Читайте нас на сайті: https://med-expert.com.ua

UDC 616.98-053.2-06:159.923

S.O. Nykytyuk, A.S. Sverstyuk, S.S. Levenets, T.V. Hariyan, V.O. Synytska, V.Y. Kulchytskyi

Psychological changes after complicated viral infections

I. Horbachevsky Ternopil National Medical University, Ukraine

Modern Pediatrics. Ukraine. (2026). 3(155): 111-120; doi 10.15574/SP.2026.3(155).111120

For citation: Nykytyuk SO, Sverstyuk AS, Levenets SS, Hariyan TV, Synytska VO, Kulchytskyi VY. (2026). Psychological changes after complicated viral infections. Modern Pediatrics. Ukraine. 3(155): 111-120. doi: 10.15574/SP.2026.3(155).111120.

Pneumonia remains one of the most pressing medical and social problems worldwide. Epidemiological research indicates that mental disorders, such as depression, bipolar affective disorder and schizophrenia, are risk factors for the development of acute respiratory infections.

Aim – to conduct a review of the literature on psychological changes following complicated viral infections using the Scopus database, and to construct a regression model to predict the risk of psychological changes following complicated viral infections.

Materials and methods. The first stage involved an analytical review and analysis of recent scientific publications. In the second stage, a questionnaire survey was conducted among 100 respondents; based on the results, a multivariate regression model was developed to predict psychological changes following complicated viral infections. The model includes 23 statistically significant factors reflecting psychological changes following complicated viral infections.

Results. A model was built to predict the risk of psychological changes after complicated viral infections, in particular pneumonia. As a result of the analysis, it was found that the studied anthropometric data and clinical indicators are highly significant predictors. The resulting regression equation allows you to predict with high accuracy the level of psychological changes in patients based on the input parameters.

Conclusions. The Scopus database makes it possible to optimise the comprehensiveness of relevant searches for scientific literature on psychological changes following complicated viral infections. For the first time, a regression model has been developed to predict the risk of psychological changes following complicated viral infections and pneumonia. A multidisciplinary approach (neurologist, psychiatrist, GP, psychologist) and early screening for anxiety and depressive disorders are required.

The authors declare no conflict of interest.

Keywords: psychological model, viral infections, pneumonia, psycho-emotional state, ANOVA, regression analysis.

Психологічні зміни в дітей після ускладнених вірусних інфекцій

С.О. Никитюк, А.С. Сверстюк, С.С. Левенець, Т.В. Гаріян, В.О. Синицька, В.Й. Кульчицький

Тернопільський національний медичний університет імені І.Я. Горбачевського, Україна

Пневмонія залишається однією з найгостріших медичних і соціальних проблем у всьому світі. Епідеміологічні дослідження свідчать про те, що такі психічні розлади, як депресія, біполярний афективний розлад та шизофренія, є факторами ризику розвитку гострих респіраторних інфекцій.

Мета – провести аналіз літературних джерел із використанням бази даних Scopus на тему психологічних змін після ускладнених вірусних інфекцій та побудувати регресійну модель для прогнозування ризику такиих змін.

Матеріали і методи. На першому етапі здійснено аналітичний огляд та аналіз сучасних наукових публікацій. На другому етапі проведено анкетне опитування 100 респондентів, за результатами якого було побудовано багатофакторну регресійну модель для прогнозування психологічних змін після ускладнених вірусних інфекцій. Модель охоплює 23 статистично значущих факторів, що відображають психологічні зміни після ускладнених вірусних інфекцій.

Результати. Побудовано модель для прогнозування ризику психологічних змін після ускладнених вірусних інфекцій, зокрема пневмонії. Встановлено, що досліджувані антропометричні дані та клінічні показники є високозначущими предикторами. Отримане регресійне рівняння дає змогу з високою точністю прогнозувати рівень психологічних змін у пацієнтів на основі вхідних параметрів.

Висновки. База даних Scopus дає змогу оптимізувати комплексність релевантного пошуку наукової літератури щодо психологічних змін після ускладнених вірусних інфекцій. Вперше розроблено регресійну модель для прогнозування ризику психологічних змін після ускладнених вірусних інфекцій та пневмонії. Необхідний мультидисциплінарний підхід (невролог, психіатр, сімейний лікар, психолог) та раннє виявлення тривожних і депресивних розладів.

Автори заявляють про відсутність конфлікту інтересів.

Ключові слова: психологічна модель, вірусні інфекції, пневмонії, психоемоційний стан, ANOVA, регресійний аналіз.

Introduction

Respiratory viral infections, in particular influenza A virus (IAV) and coronavirus-induced severe acute respiratory syndrome 2 (SARS-CoV-2), are increasingly being considered a serious global threat to public health through their high contagion, growth equal morbidity and mortality. In addition to etiological factors, epidemiological research indicates that mental disorders, such as depression, bipolar affective disorder, and schizophrenia, are risk factors for the development of severe respiratory infections [2].

With the moment of your first appearance, coronavirus 2, which causes SARS-CoV-2, had a considerable and long-lasting negative influence on health and economic situation among millions of people all around the world. On the level of individual health, many patients do not recover fully and suffer from long-term disease that is now usually called «long COVID». Long-term COVID is a totality of symptoms that persist over 12 weeks after primary

Читайте нас на сайті: https://med-expert.com.ua

COVID infection, which can not be adequately explained by alternative diagnoses. Neurological and psychosocial influence long-term COVID itself; there is a global crisis in industrial security health; therefore, prevention, diagnostics and treatment of these patients have extremely important value. This review concentrates mainly on violations of neurological functions; influence on mental health; long-term problems with mood; and related psychosocial problems in patients who suffer from long-term COVID, taking into account neurological basics of these symptoms. From the literature, a concise description of the clinical significance of neurological and psychosocial consequences of long-term COVID was analyzed and presented, including the impact on long-term morbidity and different approaches to treating patients with significant chronic neurological symptoms and states. An exhaustive description of probable pathophysiological mechanisms that participate in the development of long-term COVID, its treatment and future needs in studies [10,20].

