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THE INFLUENCE OF ELECTROMAGNETIC FIELDS OF ANTHROPOGENIC ORIGIN ON THE INCIDENCE OF CARDIO-VASCULAR SYSTEM AMONG RESIDENTS OF URBAN TERRITORY OF THE CITY OF IVANO-FRANKIVSK

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Purpose. Based on the analysis of the literature substantiates the relevance of research of influence of electromagnetic fields of anthropogenic origin of the radio-frequency range on the adaptive capacity of the cardiovascular system, determines the influence of electromagnetic fields of anthropogenic origin as a physical environmental factor that affects the social aspect of ecological safety of urbanized territories is of considerable scientific interest. ***Methods.*** The statistical method is used, the method of constructing environmental maps and the monitoring of the impact of electromagnetic fields of anthropogenic origin on the social dimension of ecological safety of the urbanized area. ***Results.*** The greatest influence on adaptive mechanisms of the cardiovascular system of residents of urban areas have the largest density of electromagnetic energy flux and the electric component of electromagnetic field. Electromagnetic fields of anthropogenic origin have a greater influence on the medical etiology of hypertension and cerebrovascular diseases and have less influence on the occurrence of coronary heart disease. Except that, physiology adaptation to the electromagnetic fields of technogenic origin for men and women differs, and percent of morbidity on hypertensive illness (all forms) and cerebrovascular illnesses for women is higher, than for men, percent of morbidity on ischemic hearttrouble for men is higher, than for women. ***Practical value.*** As a result, identification of experimental and statistical data some regularities of the relationship between the intensity of radio frequency electromagnetic fields and diseases of the cardiovascular system. *References 14, tables 2, figures 4.*

Key words: electromagnetic fields, cardiovascular disease, urbsocioecosystem, the social component of environmental security.

ВПЛИВ ЕЛЕКТРОМАГНІТНИХ ПОЛІВ ТЕХНОГЕННОГО ПОХОДЖЕННЯ НА ЗАХВОРЮВАНІСТЬ СЕРЦЕВО-СУДИННОЇ СИСТЕМИ У ЖИТЕЛІВ УРБАНІЗОВАНОЇ ТЕРИТОРІЇ МІСТА ІВАНО-ФРАНКІВСЬКА

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На основі аналізу літературних даних обґрунтовано актуальність дослідження впливу електромагнітних полів техногенного походження радіочастотного діапазону на адаптаційну здатність серцево-судинної системи людини, визначено вплив електромагнітних полів техногенного походження як фізичний фактор середовища, котрий впливає на соціальну складову екологічної безпеки урбанізованих територій та представляє значний науковий інтерес. Використано статистичний метод, метод побудови екологічних карт та моніторинг впливу електромагнітних полів техногенного походження на соціальну складову екологічної безпеки урбанізованої території. Найбільший вплив на адаптаційні механізми серцево-судинної системи жителів урбанізованої території мають максимальні значення густини потоку енергії електромагнітного поля та напруженості електричної складової електромагнітного поля. Електромагнітні поля техногенного походження більше впливають на медичну етіологію гіпертонічної хвороби і цереброваскулярних хвороб і спричиняють менший вплив на виникнення ішемічної хвороби серця. В результаті ідентифікації експериментальних і статистичних даних встановлено деякі закономірності взаємозв'язку між напруженістю електромагнітного поля радіочастотного діапазону та хворобами серцево-судинної системи людини.

Ключові слова: електромагнітні поля, захворювання серцево-судинної системи людини, урбосоціоекосистема, соціальна складова екологічної безпеки.

PROBLEM STATEMENT. The development of television, radio, radar, expanding the network of high voltage transmission lines, the use of high-frequency energy in different spheres of national economy and at home has led to a significant increase in the level of electromagnetic radiation (EMR) in the cities and towns. Electromagnetic waves of different ranges, including radio frequency, exist in nature, forming a natural background. The increase in the number and growth capacity of various artificial sources of non-

ionizing radiation creates an electromagnetic field of technogenic origin, under certain conditions, may adversely affect the health of the population [1, 2]. Despite this arose the problem of studying the impact of EMR on the human body in the context of urbosocioecosystem.

