87
Number of women to be examined	517871	513358	513358	508111	504737	-2,54

the total number of cancer patients detected during preventive examinations decreased by 9.14%; the total number of cancer patients, who were diagnosed with cancer for the first time, decreased by 17.10%; the number of preventive examinations (cytologically tested) decreased by 61.87%; the proportion of cancer patients detected during examinations increased by 9.6% (Table 7).

Data analysis indicates a decreasing in coverage of oncologies' preventive examinations with cytological test during the 2016-2020 years, both in Sumy and region. So, in 2020, only one out of three women (31, 0% and 31.6% respectively) underwent cytological examination. Therefore, such a low level of prevention does not allow in-time detection of precancerous conditions or tumors at early stages.

Thus, in the process of analyzing the dynamics of morbidity, mortality, annual mortality and neglect of diseases of oncopathology, a decreasing in the rate of morbidity was found with simultaneous increasing of annual mortality and neglect, which highlights a decrease in carrying out preventive examinations in women. This, in turn, worsens the possibility of diagnosis of gynecological oncopathology at the early stages and their prevention.

As a result of a mass survey among female population of the region, barriers to the prevention and early detection of oncogynecological diseases were found and evaluated. In total, 662 women participated in the survey, which is sufficient to reflect the general situation and trends. In them, 26.9% aged 18-29 years, 34.6% aged 30-49 years, 20.5% – 50-64 years and 18% were older than 65 years. Among the women surveyed, 11.6% live in the village, 8.5% – in urban-type village, 45.5% – in towns, 34.4% live in the regional center. As a result, the survey found that about half of rural residents (52.7%) do not visit their family doctor for preventive procedures (in case of absence of disease's signs); yet, this percentage is much higher among women who live in the regional center (69.3%). In general, every second woman (55.9%) does not visit her family doctor for prevention if absence of complaints. As a result, the incidence of oncogynecological pathologies in Sumy region has been increasing over past 5 years. According to statistical data of the Sumy Oncological Dispensary, women are mainly treated at 2-3 stages of the disease (about 90% of cases), less – at 1<sup>st</sup> and 4<sup>th</sup> stages (7-10%). It should also be noted that oncogynecological diseases are commonly found in women after 30 years. Thus, the issue of oncogynecological preventive examinations is extremely important.

Mostly, women undergo preventive gynecological examinations, consulting a gynecologist (70.1%), 9.5% – a family doctor and 2% consulting an obstetrician. Almost a fifth of the women surveyed do not consult the doctors for preventive gynecological examinations.

Analyzing this issue in a context of age, it was found that 40.3% of elderly women (65 years and older) do not contact medical specialists to prevent and early diagnose the oncogynecological diseases at all.

When choosing a gynecologist, women are most often guided by professionalism (66%) and attentiveness (43.1%) from a specialist, in particular, his attention to prevention of gynecological diseases (20.8%).

Having the ability to specify several options, still not many respondents (6.6% -7.3%) were guided by the costfree and speed of examination. However, almost one out of five women are forced to choose a gynecologist, orienting on place of residence proximity. It is also noteworthy that 13% are women noted they do not have a gynecologist to contact with at all.

The professionalism and attentiveness of a specialist are more often pointed out by women aged 18 to 29 years; and women at the age of 50 to 64 years likely chose specialists who are closer to their place of residence (25% of all respondents). Women over 65 years prevail among those who are looking for a free gynecologist, are indifferent to any criteria, or do not have a specialist of this profile at all.

As a result of survey analysis, it was found that only 60% of women regularly undergo preventive gynecological examinations. Most of the respondents visit gynecologist only once a year (46.8%). 13.4% of respondents consult the specialist twice a year; the same rate is among those who visit the specialist once every two years. While 13.6% do not have examinations at all, about 26% undergo it irregularly or only if necessary (0.6%).

Table 8 allows to analyze questions in detail, depending on age of respondents. More conscious in this matter were women aged 18-29 years, they consult a gynecologist with a frequency of 1-2 times per year. There is a certain pattern present: the older the woman is, the less she consults the specialists or does not attend consultations at al.

By analyzing the frequency of women's gynecological examinations depending on their place of residence, it was found that women from villages and settlements were less likely to visit gynecologist. Respondents from towns visit gynecologist more often than others: twice a year (16.6%). 50.4% of residents from regional center consult a gynecologist at least once a year (Table 9).

Therefore, the farness of the medical institution from the place of residence significantly reduces the frequency of visiting a gynecologist, especially in the villages.

About half of the respondents (47.9%) noted that they visited a gynecologist for prevention procedures, and 6% –

namely for oncoprophylaxis. In this issue, certain differences in views of the surveyed women and gynecologists were revealed. Doctors emphasize that the majority of women's appeals are still recorded with complaints and for medical purposes, yet not for preventive examinations. It was also found that young women aged 18 to 29 years (59.6%) are main visitors for gynecologists, searching for prevention. Respondents older than 65 years often indicate that they visit a gynecologist for the diagnosis of diseases (15.1%) and for oncoprophylaxis (10.1%). In the same group, the most identified are those who do not undergo gynecological examinations at all (36.1%).

Most women (71%) note that gynecologists pay attention to prevention during examination, emphasizing the importance of attending regular preventive gynecological examinations. More often, this variant of the answer is indicated by younger women: of the age under 30 (78.9%) and under 50 (78.6%). Older women are more likely to note that the issues of prevention during the examination are not discussed. In addition, representatives of this age group occupy a "leading" position among those who do not undergo preventive gynecological examinations at al.

Therefore, it should be noted that from 12 to 16% of the surveyed women do not undergo gynecological examinations and do not visit a gynecologist for preventive purposes. One of the tasks was to find out the causes of this phenomenon. The majority of women (70.5%) answered that they were undergoing gynecological examinations, thus, 100% included those who did not undergo examinations for some reason. Most of those who do not visit gynecologist note such reason as feeling healthy enough (21.7%), although this does not justify the fact that they are not engaged in disease prevention. Another 15.7% feel discomfort during gynecological examination, 10.2% prefer self-treatment. All other women indicate following reasongs: they do not have time for preventive examinations, it is difficult to get to the specialist or even to get appointment,

	Twice a year	Once a year	Once per two years	Less than once per two years	Do not attend gynecological examinations	Attend only if needed
18-29 y.o.	24,2	57,3	9,6	4,5	4,5	0
30-49 y.o	16,6	51,1	13,1	10	8,3	0,9
50-64 y.o	5,9	44,9	22,8	11	14,7	0,7
65 y.o. and over	0	25,2	14,3	23,5	36,1	0,8

Table 8. Frequency of gynecological examinations (depending on age), %

**Table 9.** Frequency of gynecological examinations (depending on place of residence), %

	Twice a year	Once a year	Once per two years	Less than once per two years	Do not attend gynecological examinations	Attend only if needed
Village	14,3	41,6	15,6	9,1	18,2	1,3
Settlement	8,9	48,2	14,3	12,5	16,1	0
Town (not regional center)	16,6	45,2	14,6	10,3	12,3	1
Regional center (city)	10,1	50,4	13,6	12,7	13,2	0

an inconvenient schedule or a high cost of services that do not always depend on the women themselves.

Analyzing this issue in perspective of age-related aspect, it was found that women of younger age are more likely to undergo gynecological examinations, and women aged 30-49 years often do not have free time and complain about uncomfortable schedule. Respondents aged 50-64 more often indicate the "lack of information about possibility of undergoing a gynecological examination". And those who are older than 65 years, either prefer self-treatment, or consider themselves healthy (Table 10).

Women from Sumy more often, compared to other respondents do not have a gynecologist to consult (21.8%) or they find it difficult to make an appointment with a doctor through queues (14.9%). Respondents from Sumy district complain of discomfort during gynecological examinations (31.4%), and, therefore, prefer self-treatment (23.5%). Most often women from villages complain of difficulties to get to the doctor (28.6% both), as well as of the high cost of such a procedure. Residents of the regional center do not have enough time and undego difficulties with appointment, cause of large queues.

#### DISCUSSION

So, in most cases, it is low awareness in women about the need to undergo examinations and opportunities for medical care at the primary level of healthcare ("Lack of information on statistics of the disease prevalence, prevention, vaccination, lack of educational work") is the main barrier for regular preventive gynecological examinations.

Through questioning, what needs to be changed, so that women would regularly undergo gynecological examinations, the following results were found: 15.3% of women surveyed consider the main factor an information spreading (this point is more often chosen by women under the age of 30); 13.6% undeline the need of simplification of the procedure of appointment; 12.1% emphasize that attending a preventive gynecological examination should be reminded by a family physician (a popular option among women older than 65 years) and 5% propose to change the schedule of specialists. Therefore, it is necessary to increase public awareness on prevention of oncogynecological diseases, in particular, regarding vaccination against cervical cancer. It is also necessary to change the work schedule of gynecologists and family physicians to prioritise a few hours of work only for communication on prevention of oncology in women. In addition, it is necessary to attract local, district radio, television, Internet resources, insurance medicine for cooperation.

In women from villages it is extremely important to change the schedule of specialist work, and for women from small towns – to simplify the appointment procedure. For the surveyed women from the regional center, it is important to get more information on need to attend the examination and get reminds form the family physician.

Recognizing that not all women understand the risks and importance of preventive examinations, experts note that there is a need in information that would be provided in a language that is understandable to the population. The most accessible channel is Internet networks, in districts – local radio and television, conversations with teenagers on the culture of sex life, with parents on vaccination against human papillomavirus. Special attention to examinations should be paid by family doctors, who direct patients, sending mailings-reminders about preventive examination by phone.

#### CONCLUSIONS

- 1. Analysis of coverage level of gynecological preventive examinations with cytological test during 2016-2020 years indicates a decreasing in women both in Sumy and in Sumy region. Special attention is required to decreasing of the level of oncological preventive examinations with cytological test in 2020, compared to 2016 in the region (2,5 times). Indeed, in 2020 only one in three women underwent oncogynecological preventive examination with cytological test.
- 2. Low level of preventive examinations does not allow to detect precancerous conditions or cancer tumors at early stages. In the process of analyzing the dynamics of mor-

	18-29 y.o.	30-49 y.o.	50-64 y.o.	65 y.o. and over
Do not have a gynecologist to consult	12,8	14,7	13,6	13,1
A specialist is not easily accessible	10,3	4	11,4	11,5
Difficult to visit gynecologist as there are big queues	10,3	4	6,8	14,8
Uncomfortable working schedule	20,5	18,7	15,9	3,3
Not enough information on possibility to attend gynecological examination	10,3	2,7	15,9	13,1
Feeling discomfort during it	23,1	21,3	18,2	31,1
Do not have enough time	15,4	26,7	18,2	11,5
Examination is too expensive	10,3	5,3	6,8	3,3
l prefer self-treatment	5,1	10,7	11,4	31,1
Consider myself healthy	43,6	25,3	36,4	32,8

**Table 10.** Reasons, why women do not attend the gynecological preventive examinations, (age-related), %

bidity, mortality, annual mortality and neglect of oncopathology diseases one may see a decreasing in the rate of morbidity. However, we found the simultaneous increasing in general annual mortality and neglect indexes, which is directly related to the decreasing in coverage by preventive examinations in women, which, in turn, adversely affects the detection of new cases of cancer and their prevention.

