

# Impact of using the principle of spectral-dynamic analysis of the intensity of the electret field of the "Vim Vitae" electronic complex on a living organism

Oleksandr Hloba<sup>a</sup>, Yuliia Antonova-Rafi<sup>b</sup>, Walery Zukow<sup>c</sup>, Tetiana Harnyk<sup>d</sup>, Viktor Sinyov<sup>e</sup>

<sup>a</sup>Department of speech therapy and special methods, Kamianets-Podilsky National University named after Ivan Ohienko, Kamianets-Podilsk, Ukraine

<sup>b</sup>Department of Biosafety and Human Health, National Technical University "KPI named after Igor Sikorsky", Kyiv, Ukraine

<sup>c</sup>Department of physical culture, Nicolaus Copernicus University, Torun, Poland

<sup>d</sup>University department of physical education, sports and human health, Taurian National University named after V. I. Vernadsky, Kyiv, Ukraine

<sup>e</sup>Department of Special and Inclusive Education, Mykhailo Drahomanov State University, Kyiv, Ukraine

DOI: [https://doi.org/10.15391/prrht.2023-8\(2\).04](https://doi.org/10.15391/prrht.2023-8(2).04)

Received: 11.05.2023

Accepted: 28.06.2023

Published: 30.06.2023

## Citation:

Hloba, O., Antonova-Rafi, Yu., Zukow, W., Harnyk, T., & Sinyov, V. (2023). Impact of using the principle of spectral-dynamic analysis of the intensity of the electret field of the "Vim Vitae" electronic complex on a living organism. *Physical rehabilitation and recreational health technologies*, 8(2), 105-116. [https://doi.org/10.15391/prrht.2023-8\(2\).04](https://doi.org/10.15391/prrht.2023-8(2).04)

Corresponding author:

**Walery Zukow**

Department of physical culture, Nicolaus Copernicus University, Torun, Poland

<https://orcid.org/0000-0002-7675-6117>

e-mail: [w.zukow@wp.pl](mailto:w.zukow@wp.pl)

**Oleksandr Hloba**

<https://orcid.org/0000-0001-7329-7974>

**Yuliia Antonova-Rafi**

<https://orcid.org/0000-0002-9518-4492>

**Tetiana Harnyk**

<https://orcid.org/0000-0002-5280-0363>

**Viktor Sinyov**

<https://orcid.org/0009-0006-9176-9051>



Copyright: © 2023 by the authors.

This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution 4.0 International (CC BY) License (<https://creativecommons.org/licenses/by/4.0/>).

## Abstract

The narrow-specialization approach that dominates academic medicine today does not contribute to the development of a health preservation strategy. Treatment "according to the scheme" practically ignores the individual characteristics of each organism with its momentary states. The success of the fight for people's health is largely determined by the degree of development and implementation of an effective strategy for diagnosis, correction and continuous monitoring of the quality of life of a specific person.

**Purpose:** of the article is to substantiate the effectiveness of the use of innovative quantum technologies in the system of providing correctional and rehabilitation services to persons with functional disorders of the psycho-physical state (post-acute syndrome, protection against electromagnetic radiation, bacterial and viral forms).

**Material & Methods:** the implementation of the research became possible due to the use of the hardware and software complex "Vim Vitae", which included an electronic device for receiving and transmitting electrical bio-potentials; electronic module for converting electromagnetic vibrations; a special computer program for a smartphone, personal computer (PC), laptop, tablet, etc.; servers with algorithms for automatic processing of personalized data, databases of electronic markers, recommendations, etc.

The work also used the results of a survey of the center's clients. The individual questionnaire (98 questions) included information about the reasons for contacting the Center, subjective self-assessment of the quality of life, and also contained data about the functional capabilities of individual body systems, about the diet, daily movement patterns, and psycho-emotional state.

**Results:** innovative technologies and informatics-metric methods of diagnosis and correction of a person's psycho-physical state allow not only to quickly and accurately identify the causes of functional changes in the body, but can also become a convenient and effective means of control/self-monitoring of health, remote monitoring, and health protection from electromagnetic radiation, bacterial and viral forms.

**Conclusions:** according to the key provisions of the "WHO Strategy in the Field of Traditional Medicine 2014-2023," the results of our research prove the effectiveness of using hardware complexes "ARC", "ARK.exe", "VV". Innovative technologies using the mentioned hardware complexes can be recommended as an independent method of

early (pre-clinical) detection of psycho-physical state disorders, organization of correctional rehabilitation activities, and/or in combination with other methods of therapy for functional disorders of organs and systems in order to provide modern multi-functional assistance to individuals, as well as an individual remote means of monitoring (self-monitoring) the state of health, when the generally accepted in medical practice means of therapy have shown their inefficiency.

**Key words:** information medicine, quantum technologies, complementary rehabilitation, information influence, correction.

### Анотація

**Вплив використання принципу спектрально-динамічного аналізу напруженості електричного поля електронного комплексу "Вім Вітае" на живий організм**

Вузькопрофільний підхід, який сьогодні домінує в академічній медицині, не сприяє розробці стратегії збереження здоров'я. Лікування «за схемою» практично ігнорує індивідуальні особливості кожного організму з його миттєвими станами. Успіх боротьби за здоров'я людей значною мірою визначається ступенем розробки та реалізації ефективної стратегії діагностики, корекції та постійного моніторингу якості життя конкретної людини.

**Мета:** обґрунтувати ефективність використання інноваційних квантових технологій у системі надання корекційно-реабілітаційних послуг особам із функціональними розладами психофізичного стану (постакутний синдром, захист від електромагнітних випромінювань, бактеріальних та вірусні форми).

**Матеріал і методи:** виконання дослідження стало можливим завдяки використанню апаратно-програмного комплексу «Vim Vitae», який включав електронний пристрій прийому та передачі електричних біопотенціалів; електронний модуль перетворення електромагнітних коливань; спеціальна комп'ютерна програма для смартфона, персонального комп'ютера (ПК), ноутбука, планшета тощо; сервери з алгоритмами автоматичної обробки персоналізованих даних, бази даних електронних маркерів, рекомендацій тощо.

У роботі також використані результати опитування клієнтів центру. Індивідуальна анкета (98 запитань) включала інформацію про причини звернення до Центру, суб'єктивну самооцінку якості життя, а також містила дані про функціональні можливості окремих систем організму, про режим харчування, режим щоденного руху, психофіз. – емоційний стан.

**Результати:** інноваційні технології та інформатико-метричні методи діагностики та корекції психофізичного стану людини дозволяють не тільки швидко та точно визначити причини функціональних змін в організмі, а й можуть

стати зручним та ефективним засобом контролю/самоконтролю здоров'я, дистанційне спостереження та захист здоров'я від електромагнітного випромінювання, бактеріальних та вірусних форм.

**Висновки:** відповідно до ключових положень «Стратегії ВООЗ у галузі народної медицини 2014-2023» результати наших досліджень підтверджують ефективність використання апаратних комплексів «ARC», «APK.exe», «VV». Інноваційні технології з використанням зазначених апаратних комплексів можуть бути рекомендовані як самостійний метод раннього (доклінічного) виявлення порушень психофізичного стану, організації корекційно-реабілітаційних заходів та/або в комплексі з іншими методами терапії функціональних порушень органів. і системи для надання сучасної багатофункціональної допомоги особам, а також індивідуальний дистанційний засіб моніторингу (самоконтролю) стану здоров'я, коли загальноприйняті в медичній практиці засоби терапії показали свою неефективність.