Persons with diagnosed mental diseases have elevated susceptibility to respiratory viruses, in particular flu and SARS-CoV-2, compared to people with positive emotional states and proper social support, who usually demonstrate greater resistance to viral infections [4,18]. According to recent research, psychological distress experienced in the post-acute phase may be associated with the persistence of post-acute COVID-19 syndrome (PACS) – especially general and respiratory manifestations – at the one-year follow-up among individuals with PACS [5], as well as the presence of comorbidities [20]. In this regard, there is an urgent need for in-depth study of the mechanisms of interaction between mental health and respiratory viral infections and for the development of effective approaches to their prevention and control.

The modern development of interdisciplinary research combining medical, biological and technical sciences is leading to a growing interest in the use of analytical, informational and mathematical methods to study complex biological systems.

Meanwhile, questions remain open regarding the mechanisms of action of various psychological changes after complicated viral infections and optimal rehabilitation schemes. That is why a comprehensive analysis of modern scientific publications using the Scopus database, which provides quick access to relevant and high-quality sources, is a necessary condition for forming a holistic understanding of this problem and determining directions for further research.

The aim of this study was to analyse the literature on psychological changes following complicated viral infections using the Scopus database and to develop a regression model for predicting the risk of psychological changes following complicated viral infections.

Materials and methods of the study

At the first stage, an analytical review of contemporary scientific publications in the Scopus database was carried out, which made it possible to identify a growing scholarly interest in this issue.

At the second stage, with the aim of developing a mathematical model to predict the extent of psychological changes following complicated viral infections, a questionnaire survey was conducted among 100 respondents aged 8–12 years using the PedsQL questionnaire. The model includes 23 statistically significant factors reflecting psychological changes following a complicated course of viral infections and pneumonia. The PedsQL does not have separate «anxiety» and «depression» scales in the classical psychiatric sense. In the basic version of PedsQL 4.0, these conditions are assessed indirectly through emotional functioning and, in part, through psychosocial health.

The main scale for anxiety/depression – It's hard for me to walk more than one block. Question 2: It's hard for me to run. Question 3: It's hard for me to play sports or do physical exercises. Question 4: It's hard for me to lift heavy objects. Question 5: It's hard for me to take a bath or shower by myself. Question 6: It's hard for me to help with household chores. Question 7: I feel pain. Question 8: I lack energy. Question 9: I'm afraid or embarrassed. Question 10: I feel sad. Question 11: I feel angry. Question 12: I don't sleep well. Question 13: I worry about what will happen to me. Question 14: I have a hard time making friends with other kids. Question 15: Other kids don't want to be friends with me. Question 16: Other kids tease me. Question 17: I can't do the things that other kids my age can do. Question 18: I have a hard time keeping up with other children when we play. Question 19: I have a hard time concentrating in class. Question 20: I have a hard time remembering things. Question 21: I have a hard time keeping up with schoolwork. Question 22: I miss school because I feel sick. Question 23: I miss school to go to the doctor or the hospital.

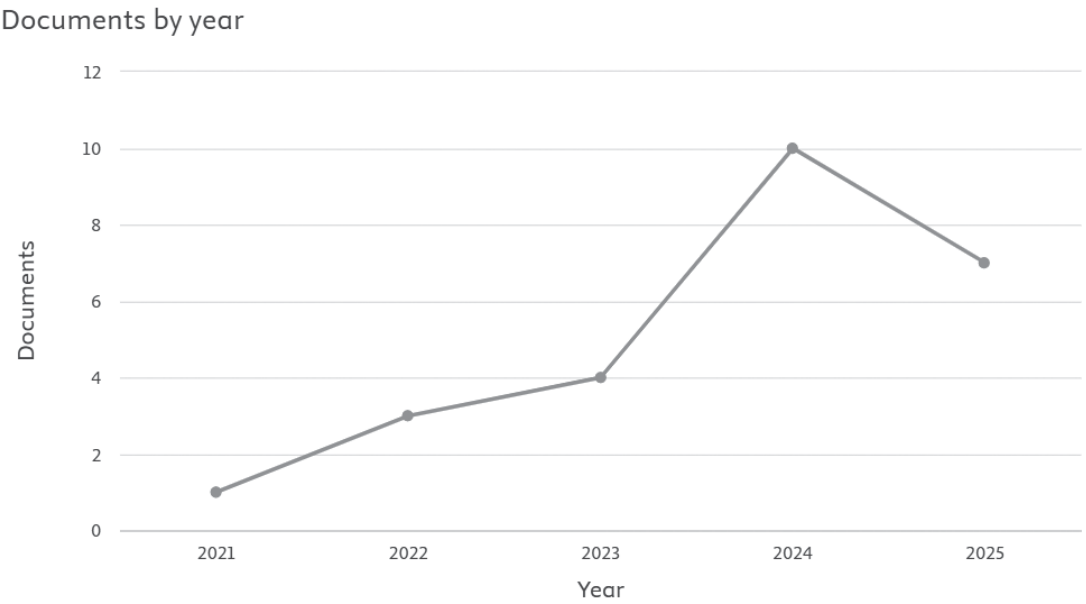

Fig. 1. Results of the search query for psychological changes after complicated viral infections in the Scopus scientometric database by year

To interpret the PedsQL scores: a higher score = better quality of life; a lower score = more emotional problems. Existing developments have prompted the search for new diagnostic methods. In the process of carrying out this research work, a comprehensive approach to predicting psychological changes after complicated viral infections and the development of pneumonia was implemented. The multifactorial regression model was constructed using the Statistics 12.0 Software programme.