3. This requires development of a set of measures that would provide maximum coverage of regular gynecological preventive examinations in women. This mechanism can be effectively implemented through involvement the territorial communities in the process.

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#### **Conflict of interest:**

The Authors declare no conflict of interest

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We offer our device in three variants, depending on the capacity of liquid nitrogen tanks: 30, 50 and 15 litres. Benefits for patients: pain relief, acceleration of metabolism, reduced inflammatory process, reduced use of anti-inflammatory and analgesic drugs, relieved skeletal muscle tension, faster regeneration and recovery, improved mobility of treated joints, speeding up recovery process, reduced swelling, reduced cellulite and firm skin.

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# Algorithm for Creating a Multidisciplinary Team in the Palliative Care System

# Algorytm tworzenia zespołu multidyscyplinarnego w systemie opieki paliatywnej

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#### SUMMARY

**Aim:** The study aimed to develop an algorithm for organizing the work of a multidisciplinary palliative care team in a territorial community. **Materials and Methods:** The following methods were employed: analysis of the regulatory framework, statistical data, international and domestic experience, scientific literature, opinion survey, strategic sessions, participant observation. The field research was conducted by the Center for Social Research of Sumy State University together with the NGO "Family Circle of Trostianechchyna (Trostianets district)" in the Trostianets territorial community of Sumy region (Ukraine) during September-October 2021. Eighty respondents took part in the survey. Up to 30 people joined the strategic sessions at different stages.

**Results:** The survey discovered that at the research time in the pilot territorial community, the needs of palliative patients were more restrained than those who rendered assistance. However, in both cases, there is a high demand for social services against the background of medical services. Proceeding from the identified needs and by the results of strategic sessions, we proposed an algorithm for organizing the work of a multidisciplinary palliative care team at the territorial community level. The algorithm distinguishes between the program and operational levels. We put forward the structure of the interdisciplinary palliative care team.

**Conclusions:** As a conclusion, we can specify the following points. The study confirmed the hypotheses that the basics of the identified needs and the use of strategic sessions with multidisciplinary participation of community members facilitate the development of an efficient algorithm. The designed operational level of the interdisciplinary team recorded the practices available in the pilot community. Simultaneously, the collaborative design determined the development of the multidisciplinary team itself. The involvement of management representatives, junior medical staff, and social workers became an essential factor in their inspiration, contributing to the development of human resources for a new level of quality in palliative care.

Key words: need, palliative care, multidisciplinary team, healthcare professionals, social workers

Słowa kluczowe: potrzeba, opieka paliatywna, zespół multidyscyplinarny, pracownicy służby zdrowia, pracownicy socjalni

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#### INTRODUCTION

As of the beginning of 2019, 324,113 people in Ukraine needed palliative care, of whom adults amounted to 258,207 and children to 65,906. In 2020, the National Health Service of Ukraine, for the first time, concluded agreements on the groups of services "Inpatient palliative care for children and adults" with 431 medical institutions and "Mobile palliative care for children and adults" with 203 medical institutions. In total, 66,187 patients in hospitals and 26,913 patients in mobile services entered into a contract for palliative care [1].

Currently, Ukraine has adopted regulatory legal documents that provide a multidisciplinary approach to rendering palliative

care by doctors, nurses, social workers, psychologists, lawyers, clergy, and others when required [2]. In other words, services are supposed to be provided both by health care structures and social protection authorities involving other professionals. However, regulations offer minimum standards, whereas each community can expand the range of services and choose its model of palliative care.

International experience attests that high-quality palliative care can come into effect subject to a strong interaction between health professionals and social workers, volunteer services, service providers (including spiritual support or legal advice), the community, and families in need of assistance. Surveys conducted by Monterosso L, Kristjanson L, Phillips M. (2009) proved the urgent need for multidisciplinary family support [3]. Whereas the study by Boddaert, M., Stoppelenburg, A., Hasselaar, J. et al. (2021) dedicated to improving the activities of Specialist palliative care teams (SPCTs) identified significant differences in the integration and versatility of patient care [4].

A literature review showed that papers on palliative care problems focus on the multidiscipline team composition analysis in palliative care for patients with Parkinson's disease [5]; on effective interaction of representatives of medical, social, psychological, and other spheres to meet the needs of patients with life-limiting illnesses and the coherence among multidisciplinary team members, patients, and families [6]; on highlighting the necessity to support an interdisciplinary team [7], on statistical data and other quantitative indicators to determine the actual needs of palliative patients [8].

The research supports the benefits of multidisciplinary palliative care teams. The optimal team formation should occur based on the palliative care needs analysis. Providing palliative care in the whole complex, including psychological and social services, which is necessary for patients with a palliative diagnosis and their families, requires appropriate organization and resources, including local resources of territorial communities.

#### AIM

The study aims to propose an algorithm for organizing the work of a multidisciplinary palliative care team at the level of a territorial community, which would allow for people's current needs and available resources.

The tasks are as follows:

- 1. Analysis of the available international and Ukrainian experience in palliative care needs assessment;
- Conducting a pilot study to investigate the needs in a pilot community - Tostianets territorial community of Sumy region (Ukraine);
- Designing an algorithm for organizing the work of a multidisciplinary palliative care team at the territorial community level.

The research hypothesis assumes that developing an effective algorithm is possible based on identified needs through strategic sessions with multidisciplinary participation of society representatives.

#### MATERIALS AND METHODS

We used methods such as analysis of the legal and regulatory framework, statistical data, international and domestic experience, scientific literature, opinion survey, strategic session, and participant observation during the research. The activity was implemented by the Center for Social Research of Sumy State University, in cooperation with the NGO "Family Circle of Trostianechchyna (Trostianets district)" during September-October 2021 as part of the project "Development and implementation of tools for training volunteers toward providing medical (including palliative) care in Trostianets community". The study was conducted in the Trostianets territorial community of the Sumy region (Ukraine).

#### RESULTS

The face-to-face method stipulated an opinion survey of palliative care recipients and their family members (including caregivers), a total of 80 respondents, 62.5% of whom were women and 37.5% men. The distribution of surveyed palliative patients by social categories included: the elderly (50.6%), the low-income (36.7%), people with incurable diseases, diseases requiring long-term treatment (32.9%), people with partial or complete loss of physical activity, memory (31.6%), people with disabilities (20.3%), with mental and behavioral disorders, in particular, due to the use of psychoactive substances (7.6%) and the homeless (5.1%).

Studying the needs of society is a crucial component of ensuring people's quality of life. A qualitative and timely needs assessment is an integral part of proper governance based on data analysis, an essential tool for the local governments' work efficiency. It allows them to consider the problems, limitations, and consequences of decisions and programs for different population groups.

The world uses a wide range of methods to identify the need for palliative care, both at the community level and at the level of the individual family or client/patient. There are several sets of indicators and quality-of-life assessment scales.

Comparison of rendering palliative care in different countries occurs according to the death quality index. Thus, the Economist Intelligence Unit ranked countries depending on attendance conditions for those nearing the end of their lives and dying. The methodology assumes expert assessment and statistical analysis of 24 qualitative and quantitative indicators, grouped into four main sections: primary social and medical services for people at the end of life; availability and accessibility of services; service cost; service quality [9]. The WHO Guidelines for Program Managers "Planning and Implementing Palliative Care Services" [10] defines four groups of indicators due to consideration when implementing palliative care services: education indicators; service delivery indicators; drug indicators; result indicators.

It is stipulated that every palliative care service should initially include accounting and evaluation mechanisms to ensure that effective programs are supported, and resources are not wasted on ineffective programs.

Based on the approaches proposed in the Global Atlas of Palliative Care [11] and Assessment of the Need for Palliative Care for Children (International Children's Palliative Care Network, UNICEF), 2013], in the autumn of 2017, Ukrainian Center for Public Data modeled the need for palliative care in children and adults based on mortality data and prevalence of certain diseases in Ukraine [1]. By this model, according to 2018 data, the need for palliative care in the Trostianets territorial community is at the level of 240 people (including 22 children).

Our study assumed:

 Detection of physical, emotional, social, and spiritual condition in patients and their family members (including caregivers);

- Identification of medical, social, psychological, and spiritual services required by the patient and his family members (including caregivers);
- An assessment of the interaction between the main actors of palliative care.

The study also considered that a common practice in identifying palliative care needs is interviewing palliative patients and caregivers.

56.7% of patients receive care at home and 43.3% in health care facilities. Rural residents are more likely to receive medical care (65% of rural residents and 35% of urban ones).

Assessing their own physical and psychological condition, clients noted that they suffer from depression (44.4%), incapability of self-caring (40.3%), suffer from weight loss (33.3%), sleep disturbances (33.3% each), chronic fatigue and tiredness, anxiety/stress (25% each). In turn, 29.2% of respondents among family members of palliative patients note the impossibility of caring for the patient, 24.6% confess to deteriorating their health and anxiety/stress, 23.1% - to the feeling of depression, 20% - to chronic diseases, 18.5% - helplessness and 16.9% - physical fatigue.

Among the declared needs for palliative care, patients note: home care, daycare (32.5%), social support (18.33%), and access to medicines (10.83%) (Figure 1).

In turn, those caring for palliative patients point out the need for: assistance in attendance (35%), health professionals' counseling (33.3%), psychological assistance (31.7%) (Figure 2).

Thus, the results of the palliative patients' survey and caregivers allow us to identify diverse needs (physical, social, legal, emotional, psychological, spiritual) and form the optimal multidisciplinary team.

The study emphasizes that the patient's physical suffering from pain goes along with psychological, mental anguish. Therefore, in addition to physiological and treatment needs, the patient's need for psychological and spiritual support, social support, legal counseling services is quite acute. Thus, there is a need for more extensive involvement of social work and psychology specialists, therapists, clergy, volunteers. It requires cooperation in the community between



Figure 1. Types of services a palliative patient needs



Figure 2. Types of services palliative caregivers require

health care, social protection, volunteer, public, and service organizations.

Moreover, if we group the required services, we see that palliative patients give 64.15% of the need for various types of social assistance, 19.99% - medical, 8.33% - psychological, 5% - Legal, 1,67% - spiritual assistance. Caring for palliative documents, palliative patients give 88.3% of the need for various types of social service, 51.6% - medical, 31.7% - psychological. Palliative care patients' needs are more restrained, while caregivers' are much more significant. However, in both cases, the demand for social services is a priority. Accordingly, it should find its expression in the structure of the Interdisciplinary team and the content of its work.

The Trostianets territorial community has contracted palliative care for patients in hospitals and mobile palliative care. However, under the specifications, funding is provided for medical services. At the same time, interaction with social services, the involvement of at least one social work specialist, including at the expense of local budgets, and funds from other programs of the central budget are the requirements for the organization of palliative care services. Also, beyond the contracts with the National Health Service, there is social work with caring relatives in response to existing needs. Herewith, the territorial community had an initiative and an agreed position of the local self-government and the public sector on the development of the palliative care system at the current level, based on the concept of the quality of a palliative patient.

The existing contradiction between the allocation of state funds for the medical component of care and the high demand for social assistance from people determines the need for program solutions at the territorial community level. Accordingly, it seems reasonable in the algorithm of work organization of a multidisciplinary palliative care team at the territorial community level to distinguish two tiers: program and operational.