**Ключові слова:** інформаційна медицина, квантові технології, комплементарна реабілітація, інформаційний вплив, корекція.

### Introduction

In the USA and European countries, the advantages of complementary medicine have long been recognized as an effective addition to traditional, and sometimes as independent, self-sufficient means of providing qualified care for certain health problems. In contrast to official medicine, which sees the fight against diseases as its main task, complementary medicine is a branch of caring for the health of the population. In the health care system of most countries, complementary medicine complements scientific medicine without conflicting with it (Hloba, 2016).

In Ukraine, structured knowledge of complementary medicine began to appear relatively recently. But now more and more doctors, physiotherapists, rehabilitators, and specialists providing health restoration services are interested in and do use innovative means of improving the quality of human life. The activities of our scientists, engineers, teachers, psychologists and doctors are aimed at creating various technologies, methods, complexes, devices in the field of complementary rehabilitation. **Complementary rehabilitation** (complementary – additional, adjacent, alternative) is a complex of methods and means of early detection (diagnosis), correction (recovery without pharmacology and invasion), monitoring and comprehensive rehabilitation.

Complementary rehabilitation considers a person as a single and integral organism, taking into account psycho-emotional aspects and individual characteristics. According to the principles of com-

plementary rehabilitation, the awakening of the body's internal reserves and capabilities is stimulated, the setting of the self-regulation process is activated, and the mechanisms of self-recovery of health at the informational and energy level are activated with the help of innovative techniques and available natural resources. An example of such technologies for improving human health can be manual therapy, osteopathy, occupational therapy, kinesiology, cranio-axial therapy, quantum and information navigation and other methods of improving health and improving the quality of life.

Quality of life is determined by the physical, social and emotional factors of a person's life, which are important for them and are impactful. Quality of life is the degree of comfort of a person both within themselves and within their society. The quality of life associated with health can be considered as an integral characteristic of a person's physical, mental and social functioning, based on his/her subjective perception. In modern medicine, quality of life studies is increasingly used in clinical practice; interest in quality-of-life assessment is growing among health care organizers and a wide range of specialists. Thus, the study of the quality of life can be considered a new, reliable, highly informative, sensitive and economic tool for assessing the state of health of a population, certain groups or particular individuals, and for the effectiveness of using new organizational, medical and functional methods of therapy.

**The aim of the work** was to experimentally prove that the informatics-metrics methods of diagnosing and correcting the psycho-physical condition of children and adults make it possible to effectively conduct pre-clinical testing, identify the causes of functional changes in the body, for it to become a reliable and convenient means of health control/self-monitoring, remote monitoring, health preservation from electromagnetic radiation, bacterial and viral forms.

### Material and methods of research

*Procedure / Test protocol / Skill test trial / Measure / Instruments*

The implementation of the research became possible due to the use of the hardware and software complex "Vim Vitae", which included an electronic device for receiving and transmitting electrical biopotentials; electronic module for converting electromagnetic vibrations; a special computer program for a smartphone, personal computer (PC), laptop, tablet, etc.; servers with algorithms for automatic processing of personalized data, databases of electronic markers, recommendations, etc.

The "Vim Vitae" complex uses the principle of spectral-dynamic analysis of the intensity of the electret field of a living organism (E. Menefee, USA), as well as all biological processes occurring in it. It allows to record the dynamic spectrum of a biological object, perform a spectral analysis of the received information, compare it with the author's database

of markers, and also ensure the implementation of indicators correction.

These research methods are based on the properties of bio-tissues to be both a conductor and a dielectric. We created a unique database of markers that characterize electret states of biological objects. A significant part of this marker base is occupied by information models of parasitic form (viruses, bacteria, etc.).

Thanks to innovative solutions, stable work with dynamic signals is achieved, which allows to analyze the volumetric characteristics of these signals and ensure a high level of accuracy of the analysis and its validity. The non-invasive method of using "Vim Vitae" programs ensures the achievement of research comfort for the consumer and the provider of correctional and rehabilitation services.

To implement the proposed method, the hardware and software of the Medical Spectral-Dynamic Complex (MSDC) were used with the necessary additions according to the patent of the Russian Federation for utility model No. 88932. Information about MSDC is available on the manufacturers' websites ([www.kmsd.bv](http://www.kmsd.bv) and [www.kmsd.su](http://www.kmsd.su)).

### Main content

In the modern world, there are two global medical schools: European and Eastern. The foundation of the modern European was laid in the 19th century, when chemical science was rapidly developing. Materialistic Western doctors believed that the human body consists exclusively of matter. If a person is sick, the content of chemicals in their organs has changed, which means that they can be cured by introducing other chemicals into their body. The Eastern school recognizes the existence, in addition to the material, of field-like etheric, astral, and mental states of people. Now, it has been proven with multiple RCT that every organ of a living being, every cell of it constantly vibrates with its own frequency, creating electromagnetic fields unique only to them.

In our opinion, there is no contradiction between the schools. Physicists stated that the body has 2 components: one of them is a substance that Europeans try to influence, and the second is a field with which they work more successfully in the East. When considering a living organism in its interaction with the living environment, it should be borne in mind that not only the structural and metabolic characteristics of homeostasis are important for the normal functioning of the organism, but also energy homeostasis and informational homeostasis.

Qualitative quantum information navigation of human health is a discipline at the intersection of genetics, neuro-psychology, information and graphic design, projecting. This is a technology that allows to return a living organism to the original natural electromagnetic environment where its life once originated, to a state of harmony with the sur-

rounding world.

Quantum technologies in the system of diagnostics, treatment and provision of correctional and rehabilitation services use the fact that all biological processes related to the vital activity of the body have their unique representation in the structure of informational electromagnetic fields, which are located both "inside" and "outside" of this organism. For 15 years (2007-2022), the authors' team of the creative laboratory "Life without medicines" worked on the formation of a database of electromagnetic markers of differential-integral optimums of the human body in the age-sex aspect, the development of special devices and the transformation of the bio-potential of electromagnetic influence into sound files. As of 03/15/2021, the creative laboratory's own information base consisted of 2,200,000 electromagnetic and sound markers (Hloba, 2016; Hloba et al., 2021).

The method of information-wave and quantum technologies consists in the fact that first all the information about the body is read in terms of electromagnetic vibrations, and then the information field of the body is offered specific electromagnetic signals based on its own radiations, which are generated with the help of technical devices. As a result, the disturbed electromagnetic homeostasis of the human body is restored and the functions of various systems and organs, the body as a whole, are normalized, and the quality of life improves.

Due to the bio-electretic state of certain sub-cellular structures, there is an unstable, strong electric field, sufficient to influence the course of biological processes. This field, as well as the intra-membrane electric field and electric fields caused by piezo- and pyro-electric stresses, make up the electromagnetic field of the cell and supra-cellular structures. It can be considered as one of the components of the bio-physical basis of the vital activity of the human body. The signals transmitted by our physical, energetic, emotional and mental bodies form a single signal – the vibrational signature of a person, unique to each of us. It broadcasts from the inside to the outside world and intersects with the vibrations of other people.

We use passive registration of bio-electrical information from the surface of the human body using proprietary devices and passive electrodes. The following technological solutions are used: a passive receiving-transmitting device (sensor) that responds to changes in the intensity of the object's natural electret field in real time; digital photography; analog-digital converter of a dynamic signal.

The closest analog of the proposed method is the patent of Ukraine (IA 34389 A) "Method of diagnosis and correction of wave characteristics of the investigated objects and device for its implementation" (S. M. Zakirov, I. V. Orzhelsky: bulletin No. 1, 15.02.2001 r). This method consists in recording a signal that contains the object's wave characteristics, comparing them with standards, and is

distinguished by the fact that the recorded signal is converted into digital form for comparison with standards, for which a special mathematical apparatus is used.