Cardiovascular diseases – medico-social problem of the social component of environmental security. Among nosologic forms of cardiovascular system in Ukraine have taken the lead hypertension was 41.2%, ischemic heart disease in 27.5%, cerebrovascular disease by 16%. The prevalence of hypertension among the population of Ukraine over the last 15 years has increased 3.6 times, coronary heart disease is 3.3 times that of cerebrovascular disease by 2.4 times [3].

According to statistics from the Ivano-Frankivsk oblast information and analytical center of medical statistics, the number of registered deaths due to diseases of the cardiovascular system of residents of the urbanized area. Ivano-Frankivsk in the last three years, has a General tendency to increase. Only the number of cases of coronary heart disease in women within three years was slightly decreased. Data registered during 2012-1014, hypertensive disease (all forms), coronary heart disease and cerebrovascular disease are presented in table. 1.

Table 1 – Diseases of the cardiovascular system, registered residents of urbanized area urban clinics m. Ivano-Frankivsk

2012		
Names of diseases	Men (18 years and over)	Women (18 years and over)
Hypertensive heart disease (all forms)	25379	35878
Coronary heart disease	18419	23344
Cerebrovascular disease	6187	9660
All diseases of the cardiovascular system	137084	170752
2013		
Names of diseases	Men (18 years and over)	Women (18 years and over)
Hypertensive heart disease (all forms)	28548	35960
Coronary heart disease	20363	21969
Cerebrovascular disease	6823	9385
All diseases of the cardiovascular system	151662	183925
2014		
Names of diseases	Men (18 years and over)	Women (18 years and over)
Hypertensive heart disease (all forms)	28611	37357
Coronary heart disease	20259	22335
Cerebrovascular disease	6344	9886
All diseases of the cardiovascular system	151089	190114

EXPERIMENTAL PART AND RESULTS OBTAINED. According to the literature, the influence of EMR of ultra-high frequency range is noted as one of the factors that can cause decrease and increase of arterial pressure, change of rhythm of the heart, degenerative changes in cardiac muscle [4, 5, 6]. Such action of electromagnetic fields (EMFs) of anthropogenic origin may be a factor that causes or exacerbates the course of hypertensive disease, ischemic heart disease and cerebrovascular diseases cerebrovascular [7, 8, 9, 10].

According to official information of the Main Directorate of statistics in Ivano-Frankivsk region the total number of the population. Ivano-Frankivsk as at 1 July 2014 amounted to 245998. Of them 227165 people of the urban population and 18833 entity of the rural population. For further study of the social component of urbosocioecosystem of the city will take into account only urban adult population that resides within the urbanized area and is exposed to the electromagnetic fields of anthropogenic origin.

Adult population. Ivano-Frankivsk (18 years and older) operates four outpatient clinics:

- city polyclinic №1 (street. Chornovola, 59 a) serves 57268 people, including 49976 persons living within the urbanized area of the city, excluding the inhabitants of villages and District center Gripin
- city polyclinic №2 (street. Long, 42) serves 58607 persons living within the urbanized area of the city;
- city polyclinic №3 (street. I. Franko, 30) serves 38648 people, including 32392 persons residing within urbanized areas of the city, excluding the inhabitants of villages and Mikitinets the street.
- city polyclinic №4 (vul. Depot, and 196) serves 43436 people, including 40333 persons residing within urbanized areas of the city, excluding residents of the village Vovchynets.

Medical data registered by the clinics in the city cardiovascular system in the course of 2014 among adults aged 18 years and older living within the urbanized area of the city, according to the medical coding of diseases, tenth revision (MKH-10),

promulgated by the Ministry of health of Ukraine dated 29.08.2008, No. 503 provided in the table. 2. Statistical information provided by the Ivano-Frankivsk regional information and analternate medical statistics

Table 2 – Statistical medical information about diseases of the cardiovascular system of the adult population (18 years) and over) living within the urbanized area. Ivano-Frankivsk, registered in 2014