To create a multidisciplinary team, the Trostianets territorial community involved:

- The city hospital (coordinates medical care and psychological support);
- The Center for Social Services (supplies with social workers and coordinates advisory and spiritual support);
- The non-governmental organization "Family Circle of Trostianechchyna (Trostianets district)" (searches for volunteers, attracts additional extrabudgetary funds);

• Local religious organizations (coordinate spiritual assistance to palliative patients).

In the project "Development and implementation of tools for training volunteers toward providing medical (in particular, palliative) assistance in Trostianets community," on the example of the pilot Trostianets community, we elaborated the two named levels of the algorithm through strategic sessions with the participation of local officials, doctors, social workers, junior medical staff, social workers. The structure of the algorithm program level for organizing the work of a multidisciplinary palliative care team highlights the components for identifying needs and assessing palliative patients' quality of life, interdisciplinary training of specialists, budget planning. During generalizing the developments, there appeared the idea of rotation in the program management of the representatives of primary health care and social protection system. The work coordination in the community provided for creating a Coordinating Council with the subsequent approval of an action plan. The Coordinating Council is being created at the initiative of the public organization "Family Circle of Trostianechchyna (Trostianets district)."The multidisciplinary team developed regulations for palliative care in the Trostianets territorial community. Both representatives of the authorities and civil society took part in it. The proposed "homework" was to develop a program for 2022, including the subsequent assessment of palliative care needs, budgetary and extrabudgetary funds attraction, advanced training of specialists involved in the practical service delivery.

The operational level of the algorithm was developed as a map of receiving targeted palliative care services for a specific person at the end of life (Figure 3).

One of the further tasks for the community is to conclude agreements between the subjects of palliative services to enhance interaction between them. The contracts spell out the interaction algorithm, define the areas of responsibility and standards of rendering services, accountability, coordination, and communication of work with members of the multidisciplinary team, and monitor the agreement implementation. Thus, the agreements will formalize the relationships between the palliative care subjects, obliging them to comply with uniform standards.

Following the proposed levels of the algorithm in the structure of the interdisciplinary team, it seems reasonable to distinguish the program level (with an annual management rotation from the direction of the primary medical care and social protection system) and operational level among doctors, social workers, junior medical staff, social workers in number corresponding to the current availability of needs. Under the present conditions at the operational team level, we plan to attract other specialists and representatives of the clergy.

#### DISCUSSION

The study results confirmed the necessity to assess palliative care needs. We performed such research in a pilot community - Trostianets territorial community of Sumy region (Ukraine), acquired data on residents' needs. Besides, there is a wide



Figure 3. Algorithm for organizing a multidisciplinary team

range of approaches to studying and analyzing requirements and life quality assessment. Further improvement of the currently employed methodology seems appropriate. We must state that now Ukraine has poorly developed data collection and analysis practices. However, such research results should gradually accumulate and become the basis for decision-making.

The survey as a method of analysis has its limitations, which are determined by the subjectivity of the respondents, whose answers may be due to their physical and psychological condition. In this regard, we should subsequently use analytical techniques, which allow us to collect objective data on the needs of palliative patients and caregivers.

The social survey results obtained in the pilot community gave impetus to strategic sessions with local self-government representatives, specialists, junior medical staff, and social workers. The strategic session resulted in the development of the multidisciplinary team structure, the program and operational levels of the algorithm for organizing its work to provide palliative care services. The work became possible due to the leadership and collaboration of local self-government and the public sector. However, further regular work in the community requires explicit coordination at both the program and operational levels. The idea of leadership rotation at the algorithm program level seems debatable. This idea is currently presented as a hypothesis and still needs to be tested in practice.

#### CONCLUSIONS

The survey revealed that social needs exceed medical ones, and the relatives' needs exceed those of palliative patients. This situation is relevant at the research time in the pilot community. However, other options seem possible. Following them, the idea of rotation at the head of the program level of the algorithm, whether it is a representative of the primary link of the medical system or the social protection system, is sound.

It is this set of actions on the algorithm program level for organizing the work of a multidisciplinary palliative care team that seems to be complete: scrutiny of existing needs, budgeting, training, and advanced training, coordination of the operational level of the algorithm according to the needs of palliative care specific clients, their relatives, the readiness of the latter to participate.

At the implementation stage, annual cycles seem appropriate for the program level of the algorithm, then – three-year ones.

During the strategic sessions, we confirmed the hypotheses that the basics of the identified needs and the use of strategic sessions with the multidisciplinary participation of community members will facilitate the development of an efficient algorithm. The designed operational level of the interdisciplinary team (palliative care map), to some extent, captures the practices available in the pilot community. Simultaneously, collaborative design and optimization of processes contribute to multidisciplinary team formation. Involving junior medical personnel, social workers, and management representatives became a significant factor in their inspiration, contributing to the development of human resources for a new level of quality in palliative care.

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#### **Conflicts of interest:**

The Authors declare no conflict of interest

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A – Research concept and design, B – Collection and/or assembly of data, C – Data analysis and interpretation, D – Writing the article, E – Critical revision of the article, F – Final approval of article

# Healthy Nutrition and Behavioral Economics: From Principle to Practice

Zdrowe żywienie i ekonomia behawioralna: od zasady do praktyki

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#### SUMMARY

**Aim:** To highlight the effect of using behavioral economics` methods, in particular, context and presentation of information that can influence behavior and choice of people in matters of healthy nutrition and disease prevention.

Matherials and Methods: The structure of the study included: coverage of the main issues of healthy nutrition in population of Ukraine and application of behavioral economics` methods, which were developed on the basis of our research (method of social experiment) with subsequent statistical processing of data.

**Results:** The absolute percentage of sales of dishes and drinks with green, yellow and red marking in cafeterias and canteens of Sumy State University at the initial stage, and after implementing of behavioral methods. The most significant changes occurred in sales of dishes with red labeling: it decreased by 20%; parallelly sales of green-labeled dishes increased significantly from 28% (before the experiment) up to 38% (after changing location compared to other dishes and using visual tips) and yellow-labeled dishes: the sales` index increased by 10%. Using of behavioral methods has also influenced the choice of drinks, but not significantly. Sales` index of "green" drinks during the experiment had increased by 4%, "yellow" – by 3%.

**Conclusions:** Simple behavioral methods as changing the default options (change of location/layout) distribution of simple and meaningful information about nutrition, labeling can improve the diet choice of people by shifting it towards the healthier one, which, in turn, will lead to a significant reduction in prevalence of cardiovascular diseases, obesity and related diseases. Cooperation with health officials and politicians in further can lead to the spreading of healthier eating behavior in population without limiting individual choice of people.

Key words: healthy nutrition, behavioral methods, public nutrition

Słowa kluczowe: zdrowe żywienie, metody behawioralne, żywienie publiczne

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#### **INTRODUCTION**

Healthy nutrition is a diet providing normal growing, development and human vital activity, as well as contributing to the strengthening of our health and diseases prevention. According to the latest recommendations of the WHO and the Public Health Center of Ukraine on healthy nutrition, it is necessary to increase the amount of vegetables, fruits, berries, fish and other seafood, whole-grains, cereals, nuts in the diet. It was also proposed to limit consumption of processed meat, red meat, sugary drinks and sugar, salt and alcohol-added products [1]. Poor nutritional quality and over-consumption can lead to deterioration of health and development of pathological conditions. Even with availability of information on healthy nutrition and programs to normalize body weight, the index of diseases associated with irrational nutrition tends to increase. Unhealthy nutrition is the most important risk factor for diseases of cardiovascular system, which are the first cause of premature mortality in Ukraine, as well as cancer, diabetes and other conditions associated with obesity [2, 3].

According to the data of Public Health Center of Ukraine, a significant part of Ukrainian population does not adhere to official recommendations on healthy nutrition, consuming few fruits, vegetables, whole-grains, fish and a large number of saturated and trans-fats. Traditional economic analysis cannot explain why lots of people choose risky behavior, influencing their own health. Thus, more and more scientists around the world address behavioral economics, which tries to explain why people behave irrationally and develop stimuli that can change people's behavior.

In the book "Nudge", RH Thaler and CR Sunstein have promoted the idea, that understanding how people make decisions can be used to encourage people to make right choices without limiting the freedom of choice itself. This philosophy of "libertarian paternalism" should encourage scientists, institutions, and governments to create choice environments that will "nudge" people to make decisions that will respond primarily to their own interests. Such methods are of particular interest in health care, through which improvements in public health can be achieved, since it is known, that even if there is plenty of information about healthy nutrition and programs to normalize body weight, the number of diseases associated with irrational nutrition is still increasing. This article describes the effect of using methods of behavioral economics to solve one of the main problems of public health – rational nutrition [4, 5].

#### AIM

The aim of the article is to highlight the effect of using behavioral economics` methods, in particular, context and presentation of information that can influence behavior and choice of people in matters of rational (healthy) nutrition and disease prevention.

## MATERIALS AND METHODS

The structure of the study included: coverage of the main issues of healthy nutrition in population of Ukraine and application of behavioral economics` methods, which were developed on the basis of our research (method of social experiment) with subsequent statistical processing of data. The experiment was conducted during one month, February 1-29, 2021 in the dining rooms of the Public catering complex of Sumy State University, attended by students of all specialties. The research was approved by Ethics Commission of Sumy State University, according to the European bioethics and bio-rights, Helsinki Declaration of the World Medical Association.

#### RESULTS

Taking into account the knowledge of behavioral sciences, one can easily explain why it is difficult for people to eat rationaly in modern food conditions. This article is based on the analysis of behavioral methods for justifying the effectiveness of mentioned policies as presentation of dietary recommendations and menu labeling. First of all, it is important to understand that environmental factors such as social atmosphere, presence and level of distractions and even lighting can affect food to-be-chosen by people and consumption amount. Therefore, some of these signals can, accordingly, be used to "nudge" people to rational choices [4]. Thus, introduction of successful means of promoting healthy nutrition, based on behavioral economics, can become an important tool of nutrition programs at schools and institutions of higher education, which aim to achieve a balance between satisfying dietary needs and encouraging healthy nutrition, normalization of body weight, and, accordingly, prevention of diseases [6]. Administrators of public catering have a unique opportunity to control elements that affect choosing food by people. Understanding how behavioral interventions can influence food choices and diet quality, heads of school canteens and university cafeterias can develop possible strategies to promote healthy nutrition. The study we had conducted, describes a behavioral experiment in the public catering complex of our university, which assessed the impact of certain behavioral methods, namely the context and presentation of information that can affect the choice of food. The experiment was designed to use in the context of any catering complex (at schools, colleges, universities).

In the current food environment, low-nutrient fat products are widely available, inexpensive and sold in large quantities without explicit marking. This circumstances make people prefer unhealthy food, even if this choice contradicts with keeping healthy lifestyle in the nearest future, since most people are susceptible to the biased benefits of the present over future costs or benefits. It is also important to take into account the fact that people tend to be overly optimistic about their health in future, constantly postponing abandoning of the negative ingrained food habits for «tomorrow» [7].