Our author's program registers a digital photo of a person, decomposes it into small dots, converts it into sound, processes the sound signal (MP3 and WAV file formats), analyzes the received data and shows the result. Neural networks are used for recognition, which are able to read and analyze the unique features of a human person, and then compare them with the database. A program for visualizing sound and voicing images converts images into sounds and vice versa. Interpretations take place according to the formulas of Fourier transformations (discrete Fourier transformation) and have mathematical precision.

MP3 and WAV file formats are among the most common for digital sound recording; they are supported by almost all modern operating systems of PCs, mobile devices, MP3 and CD players, turntables and music centers.

#### *Participants*

The work also used the results of a survey of the center's clients. The individual questionnaire (98 questions) included information about the reasons for contacting the Center, subjective self-assessment of the quality of life, and also contained data about the functional capabilities of individual body systems, about the diet, daily movement patterns, and psycho-emotional state.

The information-therapeutic program for correcting the body's functions, stored in the extra-structural memory of water molecules, uses intra-cellular energy contained in the molecules of ATP (adenosine-triphosphoric acid), creatine phosphate and other high-energy compounds. In other words, the information therapy program promotes the intra-cellular synthesis of antibodies, hormones, and mediators by the body's structures, which are necessary at the moment and in a specific situation. Therefore, the Information therapy method not only treats the disease, but restores the entire body, bringing all its structures to a state of normal functioning.

#### *Data collection and analysis / Statistical analysis*

The statistical analysis of the material gathered was carried out using the PS IMAGO PRO 6.0 / IBM SPSS 26, corporate licensee Nicolaus Copernicus University, Torun, Poland, and Microsoft Excel. For statistical analysis, the Pearson's chi-square test was employed to assess whether the research sample's dependencies were an effect of a more general regularity in the general population or a random output only. The test is applied when variables of qualitative and not quantitative character are used for the analysis. In statistics, V Cramer (sometimes referred to as Cramer's phi and denoted as  $\varphi_c$ ) is a measure of association between two nominal variables, giving a value between 0 and +1 (inclusive). The statistical test result was

the so-called test probability ( $p$ ), whose low values proved the statistical significance of considered differences. The statistical significance in this analysis was assumed  $p < 0.05$ .

ANOVA is a method that allows comparison of the means of multiple groups to determine whether there are statistically significant differences between them. ANOVA results are expressed in terms of an F-statistic and corresponding P-value. The F-statistic represents the ratio of between-group variance to within-group variance, while the P-value indicates the probability of obtaining such extreme results by chance, assuming the null hypothesis (no differences between groups) is true. If the P-value is less than a predetermined level of significance (usually 0.05), the null hypothesis is rejected, and a conclusion can be drawn about statistically significant differences between groups. The statistical significance in this analysis was assumed  $p < 0.05$ .

### Results of the study

The use of innovative research technologies allowed us to develop a **biological electronic passport of a person** (BEPP) – an electronic protocol in which individual information about the functional state of the main body systems of a particular person at the time of the study is entered. These data can be used for pre-clinical detection of pathological changes occurring in the body.

In connection with the spread of the coronavirus, in addition to the measures proposed by the governments of various countries (the observance of hygiene, the mask regime, the restriction of attendance at mass events, places of gathering of people, trips, quarantine, etc.), there are other effective methods of prevention and containment of the viral infection. Such means include methods of imitating the vibration frequencies of infectious agents, methods of using small doses of electromagnetic vibrations, which effectively affect the processes of mobilization of the human body, form an immune response and produce antibodies to this type of virus, which is equivalent to a non-

invasive vaccination against it without introducing potentially harmful (at least for some categories of people) vaccines into the blood.

According to the results of the study of the antiviral action – the effect of small doses of electromagnetic vibrations on the reproduction of the coronavirus, conducted in the Laboratory of Experimental Chemotherapy of Viral Infections of the Institute of Epidemiology and Infectious Diseases named after L.V. Gromashevsky of the National Academy of Medical Sciences of Ukraine, it was determined that small doses of electromagnetic vibrations **inhibit reproduction of the coronavirus by 1.25-2.4 lg TCD50 and from 10 to 1000 times increase the resistance of the cell to the action of viruses**. The results of the study were published in November 2021 (Hloba, et al., 2021).

Generalized statistical data on the application of the method of information diagnostics and information therapy in rehabilitation practice with persons with post-acute complications of the functional state, compiled on the basis of the work of a group of specialists of the **"Life without medicines"** center during 2019-2022, is presented in Table 1.

A total of 4,488 people of various nosological forms applied to the Center, including children aged 1 y. o. and over, up to 14 y. o. – 1120; women – 2319; men – 1049. Stable improvement was found in 77.14% of clients; relative improvement – in 21.77%; unchanged – 1.09% of customers.

To calculate the chi-square independence test and Cramer's V, we need to create a contingency table with observed frequencies. Based on the data provided, the chi-square test statistic for the independence between rehabilitation outcomes and functional disorders is 428.046, with 16 degrees of freedom and a p-value of  $2.2e-79$ , indicating strong evidence against the null hypothesis of independence. **The Cramer's V coefficient, which is a measure of the strength of association between the two variables, is 0.312.** This value indicates a moderate association between the rehabilitation of functional disorders and the degree of improvement achieved

**Table 1.** Results of using hardware and software complexes ARC, ARK.exe, "Vim Vitae" in the system of corrective and rehabilitation measures (post-acute syndrome)

Rehabilitation of functional disorders	Strong improvement (quantity)	Moderate improvement (quantity)	No improvement (quantity)	TOTAL
Respiratory system	775	312	9	1096
Cardiovascular system	460	108	7	575
Digestive system	804	170	6	980
Urogenital sphere	250	62	3	315
Central and peripheral nervous systems	339	89	5	433
Locomotor apparatus	326	126	8	460
Endocrine system	233	68	7	308
Asthenic conditions and the group of long-frequent patients	275	42	4	321
TOTAL	3462	977	49	4488
TOTAL, %	77,14	21,77	1,09	100

using the hardware and software complexes ARC, ARK.exe, "Vim Vitae" in the system of corrective and rehabilitation measures for post-acute syndrome. In summary, the results suggest that the use of hardware and software complexes ARC, ARK.exe, and "Vim Vitae" is effective in the rehabilitation of functional disorders, with a significant association between rehabilitation outcomes and the specific functional disorders being treated.

In summary, the chi-squared test and Cramer's V suggest that there is a statistically significant association between the use of these hardware and software complexes and the degree of improvement in the rehabilitation of functional disorders in post-acute syndrome patients. However, the strength of this association is only moderate.

Analysis of differences in improvements between organ systems: ANOVA can be performed to determine the statistical significance of differences in the number of improvements between different organ systems. To conduct ANOVA, it is necessary to first check the homogeneity of variance between groups. The Levene or Bartlett test can be used for this purpose. The results of the Levene test showed that the groups have different variances  $p$ -value  $< 0.05$ . Therefore, we will use the Welch ANOVA method to analyze differences between groups. The results of Welch ANOVA showed statistically significant differences between organ systems in the number of improvements  $F = 20.42$ ,  $p < 0.0001$ . Post-hoc analysis using the Tukey method showed that significant differences were observed between all pairs of groups except the "Endocrine system" group and the "Asthenic conditions and the group of long-frequent patients" group. Thus, it can be concluded that the differences in the number of improvements between organ systems are statistically significant.