Statistics		Hypertension (all forms)	Coronary heart disease	The Cerebro-vascular disease	The total number of diseases
City polyclinic №1	Registered diseases	19743	1183	5578	99692
	Of them men	9089	5965	2174	46170
	% of total number of diseases registered among men (18 and over)	19,7	13	4,7	
	Of them women	10654	5838	3404	53522
	% of total number of diseases registered among men (18 and over)	19,9	10,9	6,4	
City polyclinic №2	Registered diseases	20325	13558	4447	103883
	Of them men	8653	6210	1833	45653
	% of total number of diseases registered among men (18 and over)	18,9	13,6	4	
	Of them women	11672	7348	2614	58230
	% of total number of diseases registered among men (18 and over)	20	12,6	4,5	
City polyclinic №3	Registered diseases	12999	8325	3150	67766
	Of them men	5333	3831	1292	28824
	% of total number of diseases registered among men (18 and over)	18,5	13,3	4,5	
	Of them women	7666	4494	1858	38942
	% of total number of diseases registered among men (18 and over)	19,7	11,5	4,8	
City polyclinic №4	Registered diseases	12901	8908	3055	69862
	Of them men	5536	4253	1045	30442
	% of total number of diseases registered among men (18 and over)	18,2	14	3,4	
	Of them women	7365	4655	2010	39420
	% of total number of diseases registered among men (18 and over)	18,7	11,8	5,1	

From the data in table. 1 and table. 2 data we can conclude that according to four urban clinics the percentage incidence of hypertension (all forms) and cerebrovascular disease is higher among women than men; the percentage incidence of coronary heart disease in men higher than women; the highest percentage incidence of hypertension (all forms) in male was observed in the service area of the polyclinic No. 1, women in the service area of the polyclinic №2; the highest percentage incidence of coronary heart disease is observed in the service area of the polyclinic №2; the highest percentage incidence of cerebrovascular disease in men and women is observed in the service area of a polyclinic №1.

On the Ivano-Frankivsk's urbanized territory that was selected by test polygon, defined by 122 points at a distance of 200-500 meters. Test points of the test polygon was carried out according to the specifics of the city's buildings since the large and lengthy gatherings of people and places with supposedly high electromagnetic risk: General educational establishments, educational establishments of i-II levels of accreditation, higher educational institutions, medical institutions, religious buildings, large residential homes, the bridges over the river Bistrica Nadvirnianska and bystrytsya, railway station, railway track and bridges, big stores, cinemas, bus stops of vehicles on the streets with trolleybus traffic, and others.

For measurements of EMF were used, the electromagnetic field tester Tenmars RF three-Axis Field Strength Meter TM-195. The device used to measure electromagnetic fields of anthropogenic origin in the frequency range 50 MHZ to 3.5 GHz, in particular for measuring the field strength of high frequency electromagnetic waves, the surface density of energy flow antenna bases mobile communication, wireless communication applications (CW, TDMA, GSM, DECT), transmitters, wireless LAN (Wi-Fi), determine the leakage of microwave ovens, the security level of mobile phone radiation, electromagnetic determination of safety of working and living spaces. The device operates with a sampling rate of 3 measurements at 1, and allows the measurement of instantaneous, average and maximum values of the measured quantity. For isotopic measurements, the EMF device is equipped with a three-channel sensor. Settings allow you to use separate X, Y, or Z sensor (nettopp

measure EMF), or all axes at the same time (isotopic measurement of EMF).

To create environmental maps of the influence of EMF on the social dimension of environmental security urbanzone the territory of Ivano-Frankivsk was divided into four parts, according to the service areas of the city clinics. On each side of the map, shows the incidence (bar graph) of men and women hypertension (all forms), coronary heart disease and cerebrovascular disease.

As for determining the effects of electromagnetic fields on the social dimension of urbanizacao it is advisable to take into account indicators of ser., max., SR. and Emax. [11] it was constructed four environmental maps the influence of these parameters on the EMF social component ecological safety of the urbanized socketsite m. Ivano-Frankivsk. Maps created using geographic information systems GIS MapInfo Professional 10.0 and using the service Google Maps.