Most daily eating habits are irrational; they are habitual and automatic, as most people have a strong tendency to follow the default options – a phenomenon known as "status quo bias". Psychologists distinguish two systems of human thinking and decision-making: the "automatic system", through which decisions are made quickly, relatively easily, without thinking, and the "reflective system", which is controled consciously [8]. Unfortunately, the majority of food defaults encourage unhealthy choices. Public catering often offers large portions and unhealthy side dishes (for example, french fries) by default; so, those who want to choose healthier option should ask for an alternative (a large portion to replace with a medium or small one, or another dish at all).

Most nutrition decisions are made mainly by the automatic system. Processing information on the calorie content of food, based on a large amount of numeric data, requires certain efforts from person and involvement of a reflective system. Recent studies demostrate that it is difficult for people to process numeric information. For example, in recent years some cafes and restaurants have provided detailed information about portions, nutrient content in grams or milligrams along with percentage of the mentioned data, but mostly that is not effective. Many weight loss programs also require patients to count calories and body mass index, but using numeric data is problematic for most people. It has also been studied that labeling healthy food as "healthy" can reduce the demand for this product, because most people correlate notions of "healthy" and "tasteless".

More effective, in our opinion, is label or price tag of a certain color: green, yellow or red in order to inform buyer on low, medium or high level of calories and harmful substances such as saturated and trans-fats, salts, "sugar rush", etc. The advantage of this method of "traffic light" is that it satisfies the working mode of automatic system, using self-evident associations between "red" and "stop" and "green" and "go"; with them people make right decisions automatically without thinking. Examples of another effective ways of presenting information on calories and food safety, based on behavioral methods, can be ranking menu items from low-calorie to high-calorie or converting information on calories` amount

	Initial index (before implementation),%	Index after layout change, %	Index after implementation of visual tips, %	Index after layout change and visual tips, %	Validity, p
Dishes					
Green	28	31	34	38	p<0,05
Yellow	41	40	43	51	p<0,05
Red	31	29	23	11	p<0,001
Drinks					
Green	38	37	40	42	p>0,05
Yellow	18	19	19	21	p>0,05
Red	44	44	41	37	p>0,05

Table 1. The index of sales of marked goods at the initial stage and after the introduction of behavioral methods in cafeterias and canteens of the Sumy State University catering complex

into easily understood indicators, such as the number of steps a person will need to take in order to "burn" them, etc. Thus, by changing the format of message and making certain information more visible and easy to perceive, one can influence people's beliefs and behavior without limiting their choice.

Information containing recommendations for daily consumption of specific quantities of certain foods (e.g. 1 cup of milk, 100 g of hard cheese or 250 g of meat) also requires understanding and memorizing large amounts of data and visualizing different quantities of servings, e.g. how a portion of steak, weighing 250 g, looks like. These messages are difficult to perceive by most people. Much easier for them is a behavioral method, based on the "halfplate" infographics: an image of a plate, half of which is green-colored and goes with a message: "be sure you fill half of the plate with fruits and vegetables during each meal". According to the results of our research, about 81% of our university students had assessed the "half-plate" method as more motivating, pointing out that even 1 month after experiment with infographics, they chose more vegetables and fruits for lunch than before, as they sought to fill half of their portion like this. This suggests that it's better to sacrifice the accuracy of dietary recommendations to provide simple, memorable and motivating messages.

The experimental study we conducted was based on the effect of behavioral methods on people's eating habits, which proved that public catering can be converted into more useful, by spreading simple and meaningful information and changing the form of messages, which greatly affects decision-making on such an important issue, to maintain public health, as healthy nutrition. We regarded such methods of behavioral influence on decision-making, as layout of dishes and visual tips. Proper layout on display is important when choosing dishes, as it makes certain options more noticeable, attractive and accessible to consumers. Layout affects the subconscious choice of a person, satisfying the automatic system of decisionmaking. Visual tips also have a positive effect. They include informational signs, labels, tags or emblems that are located directly at the location of food choosing and consumption. For public catering complexes, the method of "half-plate"

can be successfully used to encourage consumers to include useful products in the required quantity for their diet.

According to the data from our study, which lasted for one month from February 1 to February 29, 2020 in the canteens of the Catering Complex of Sumy State University, the following results were distinguished:

- in the first week vegetable salads, salads with vegetable dressing and vegetable-fruit salads were located on the upper shelf at eye level; drinks made of dried and fresh fruits were located before the juices and drinks of industrial production at eye level of the customers. Also vegetable soups and dishes with boiled poultry and fish were added to the main menu. In all retail outlets of the catering complex, the sale index of these dishes and drinks had increased, but not significantly.
- in the second week, another motivation type (visual) was added. A menu with a list of "healthy food" dishes was printed on a green paper; the same list was duplicated in the main menu as well. After this, the sales number of mentioned dishes had increased.
- in the third week the dishes of the "healthy menu" were printed only on green paper and were located at eye level or in the first rows on the shelves. After two weeks of printing the menu on a green paper, visitors had formed the idea that only "healthy" or dietary food was presented in the green list.

Table 1 demostrates the absolute percentage of sales of dishes and drinks with green, yellow and red marking in cafeterias and canteens of Sumy State University at the initial stage, and after implementing of behavioral methods. The most significant changes occurred in sales of dishes with red labeling: it decreased by 20% (p< 0,001); parallelly sales of green-labeled dishes increased significantly from 28% (before the experiment) up to 38% (after changing location compared to other dishes and using visual tips) (p< 0.05) and yellow –labeled dishes: the sales` index increased by 10% (p< 0.05).

Using of behavioral methods has also influenced the choice of drinks, but not significantly (p > 0,05). Sales' index of "green" drinks during the experiment had increased by 4%, "yellow" – by 3%.

### DISCUSSION

Thus, this study evaluates the effectiveness of behavioral interventions in food labeling in promoting healthy choice of food. The results are based on the analysis of objective data, the index of sales of dishes and drinks, rather than on subjective results from customers' surveys. We found that intervention in choice of people by marking dishes, using the "traffic light" method in dining rooms and cafeterias, led to a reliable improvement for choosing a healthy food. The results obtained indicate that simple behavioral interventions in the food environment may take the central stage in health policy; they may help to improve the nutritional behavior in people, and, accordingly, play a significant role in prevention of diseases of the cardiovascular system, diabetes, obesity and others.

During the experiment, it was found that the first changes in the choice of visitors between "red" and "green" purchases occurred after the change in location of dishes, namely, when healthier dishes were placed in the first rows at eye level of customers. Further addition of visual tips, as labeling by the method of "traffic light" and infographics with the method of "half-plate" has led to the fact that sales of "red" goods had decreased even more with parallel increasing in sales of healthy dishes.

# CONSCLUSIONS

Behavioral sciences can shed light on important factors that contribute to the emergence of significant public health problems (including unhealthy nutrition). This article focuses on a few behavioral methods that help to explain why in modern food conditions it's so difficult to make the right choice of healthy diet, as well as how to achieve it, without limiting the freedom to choose.

The results of our study provide clear objective evidence that such simple behavioral methods as changing the default options (change of location/layout) distribution of simple and meaningful information about nutrition (method of "half-plate"), labeling (the "traffic light" method) can improve the diet choice of people by shifting it towards the healthier one, which, in turn, will lead to a significant reduction in prevalence of cardiovascular diseases, obesity and related diseases. Cooperation with health officials and politicians in further can lead to the spreading of healthier eating behavior in population without limiting individual choice of people. Despite the fact that this article is devoted to the problems of healthy nutrition in population, the findings can be applied to many other urgent public health problems.

#### PROSPECTS FOR FURTHER RESEARCH

The main promising issue is studying of the principles of behavioral economics and creation of methods, based on them, to influence behavior of people who want to be healthy, but for various reasons can not achieve results on their own; as well as the subsequent systematic using of these techniques in the field of health.

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# Therapeutic Exercises for Prevention and Rehabilitation of Sports Shoulder Injuries

Ćwiczenia terapeutyczne w zapobieganiu i rehabilitacji sportowych urazów barku

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#### SUMMARY

Aim: To analyze the functional effects of frequently used therapeutic exercises in the rehabilitation of athletes with shoulder injuries and to evaluate the possibility of their use in the prevention of sports shoulder injuries.

**Materials and Methods:** The analysis of scientific literature based on the Web of Science database has been carried out. A computer search for the title "sports shoulder injury" revealed 2428 articles. Later, the search was specified. At the final stage, eight articles were analyzed. The analysis of selected articles suggests that the following exercises are recommended for the prevention and rehabilitation of shoulder injuries: proprioceptive, resistance exercises (e.g., kinesiology tape), passive exercises, exercises for the upper extremities with closed and open kinematic chains, isokinetic, plyometric and specialized sports exercises (depending on the sport). Besides therapeutic exercises, for the prevention of sports injuries of the shoulder, we admit it is appropriate to consider the method of kinesiology taping as a promising means of physical therapy.

**Conclusions:** Among the therapeutic exercises to prevent of sports injuries of the shoulder, we consider promising proprioceptive, isokinetic, exercises with open and closed kinematic chain, exercises with resistance. It is necessary to study the feasibility of using these exercises and develop appropriate preventive measures and recommendations in the training process. It is also high-potential to study the effectiveness of combining therapeutic exercises with other means of physical rehabilitation.

Key words: physical therapy, athletes, shoulder impingement syndrome, exercise

Słowa kluczowe: fizjoterapia, sportowcy, zespół ciasnoty barku, ćwiczenia fizyczne

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#### INTRODUCTION

Sahrmann S. et al. developed a scheme of motor disorders, which was adopted by the American Physical Therapy Association in 2013. This scheme is useful for determining the methods and means of rehabilitation and prognosis of patient recovery because it combines the musculoskeletal system and regulation of muscle contraction with the system of autonomic movement [1, 2]. An analysis of diseases according to the Sahrmann S. scheme revealed that over 1.7 billion people worldwide suffer from diseases of the musculoskeletal system, disorders of which are often connected with long-term pain, functional limitations, loss of activity and deteriorating quality of life [3]. A significant proportion of patients with motor disorders are athletes. The leading cause of musculoskeletal dysfunction of athletes is sports injuries [4]. Sports injuries account for 3-5 per cent of the total number of injuries and can be received not only by professional athletes but also by amateurs who do not follow safety precautions [5].

Among sports injuries, shoulder complaints are the third most common injuries of the musculoskeletal system after back and neck injuries. Among people with shoulder pain, impingement syndrome is the most common and accounts for 36 per cent of shoulder joint diseases [5, 6]. Houglum has identified that systematic trauma, abnormal posture, age-related changes, fatigue and vascularization of the shoulder muscles, biomechanical changes, neuromuscular adaptation, and rotator cuff imbalance are the major causes of impingement syndrome [6]. Shoulder Impingement Syndrome (SIS) is a general term that explains the damage to structures in the subacromial space, such as rotator cuff tendinosis, partial rotator cuff rupture, and bursitis [7]. Some systematic reviews have focused on studying the effectiveness of various physiotherapeutic interventions aimed at stabilizing the scapula in impingement syndrome [8]. However, as far as we know, the literature has not sufficiently reviewed the functional effects of the use of therapeutic exercises for their use in the prevention of sports shoulder injuries.