During the study, all recommendations of the Declaration of Helsinki of 1975 (revised in 2000) were followed. The study was approved by the Bioethics Committee at the I. Ya. Horbachevsky Ternopil National Medical University of the Ministry of Health of Ukraine (protocol No. 84 dated January 2026).

At the initial examination, all parents or children who had reached the age of 8–12 signed informed voluntary consent for participation in the study, as well as for the use of diagnostic and treatment results in scientific research.

Results of the study

First stage of the study. An analytical search for results on psychological changes after complicated viral infections in the Scopus scientometric database was conducted.

To assess the relevance of our research, an analytical query was formulated in the Scopus scientometric database: (TITLE-ABS-KEY(«psychological model») OR TITLE-ABS-KEY(«viral infections»)) AND (TITLE-ABS-KEY(«children's body») OR TITLE-ABS-KEY(«children»)) AND (TITLE-ABS-KEY («psycho-emotional state») OR TITLE-ABS-KEY(“psychosomatics») OR TITLE-ABS-KEY(«stress») OR TITLE-ABS-KEY (“adaptation») OR TITLE-ABS-KEY(«development»)) AND (TITLE-ABS-KEY («regression analysis») OR TITLE-ABS-KEY («machine learning methods») OR TITLE-ABS-KEY («artificial intelligence»)).

Figure 1 shows the results of a search query in the Scopus database by year.

According to Figure 1, based on the results of a search query on psychological changes following complicated courses of viral infections in the Scopus database, 1 article was published in 2021, 3 – in 2022, 4 – in 2023, 10 – in 2024, and 7 publications in 2025.

Figure 2 shows the results of the search query for psychological changes after complicated viral infections in the Scopus scientometric database by distribution of works by scientific institutions in the world.

According to Figure 2, in terms of scientific institutions, the leading positions are occupied by China – 6, the USA – 5, India – 3, Italy – 2, Albania, Canada, Denmark, and the Netherlands with 1 scientific paper each. An increase in scientific interest in this issue has been established.

Figure 3 shows the dynamics of the number of scientific publications on the topic of psychological changes after complicated viral infections (2015–2025), divided into eight sources.

Читайте нас на сайті: https://med-expert.com.ua

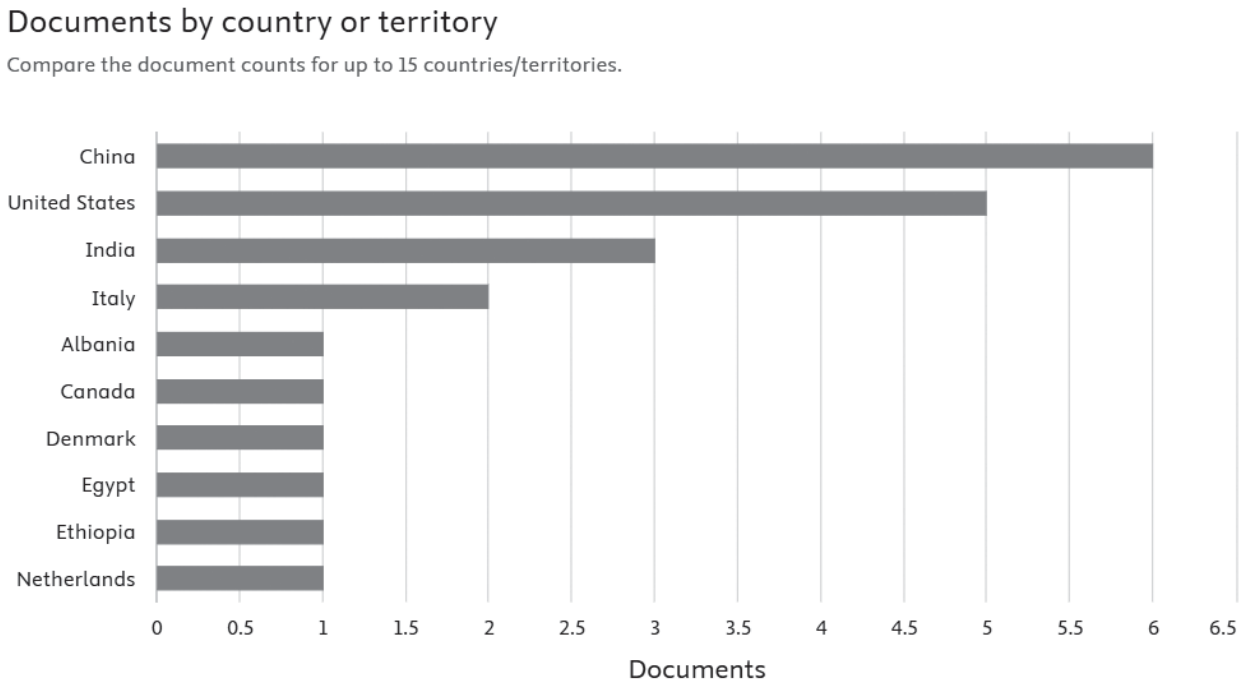

Fig. 2. Results of the search query for psychological changes after complicated viral infections in the Scopus scientometric database by distribution of works by scientific institutions in the world