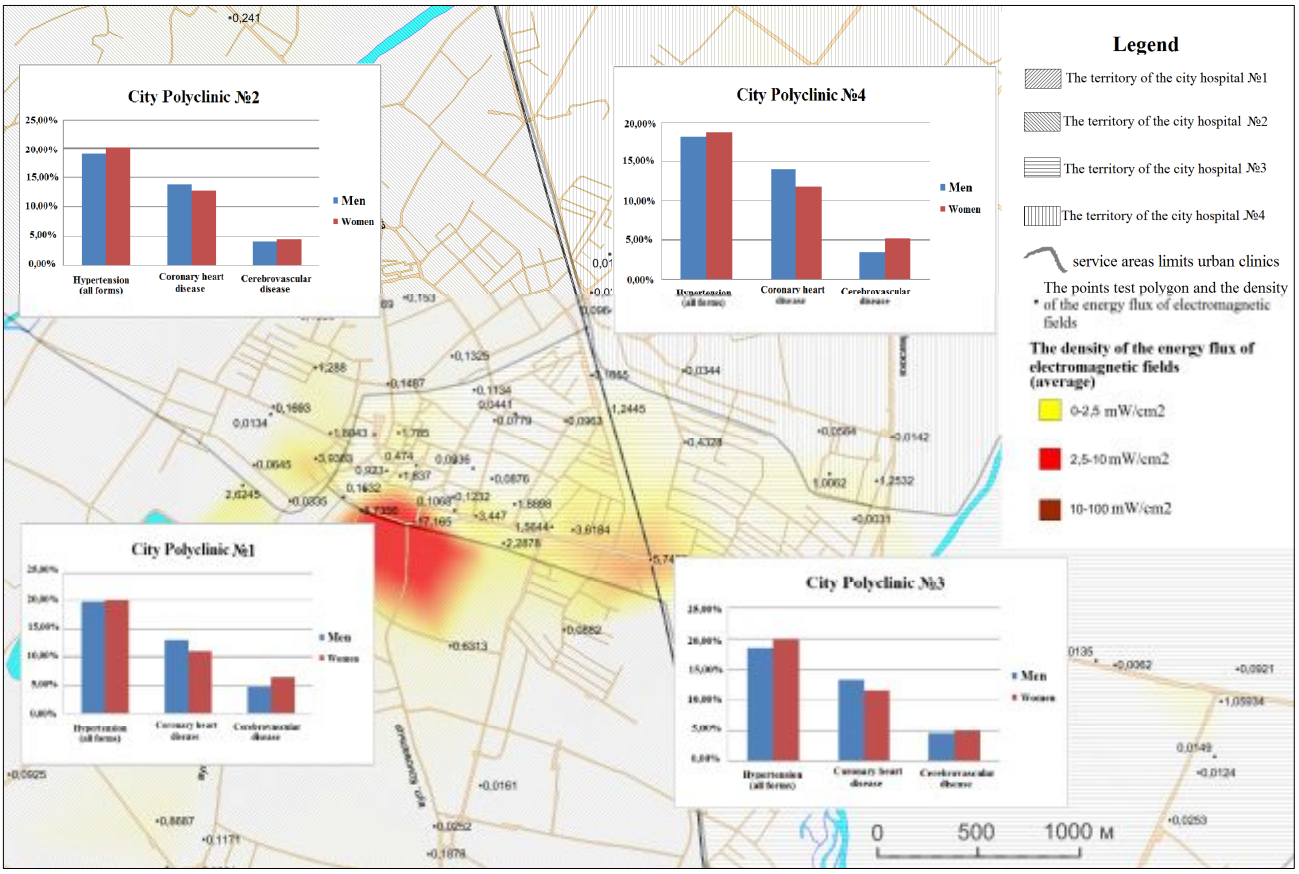

Figure 1 – Map of the influence of the average density of electromagnetic energy flux in diseases of the cardiovascular system of men and women living in urbanzone site. Ivano-Frankivsk

CONCLUSIONS. Ecological-geographical analysis of influence of EMF, as one of the anthropogenic factors of urban socketsite, the social component of ecological safety of the urbanized area. Ivano-Frankivsk allows to draw some conclusions.

The greatest influence on adaptive mechanisms of the cardiovascular system of residents of the urbanized area (18 years and older) have the largest density of electromagnetic energy flux (max.) and the strength of the electric component of electromagnetic field (Emax).

The least influence of the electromagnetic field and, accordingly, the lowest incidence of hypertension (all forms), coronary heart disease and cerebrovascular disease observed in the service area of the city polyclinic №4.