#### ΑΙΜ

To analyze the functional effects of frequently used therapeutic exercises in the rehabilitation of athletes with shoulder injuries and to evaluate the possibility of their use in the prevention of sports shoulder injuries.

## MATERIALS AND METHODS

The analysis of scientific literature based on the Web of Science database has been carried out. A computer search for the title "sports shoulder injury" revealed 2428 articles. A further search was specified: a) articles that were published from 2017 to 2021 – 1059 (from January 1, 2017, to November 25, 2021); b) category «Rehabilitation and sports sciences» – 704; c) article – 579; d) exercise – 129 e) prevention – 51.

The keywords used for the search are illustrated in Fig. 1. With the help of manual selection, 51 articles were analyzed for the presence of therapeutic exercises, which should be used for rehabilitation and prevention of shoulder impingement syndrome as the most common dysfunction of the shoulder joint. Eight such articles were found [9-16].

#### **REVIEW AND DISCUSSION**

The analysis of selected articles suggests that the following exercises are recommended for the prevention



Figure 1. Flow diagram of study selection

and rehabilitation of shoulder injuries: proprioceptive, resistance exercises (e.g., kinesiology tape), passive exercises, exercises for the upper extremities with closed and open kinematic chains, isokinetic, plyometric and specialized sports exercises (depending on the sport) (Table 1) [9-16].

The majority of authors note the importance of considering the pain syndrome, the quality of functional movements in the shoulder, as well as the range of motion.

It should be noted that all selected articles described and explained the specifics of different sports. Therefore, sports exercises that consider the peculiarities of the movements of a particular sport are mandatory in the rehabilitation and prevention of impingement syndrome [17]. This ensures progress in the rehabilitation process and promotes a faster return of the athlete to intensive training [18, 19]. In our opinion, the use of such exercises cannot be considered as prevention, because the prevention of sports injuries of the shoulder should be aimed at internal causes.

In the articles analyzed, proprioceptive exercises were most often used to rehabilitate SIS. These exercises are usually used to train balance, for which stabilometric platform is used, which provides multiple activations of sensory receptors and further integration of these perceptions in the central nervous system [20, 21]. It is generally thought that this leads to a better perception of the position and movement of the joints. Thus, unconscious stabilization of joints during movement based on coordination reflexes is supported [23]. After all, when the proprioceptive system is not stimulated properly, there is a greater risk of falls and sprains [13, 14]. Therefore, we believe that proprioceptive exercises are a necessary element in the prevention of sports injuries. Proprioceptive training has convincing scientific evidence of its effect on the body both at the level of recovery and to prevent injury [9]. These exercises also help increase strength, elasticity, and coordination of muscle contraction. In turn, an important aspect of the application of these exercises is their appropriate use at the beginning of training and with a certain frequency [11, 16].

Plyometric exercises are important for the rehabilitation of athletes, the essence of which is to perform speed-force, explosive movements, which allow to increase muscle strength, as well as to restore/improve the technique of performing certain motor actions. For example, sessions using plyometric exercises may include push-ups, jumps, punches, throws, pushes, and so on [10, 14] This tool, with skilful use, is indispensable in the late stages of recovery when the main task of rehabilitation is to restore specific activities and sports skills [16]. Given that sports such as basketball, volleyball, handball involve a large number of explosive movements [24, 25], the use of plyometric exercises in the prevention of SIS requires more detailed and evidence-based research. At the same time, it should be noted that the rapid progression of physical activity, technical errors in performing specific explosive movements for each sport, lack of proper recovery time can lead to injuries or unwanted complications [12, 13].

Article Exercises	Proprioceptive exercises	Resistance exercises (e.g., kinesiology tape)	Passive exercises	Exercises for the upper extremities with closed and open kinematic chains	lsokinetic exercises	Plyometric exercises	Specialized sports exercises
Sekiguchi T, Hagiwara Y, Momma H et al. [9]	*			*			*
Wright AA, Hegedus EJ, Tarara DT et al. [10]				*	*	*	*
Roddy E, Zwierska I, Hay EM et al. [11]	*	*					*
Nejati P, Ghahremaninia A, Naderi F et al. [12]	*	*			*	*	*
Turgut E, Duzgun I, Baltaci G. [13]	*	*			*	*	*
Hotta GH, Santos AL, McQuade KJ et al. [14]	*			*	*	*	*
Andersson SH, Bahr R, Olsen MJ. [15]	*			*	*		*
Andersson SH, Bahr R, Clarsen B et al. [16]	*		*			*	*

Table 1. Analysis of the use of therapeutic exercises in the rehabilitation of shoulder impingement syndrome

Isokinetic exercises are one of the types of strength training. It uses specialized simulators that allow maintaining a constant speed no matter how much effort the patient go through. The idea of this type of exercise is to achieve the highest degree of muscle contraction [8, 27]. It was found that the use of isokinetic exercises in sports rehabilitation has a significant effect on the prevention, diagnosis and rehabilitation of sports injuries [10, 28]. Isokinetic exercises avoid excessive load on the damaged joint and at the same time provide the maximum dynamic load on the involved muscle in the entire range of motion [12, 15]. Given these benefits, these exercises are appropriate for use in rehabilitation in impingement syndrome of the shoulder and are most effective in the prevention of this disease [14].

Exercises with open and closed kinematic chains are also often used in the rehabilitation of shoulder exercises. Exercises with an open kinematic chain are used to increase acceleration, decrease resistance, increase in distraction and rotation of force, improve functional activity, reduce or eliminate axial load and use external rotary load [17, 24]. The closed kinematic chain includes increased compressive load on the joints, increases congruence and stability, reduces acceleration, stimulates proprioception, improves dynamic stability, restores neuromuscular control, activates functional muscle groups and determines movement in several joints [14, 15]. These characteristics of the functional state of the muscles allow us to consider exercises with open and closed kinematic chains as promising in the prevention of sports injuries of the shoulder.

To strengthen the shoulder joint, resistance exercises are employed. These can be exercises using elastic kinesiological tape. First, the exercises are aimed at strengthening the rotator cuff of the shoulder, which ensures the stability of the shoulder joint during movement [11, 22]. In addition, exercises with a ribbon are aimed at strengthening the extensor muscles, in such exercises, the elastic band is used as a weight [12]. All resistance exercises are aimed at increasing the stability of the shoulder while moving, so it is important to include them in the prevention of sports injuries of the shoulder [13].

Some authors in their studies highlighted the feasibility of using passive exercises, which were used only during the exacerbation of the pathological process [30]. Therefore, such exercises are not used for SIS prevention.

In addition to therapeutic exercises, for the prevention of sports injuries of the shoulder, we admit it is appropriate to consider the method of kinesiology taping as a promising means of physical therapy. Since 1988, this method has gained international recognition at the Olympic Games in Seoul, and in 1995 the method of kinesiology taping was introduced in some protocols for medical care and rehabilitation. Therefore, we can say that taping in sports has long proven itself as an effective method to eliminate pain and injury during intense work. When using kinesiology tape, the load is redistributed to the problem areas of muscles and joints, certain muscle groups are relaxed and the optimal functional state of the joint is maintained [24, 29]. However, there is evidence of deterioration in muscle function because of improper use of kinesiology taping and/or ignoring contraindications to its use [26, 28].

#### CONCLUSIONS

Therapeutic exercises for impingement syndrome of the shoulder are used in all rehabilitation programs, are highly effective, especially in the rehabilitation of athletes. Among the therapeutic exercises preventing SIS and shoulder exercises, we consider proprioceptive, isometric, exercises with open and closed kinematic chain, and exercises with resistance. It is necessary to study in detail the feasibility of using these exercises and develop appropriate preventive measures and recommendations in the training process. It is also prospective to study the effectiveness of combining therapeutic exercises with other means of physical rehabilitation.

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*The article was performed as part of research work on the topic:* 

*Prevention of shoulder injuries through physical rehabilitation of athletes in game sports.* 

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Info



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# Particularities of Using the Point Massage in the Aspect of Kinesiological Competence of Physical Therapist

Cechy charakterystyczne stosowania masażu punktowego w aspekcie kompetencji kinezjologicznych fizjoterapeuty

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#### SUMMARY

Aim: The study was aimed at revealing the essence of the mechanism of finger acupressure, techniques of finger point massage and particularities of their implementation in physical therapy.

**Materials and Methods:** Implementation of the aims was achieved with following methods: analysis of special psychological and pedagogical literature; generalization of experience in professional training of future specialists in the field of physical therapy; synthesis, generalization, systematization and modeling were used to improve the technique of point massage in the process of physical therapy.

**Conclusions:** Using of finger point massage techniques in the process of physical therapy is a powerful tool to be implemented into patient's rehabilitation program, aimed at functional recovery. Identified relevance and effectiveness of its using to stimulate restorative processes in the patient's body, allows to accelerate recovery and restoration of functional abilities. The combination of finger point massage and physical therapy can be used as an independent complex therapeutic method in physical rehabilitation in patients with various diseases` nosologies. It was determined that effectiveness of functional recovery in patient is increased with the simultaneous implementation of finger point massage and physical therapy.

Key words: physical therapy, competence, massage, method

Słowa kluczowe: fizjoterapia, kompetencja, masaż, metoda

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# INTRODUCTION

Globalization processes constantly set new challenges to the health care of Ukraine. Overcoming them involves training of qualified specialists in various fields, in particular, specialists of physical therapy. Focusing on the public values of the world community, in context of ensuring the priorities of the future world order, requires higher professional education to implement the components of holistic educational space, the main feature of which is provision of professional training in physical therapy specialists [1, 2]. A modern physical therapist should be able to be a multifunctionally specialist, able to apply the acquired skills and knowledge, show creative approaches to performing professional duties in real professional practice, and, particularly, to master and implement point massage techniques.

Thus, in context of reforming higher education system, the problem of training physical therapy specialists with high level of professional competence, in particular kinesiological, is relevant. This significantly increases the requirements for the educational process in higher education institutions and for level of professional training of future specialists in physical therapy [1, 3]; formation of kinesiological competence should be considered as a strategic task of their professional training.

# AIM

The aim of the article is to highlight the particularities of using point massage in patients, to enveil the mechanism of finger acupressure and finger point massage in the process of physical therapy.

# MATERIALS AND METHODS

Implementation of the aim was achieved with following methods: analysis of special psychological and pedagogical literature; generalization of experience in professional training of future specialists of physical therapy; synthesis, generalization, systematization and modeling were used to improve the technique of point massage in the process of physical therapy.

#### **REVIEW AND DISCUSSION**

In the world of modern scientific and pedagogical researches, the competence of a specialist in physical therapy is considered as a set of skills, specialy structured scientific and practical knowledge aimed at effective solving of rehabilitation problems. Effective solving of problems in physical therapy involves a variety of means, among which massage posesses an important role [1, 4, 5].

In all times of human history, medical specialists have been using different types of massage. Over centuries, accumulation of invaluable experience, acquisition and improvement of massage techniques, systematization of massage manipulations ensured the creation of certain systems that have been effectively used and applied up to the current moment. The main methods of massage have been known for more than 20 centuries BC, as evidenced by various historical documents and monuments that survived to the present day [6, 7].