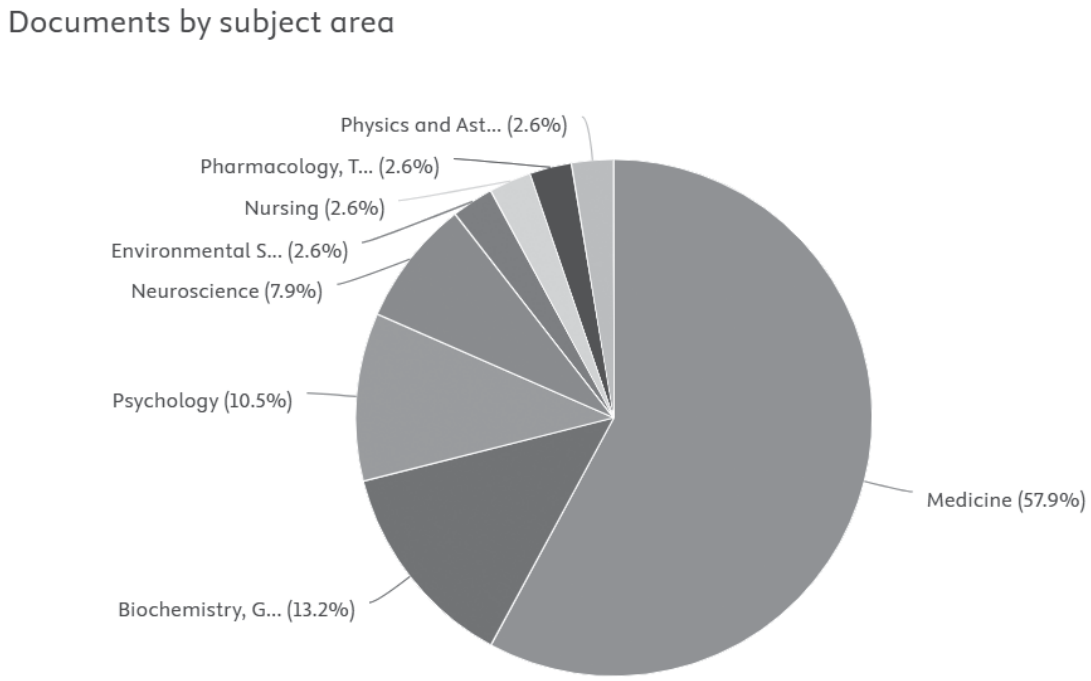

Fig. 3. Results of the search query for psychological changes after complicated viral infections in the Scopus scientometric database (scientific publications section)

Among the scientific publications, research articles predominated in the following subject areas: Medicine – 57.9%, Physics – 2.6%, Pharmacology, Nursing, and Environmental Science – 2.6% each, Psychology – 10.5%, and Biochemistry – 13.2%.

Dynamics of the number of scientific publications on the topic of research on psychological changes (2015–2025), divided into five sources: Microorganism, International Journal of Molecular Sciences, Journal of Cosmetic Dermatology, Antibiotics and

Table 1

Significant factors predicting the risk of developing psychological changes after complicated viral infections

Conventional designations of factors in the mathematical forecasting model	Full name (extended question)	Possible answer options	Weight points
Q1	I have difficulty walking more than one block	Yes	2
		Sometimes	1
		No	0
Q2	It's hard for me to run	Yes	2
		Sometimes	1
		No	0
Q3	I find it difficult to do sports or exercise	Yes	2
		Sometimes	1
		No	0
Q4	I have a hard time lifting heavy things	Yes	2
		Sometimes	1
		No	0
Q5	I find it difficult to bathe or shower by myself	Yes	2
		Sometimes	1
		No	0
Q6	I find it difficult to help with housework	Yes	2
		Sometimes	1
		No	0
Q7	I'm in pain	Yes	2
		Sometimes	1
		No	0
Q8	I don't have enough strength	Yes	2
		Sometimes	1
		No	0
Q9	I am scared or timid	Yes	2
		Sometimes	1
		No	0
Q10	I am sad	Yes	2
		Sometimes	1
		No	0
Q11	I feel angry	Yes	2
		Sometimes	1
		No	0
Q12	I sleep badly	Yes	2
		Sometimes	1
		No	0
Q13	I am worried about what will happen to me	Yes	2
		Sometimes	1
		No	0
Q14	I have a hard time making friends with other children	Yes	2
		Sometimes	1
		No	0

Читайте нас на сайті: https://med-expert.com.ua

Continuation of Table 1

Conventional designations of factors in the mathematical forecasting model	Full name (extended question)	Possible answer options	Weight points
Q15	Other kids don't want to be friends with me	Yes	2
		Sometimes	1
		No	0
Q16	Other children tease me	Yes	2
		Sometimes	1
		No	0
Q17	I can't do what other kids my age can do	Yes	2
		Sometimes	1
		No	0
Q18	I have a hard time keeping up with the other children when we play	Yes	2
		Sometimes	1
		No	0
Q19	I have a hard time concentrating in class	Yes	2
		Sometimes	1
		No	0
Q20	I have a hard time remembering anything	Yes	2
		Sometimes	1
		No	0
Q21	I have a hard time keeping up with my schoolwork	Yes	2
		Sometimes	1
		No	0
Q22	I'm skipping school because I'm not feeling well	Yes	2
		Sometimes	1
		No	0
Q23	I skip school to go to the doctor or hospital	Yes	2
		Sometimes	1
		No	0

Clinics in Dermatology. It is seen that in most sources there is a general trend towards an increase in publications, but with different intensity.

Second stage of the study. Using the method of multivariate regression analysis, by building a mathematical model, it is possible to predict the occurrence of psychological changes based on the significant factors listed in Table 1.