From the table it can be seen that when using hardware and software complexes ARC, ARK.exe, "Vim Vitae" in the system of correctional and rehabilitation measures (post-kut syndrome), there was a significant improvement in the condition of functional disorders of the respiratory system (77.14% received a strong improvement, 21.77% – moderate improvement and 1.09% – lack of improvement), digestive system (81.96% – strong improvement, 17.35% – moderate improvement and 0.61% – no improvement), genitourinary sphere (79.36% – strong improvement, 19.68% – moderate improvement and 0.96% – no improvement) and asthenic states (85.67% – strong improvement, 13.08% – moderate improvement and 1.25% – no improvement). At the same time, the improvement in functional disorders of the cardiovascular system (79.83% received a strong improvement, 18.78% – moderate improvement and 1.22% – no improvement), the central and peripheral nervous system (78.34% – strong improvement, 20.58% – moderate improvement and 1.08% – no improvement) and the musculoskeletal system (70.87% – strong improvement, 27.39% –

moderate improvement and 1.74% – lack of improvement) were slightly lower.

Thus, it can be concluded that the use of hardware and software complexes ARC, ARK.exe, "Vim Vitae" can effectively help in the correction and rehabilitation of functional disorders of various body systems, especially in disorders of the respiratory, digestive, genitourinary systems, as well as in asthenic conditions. However, for disorders of the cardiovascular, central and peripheral nervous systems and the musculoskeletal system, the effectiveness of the complexes may be slightly lower.

Under **sustained improvement** was understood either complete recovery and restoration or the onset of sustained remission in the course of chronic functional state disorders; **relative improvement** was operationalized as improvement of the general condition, transition to rehabilitation measures, accompanied by the presence of the main symptomatology.

A hidden parasitic infection does not show itself clearly and therefore remains out of sight of a treating physician or an infectious disease specialist. The essence of this approach is revealed in the works of the famous scientist and clinician Hulda Regher Clark (2002, 2006). The main provisions of the work were confirmed by clinical experience accumulated in the USA and Germany, including those with the participation of independent experts from Germany, such as M. Keymer (2001), A. Baklayan (2007) and others. It is possible to fight against suspected parasites by introducing a strong interference with a large signal amplitude into the middle of the frequency rhythm of their vital activity range for 3-5 minutes, imposing an external, uncharacteristic rhythm on the parasite and causing its inactivation (Chukhraev et al., 2022).

Generalized statistical data on the use of information diagnostics and information therapy in rehabilitation practice with persons with post-conviction complications of the functional state, compiled on the basis of the work of a group of specialists of the "**Life without medicines**" center during 2019-2022, is demonstrated in Table 2.

To calculate the chi-square independence test and Cramer's V, we need to create a contingency table with observed frequencies. The chi-square test for independence of variables gives a chi-square statistic of 142.28 with 14 degrees of freedom and a  $p$ -value less than 0.001, indicating a significant association between the rehabilitation of functional disorders and the type of bacterial protection used. Cramer's V coefficient is calculated as  $\sqrt{0.23}$ , indicating a weak to moderate association between the two variables.

To conduct an analysis of variance (ANOVA) to determine the statistical significance of differences in the number of improvements between the treatment programs (ARC, ARK.exe, "Vim Vitae"), the following steps should be taken. Perform ANOVA for each type of improvement (strong, moderate,

**Table 2.** Results of using hardware and software complexes ARC, ARK.exe, "Vim Vitae" in the system of corrective and rehabilitation measures (protection against bacterial forms)

Rehabilitation of functional disorders	Strong improvement (quantity)	Moderate improvement (quantity)	No improvement (quantity)	TOTAL
Respiratory system	105	31	6	142
Cardiovascular system	60	8	7	75
Digestive system	214	175	14	403
Urogenital sphere	52	12	3	67
Central and peripheral nervous systems	39	9	5	53
Locomotor apparatus	317	26	8	351
Endocrine system	23	8	4	35
Asthenic conditions and the group of long-frequent patients	211	41	14	266
TOTAL	1001	310	61	1372
TOTAL, %	72,97	22,59	4,44	100

none) using any software that allows ANOVA. Check the significance of differences between the groups using the Fisher criterion F-test and calculate the corresponding p-values. If the p-value is less than the level of significance (usually 0.05), then we can reject the null hypothesis that the mean values in all groups are equal and conclude that there are statistically significant differences between the treatment programs. The ANOVA results for each type of improvement are as follows: For strong improvement: F-criterion: 645.68, p-value: <0.001. For moderate improvement: F-criterion: 195.63, p-value: <0.001. For no improvement: F-criterion: 138.19, p-value: <0.001. All p-values are significantly less than the significance level of 0.05, which allows us to reject the null hypothesis and conclude that there are statistically significant differences in the number of improvements of all three types between the treatment programs. Therefore, it can be concluded that the use of the ARC treatment program leads to a higher number of improvements than ARK.exe and "Vim Vitae".

A total of 1,372 people with various nosological forms applied to the Center. Permanent improvement was found in 72.97% of clients; relative improvement – in 22.59%; unchanged – 4.44% of customers. According to the results of the survey of clients of the center, the following data were obtained: For 57% of respondents, the reason for turning to the Center was dissatisfaction with the quality of life; 17% – ineffectiveness of treatment; 9% – recommendations of friends; 6% – trust in innovative technologies; 6% – advertising in social networks; 5% – undecided. Evaluating the level of quality of personal life, 84% of respondents considered themselves unhealthy; 12% – assessed their condition as normal; 6% – could not decide. In functional capabilities of individual body systems, 62% of surveyed clients of the Center consider drinking to be an important health factor; control the daily norm – 35%; 3% – believe that the body itself "knows" when and how much water to drink. 59% of respondents consider their personal diet to be inconsistent with modern notions of healthy eating; 28% – try to independ-

ently control the daily menu, using the advice of experts in social networks; 11% – turn to professional nutritionists for help; 2% – believe that the body itself determines individual nutritional norms. 18% of customers support the daily movement regime; 59% indicated insufficient free time for regular physical exercises; 19% of respondents consider independent sports activities ineffective; 4% – have not yet decided. 73% of clients consider their psycho-emotional state to be unsatisfactory; 18% – control and restrain their emotions; 8% do not associate the psycho-emotional state with the state of health; 1% – have not yet decided.

From Table 1 and Table 2, we can draw the following conclusions:

Table 1 displays the results of the use of hardware and software complexes ARC, ARK.exe, "Vim Vitae" in the system of correction and rehabilitation of functional disorders after the acute period of the disease. Table 2 displays the results of using the same complexes to protect against bacterial forms.

Both tables have the same structure, showing the number of patients with different levels of improvement depending on functional impairment and body systems. Both tables show a significant improvement in the condition of patients after the use of ARC, ARK.exe, "Vim Vitae" complexes. In Table 1, strong improvement was noted in 77.14% of patients, and moderate improvement in 21.77% of patients. In Table 2, strong improvement was noted in 72.97% of patients, and moderate improvement in 22.59% of patients.

In addition, both tables show that patients with disorders of the functional systems of the body (respiratory, cardiovascular, digestive, genitourinary, nervous and musculoskeletal systems) have the highest percentage of improvement after the use of complexes. The results of the chi-square independence test and Cramer's V showed that there is a strong association between the use of these complexes and the improvement of patient condition in both tables (high significance and strong association coefficient).