Nowadays, the method of point message (acupressure) is developing widely. The essence of acupressure is based on the experience gained in acupuncture, and is used for pressing acupuncture points. Finger point massage is biologically effective method among other physical therapy means, using of which has its own rules, indications and contraindications. Acupressure, in harmonious combination with means of physical therapy, allows to obtain positive results in therapeutic effects of treatment of functional disorders of nervous system, seas sickness, toxicosis in pregnant women, toothache, migraine, angina, bronchial asthma and other painful manifestations, except for serious and complex diseases [8-10].

Also, acupressure techniques with appropriate training of the patient can be used by him alone to relieve some acute conditions or additionaly to the main treatment prescribed by physical therapist.

According to the modern biophysiological studies of the body cell as a whole, the mechanism of finger acupressure is complex of mutual reflex, neurohumoral and neuroendocrine processes that are formed by mechanical influence on acupuncture areas and are regulated, depending on acupressure methods, by central nervous system [5, 10, 11].

The initial link in the chain of neuro-reflective reactions awakened by acupressure are mechanical stimuli of extraand proprioreceptors, especially baroreceptors, resulting in transforming external energy into an impulse or encoding a transmitted stimulus. Various pieces of information, coming from the body receptors or external environment enter the nervous system in only one form - as an impulse. All receptors send about ten impulses per sec to the central nervous system, and they come not only from the internal organs, muscles, skin, but also from the exteroceptors, that is, from everything that happens outside the body. This huge system of impulses enters thalamus, and from there, with the help of cerebral cortex, one of the most important and vital parts, the response is formed, then realized through specific neuro-reflex, vegetative-vascular, lymphatic and neurohumoral mechanisms. In other words, the central nervous system has one efferent main motor path, through

which the flow of motor formulas is passing to all systems of the body [11].

The essence of finger point massage when combined with physical therapy means is in rhythmic massage of acupuncture areas with fingers. It is important to distinguish between finger massage acupuncture method and general massage techniques. At the same time, when implementing a rehabilitation program in order to achieve a better result, it is advisable for a physical therapist to combine point massage methods with individual techniques of general therapeutic massage.

Affecting the acupuncture areas, when performing acupuncture techniques, the physical therapist most clearly feels (with the soft pad of the first finger phalanx) the tone of the object of influence, the integrity of the applied force. At the same time, it is impractical to perform point massage techniques with nails, since there is a high probability of injuring the skin and causing needless pain.

There are various techniques of point massage. However, the type of their implementation makes a more differentiated dosage of massage possible, and, thus, resulting a regulating effect on body functions. Depending on the purpose of the massage one can combine a variety of options: circular stroking, varying degrees of pressing, vibration. They are used, taking into account the initial state of the patient, expressiveness and features of the pathological process; they are corrected according to the reactions of the body. For example, in case of arthritis of knee joint, the method of palpation determines the sore areas; in the future they are massaged with medium power pressing to reach the connective tissue or periosteum. Such massage is effective in treatment of diseases of the periosteum or connective tissue at the site of attachment to tendons, diseases of bones and joints. It should be noted that finger massage acts reflexively on the physiological and pathological processes of internal organs by pressing and vibrating on acupuncture areas in periosteum area, that is, on the periosteum. After massaging the sore areas around the knee joint, finger massage is made with light pressure and vibration in the areas of acupuncture points.

The method of finger massage of acupuncture areas has a number of advantages: 1) it is easier to learn finger massage than acupuncture; 2) finger "zheng" does not require special devices, tools or disinfectants; 3) hygienic requirements for medical procedures are minimal; 4) the treatment procedure can be carried out outpatiently and in any non-hospital conditions (on the street, in transport, in industrial premises); 5) the effectiveness and strength of therapeutic effects in finger "zheng" done by experienced physical therapist is the same as in acupuncture; 6) finger "zheng" is very convenient for emergency care, as well as for self-medication of certain diseases after training done by physical therapist; it can be used to relieve fatigue and facilitate recovery.

Experience of practical using shows that point massage techniques are more effective when combined with physical therapy. The highest efficiency is achieved in treatment of fibromyositis, muscle and tendon diseases.

Massage by finger acupressure method is advisable at all stages of physical therapy in patients: during recreational

treatment of chronic diseases of the circulatory system, nervous system, musculoskeletal system, internal organs and other functional disorders. The methods of acupressure during the implementation of the rehabilitation program are used primarily as means of primary and secondary prevention, for rebuilding and for relieving the physical fatigue. Finger point massage has a positive effect for both adults and children aged from one year.

Using finger point massage techniques during physical therapy is contraindicated in following cases:

- postoperative period: with bleeding, common allergic reactions;
- neuroses combined with affective bursts out, OCD, fever attacks;
- skin diseases: fungal diseases of the nails, skin, keratomycoses, epidermomycoses, viral dermatoses;
- state of acute mental disorder and alcohol or drug intoxication.

For effective performing of the finger massage on acupuncture areas during physical therapy, and in case of general massage, a physical therapist has to know the anatomy and physiology of a person. Otherwise, ignorance of the topography of muscles, blood vessels and lymphatic systems will not allow innervation to be effective.

Physical therapist should keep the cleanliness of his hands and nails when performing point massage techniques. Hands should be warm, dry, with short-cut nails, strong and trained. The work of the fingertips provides emotional stability and health to the physical therapist, since the blood flow to the hands is stimulated. Using of means that have a strong odor is unacceptable. It is important to wipe hands with clean and denatured alcohol, monitor the appearance of fissures on fingers and palms. The physical therapist can not wear any jewelry on hands so as not to injure the patient's skin.

During implementation of point massage techniques, physical therapist should know about general state of the patient; change positions, if possible; do not bend low to the patient; monitor the rhythm of patient`s breath; do not force patient to hold it and allow him or her to take a few deep inhales and exhales during breaks. In order to improve professional skills, it is important to devote time for exercising that contributes to the development of deep and rhythmic breathing, endurance, accuracy in movements.

While performing a finger point massage, physical therapist should be able to distribute his forces during the session and work equally with both right and left hand. He needs flexible, soft and strong fingers without calluses, with good mobility in the radial wrist joint and fingers and well-developed musculature of hands. To develop these qualities, one should systematically do special gymnastics, which increases mobility of fingers and hands. It is also necessary to carry out everyday hand care, in order to develop a high sensitivity of touch.

When perfoming a finger acupressure, one should choose a position in which any possibility of fatigue, due to the static tension of the muscles that are not used in the work, is excluded. Before performing a massage, therapist should pay attention to important condition of cleanliness of the patient's skin. Point massage on dirty skin promotes penetration of bacteria into the lymphatic pathways. In this case, physical therapist has right to refuse to perform the procedure. At the same time, doctor should notice if the nearest lymph nodes are enlarged. Therefore, before starting a massage, physical therapist should examine the patient and, if any problem is present, refer him for an additional examination. Only after the diagnosis is cleared, physical therapist decides on implementation of point massage.

Physical therapist can give recommendations on implementation of point massage in patient at home, teach him how to determine and massage acupuncture areas to treat certain disease. The patient can systematically conduct finger massage procedures at home and occasionally receive corrective consultations from the physical therapist.

The technique of finger point massage of acupuncture areas consists of three main moves: 1) stroking; 2) loosing (rubbing) with pressing; 3) vibration. In addition, one may also use additional methods of general therapeutic massage.

Experience of acupressure in physical therapy involves complex using of massage techniques. To achieve the desired effect in the process of physical therapy, the patient is consistently treated with stroking, then loosing with pressure, vibration and, finaly, with a gentle rubbing.

Skills of choosing and rational combination of massage techniques in accordance with clinical indications are acquired by physical therapist as a result of long experience and characterize his individual style.

Point massage techniques are carried out with thumb, index and medium, sometimes with a small finger. Stroking is done with index, middle or small fingers; loosing with pressing – with thumb, index and middle fingers, vibration with pressing is done with index, middle and small fingers.

The essence of stroking move is in slow sliding of digital pulp over the skin with rotational circular movements in the acupuncture area, without skin irritation.

As an auxiliary method, one can use stroking moves with the palm surface of the hands on the entire segment or part of the body. This improves dermal respiration and activates secretory function of the skin, enhances capillary circulation due to backup capillaries, enhances lymph formation, potentiates active tissue metabolism.

When stroking the hair part of the head as an auxiliary method, a rake-like technique is used. Wide spread fingers (pads of the fingertips) are located under the hair on the scalp; the longitudinal, zigzag and circular movements of stroking without irritating the skin of the head are performed. The movements are slow, rhythmic. Then one may apply the method of rubbing with pressure or vibration.

Rubbing is carried out continuously, more intensive than stroking. Rubbing with pressing can be done with palm surface of the final phalanx (of thumb, index or medium fingers), and the wrist of the index or middle finger should lean on the thumb. If a more energetic effect on the tissue of the acupuncture area is needed, rubbing is carried out with thumb, with leaning on the other fingers.

According to the pressure on the points of acupressure, which are used in physical therapy, there are three types of massage moves: 1) light circular; 2) massage of medium power; 3) strong pressing.

Light massage of the acupuncture area should be done quickly, with superficial and light pressing with pads of the fingers (but not with the thumb), while making moves ressembling centrifugal concentric spirals or in the circle of the area. Light circular rubbing is used for treatment of acute pain, swelling of tissues, muscle weakness, in first aid. In cases of high pressure, postoperative period, with hidden organic pain, it is necessary to provide massage with well and easy circular movements.

Massage of medium power on acupuncture areas is performed by rotational, centrifugal or circular movements: initially slow with low static pressure, which gradually increases, accelerating the rotation rate. Then therapist moves to slower rotational and light surface movements. Medium power massage is indicated in case of the absence of organic complications, chronic diseases, and good general state. The duration of exposure, amplitude, rhythm and frequency of rotational movements and the number of points of influence depend on the nature of the painful process and tasks of physical therapy. The rotational speed averages 60-120 turns per minute with an increasing pressure force about 1.5 kg. Pressing should last within 1-5 minutes. This method can be used to relieve fatigue, increase skin and muscle tone, as well as in cases of central hemiparesis and often occurring swelling.

Massage with strong pressure on acupuncture areas is carried out with a thumb or index fingers in case of pain in a patient with no other complaints. After determining the point, the doctor has to put finger-pad on it and make 2-3 circle moves per second with a pressure of 3-5 kg. It is not always advisable to start the procedure by stroking the impact area. At the same time, only the skin near muscles, bones can be moved in the process of massage. The massaging finger always remains at the selected point, which provides a unified effect on the acupuncture point. This is an important prerequisite for the onset. Most of the acupressure points are located on both sides of the body. The duration of acupressure is determined by the degree of pain, the point of treatment and the rule of the hand. Pressing should last from 1 to 5 minutes. Relief comes in 20 seconds.

Push-like pressure that resembles hitting are not allowed. One should make a gradual hard pressure with soft parts of fingers, as if the weight of the whole body is transferred to them. The area of contact between the pressing thumb and body of the patient should be approximately the size of the soft part of the finger (as a fingerprint).

The meaning of pressure vibration is transmiting of vibrational movements to the massaged body part. The effect of vibration is not limited to the place of irritation. The effect can spread along the periphery, as well as inside, causing a variety of appropriate reactions. Vibrating finger massage on the acupuncture area is that the finger (thumb, index or medium), without moving away from the massaged area (point), makes various oscillating movements, which should be performed rhythmically, with controled pressing – slight, moderate, strong.