Figure 4 shows the result of obtaining significant factors for the coefficient of prediction of the risk of psychological changes after complicated viral infections (CPRPDPCHVI) when conducting multivariate regression analysis in the Statistica 10.0 program without the factors Gender and Q3.

The constructed regression model shows high predictive ability. The adjusted coefficient of determination R^2=0.999, which indicates that the selected predictors explain 99.9% of the variance of the dependent variable.

The statistical significance of the model is confirmed by Fisher's test: F(25, 114)=946300, p<0.0001. The standard error of the estimate is low and is 0.0423, which indicates a high accuracy of data approximation by the regression model.

The free term of the regression equation (Intercept) is -21.38 (p<0.001). Analysis of unstandardized (b) and standardized (b*) coefficients allowed us to identify the nature and strength of the influence of each variable:

All indicators included in the analysis (Q1, Q2, Q4-Q23) demonstrated statistical significance (p<0.001; for Q6 p<0.002).

First, let's consider the positive impact (increasing the level of psychological changes). The largest contri-

Читайте нас на сайті: https://med-expert.com.ua

bution among all variables, judging by the standardized coefficients (b*), is made by indicators Q7 (b*=0.466), Q16 (b*=0.455), Q20 (b*=0.353) and Q1 (b*=0.325). The growth of these indicators is most strongly associated with an increase in the coefficient of development of psychological changes. Q4, Q5, Q8, Q10, Q12, Q14, Q15, Q19, Q22 also have a positive impact.

Regarding the negative impact (reducing the level of psychological changes), it is necessary to consider the factors that reduce the value of the dependent variable and the most significant are Q2 (b*=-0.280) and Q21 (b*=-0.221). Also, a negative relationship was found for Q9, Q11, Q13, Q17, Q18, and Q23.

The resulting indicator, based on the results of monitoring the psychological state of patients, is presented in the form of CPRPDPCHVI, which was formed based on the total number of points scored by each patient, in accordance with Table 1.

Based on the results obtained, which are shown in Figure 4, we build a mathematical model for determining the CPRPDPCHVI:

$$CPRPDPCHVI=-1.2422\times AGE-$$
$$-0.0895\times WEIGHT+$$
$$+0.2662\times HEIGHT+4.0221\times Q1-3.0373\times Q2+$$
$$+1.1293\times Q4+1.2740\times Q5+0.1126\times Q6+$$
$$+8.7594\times Q7+1.8618\times Q8-1.9594\times Q9+$$
$$+2.3221\times Q10-1.1221\times Q11+0.3134\times Q12-$$
$$-1.7226\times Q13++2.2540\times Q14+0.3403\times Q15+$$
$$+6.9843\times Q16--2.8651\times Q17-0.8129\times Q18+$$
$$+0.6821\times Q19+6.0451\times Q20-2.7352\times Q21+$$
$$+2.6837\times Q22-0.3612\times Q23-21.3843$$

The next step was to assess the overall fit of the model, for which we conducted an analysis of variance (ANOVA) (Fig. 5).

Analyzing the obtained data, we can conclude that the high level of acceptability of the prediction model for predicting the risk of psychological changes after complicated viral infections in general, using ANOVA analysis, since the significance level is $p<0.001$, and the model itself will work better than a simple prediction using average values.

As a result of the conducted analysis, it was found that the studied clinical indicators (Q) are highly significant predictors. The obtained regression equation makes it possible to predict the level of psychological changes in patients with high accuracy based on the input parameters.

Discussion

In analyzing current studies addressing patients' conditions after viral infections, particular attention

Regression Summary for Dependent Variable: КПЗППВІ_8-12 (8-12 in 1__8-12
R= ,99999759 R?= ,99999518 Adjusted R?= ,99999412
F(25,114)=9463E2 p<0.0000 Std Error of estimate: ,04230

N=100	b*	Std.Err. of b*	b	Std.Err. of b	t(114)	p-value
Intercept			-21,3843	0,440613	-48,5331	0,000000
Вік	-0,098000	0,002198	-1,2422	0,027865	-44,5795	0,000000
Маса	-0,047316	0,001570	-0,0895	0,002967	-30,1453	0,000000
Зріст	0,138194	0,002720	0,2662	0,005239	50,8134	0,000000
Q1	0,325481	0,005210	4,0221	0,064386	62,4682	0,000000
Q2	-0,280345	0,010710	-3,0373	0,116032	-26,1767	0,000000
Q4	0,066064	0,001031	1,1293	0,017625	64,0748	0,000000
Q5	0,118282	0,001395	1,2740	0,015026	84,7848	0,000000
Q6	0,007831	0,002465	0,1126	0,035438	3,1763	0,001920
Q7	0,466433	0,007240	8,7594	0,135969	64,4220	0,000000
Q8	0,117002	0,002566	1,8618	0,040835	45,5921	0,000000
Q9	-0,117965	0,005021	-1,9594	0,083392	-23,4964	0,000000
Q10	0,118388	0,002283	2,3221	0,044780	51,8559	0,000000
Q11	-0,058310	0,002929	-1,1221	0,056371	-19,9055	0,000000
Q12	0,018693	0,000758	0,3134	0,012705	24,6708	0,000000
Q13	-0,102735	0,003977	-1,7226	0,066679	-25,8338	0,000000
Q14	0,150448	0,002415	2,2540	0,028576	78,8758	0,000000
Q15	0,023090	0,001512	0,3403	0,022287	15,2697	0,000000
Q16	0,455496	0,008814	6,9843	0,135153	51,6772	0,000000
Q17	-0,168942	0,005681	-2,8651	0,096347	-29,7375	0,000000
Q18	-0,048743	0,001935	-0,8129	0,032273	-25,1892	0,000000
Q19	0,054827	0,000815	0,6821	0,010138	67,2825	0,000000
Q20	0,353627	0,006962	6,0451	0,119012	50,7940	0,000000
Q21	-0,221912	0,006990	-2,7352	0,086155	-31,7473	0,000000
Q22	0,163067	0,003096	2,6837	0,050953	52,6700	0,000000
Q23	-0,021540	0,001652	-0,3612	0,027695	-13,0403	0,000000