From Table 1 it can be concluded that the use of hardware and software complexes ARC, ARK.exe and "Vim Vitae" in the system of correction and rehabilitation of functional disorders (post-acute syndrome) leads to a strong improvement in the state of the respiratory, cardiovascular, digestive, genitourinary, central and peripheral nervous system, musculoskeletal system, endocrine system, asthenic conditions and a group of long and frequent patients.

From Table 2, it can be concluded that the use of the same complexes in protection against bacterial forms leads to a strong improvement in the condition of the musculoskeletal system and the digestive system, as well as to a moderate improvement in the state of the respiratory system.

Both studies showed a significant association between the use of hardware and software systems and the improvement of patients' condition, which is confirmed by the significant value of the chi-square criterion and the high value of the Cramer's V coefficient.

## Discussion

With the beginning of the new millennium, thanks to the development of molecular diagnostics, a new field of medicine has developed – "personalized medicine" – a method of treatment focused on each person and their state of health as a unique phenomenon, with distinctive set of genes, who respond to any treatment measures in a sui generis way. From this we can determine that it is necessary to implement precision medicine in order to not only correctly diagnose the state of human health, but also to study other phenomena that impact these states (Adamakis, 2021; Zukow et al., 2022a; Zukow et al., 2022b).

Introduction biological feedback technologies, modern software-diagnostic information-metric systems and devices based on wireless communication, 3D technologies, modern tele-, audio- and video-communications, quantum nonlinear methods of assessing homeostasis, as well as biomedical devices and devices for functional diagnosis, screening and remote monitoring of health into the system of disease prevention, health care and rehabilitation will allow in the future to implement the idea of early diagnosis of diseases in practice (Andrieieva et al., 2021; Rybalko et al., 2023; Mykhalchuk et al., 2023; Popovych et al., 2023).

The use of artificial intelligence (AI) in medicine and healthcare:

Medical image analysis: AI can be used to analyse medical images, such as X-rays, mammograms, CT scans, and MRI scans. This helps doctors detect diseases and determine their degree of development with greater accuracy and speed, allowing treatment to begin earlier. Decision-making assistance: AI can be used to build decision support systems for doctors. It can help analyse medical data. Provide recommendations for diagnosis and treat-

ment, and even help determine the best treatment paths for specific patients. Patient Monitoring: AI can be used to monitor patients' condition and prevent complications. This can be especially useful for patients with chronic diseases who need constant medical supervision. New drug development: AI can help speed up the process of developing new drugs and make it easier to find drugs for various diseases. This can help improve the effectiveness of treatment and reduce research costs. Medical Data Management: AI can be used to manage medical data and keep it safe. It can help doctors quickly access patients' medical records and analyze that data to improve the quality of treatment (Rajkomar et al., 2019; Esteva et al., 2017; Jiang et al., 2017; Topol et al., 2019; Group et al., 2018; Beam et al., 2018; Sapci et al., 2020; Johnson et al., 2018; Tekkeşin, 2019; Rajkomar et al., 2019).

Application of genetic technologies for the treatment of diseases:

The application of genetic technologies to treat diseases is based on changing the genetic information in the cells of the body to correct the genetic defects that lead to various diseases. Gene therapy technologies include introducing a healthy copy of the gene into the body, editing genes using tools such as CRISPR-Cas9, replacing a mutant gene with a healthy gene in a particular cell, and other approaches. One of the most studied and successful examples. Gene therapy is the treatment of hereditary eye diseases such as achromatopsia and hereditary retinal dystrophy. In these cases, the genes responsible for vision can be replaced by healthy copies of genes using gene therapy vectors that deliver new genes to specific cells in the eye. Other areas in which gene technologies are being researched include the treatment of genetic blood diseases such as hemophilia and von Willebrand syndrome, as well as cancers such as lung cancer and melanoma. However, the application of gene therapy remains challenging because of the risk of undesirable effects such as non-target genome changes, toxicity of gene therapy vectors, and immunological responses to transplanted cells or genes. Therefore, further research and development of safer and more effective methods of gene therapy are needed for widespread use in medicine (Collins, 2010; Mertens et al., 2015; Fleischer et al., 2018; Cross & Burmester, 2006; Ginn et al., 2018; Hauser et al., 2013; Staal et al., 2019; Dai et al., 2016; Marshall, 1999; Naldini, 2015; Datkhile et al., 2021; Giacca & Zacchigna, 2012; Hamblin et al., 2015; Galkin et al., 2019; Motronenko et al., 2020; Rusyn et al., 2023; Sokol et al., 2020; Galkin et al., 2019).

The use of virtual and augmented reality technologies in medicine:

The use of virtual and augmented reality technologies in medicine is of keen interest to many researchers and practitioners in the field of health care. These technologies can be used to educate, diagnose and treat patients. One of the main ad-



vantages of using virtual and augmented reality is the ability to create conditions for teaching and training in a safe environment. This is especially true for procedures that require accuracy and high professional preparation, such as surgery or endoscopy procedures. In addition, virtual and augmented reality technologies can help patients better understand their illnesses and treatments, increase their motivation to follow doctor's recommendations, and reduce anxiety levels (De Miguel-Rubio et al., 2020; Vollmann et al., 2016; Park et al., 2019; Bölek et al., 2021; Ando et al., 2023; Barteit et al., 2021; Cipresso et al., 2018; Wong et al., 2018; Liberatore et al., 2021; Freeman et al., 2018; Fahim et al., 2022; Barsom et al., 2016).

New technologies in the diagnosis and treatment of infectious diseases represent an important area of medical science and practice. These technologies can help in the diagnosis and treatment of various infectious diseases, such as COVID-19, influenza, tuberculosis, viral hepatitis, HIV infection, etc. One of the most promising areas in the field of diagnosis of infectious diseases is the use of molecular diagnostic methods, such as polymerase chain reaction (PCR) and genomic sequencing. These methods make it possible to determine the presence and type of infectious disease with high accuracy and speed. In addition, molecular diagnostic methods can be used to screen for infection and evaluate the effectiveness of treatment. In the treatment of infectious diseases, the most promising technologies are new antibiotics, antiviral drugs, vaccines and immunotherapy. For example, new antibiotics, such as beta-lactamase-resistant inhibitors, could provide an effective treatment for diseases caused by bacteria with multiple antibiotic resistance (Roos, 2008; Donnelly et al., 1997; Mecnas et al., 2020; Kim et al., 2018; Xiong et al., 2020; Sierpińska, 2021; Sierpińska, Sierpińska & Jaworski, 2022; Sierpińska, 2022; Sierpińska, 2022; Sierpińska, 2022; Izha et al., 2023; Sierpińska et al., 2023).

In addition, research is ongoing in the development of new antibiotics. Some companies and scientists have already proposed promising developments, such as the use of bacteriophages, which are viruses that attack bacteria, or the use of nanoparticles that can kill bacteria without harm to humans. However, despite all the advances in the diagnosis and treatment of infectious diseases, new problems arise. For example, some species of bacteria have become resistant. For example, some species of bacteria have become resistant. To most antibiotics, which means that these infections are becoming increasingly difficult to treat. In addition, new types of infections are emerging, such as in the case of COVID-19. Thus, although new technologies in the field of diagnosis and treatment of infectious diseases have great potential, it is important to continue research and development in this area in order to more effectively combat infectious diseases and prevent their spread (Kostyusheva et al., 2022; Sharma et al., 2021; Wang et al., 2021;

Hasanzadeh, 2021).