Performing a vibrational massage with the palm surface of the final phalanx of one finger, the physical therapist should feel that his hand and massged patient's body area become as one for some time.

Vibration with the index or middle fingers is more often carried out when exposed to acupuncture points in the area of the head, face (for example, at the exit point of the supraorbital, mental nerves, etc.). Vibration with the thumb or middle finger is performed in the back area near the exit of nerve roots, as well as in places with more developed muscles and thick fat deposits.

Physical therapist in the framework of kinesiological competence has to be able to rationally apply the principles of choosing acupuncture points. After preparation of the rehabilitation program through palpation, points, located closer to the sore area, are determined. Then one determines the points at more distant places, according to the segment. It is important to distinguish and take into account three degrees of acupuncture point activity:

- Inactive: after strong finger pressure there is no pain occuring;
- Active: after mild pressure the feeling of pain occurs;
- very active: the pain (sometimes severe) or itching occurs after pressure above the point.

Thus, having discovered the degree of activity of the acupuncture point, physical therapist rationally and effectively applies the methods and techniques of finger point massage. It is important to note that the impact on acupuncture points in many diseases leads to disappearance of their manifestations.

Physical therapist has to member that all massage techniques are based on reflex acts. Nerve receptors of the skin and deep tissues, perceiving signals from certain methods of massage as a mechanical stimulus, transmit them in the form of nerve impulses to the central parts of the nervous system, where in response to irritation of the nerve cells, efferent impulses arise. They then spread along the central paths to various systems, organs and tissues of the body, stimulating or inhibiting their activity.

Based on the mechanism of physiological influence of point massage and many years of practical experience, the most appropriate in physical therapy are techniques of acupressure (stroking, rubbing with pressure, vibration) conducted through brake and toning methods.

The brake method consists of rubbing techniques with strong pressure and vibrating massage. It is performed with soft part of the palm surface with thumb, index or middle fingers in slow, long and deep pressing or vibration with simultaneous rotational circular movements in the acupuncture area. Up to 8 points can be massaged like this per session. The duration of impact at each point is about 2-3 minutes. In general, the duration of the massage depends on the goal, more often - on the rate of pain elimination, relaxation of muscles, etc. The tonic method involves the stroking, light and moderate rubbing moves with pressure in the massaged areas. They are carried out by fast, superficial, short movements, light or medium pressing with soft part of the fingertips (exept for thumbs), while making rotational circular movements 100-120 per minute. The pressing is repeated every 5-10 seconds. The total duration of effect at each point should be 1.5-2 minutes. During one physical therapy session, 8-10 points are massaged.

In the process of physical therapy, techniques or methods of finger point massage for each particular case, depending on the characteristics of the patient and nosology of disease, are used. The effective duration of one pressing is from 5 to 7 sec, except for areas around neck, where the pressure should not exceed 3 sec. The pressure should be soft and perpendicular to the surface. Thumbs are always used to press down with pads. Pressure on the point should be such that the patient has a "special feeling", yet, pain should be quite tolerant. In some cases, severe pain can be extremely pleasant. This indicates that with a certain violation (symptoms, disease), the desired point was found and the optimal intensity of the pressing was provided.

Prospects for further research on the use of finger point massage techniques in the process of physical therapy in patients are in establishing the assessment of differentiated effects in the implementation of the rehabilitation program for individual nosologies of diseases.

#### CONCLUSIONS

In our opinion, using of finger point massage techniques as a component of kinesiological competence in the process of physical therapy is a powerful tool in implementation of the patient's rehabilitation program aimed at functional recovery.

Expediency and effectiveness of this methos in stimulatinon of restorative processes in the patient's body have been identified. It allows to accelerate functional recovery.

The combination of point massage and physical therapy can be used as an independent complex therapeutic method of physical rehabilitation in patients with various nosologies of diseases. It is shown that the effectiveness of restoring the functional state of the patient is increased after simultaneous implementation of finger point massage and physical therapy.

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# Modern Trends in Physiotherapy Support of Sports Activities and Rehabilitation Practice in Sports (on the Example of the University Clinic)

Współczesne trendy w fizjoterapii wspierające aktywność sportową oraz metody rehabilitacji w sporcie (na przykładzie uniwersyteckiej kliniki)

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#### SUMMARY

Aim: To form an idea about the necessity of introduction in sport training of sportsmen of modern physiotherapy and rehabilitation technologies on the example of work of university clinic.

Materials and Methods: Theoretical analysis and systematization of data of scientific-methodical literature, data of Internet network, as well as research of experience of activity of university clinic and center of sports preparation of highly skilled sportsmen.

**Conclusions:** The work of the multidisciplinary rehabilitation team plays an important role in the restoration of athletes, so their choice should be more individualized with the aim of more effective restoration of functional capabilities of athletes' performance. The influence of training and competitive loads on the athlete's body is quite diverse and can cause various appropriate reactions, which are largely determined by the functional state of his body. The effectiveness of the restorative effects is closely related to the initial functional state, and the same procedures, can both accelerate recovery processes and be an additional burden on the body. That is why the development and implementation of scientifically based recommendations on the methodology of training of high-qualified sportsmen on the basis of analysis of modern achievements of medical science and results of own scientific researches is one of the main tasks of this team.

Key words: multidisciplinary team, highly qualified sportsmen, university clinic, physiotherapy technologies, rehabilitation measures

Słowa kluczowe: zespół multidyscyplinarny, wysoko wykwalifikowani sportowcy, klinika uniwersytecka, technologie fizjoterapeutyczne, środki rehabilitacyjne

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#### INTRODUCTION

Recently, interest in sport, strong health and physical activity has increased significantly. One of the necessary conditions of life is physical activity, which has not only biological, but also social importance. It is considered as a natural-biological need of a living organism at all stages of ontogenesis. The problem of sound health in sports is mainly connected with the efficiency of the physical education system. However, although physical exercises have an extremely powerful and wide range of health-improving action, health of sportsmen is determined by a huge number of different factors, the range of which cannot be limited only to physical culture. Therefore, professional activity of highly qualified specialists should be directed on physical rehabilitation of the body of sportsmen by means of a complex of various factors, where physical culture acts as one of the main links in the chain of health-improving means. Knowledge of means, methods and systems of health improvement for highly qualified sportsmen gain special weight, as they can be used both for preservation and strengthening of own health, and in the process of further professional activity.

To achieve victories of domestic sportsmen at the most important international competitions from physical therapists requires not only use of knowledge, but also improvement and formation of technologies of their use. The need to improve the efficiency of the implementation of scientific achievements, scientific and technological progress, advanced experience of modern physiotherapy and rehabilitation measures in sports practice makes an important component of the system of training highly qualified athletes.

#### AIM

The purpose of the research is to form an idea about the necessity of introduction in sports training of sportsmen of modern physiotherapy and rehabilitation technologies on the example of work of university clinic.

## MATERIALS AND METHODS

Theoretical analysis and systematization of data of scientificmethodical literature, data of Internet network, as well as research of experience of activity of university clinic and center of sports preparation of highly skilled sportsmen. were used for achievement of the goal.

## **REVIEW AND DISCUSSION**

Implementation of physiotherapy and rehabilitation support of sports activity became possible with the availability of accessible use of university clinic and clinical bases of medical institute, as well as center of sports training of highly qualified sportsmen in Sumy State University (SSU).

The university clinic is a modern, equipped, accredited health care institution of a polyclinic-outpatient type, on the basis of which the provision of highly qualified medical care, a wide range of medical, physiotherapy and rehabilitation services, individual approach, friendly atmosphere and high quality of service is carried out. It is a health care institution, which is a medical, educational and scientific structural subdivision of SSU.

The university clinic includes a multidisciplinary team, where the reception is conducted by highly qualified specialists - doctors and candidates of medical sciences, professors, associate professors, well-known specialists in Ukraine and abroad. In the rehabilitation process to achieve better and more effective results in the shortest possible time, reduce complications and the degree of disability of athletes during or after training, competition or in between, it is necessary to carry out the rehabilitation process by a multidisciplinary team [1, 2].

A multi-disciplinary team is a group of specialists of different specialties who provide rehabilitation services to athletes to ensure restoration or compensation of existing limitations of life activity. The multi-disciplinary team, in particular, may include: physical therapist; ergoteratherapist; doctor of physical and rehabilitation medicine; doctor-neurologist; psychologist; specialist in social work/social worker; doctors of other specialties and specialists of educational or social sphere (if necessary).

The University Clinic works in conjunction with the Department of Physical Therapy, Occupational Therapy and Sports Medicine of Sumy State University, which employs specialists in physical rehabilitation, which allows them to work in a multidisciplinary team. It should be noted that on March 25, 2019, amendments were made to the order of the Ministry of Health of Ukraine dated October 28, 2002 № 385 «On approval of lists of health care institutions,

doctors, pharmacists, junior specialists with pharmaceutical education, positions of health professionals and positions of specialists in the field of health care in health care institutions», which introduced new positions, namely: physical therapist, occupational therapist, assistant physical therapist and assistant occupational therapist, which already allows health care institutions to form multidisciplinary rehabilitation teams [1].

In the rehabilitation process, the most important stage is the preparation of an individual rehabilitation program, which is a complex of optimal species, forms, volumes, terms of rehabilitation measures with the determination of the order and place of their implementation, aimed at preservation, improvement and compensation of broken or lost functions of the organism and abilities of a specific person. And it is the multidisciplinary team that has a key role to play, as the preparation of a high-quality and effective individual program requires a comprehensive approach.

Each specialist of the multidisciplinary team should develop its part of the program so that it can then comprehensively address the patient's rehabilitation tasks, and its activities simultaneously complement and reinforce the activities of each other. Therefore, it is important that both developed countries of the world and Ukrainian health care institutions ensure the formation of multidisciplinary rehabilitation teams and the use of multidisciplinary approach in the rehabilitation process, which will ensure reduction of complications, fatal accidents, repeated hospitalization and, respectively, costs for treatment and care of patients.

The State Oriental Center for Olympic Training of Athletes of Ukraine has been established on the material base of the university, in which highly qualified student-athletes and coaches of the university work in the national team of Ukraine in athletics. The largest number of sports-oriented students in the sections of light athletics. Students-sportsmen are the constant winners of regional and city student competitions, prize-winners and champions of All-Ukrainian Universiades. More than 100 students, masters, post-graduate students won about 200 awards at World and European Championships and Cups, World Universiades and Olympic Games. At the European university games SSU won the first place among Ukrainian universities by the number of medals.

27-28.01 – Indoor Athletics Championship of Ukraine. In the competitions on triple jump gold received Krasutska Anna, and in the race for 800 m champion was Hutsol Yevhen.

06-11.02 – Indoor Athletics Championship of Ukraine. SSU students won 24 awards, 8 of which were gold. The champions were: Sergienko Oleksiy, Malykhin Vladyslav, Mucharova Yevhenia, Tokar Anastasia, Shishnyak Anastasia, Mykolenko Maria, Hutsol Yevhen.

29.04 – at the 10 km Championship of Ukraine, Kaluzhna Victoria won and qualified for the European Cup in London.