The greatest impact of EMF and, therefore, the high incidence of hypertension (all forms) and cerebrovascular disease observed in the service area of the city polyclinic №1.

The greatest impact of EMF and the lowest incidence of coronary heart disease observed in the service area of the city polyclinic №1.

The electromagnetic fields of anthropogenic origin have a greater influence on the medical etiology of hypertension and cerebrovascular diseases and have less influence on the occurrence of coronary heart disease.

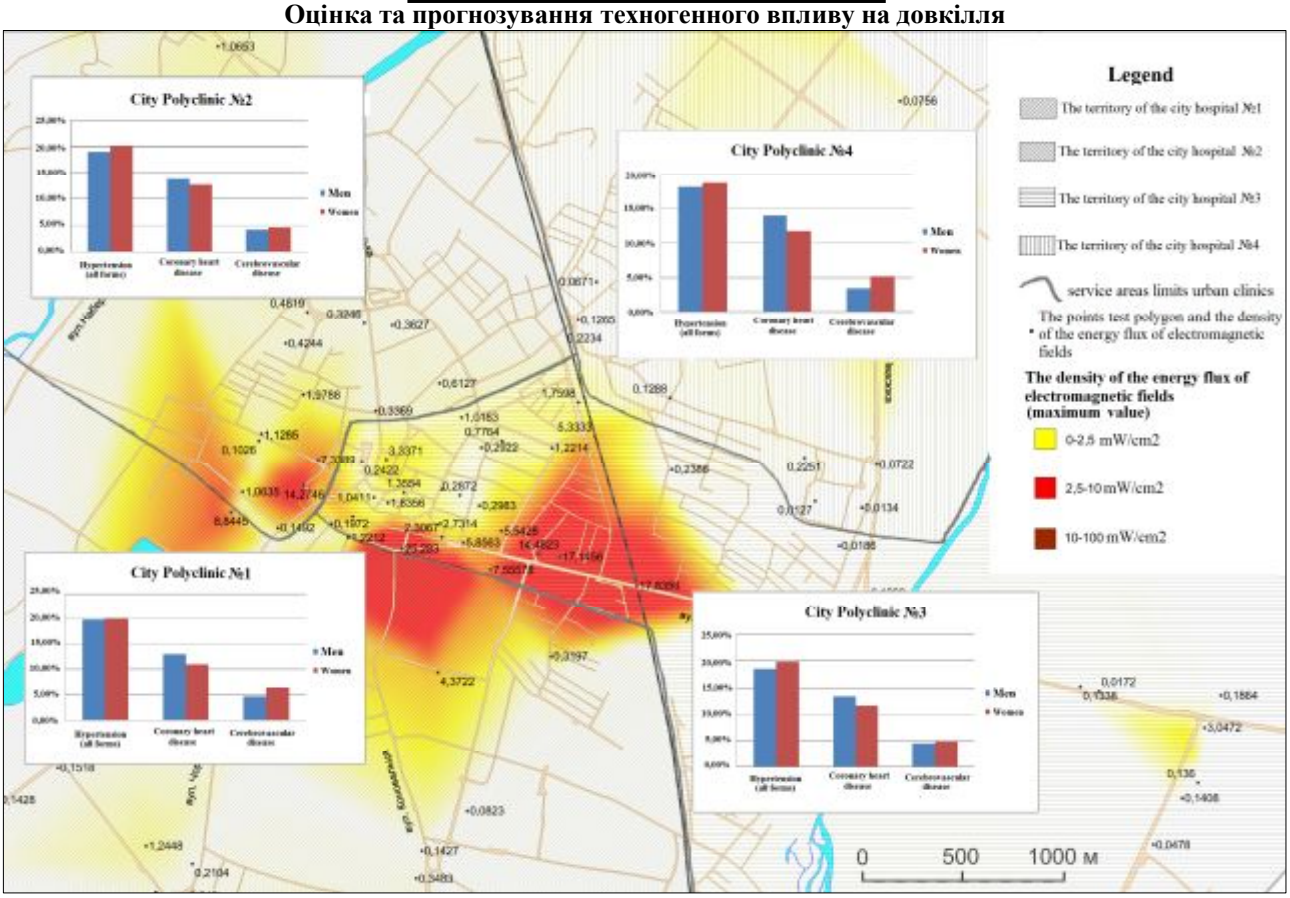

Figure 2 – Map of the influence of the maximum values of flux density of electromagnetic energy on diseases of the cardiovascular system of men and women living in urbanzone site. Ivano-Frankivsk