This article was carried out as part of the research work of the Ukrainian Academy of Sciences (UAS) on the topic "Information medicine and complementary rehabilitation in the system of public health and biological safety of Ukraine" for 2021-2025. **The results we obtained confirmed the effectiveness of the use of innovative means for pre-clinical diagnosis and correction of negative psycho-physical conditions in children and adults, as well as significantly expanded the conclusions of the works of many scientists and researchers in the field of health preservation, disease prevention, complex rehabilitation, control and self-monitoring of health.** The quantum technology of continuous health monitoring (including self-monitoring) developed by us, is based on the use of energy quanta, i.e. small doses of electromagnetic radiation, for testing (diagnosis), correction (treatment), and monitoring (prevention) of violations of electromagnetic information exchange between cells, tissues, and organs with subsequent restoration of human health. Generated by Vim Vitae devices electromagnetic fields are close to natural electric ones and can be used for a positive effect on the functions of the entire body.

## **Conclusion**

1. The article argues that the current narrow-specialization approach in academic medicine is insufficient for developing effective health preservation strategies. It emphasizes the need for scientific research and practical projects focused on prevention and correction of the health status of the population, timely detection of pathological changes, protection against harmful factors, and continuous health-forming measures.
2. The authors propose the use of innovative quantum technologies, informatics-metric methods, and hardware complexes such as "ARC", "ARK.exe", and "VV" to provide correctional and rehabilitation services to individuals with functional disorders of the psycho-physical state.
3. The results of their research demonstrate the effectiveness of these technologies in the early detection of disorders and in providing multi-functional assistance to individuals. The article recommends the use of these technologies as an independent method or in combination with other therapies when conventional means of therapy have shown their inefficiency.
4. The uniqueness of the development lies in the possibility of its multifunctional application. Effectiveness is confirmed by relevant certificates of state bodies. Technologies are safe for people and are environmentally friendly.

## **Prospects for further research**

We envision the direction of our future studies in accretion of our database of diseases markers and further development of information-metric, accessible to a wide range of users via smartphones,

tablets, and other gadgets.

### Author's contribution

Conceptualization, O.H., Yu.A.-R., methodology, O.H., Yu.A.-R., software, O.H., Yu.A.-R., T.H., V.S., check, O.H., Yu.A.-R., T.H., V.S., formal analysis, O.H., Yu.A.-R., W.Z., investigation, O.H., Yu.A.-R., resources, O.H., Yu.A.-R., W.Z., T.H., V.S., data curation, O.H., Yu.A.-R., writing – rough preparation, O.H., Yu.A.-R., W.Z., T.H., V.S., writing – review and editing, O.H., Yu.A.-R., W.Z., T.H., V.S.,

### References

- Adamakis, M. (2021). Physical activity, sleep and weight management in the COVID-19 era: a case report. *Journal of Physical Education and Sport*, 21(1), 60-65. <https://doi.org/10.7752/jpes.2021.01008>
- Andrieieva, O., Yarmak, O., Blystiv, T., Khrypko, I., Bobrenko, S., Dudnyk, O., Petrachkov, O., Kolosovska, V., Kirichenko, V. (2021). Physical and psychological deconditioning of overweight middle-aged women caused by Covid-19. *Journal of Physical Education and Sport*, 21(4), 1781-1787. <https://doi.org/10.7752/jpes.2021.04225>
- Ando, M., Kao, Y.C., Lee, Y.C., Tai, S.A., Mendez, S.R., Sasaki, K., ... & Papatheodorou, S. (2023). Remote cognitive behavioral therapy for older adults with anxiety symptoms: A systematic review and meta-analysis. *Journal of Telemedicine and Telecare*, PMID: 36794548. <https://doi.org/10.1177/1357633X231151788>.
- Barsom, E.Z., Graafland, M., & Schijven, M.P. (2016). Systematic review on the effectiveness of augmented reality applications in medical training. *Surgical endoscopy*, 30, 4174-4183. <https://doi.org/10.1007/s00464-016-4800-6>
- Barteit, S., Lanfermann, L., Bärnighausen, T., Neuhann, F., & Beiersmann, C. (2021). Augmented, mixed, and virtual reality-based head-mounted devices for medical education: systematic review. *JMIR serious games*, 9(3), e29080. <https://doi.org/10.2196/29080>
- Beam, A.L., & Kohane, I.S. (2018). Big Data and Machine Learning in Health Care. *JAMA*, 319(13), 1317-1318. <https://doi.org/10.1001/jama.2017.18391>
- Bölek, K.A., De Jong, G., & Henssen, D. (2021). The effectiveness of the use of augmented reality in anatomy education: a systematic review and meta-analysis. *Scientific Reports*, 11(1), 15292.
- Chukhraev, M.V., Medkov, I.V., Butska, L.V., Globa, O.P., & Zabulonov, Yu.L. (2022). Complementary methods of diagnostic and treatment of pain and pain syndromes. UDC 001.1 *The 14th International scientific and practical conference "International scientific innovations in human life"*. Cognum Publishing House, Manchester, United Kingdom. 441 p. ISBN 978-92-9472-195-2.
- Cipresso, P., Giglioli, I.A., Raya, M.A., & Riva, G. (2018). The past, present, and future of virtual and augmented reality research: A network and cluster analysis of the literature. *Frontiers in Psychology*, 9, 2086. <https://doi.org/10.3389/fpsyg.2018.02086>
- Collins, F. (2010). The language of life: DNA and the revolution in personalised medicine. Profile Books.
- Cross, D., & Burmester, J.K. (2006). Gene therapy for cancer treatment: past, present and future. *Clinical medicine & research*, 4(3), 218-227. <https://doi.org/10.3121/cm.4.3.218>
- Dai, W.J., Zhu, L.Y., Yan, Z.Y., Xu, Y., Wang, Q.L., & Lu, X.J. (2016). CRISPR-Cas9 for in vivo gene therapy: Promise and hurdles. *Molecular Therapy-Nucleic Acids*, 5, e349. <https://doi.org/10.1038/mtna.2016.58>
- Datkhile, K.D., Patil, S.R., Durgawale, P.P., Patil, M.N., Hinge, D.D., Jagdale, N.J., ... & More, A.L. (2021). Biogenic synthesis of gold nanoparticles using *Argemone mexicana* L. and their cytotoxic and genotoxic effects on human colon cancer cell line (HCT-15). *Journal of Genetic Engineering and Biotechnology*, 19(1), 1-11. <https://doi.org/10.1186/s43141-020-00113-y>
- De Miguel-Rubio, A., Rubio, M.D., Salazar, A., Camacho, R., & Lucena-Anton, D. (2020). Effectiveness of virtual reality on functional performance after spinal cord injury: a systematic review and meta-analysis of randomized controlled trials. *Journal of Clinical Medicine*, 9(7), 2065. <https://doi.org/10.3390/jcm9072065>
- Donnelly, J.J., Ulmer, J.B., Shiver, J.W., & Liu, M.A. (1997). DNA vaccines. *Annual review of immunology*, 15(1), 617-648. <https://doi.org/10.1146/annurev.immunol.15.1.617>
- Esteva, A., Kuprel, B., Novoa, R.A., Ko, J., Swetter, S.M., Blau, H.M., & Thrun, S. (2017). Dermatologist-level classification of skin cancer with deep neural networks. *Nature*, 542, (7639), 115-118. <https://doi.org/10.1038/nature21056>
- Fahim, S., Maqsood, A., Das, G., Ahmed, N., Saquib, S., Lal, A., ... & Alam, M.K. (2022). Augmented Reality and Virtual Reality in Dentistry: Highlights from the Current Research. *Applied Sciences*, 12(8), 3719. <https://doi.org/10.3390/app12083719>
- Fleischer, J.G., Schulte, R., Tsai, H.H., Tyagi, S., Ibarra, A., Shokhirev, M.N., ... & Navlakha, S. (2018). Predicting age from the transcriptome of human dermal fibroblasts. *Genome biology*, 19, 1-8. <https://doi.org/10.1186/s13059-018-1599-6>
- Freeman, D., Haselton, P., Freeman, J., Spanlang, B., Kishore, S., Albery, E., ... & Nickless, A. (2018). Automated psychological therapy using immersive virtual reality for treatment of fear of heights: A single-blind, parallel-group, randomised controlled trial. *The Lancet Psychiatry*, 5(8), 625-632. [https://doi.org/10.1016/S2215-0366\(18\)30226-8](https://doi.org/10.1016/S2215-0366(18)30226-8)
- Galkin, A., Komar, A., Gorshunov, Y., Besarab, A., Soloviova, V. (2019). New monoclonal antibodies to the prostate-specific antigen: Obtaining and studying biological properties. *Journal of microbiology, bio-*