Fig. 4. The result of obtaining significant factors for predicting the risk of CPRPDPCHVI when conducting multivariate regression analysis in the Statistica 10.0 program without the factors Gender and Q3

Analysis of Variance; DV: КПЗППВІ_8-12 (8-12 in 1__8-12

Effect	Sums of Squares	df	Mean Squares	F	p-value
Regress.	42320,33	25	1692,813	946256,3	0,00
Residual	0,20	114	0,002		
Total	42320,54				

Fig. 5. ANOVA

was drawn to works examining the long-term association between psychological stress in the post-acute phase and subsequent persistent symptoms of PACS [5]. Notably, among individuals with PACS symptoms, 17.0% experienced psychological distress 5.1 months after infection, which was primarily associated with general and respiratory symptoms. An association between pre-existing depressive or anxiety symptoms and PACS manifestations was identified in several cross-sectional studies [8].

The obtained data served as a basis for further statistical analysis and the application of a multivariate regression analysis method aimed at identifying the most significant factors influencing the prediction of recurrent complications following viral infections. Approaches to constructing multivariate regression models for medical prediction have been discussed in studies [6,9,12–14,16].

The COVID-19 pandemic has highlighted the importance of understanding the long-term consequences of this disease, as well as other viral illnesses, for the quality of life of infected individuals [1].

Читайте нас на сайті: https://med-expert.com.ua

A group of authors [3] studied the impact of off-season and pre-competition periods on oxidative stress, inflammatory, immunological, and psychological markers in bodybuilders and the impact on physical activity, mood, and recovery-stress in athletes.

Research findings identify components of optimism and pessimism [15] and describe the heterogeneity of these attitudes across different groups of patients (situational optimism regarding the expectation of positive events under uncertain conditions tends to prevail; at the same time, a tendency toward heightened pessimistic perception is also observed). This may indicate an internal inconsistency of cognitive-emotional attitudes and underscores the need for further psychological support.

It is worth noting the scientific contributions in which the author [3] examines the main neuropsychiatric manifestations following acute respiratory infection, namely COVID-19, and systematizes a broad spectrum of symptoms classified into cognitive and affective disorders. Cognitive symptoms include brain fog, reduced concentration, memory impairment, and slowed thinking; these manifestations are often accompanied by pronounced fatigue and significantly complicate daily activities, learning, and professional performance. Affective and anxiety disorders include generalized anxiety disorder, panic attacks, social anxiety, health-related anxiety, major depressive disorder, and emotional lability (mood swings, episodes of euphoria or irritability). Particular attention is paid to research findings obtained using validated instruments assessing health-related quality of life (HRQoL). A significant decline in physical functioning, vitality, and overall health status was identified among patients. Most patients reported limitations in daily activities, pain, discomfort, anxiety, and depression.

Studies (including EPICOVID-AP21) demonstrate a high prevalence of persistent symptoms after the acute phase of COVID-19. The authors emphasize that depressive symptoms can be caused by both biological factors (neuroinflammation, hormonal changes) and psychosocial factors – isolation, fear of relapse, uncertainty of prognosis.

Neurological and somatoneurological manifestations include sleep disturbances, chronic fatigue, headache, tremor, neuropathic pain, and seizure episodes. The combination of somatic and psychological symptoms creates a complex clinical picture that requires an interdisciplinary approach.

Researchers have also established [8] that the most common respiratory viruses detected among pilgrims were influenza and rhinovirus. Among the studied individuals, the bacterial pathogens *Streptococcus pneumoniae* and *Haemophilus influenzae* were also identified. Article [21] compiled 530 survey responses from residents of 66 buildings with operable windows in Melbourne in 2023. Occupant behavior changes (OBC) were grouped, measured, and analyzed using univariate and multivariate regression analyses in relation to three indoor respiratory disease transmission pathways: (1) fomites: hand hygiene; (2) airborne transmission: individual indoor air quality measures, including mask-wearing and window opening; and (3) droplets: social distancing and reduced working hours at the workplace. Regression analyses indicate that OBC related to different transmission pathways share common key determinants, including risk perception and changes in colleagues' behavior. Older age significantly influenced airborne-related OBC, whereas fomite-related OBC were more associated with gender. In contrast, personal factors were not significant for droplet-related OBC, which were more strongly influenced by perceptions of personal space in the workplace.

Autism spectrum disorder (ASD) [19] is a complex and heterogeneous neurodevelopmental disorder. Its prevalence has increased dramatically over the past few decades. ASD is a multifactorial disorder. In addition to genetic factors, the environment plays a key role in critical periods of neurodevelopment. The prenatal environment, as well as perinatal and postnatal exposure to infections and inflammation, are increasingly recognized as potential risk factors for autism. Quality control of the constructed model confirmed its adequacy and the possibility of practical use for quantitative assessment of the level of psychological changes after complicated viral infections [19]. In the study by Leshchyn [7], anxiety disorders following a viral infection were investigated. The results revealed characteristic features, including: lowered mood background; feelings of anxiety; unmotivated worry; inner tension with an inability to relax; anxious apprehensions; intrusive anxious thoughts intensifying in the evening and at night, which interfere with falling asleep; panic attacks accompanied by shortness of breath, a sense of unreality, and fear of death; exaggerated vigilance; inability to control anxiety; a sense of loss of control over one's life; irritability; decreased ability to concentrate; motor tension; autonomic hyper-

Читайте нас на сайті: https://med-expert.com.ua

activity; and sleep disturbances. The data obtained in the course of the study formed the basis for the development of a comprehensive personalized program for the correction of anxiety disorders in patients who had recovered from COVID-19. It was found that these patients commonly exhibited pronounced anxiety disorders, including prolonged anxiety-depressive reaction, panic disorder, generalized anxiety disorder, and anxiety disorder of organic origin.