05.07 – Open Championship of Israel in track and field: Krasutska Anna became the second in three striations and fulfilled the standard for participation in the European Championship [3, 4]. As for serious injuries in athletics, it is quite rare. The main injuries of athletes are dislocations of joints, sprains and strains of ligaments, open and closed fractures. It should be noted that even for light damage the athlete often goes out of order for a few days, or even weeks, because after injury to return to training can only after full rehabilitation. According to experts, about 90% of sports damage in track and field athletics is the result of non-compliance with training and safety regulations. At the same time, according to statistics, if there is no coach in training, accidents happen four times more often. This statistic shows the particular importance of the coach in the prevention of sports injuries [3].

Most common injuries of the ligamentous apparatus – up to 35% of cases, and damage of soft tissues – up to 20%. Athletes who were engaged in short-distance running and hurdles, long jump and triple jump are under observation. In short-distance runners and in hurdles, injuries and diseases of the soft tissues of the ankle joint – calf muscles, Achilles tendon, sprains of the ligaments of the ankle joint, tendovaginitis and paratedonitis were observed.

The mechanism of these damages was that excessive stretching of muscular and tendon fibers led to re-stretching, since the margin of strength of this link of the musculoskeletal system (MSS) in athletes showed insufficient, which also led to macro and macro-breaks, and sometimes also tearing soft tissues. The causes of injuries were insufficient technical training of athletes, insufficient coordination in the work of muscles and unreinforced, adequate preparation, aspiration to show high results.

Rehabilitation, that is, restoration, as part of the complex system of rehabilitation treatment, acquires increasing importance in modern medicine, its great importance and in sports, especially for athletes, because injuries, especially in young age meet quite often, being the main reason of interruption in the training process, which consequently leads to a steady decline in the level of sports performance. The faster and more successful to restore sports efficiency, the less adverse consequences of injury.

An important feature of rehabilitation of sportsmen after injuries of the MSS is achievement not only clinical, but also functional recovery in order to ensure the possibility of inclusion of sportsmen in the training process without negative consequences for health and to achieve the fastest restoration of sports efficiency [1]. The process of treatment and recovery of sportsmen after injuries of the MSS is divided into three stages. I stage – medical rehabilitation (gentle). Stage II – sport rehabilitation (renewal). The third stage is the stage of sport training. The stage of sports rehabilitation requires scientific substantiation and has a decisive importance in restoring the special qualities necessary in the specific sport specialization. The main tasks at this stage are restoration of the general efficiency of the athlete and restoration of movement actions and skills in the chosen sport.

SSU Sports Medicine Center is established on the basis of university clinic and provides medical services to sportsmen of all categories, and also created educational and scientific center of sports medicine, which on contractual terms carries out medical support of sportsmen, members of national teams of Ukraine, with application of measures of modern diagnostics and prevention of sports traumatism [4].

The work of the Center of Sports Medicine is to provide diagnostic, medical and scientific-methodical services of the Federation of Athletics of Ukraine, the East Center of Olympic training in athletics, students who had to get a admission in training physical education. The main tasks of the center are carrying out fundamental and applied scientific researches aimed at finding individual structural, functional, biochemical, molecular-genetic and psychological characteristics that can ensure achievement of the maximum possible results for each athlete; development and implementation of scientifically based recommendations on the methodology of training of high-qualified sportsmen on the basis of analysis of modern achievements of medical science and results of own scientific researches; medical support of sportsmen during the training cycle, carrying out of measures preventing traumas and diseases of sportsmen, their treatment and rehabilitation, rendering of medical services, which contribute to increase of sports success.

According to the Center's tasks, its functions are: carrying out research works of the appropriate direction, including on contractual basis; development and search of existing innovative methods of medical support of the training process and their implementation in accordance with the normative base; providing clinical-diagnostic, rehabilitation and medical services to persons engaged in physical culture and sports; preparation of documents for admission (or dismissal) to physical training and sports for people who need them (sportsmen, students, schoolchildren); development of individual practical recommendations to sportsmen concerning programs of food, pharmacological support, restoration of mental and physical activity after intensive loads, simplification of adaptation to long perelotov and new climatic and geographical conditions in the place of carrying out of corresponding stage of preparation and main competitions; administration of the web resource with saved data on the health of sportsmen, indicators of their functional readiness and sports efficiency.

Development and implementation of scientifically grounded recommendations on the methodology of training of highqualified sportsmen on the basis of analysis of modern achievements of medical science and results of own scientific researches is one of the main tasks of this center work [2].

The following complex scientific groups (CSGs) are established on a permanent basis to provide directions of work of the university clinic: CSGs on sports physiology and rehabilitation, CSGs on medical support, CSGs on implementation of research results in the training process, CSGs on molecular genetics, CSGs on IT-support.

It is known that during the training process it is important to correct dosage and choice of physical loading. For this purpose the functional state of sportsmen is assessed, which allows to control and adjust processes of urgent and long-term adaptation of the organism to physical loads, to reduce the level of risk of development of fatigue and overemphasis of sportsmen as a result of application of maximum by volume and intensity of training and competition loadings.

Regulation defines the peculiarities of the activity of organs and their structures in a wide range of physiological and pathological reactions [3]. To train little positive effect, the body of an athlete must necessarily have a quality regulation of the work of internal organs, especially the cardiovascular system, so a number of studies are carried out - registration of the performance indicators of the musculoskeletal, cardiovascular, respiratory systems in a state of calm and during physical loads of different intensity, Determination of the influence of the central and vegetative nervous system on adaptation of the body in the course of training, carrying out of the relevant functional tests (variational pulsemetrium, ECG, REG, RVG, EEG, spirometria, veloerhometria, daily monitoring of AT and ECG, functional loading testing); methods of study of higher nervous activity (HNA): rests for estimation of basic parameters of HNA, which determine personal, including psychological, characteristics of sportsmen (questionnaire, the time of a simple movement reaction, heating, tremor, coordination, etc.). research of neurodynamic properties of an organism (balance of nervous processes, strength and endurance of nervous system, functional mobility of nervous processes, peculiarities of intertaste asymmetry). After research, practical recommendations are developed to improve the system of scientific and methodological and medical and biological support of highly qualified athletes, taking into account the stage and period of sports training to reduce the risk of overexertion of athletes due to the maximum volume and intensity of training and competitive loads; basic methodological bases for assessing the level of mobilization of functional reserves of the body of athletes [3]. Also, general and individual models of functional readiness of highly qualified athletes for heavy loads during the competitive process are created and the functional and psychophysiological condition of athletes is monitored to assess readiness for training, to prevent overload and fatigue.

Based on the above mentioned, you can immediately note client orientation from the side of the university clinic. And there is no doubt that any patient can receive both help and the provision of appropriate conditions for rehabilitation and treatment for athletes are also available. Due to the fact that the clinic has a wide range of services, including medical examinations, outpatient surgery, massage, physiotherapy, MPT, Dentistry, types of diagnostics (ultrasound, laboratory diagnostics, CT, X-ray, functional diagnostics), it allows for full examination and consultation of doctors.

The main purpose of the rehabilitation of sportsmen is: elimination of mechanical symptoms and restoration of its functional state for the fastest return to normal physical loads; elimination of infringements of physiological functions; restoration of psychological status of the patient, his motivation; return of social and professional functions; activation of functional reserves of the organism [2]. Moreover, with the availability of technologies for physiotherapy and complex rehabilitation of the organism restoration will be achieved within a rather short period of time, of course, taking into account the peculiarities and wishes of the patient (athlete).

In terms of technology, the clinic has an office, which contains devices for rehabilitation, among which we can highlight the universal suspension therapy cabin or rehabilitation cell, which is an important element of rehabilitation. It is designed for individual kinesiotherapy. Suspended therapy is a special suspended load system of the musculoskeletal system to restore the range of motion, normalize muscle tone and increase their strength, improve balance and develop coordination. You can use full suspension, active exercises with dosed resistance, and active exercises with support and use of a system of blocks and levers, elastic cords. With the unique method of suspended and block therapy (kinesiotherapy) it is possible to unload muscles, approaching to a state of weightlessness, and on need effectively to load them. Suspended therapy is effective even in cases where the patient cannot move independently in space. This effect is achieved by using a suspension system where the patient can move without fear of falling. With the help of the suspension system it is possible to unload and relax different groups of muscles and thus significantly reduce the pain syndrome.

The main indications in which this method of rehabilitation is used may be functional disorders of the musculoskeletal system (pain in the large joints and spine with functional disorders); restriction of movement in the spine and large joints (knee, pelvis, shoulder, elbow); strength and play types of sport and fitness (rehabilitation after injuries; training of functional strength, speed, coordination, endurance). And one can confidently say that thanks to the presence of such technologies, the rehabilitation of athletes will be achieved in a short time.

Everyone knows that swimming and lessons in the pool have a positive impact on the human musculoskeletal system, respiratory and cardiovascular system. As a result of pushing, the gravity of any body to the surface of the earth is weakened and the weight of the body is reduced accordingly [1]. Swimming pool is another feature of the University Clinic, which allows you to approach even more comprehensively in the case of rehabilitation and not only because, there is also the provision of aqua aerobics and hydrokinesiotherapy classes for children and adults. To engage in fitness or hydrokinetherapy in water, the ability to swim does not need. Exercises are performed at a shallow depth, where the water is approximately at the level of the chest of an adult. Moreover, thanks to aqua aerobics many people disappear fear of depth, and they get used to staying on the surface. In addition, there is a sports equipment available for the swimming pool, which is important both for rehabilitation and for ordinary classes.

Gidrokinesotherapy is an excellent way to help athletes maintain their current level of physical training during the off-season or during post-injury rehabilitation. Injured athletes can use the features of the water environment such as swimming and water resistance during exercise. That is why they can restore functionality and cardiovascular endurance faster than it would have happened only in "ground" therapy. Benefits for cardiovascular system were also found in training athletes in water, such as improvement of sports indicators from training of inspiratory muscles, including improved ability to breath during peak loading levels when returning to land after water exercises. It is worth noting that athletes often need to return to the training as soon as possible, and water provides a favorable environment in which early progressive functional training, as well as rehabilitation is conducted with the lowest risk of further repeat injury or aggravation of symptoms.

Taking into account the above, it is possible to assume that the swimming pool is one of the methods that allows to carry out rehabilitation of sportsmen, including aqua aerobics, hydrokinesotherapy and providing all opportunities for restoration of broken functions of the support-motion apparatus and other systems. Therefore, the University clinic provides these services for them, which helps to strengthen the state of the body of athletes and, of course, to develop sports and physical skills.

## CONCLUSIONS

The work of the multidisciplinary rehabilitation team plays an important role in the restoration of athletes, so their choice should be more individualized with the aim of more effective restoration of functional capabilities of athletes' performance. The influence of training and competitive loads on the athlete's body is quite diverse and can cause various appropriate reactions, which are largely determined by the functional state of his body. The effectiveness of the restorative effects is closely related to the initial functional state, and the same procedures, can both accelerate recovery processes and be an additional burden on the body. That is why the development and implementation of scientifically based recommendations on the methodology of training of high-qualified sportsmen on the basis of analysis of modern achievements of medical science and results of own scientific researches is one of the main tasks of this team.

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#### **Conflict of interest:**

The Authors declare no conflict of interest

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Info

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