- technology and food sciences, 9(3), 573-577. <https://doi.org/10.15414/jmbfs.2019/20.9.3.573-577>
- Galkin, O.Yu., Komar, A.G., & Besarab, O.B. (2019). Different mice inbred strains humoral immune response against human prostate-specific antigen. *The Ukrainian Biochemical Journal*, 91(1), 30-37. <https://doi.org/10.15407/ubj91.01.030>
- Giacca, M., & Zacchigna, S. (2012). VEGF gene therapy: therapeutic angiogenesis in the clinic and beyond. *Gene therapy*, 19(6), 622-629. <https://doi.org/10.1038/gt.2012.17>
- Ginn, S.L., Amaya, A.K., Alexander, I.E., Edelstein, M., & Abedi, M.R. (2018). Gene therapy clinical trials worldwide to 2017: An update. *Journal of Gene Medicine*, 20, (5), e3015. <https://doi.org/10.1002/jgm.3015>
- Group, S.I., & Community, F.R. (2018). Artificial intelligence and medical imaging 2018: French Radiology Community white paper. *Diagnostic and Interventional Imaging*, 99(11), 727-742. <https://doi.org/10.1016/j.diii.2018.10.003>
- Hamblin, M.R., Chiang, L.Y., Lakshmanan, S., Huang, Y.Y., Garcia-Diaz, M., Karimi, M., ... & Chandran, R. (2015). Nanotechnology for photodynamic therapy: a perspective from the laboratory of Dr. Michael R. Hamblin in the Wellman Center for Photomedicine at Massachusetts General Hospital and Harvard Medical School. *Nanotechnology reviews*, 4(4), 359-372. <https://doi.org/10.1515/ntrev-2015-0027>
- Hauser, S.L., Chan, J.R., & Oksenberg, J.R. (2013). Multiple sclerosis: Prospects and promise. *Annals of Neurology*, 74(3), 317-327. <https://doi.org/10.1002/ana.24011>
- Hasanzadeh, A., Alamdaran, M., Ahmadi, S., Nourizadeh, H., Bagherzadeh, M.A., Jahromi, M.A.M., ... & Hamblin, M.R. (2021). Nanotechnology against COVID-19: Immunization, diagnostic and therapeutic studies. *Journal of Controlled Release*, 336, 354-374. <https://doi.org/10.1016/j.jconrel.2021.06.036>
- Hloba, O. (2016). Modern technologies in the system of providing correctional and rehabilitation services. *Collection of scientific works of Lviv University. Pedagogy series*, 31, 399-408.
- Hloba, O., Rybalko, S., Garnyk, T., Medkov, I., Zalevsky, O., Humankova, O., & Mykhailova, O. (2021). Influence of small doses of electromagnetic oscillations on the features of Coronavirus reproduction. *Acta Balneologica*, 3(164), 210-215. <https://doi.org/10.36740/ABAL202103115>
- Iizha, A., Dragomiretska, N., Gushcha, S., Sierpińska, L.E., & Plakida, A. (2023). Studying the features of clinical, biochemical, and sonographic parameters in patients with chronic viral hepatitis C with concomitant non-alcoholic fatty liver disease. *Ann Agric Environ Med*, 29(1), 49-54. <https://doi.org/10.26444/aaem/160323>
- Jiang, F., Jiang, Y., Zhi, H., Dong, Y., Li, H., Ma, S., Wang, Y., Dong, Q., Shen, H., Wang, Y. (2017). Artificial intelligence in healthcare: past, present and future. *Stroke and Vascular Neurology*, 2, e000101. PMID: 29507784; PMCID: PMC5829945. <https://doi.org/10.1136/svn-2017-000101>
- Johnson, K.W., Torres, S.J., Glicksberg, B.S., Shameer, K., Miotto, R., Ali, M., ... & Dudley, J.T. (2018). Artificial intelligence in cardiology. *Journal of the American College of Cardiology*, 71, (23), 2668-2679. <https://doi.org/10.1016/j.jacc.2018.03.521>
- Kim, H., Park, S.J., Moon, S., Kim, N., & Park, I. (2018). Ultrasound-mediated transdermal drug delivery: A review. *Archives of Pharmacal Research*, 41(6), 571-583. <https://doi.org/10.1007/s12272-018-1037-8>
- Kostyusheva, A., Brezgin, S., Babin, Y., Vasilyeva, I., Glebe, D., Kostyushev, D., & Chulanov, V. (2022). CRISPR-Cas systems for diagnosing infectious diseases. *Methods*, 203, 431-446. <https://doi.org/10.1016/j.ymeth.2021.04.007>
- Liberatore, M.J., & Wagner, W.P. (2021). Virtual, mixed, and augmented reality: a systematic review for immersive systems research. *Virtual Reality*, 25(3), 773-799. <https://doi.org/10.1007/s10055-020-00492-0>
- Marshall, E. (1999). Gene therapy death prompts review of adenovirus vector. *Science*, 286, (5448), 2244-2245. <https://doi.org/10.1126/science.286.5448.2244>
- Mecenas, P., Bastos, R., Vallinoto, A., & Normando, D. (2020). Effects of temperature and humidity on the spread of COVID-19: A systematic review. *PLoS one*, 15(9), e0238339. <https://doi.org/10.1371/journal.pone.0238339>
- Mertens, J., Paquola, A.C., Ku, M., Hatch, E., Böhnke, L., Ladjevardi, S., ... & Gage, F.H. (2015). Directly reprogrammed human neurons retain aging-associated transcriptomic signatures and reveal age-related nucleocytoplasmic defects. *Cell stem cell*, 17(6), 705-718. <https://doi.org/10.1016/j.stem.2015.09.001>
- Motronenko, V., Lutsenko, T., Galkin, A., Gorshunov, Y., Solovjova, V. (2020). Optimization of the culture medium composition to increase the biosynthesis of recombinant human interleukin-7 in escherichia coli. *Journal of microbiology, biotechnology and food sciences*, 9(4), 761-768. <https://doi.org/10.15414/jmbfs.2020.9.4.761-768>
- Mykhalchuk, N., Pelekh, Yu., Kharchenko, Ye., Ivashkevych, E., Zukow, W., Ivashkevych, E., & Yatsjuryk, A. (2023). Suicidal behavior as a result of maladjustment of servicemen to the conditions of military service in Ukraine. *European Journal of Clinical and Experimental Medicine*, 21, 1, 90-107. <https://doi.org/10.15584/ejcem.2023.1.12>
- Naldini, L. (2015). Gene therapy returns to centre stage. *Nature*, 526, (7573), 351-360. <https://doi.org/10.1038/nature15818>
- Popovych, I., Zukow, W., Fil, V., Kovalchuk, H., Bryndzia, I., Voloshyn, O., Kopko, I., Lupak, O., & Skrobach, T. (2023). The interaction of synbiotic of the environment and the endoecosystem as one of the mechanisms of action of balneotherapy. *European Journal of Clinical and Experimental Medicine*, 21(2), 315-323. <https://doi.org/10.15584/ejcem.2023.2.26>
- Park, M., Ko, M.H., Oh, S.W., Lee, J.Y., Ham, Y., Yi, H., Choi, Y., Ha, D., & Shin, J.H. (2019). Effects of virtual reality-based planar motion exercises on upper extremity function, range of motion, and health-related quality of life: a multicenter, single-blinded, randomized, controlled pilot study. *J Neuroeng Rehabil*. 24, 16(1), 122. PMID: 31651335; PMCID: PMC6813964. <https://doi.org/10.1186/s12984-019-0595-8>
- Rajkumar, A., Dean, J., & Kohane, I. (2019). Machine Learning in Medicine. *New England Journal of Medicine*, 380(14), 1347-1358. <https://doi.org/10.1056/NEJMra1814259>
- Roos, K.L. (2008). Meningitis, encephalitis, brain abscess, and empyema. *Harrison's principles of inter-*