The authors [11,17] found that children with chronic fatigue and stress disorders caused by war demonstrate a decrease in physical activity, emotional stability, learning motivation, and social interaction. Significant factors that worsen the quality of life are prolonged stress, acute respiratory diseases, sleep disorders, concentration problems, and recurring somatic complaints.

Conclusions

An analysis of scientific publications in the Scopus database revealed an increase in the number of studies focusing on psychological changes following a complicated course of viral infections, particularly between 2023 and 2025, which confirms the relevance of this research topic.

Based on the results of a survey of children aged 8–12 years, a multivariate regression model was developed to predict the risk of psychological changes following a complicated course of viral infections. The model included anthropometric indicators and clinical-psychological factors identified from the survey results.

The model demonstrated high predictive performance. Its statistical significance was confirmed by analysis of variance (ANOVA, $p<0.001$), whilst the high coefficient of determination ($R^2=0.999$) indicates the model's considerable explanatory power in predicting psychological changes.

The study emphasizes the need for a multidisciplinary approach (neurologist, psychiatrist, family doctor, psychologist); early screening of anxiety and depressive disorders; the use of standardized questionnaires; and individualized therapy (pharmacotherapy, psychotherapy, cognitive rehabilitation, and recovery programs).

Prospects for further research. The proposed approach can be used for educational and preventive purposes and may serve as a basis for further research involving data analysis methods and elements of intelligent technologies. An important stage of our study was surveying children aged 8–12 years to assess the level of optimism using the Life Orientation Test. The obtained results demonstrate the feasibility of applying data analysis methods and mathematical modelling in studying psychological changes after complicated courses of viral infections and create a basis for developing practical recommendations for preventing psychological problems among adolescents and young people.

Acknowledgements. We express our sincere gratitude to all medical staff of the pediatric infectious disease department of Ternopil Regional Child Hospital for their great help in involving patients in our work. We are very grateful to all patients and their parents who agreed to participate in the study and conscientiously fulfilled all requirements and requests.

The authors declare no conflict of interest.

REFERENCES/ЛІТЕРАТУРА

1. Caliman-Sturdza OA, Gheorghita R, Lobiuc A. (2025). Neuropsychiatric Manifestations of Long COVID-19: A Narrative Review of Clinical Aspects and Therapeutic Approaches. Life. 15: 439. https://doi.org/10.3390/life15030439.
2. Coughlin SS. (2012). Anxiety and Depression: Linkages with Viral Diseases. Public Health Rev. 34(2): 7. doi: 10.1007/BF03391675. PMID: 25264396; PMCID: PMC4175921.
3. De Moraes WMAM, de Moura FC, da Costa Moraes TC, Oliveira de Sousa LG, Dos Santos Rosa T et al. (2019, May). Oxidative stress, inflammation, psychological status, and severity of respiratory infections are negatively affected during the pre-contest period in amateur bodybuilders. Appl Physiol Nutr Metab. 44(5): 468-476. Epub 2018 Sep 24. doi: 10.1139/apnm-2018-0430. PMID: 30248274.
4. Gao Y, Liang Z, Mao B, Zheng X, Shan J, Jin C et al. (2024, Jun). Gut microbial GABAergic signaling improves stress-associated innate immunity to respiratory viral infection. J Adv Res. 60: 41-56. Epub 2023 Jun 22. doi: 10.1016/j.jare.2023.06.008. PMID: 37353002; PMCID: PMC10284622.
5. Hazumi M, Kataoka M, Narita Z, Usuda K, Okazaki E, Nishi D. (2025, Sep). Psychological distress after COVID-19 recovery and subsequent prolonged post-acute COVID-19 syndrome: A longitudinal study with one-year follow-up in Japan. J Psychosom Res. 196: 112323. Epub 2025 Jul 9. doi: 10.1016/j.jpsychores.2025.112323. PMID: 40651324.
6. Herasymiuk M, Sverstiuk A, Kit I. (2023, May). Multifactor regression model for prediction of chronic rhinosinusitis recurrence. Wiadomości Lekarskie Medical Advances. LXXVI; 5; I: 928-935. doi: 10.36740/WLek202305106.
7. Leshchyna IV. (2023, Dec). Phenomenological structure of anxiety disorders in persons who have transferred COVID-19. Medicine Today and Tomorrow. 92(4): 82-86 doi: 10.35339/msz.2023.92.4.les.
8. Mathkor DM, Tawil S, Johargy AK, Faidah H, Babalghith AO, Jalal NA et al. (2025, Nov). Respiratory and gastrointestinal infections among Hajj pilgrims during the 2012-2025 seasons: A systematic review. J Infect Public Health. 18(11): 102951. Epub 2025 Sep 3. doi: 10.1016/j.jiph.2025.102951. PMID: 40914991.

