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## Dynamics of morbidity of mental disorders of neurotic origin in the Ternopil region in the context of global warming

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### Abstract

**Relevance:** Over the last century, the modern climate is characterized by an average annual increase in global air temperature. According to existing scientific data, heat waves are often accompanied by mental, behavioral disorders that are combined with mood swings and increased anxiety. That is why the analysis of the incidence of mental disorders of the neurotic spectrum in the Ternopil region in the context of global warming is relevant.

**Materials and methods:** To analyze the incidence of mental disorders of the neurotic spectrum, the archival data of the Ternopil Regional Clinical Psychoneurological Hospital for 10 years, from 2010 to 2019 were analyzed. The average annual air temperatures were determined according to the archival data of hydrometeorological observations by the meteorological station of the city of Ternopil during 2010-2019. The growth rate of these indicators was estimated by the time series method. Pearson's correlation coefficient was used

to measure the degree of linear dependence between two variables, namely the rate of hospitalization growth and the average annual temperature in the region. Tables and graphs are built using Microsoft Excel and Microsoft Word.

**Results:** The primary analysis of the incidence of mental disorders of the neurotic spectrum in Ternopil region showed that the percentage growth rate for the year ranged from -19.55% to +20.62% and it was difficult to determine the direction of this phenomenon. In this regard, we carried out the alignment of the series by increasing the period and determining the arithmetic mean of the data for three years, respectively, we obtained data showing that for 10 years the prevalence of mental disorders of the neurotic spectrum in Ternopil region increased, the growth rate ranged from +1.66% to +6.32%.

**Conclusions:** Analyzing the obtained results, we found that in the conditions of global warming in Ternopil region there is a dynamics of growth in the incidence of mental disorders of neurotic origin. Also, by calculating the correlation coefficient, a direct correlation between the increase in the average annual temperature and the increase in morbidity rates was proved. The data obtained should be taken into account in the development of protocols for the prevention and treatment of mental illness associated with the effects of climate change, and will also be used in the educational process at the Departments of Physiology, Pathological Physiology and Psychiatry.

**Keywords:** Mental disorders; global warming; neurotic origin

**Relevance:** Mental disorders of a neurotic nature belong to the category of diseases that are manifested by temporary recurrent mental disorders of a functional nature and excessive activation of major nervous processes such as excitation and inhibition [1, 2].

Global climate change is one of the most pressing environmental problems, the solution of which is the focus of human attention. Its consequences are dangerous weather cataclysms, sudden weather changes, floods, floods, strong winds, showers and rains, hail, droughts, which lead to significant environmental and economic damage around the world. but in the long run, high temperatures cause fatigue, stress, and, as a result, an increase in mental illness, including PTSD, depression, anxiety, phobias, sleep disorders, attachment disorders, and drug abuse. Together, they create a predisposition to the adverse effects of adult mental health. Mental health professionals play an important role in contributing to climate change mitigation and in researching and implementing approaches to help address their effects [3, 4, 5, 6].

Over the last century, modern global warming is characterized by an average annual increase in global air temperature. During the last 10 years, an increase in atmospheric air temperature in Ternopil within 0.8–2.30 C has been registered, with the highest indicator in 2015, which corresponds to the general trends in both Ukraine and Europe [8]. According to existing scientific data, heat waves are often accompanied by mental, behavioral disorders that are combined with mood swings and increased anxiety [9]. That is why the analysis of mental morbidity is relevant disorders of the neurotic spectrum in the Ternopil region in the context of global warming.

**The aim of our study** was to assess the dynamics of changes in the incidence of mental disorders of the neurotic spectrum over ten years in the Ternopil region in the context of global warming.

**Materials and methods:** To achieve the above goal, the following research methods were used: to analyze the incidence of mental disorders of the neurotic spectrum was evaluated archival data of Ternopil Regional Clinical Psychoneurological Hospital for 10 years, from 2010 to 2019. To determine the average annual temperature was archival data of hydrometeorological observations at the meteorological station of the city of Ternopil during 2010-2019 were used. The growth rate of these indicators was estimated by the time series method. Pearson's correlation coefficient was used to measure the degree of linear dependence between two variables, namely the rate of hospitalization growth and the average annual temperature in the region.

**Results:** The primary analysis of the incidence of mental disorders of the neurotic spectrum in the Ternopil region and evaluation of archival data of hydrometeorological observations at the weather station of Ternopil showed that the percentage rate of increase in morbidity for the year ranged from -8.68% to + 17.79%, the percentage rate the increase in average annual temperature ranged from -10.38% to 18.84% (Table 1), in connection with which it was difficult to determine the direction of development of this phenomenon.

Therefore, we performed the alignment of the series by increasing the period and determining the arithmetic mean from the data for three years. Accordingly, we obtained data showing that for 10 years the prevalence of mental disorders of the neurotic spectrum in the Ternopil region increased, the growth rate ranged from + 0.35% to + 9.22%. In turn, we noted that the average growth rate of the average annual temperature also increased, the growth rate ranged from -1.06% to 7.03% (Table 2).