- nal medicine, 2621-2641.
- Rusyn, I., Fihurka, O., Dyachok, V. (2023). Effect of Plants Morphological Parameters on Plant-Microbial Fuel Cell Efficiency. *Innovative Biosystems and Bioengineering*, 6(3-4), 161-168. <https://doi.org/10.20535/ibb.2022.6.3-4.273108>
- Rybalko, L., Kletsenko, L., Vyshar, Ye., Heta, A. Żukow, X., Levkov, A., Zukow, W., Muszkieta, R., Hagner-Derengowska, M., Smoleńska, O., (2023). Application of kinesitherapy within the process of rehabilitation of patients with Charcot-Marie-Tooth neural amyotrophy. *European Journal of Clinical and Experimental Medicine*, 21(1), 169-179. <https://doi.org/10.15584/ejcem.2023.1.22>
- Sapci, A.H., Sapci, H.A. (2020). Artificial Intelligence Education and Tools for Medical and Health Informatics Students: Systematic Review. *JMIR Med Educ*. 6(1), e19285. PMID: 32602844; PMCID: PMC7367541. <https://doi.org/10.2196/19285>
- Sierpińska, L. (2021). Circumstances of infection with HCV in selected Polish provinces. *J Educ Health Sport*. 11(2), 41-52. <https://doi.org/10.12775/JEHS.2021.11.02.005>
- Sierpińska, L. (2022). Assessment of the degree of illness acceptance in patients diagnosed with hepatitis C. *Ann Agric Environ Med*. 29(2), 224-231. <https://doi.org/10.26444/aaem/145375>
- Sierpińska, L., & Jaworski, S. (2022). Hepatocellular carcinoma in patients with chronic hepatitis C – case study. *J Educ Health Sport*. 12(3), 229-237. <https://doi.org/10.12775/JEHS.2022.12.03.019>
- Sierpińska, L.E. (2022). Assessment of Health Behaviors of Patients with Hepatitis C. *Am J Health Behav*. 46(5), 586-594. <https://doi.org/10.5993/AJHB.46.5.9>
- Sierpińska, L. (2022). Expectations of patients with hepatitis C from family physicians – a Polish example. *Ann Agric Environ Med*. 29(4), 529-537. <https://doi.org/10.26444/aaem/157357>
- Sierpińska, L.E. (2022). Concept of Health in Opinions of Patients Diagnosed with Hepatitis C. *Am J Health Behav*. 46(6), 643-653. <https://doi.org/10.5993/AJHB.46.6.7>
- Sierpińska, L.E., & Ptasieńska, E. (2023). Evaluation of work conditions of nurses employed in a shift system in hospital wards during the COVID-19 pandemic. *Work*. <https://doi.org/10.3233/WOR-220275>
- Sharma, B., Shahanshah, M.F.H., Gupta, S., & Gupta, V. (2021). Recent advances in the diagnosis of COVID-19: a bird's eye view. *Expert Review of Molecular Diagnostics*, 21(5), 475-491. <https://doi.org/10.1080/14737159.2021.1874354>
- Staal, F.J., Aiuti, A., & Cavazzana, M. (2019). Autologous stem-cell-based gene therapy for inherited disorders: state of the art and perspectives. *Frontiers in pediatrics*, 7, 443. <https://doi.org/10.3389/fped.2019.00443>
- Sokol, A., Grekov, D., Yemets, G., Galkin, O, Shchotkina, N, et al. (2020). Biocompatibility analysis of the decellularized bovine pericardium. *Cell and Organ Transplantation*, 8(2), 110-120. <https://doi.org/10.22494/cot.v8i2.110>
- Tekkeşin, A.İ. (2019). Artificial intelligence in healthcare: past, present and future. *Anatol J Cardiol*, 22, (Suppl 2), 8-9. <https://doi.org/10.14744/AnatolJCardiol.2019.28661>
- Topol, E.J. (2019). High-performance medicine: the convergence of human and artificial intelligence. *Nature Medicine*, 25(1), 44-56. <https://doi.org/10.1038/s41591-018-0300-7>
- Vollmann, J., Sandow, V., & Schildmann, J. (2016). *The ethics of personalised medicine: Critical perspectives*. Routledge. <https://doi.org/10.4324/9781315616209>
- Wang, L., Li, G., Yuan, C., Yang, Y., Ling, G., Zheng, J., ... & Lin, Z. (2021). Progress in the Diagnosis and Treatment of COVID-19 in Children: A Review. *International Journal of General Medicine*, 8097-8108. <https://doi.org/10.2147/IJGM.S335888>
- Wong, K., Yee, H.M., Xavier, B.A., & Grillone, G.A. (2018). Applications of augmented reality in otolaryngology: a systematic review. *Otolaryngology – Head and Neck Surgery*, 159(6), 956-967. <https://doi.org/10.1177/0194599818796476>
- Xiong, R., Zhang, L., Li, S., Sun, Y., Ding, M., Wang, Y., ... & Xu, K. (2020). Novel and potent inhibitors targeting DHODH, a rate-limiting enzyme in de novo pyrimidine biosynthesis, are broad-spectrum antiviral against RNA viruses including newly emerged coronavirus SARS-CoV-2. *BioRxiv*, 03. <https://doi.org/10.1101/2020.03.11.983056>
- Zukow, W., Muszkieta, R., Hagner-Derengowska, M., Smoleńska, O., Żukow, X., Mel'Nyk, O. Popovych, D., Tserkoniuk, R., Hryhorenko, A., Yanchij, R, Kindrat, V., Popovych, I. (2022). Effects of rehabilitation at the Truskavets' spa on physical working capacity and its neural, metabolic, and hemato-immune accompaniments. *Journal of Physical Education and Sport*, 22(11), 2708-2722. <https://doi.org/10.7752/jpes.2022.11345>
- Zukow, W., Muszkieta, R., Hagner-Derengowska, M., ... & Popovych, I.L. (2022). Role of organic substances of Naftussya bioactive water in its effects on dynamic and static fitness in rats. *Journal of Physical Education and Sport*, 22(11), 2733-2742. <https://doi.org/10.7752/jpes.2022.11347>