Читайте нас на сайті: https://med-expert.com.ua

9. Musiienko V, Marushchak M, Sverstuik A, Filipyuk A, Krynytska I. (2021). Prediction Factors For The Risk Of Hypothyroidism Development In Type 2 Diabetic Patients. Pharmacology OnLine. 3: 585-594.
10. Narayanan SN, Padiyath S, Chandrababu K, Raj L, PS BC, Ninan GA et al. (2025, Jan). Neurological, psychological, psychosocial complications of chronic-COVID and their management. Neurol Sci. 46(1): 1-23. Epub 2024 Nov 9. doi: 10.1007/s10072-024-07854-5. PMID: 39516425; PMCID: PMC11698801.
11. Nykytyuk S, Levenets S, Gariyan T, Gariyan T, Synytska V, Sverstyuk A. (2025). Quality of life of children with chronic fatigue and stress disorders during war: a systematic review of the literature. Neonatology, Surgery and Perinatal Medicine. 15; 4(58): 204-211. https://doi.org/10.24061/2413-4260.XV.4.58.2025.29.
12. Nykytyuk SO, Hariyan TV, Levenets SS. (2024). Hemorrhagic vasculitis in an adolescent induced by the COVID-19 virus. Modern Pediatrics. Ukraine. 6(142): 120-126 doi: 10.15574/SP.2024.6(142).120126.
13. Nykytyuk SO, Klymnyuk SI, Pivovarchuk DS, Sverstiuk AS. (2023). Multifactorial model of prediction of severe course and organ and system damage in Lyme borreliosis in children. Modern paediatrics. 2(130): 6-17. doi 10.15574/SP.2023.130.6.
14. Nykytyuk SO, Kuchma PM, Kito VV, Levenets SS, Hariyan TV, Yakymchuk YuB. (2023). Multisystem inflammatory syndrome MIS-C in children after COVID-19 infection article Ukrainian Journal of Perinatology and Pediatrics. 4(96): 128-135 doi: 10.15574/PP.2023.96.128.
15. Nykytyuk SO, Sverstiuk AS, Klymnyuk SI, Pyvovarchuk DS, Palaniza YB. (2023). Approach to prediction and receiver operating characteristic analysis of a regression model for assessing the severity of the course of Lyme borreliosis in children. Rheumatology. 61(5): 345-352. doi: 10.5114/reum/173115.
16. Nykytyuk SO, Sverstiuk AS, Pyvovarchuk DS, Klymnyuk SI. (2023). A multifactorial model for predicting severe course and organ and system damage in Lyme borreliosis in children. Modern pediatrics. 2(130): 6-16. https://doi.org/10.15574/SP.2023.130.6.
17. Perestiuk V, Sverstyuk A, Kosovska T, Volianska L, Boyarchuk O. (2025). A Predictive Model for the Development of Long COVID in Children. International Journal of Environmental Research and Public Health. 22(11): 1693. https://doi.org/10.3390/ijerph22111693.
18. Teixeira AL, Krause TM, Ghosh L, Shahani L, Machado-Vieira R, Lane SD et al. (2021, Nov 1). Analysis of COVID-19 Infection and Mortality Among Patients With Psychiatric Disorders, 2020. JAMA Netw Open. 4(11): e2134969. doi: 10.1001/jamanetworkopen.2021.34969. PMID: 34812848; PMCID: PMC8611476.
19. Turriziani L, Mancini A, Midiri M, Albertini ML, Butera A. (2025). Association Between Respiratory Infections and Risk of Autism Spectrum Disorder: An Overview, Current Respiratory Medicine Reviews. 21(1): 48-58. https://doi.org/10.2174/01157339 8X281954240614075538.
20. Wang Q, Xu R, Volkow ND. (2021). Increased risk of COVID-19 infection and mortality in people with mental disorders: analysis from electronic health records in the United States. World Psychiatry. 20(1): 124-130.
21. Zhang Y, Hui FKP, Duffield C, Gao CX. (2025). Profiling factors of occupant behavior change towards indoor respiratory infection control in post-pandemic Australia. Facilities. 43; 910. 616-637. https://doi.org/10.1108/F-07-2024-0093.

Відомості про авторів:
Никитюк Світлана Олексіївна – лікар-інфекціоніст, д.мед.н., доц. каф. педіатрії дитячих хвороб з дитячою хірургією ТНМУ ім. І.Я. Горбачевського. Адреса: м. Тернопіль, майдан Волі, 1. https://orcid.org/0000-0003-3146-9664.
Сверстюк Андрій Степанович – д.мед.н., проф. каф. медичної інформації ТНМУ ім. І.Я. Горбачевського. Адреса: м. Тернопіль, майдан Волі, 1. https://orcid.org/0000-0001-8644-0776.
Левенець Софія Сергіївна – лікар педіатр, к.мед.н., доц. каф. дитячих хвороб та дитячої хірургії ТНМУ ім. І. Горбачевського. Адреса: м. Тернопіль, майдан Волі, 1. https://orcid.org/0000-0002-2400-8328.
Гаріян Тетяна Вікторівна – лікар педіатр, к.мед.н., доц. каф. дитячих хвороб та дитячої хірургії ТНМУ ім. І. Горбачевського. Адреса: м. Тернопіль, майдан Волі, 1. https://orcid.org/0000-0002-9882-9831.
Синицька Віра Олексіївна – лікар педіатр, к.мед.н, доц. каф. дитячих хвороб та дитячої хірургії ТНМУ ім. І. Горбачевського. Адреса: м. Тернопіль, майдан Волі, 1. https://orcid.org/0000-0002-5746-109X.
Кульчицький Віталій Йосипович – д.пед.н., проф., зав. каф. педагогіки вищої освіти та соціальних наук ТНМУ ім. Тернопі І. Горбачевського. Адреса: м. Тернопіль, майдан Волі, 1. https://orcid.org/0000-0001-5863-3204.

Стаття надійшла до редакції 18.12.2025 р., прийнята до друку 13.04.2026 р.