**Table 1.** Time series of increase in the incidence of mental disorders and the average annual temperature of neurotic origin in the Ternopil region from 2010 to 2019.

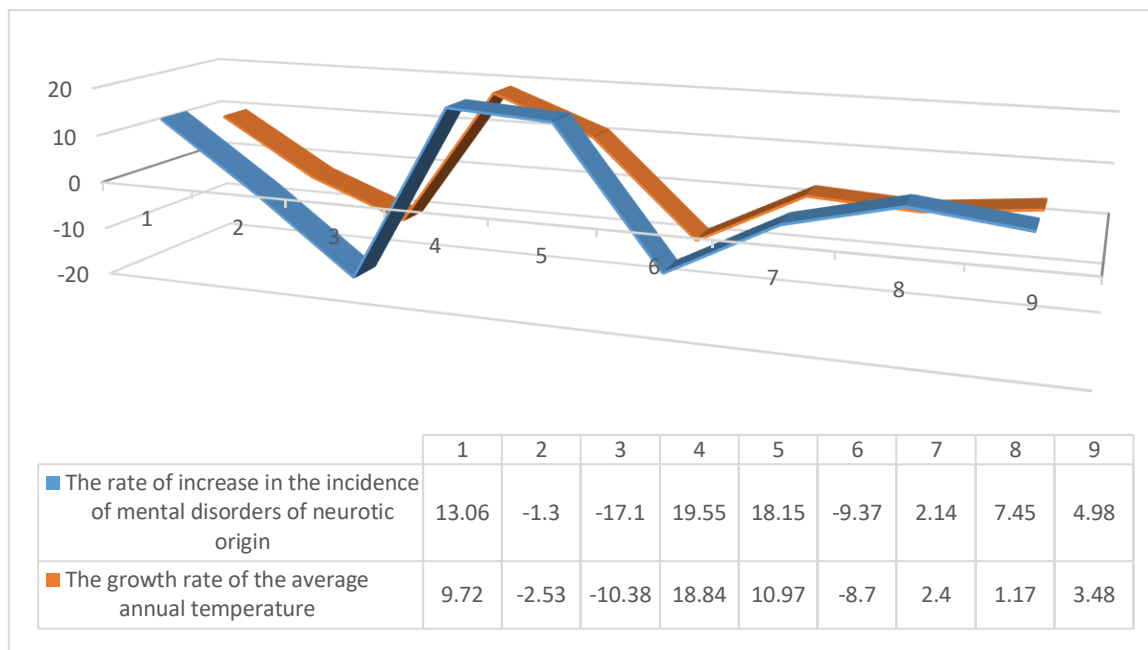
Years	Incidence of mental disorders of neurotic origin in Ternopil region			Average annual air temperature in Ternopil region		
	<i>Absolute level</i>	<i>Absolute growth</i>	<i>Growth rates,%</i>	<i>Absolute level</i>	<i>Absolute growth</i>	<i>Growth rates,%</i>
2010	329	-	-	7.2	-	-
2011	372	+43	+13.06	7.9	+0.7	+9.72
2012	357	-15	-4.03	7.7	-0.2	-2.53
2013	326	-31	-8.68	6.9	-0.8	-10.38
2014	384	+58	+17.79	8.2	+1.3	+18.84
2015	446	+62	+16.14	9.1	+0.9	+10.97
2016	418	+28	-6.27	8.3	-0.8	-8.70
2017	429	+11	+2.63	8.5	+0.2	+2.40
2018	437	+8	+1.86	8.6	+0.1	+1.17
2019	456	+19	+4.34	8.9	+0.3	+3.48

**Table 2:** Growth rates of average annual temperature and mental disorders of neurotic origin

<i>Years</i>	<i>The average growth rate of the incidence of mental disorders,(%)</i>	<i>The average value of the growth rate of the average annual air temperature,(%)</i>
2011-2013	+0.35	-1.06
2014-2016	+9.22	+7.03
2017-2019	+2.94	+2.35

With using Microsoft Excel we have drawn a graphical comparison of the growth rate of the incidence of mental disorders of neurotic origin and the growth rate of the average annual temperature in the Ternopil region and their interconnectedness (Fig. 1).

After the next stage of our study, we determined the Pearson correlation coefficient between the two variables, namely the growth rate of hospitalizations and the growth rate of the average annual temperature in the region was +0.97. Since the calculated correlation coefficient is greater than its critical value ( $0.6 > 0.3809$ ), with a probability of 0.97 we can say a statistically significant relationship between these indicators.



**Fig. 1.** Graphical comparison of the growth rate of the incidence of mental disorders of neurotic origin and the growth rate of the average annual temperature in the Ternopil region and their interconnectedness.

**Conclusions:** Analyzing the obtained results, we found that in the conditions of global warming in Ternopil region there is a dynamics of growth in the incidence of mental disorders of neurotic origin. Also, by calculating the correlation coefficient, a direct correlation between the increase in the average annual temperature and the increase in morbidity rates was proved. The data obtained should be taken into account in the development of protocols for the prevention and treatment of mental illness associated with the effects of climate change, and will also be used in the educational process at the Departments of Physiology, Pathological Physiology and Psychiatry.

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