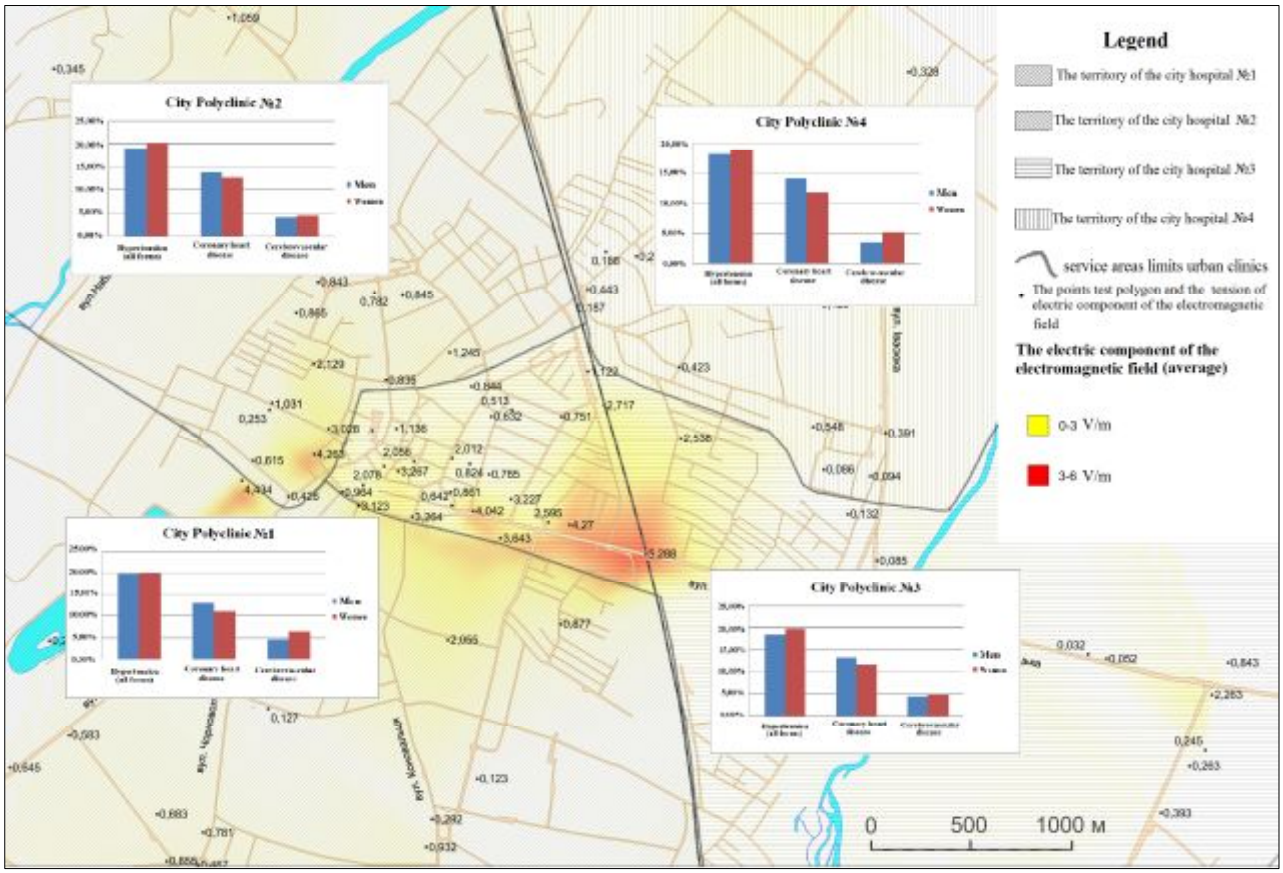

Figure 3 – Map of influence of the average values of the electric component of electromagnetic fields on diseases of the cardiovascular system of men and women living in urbanzone site. Ivano-Frankivsk

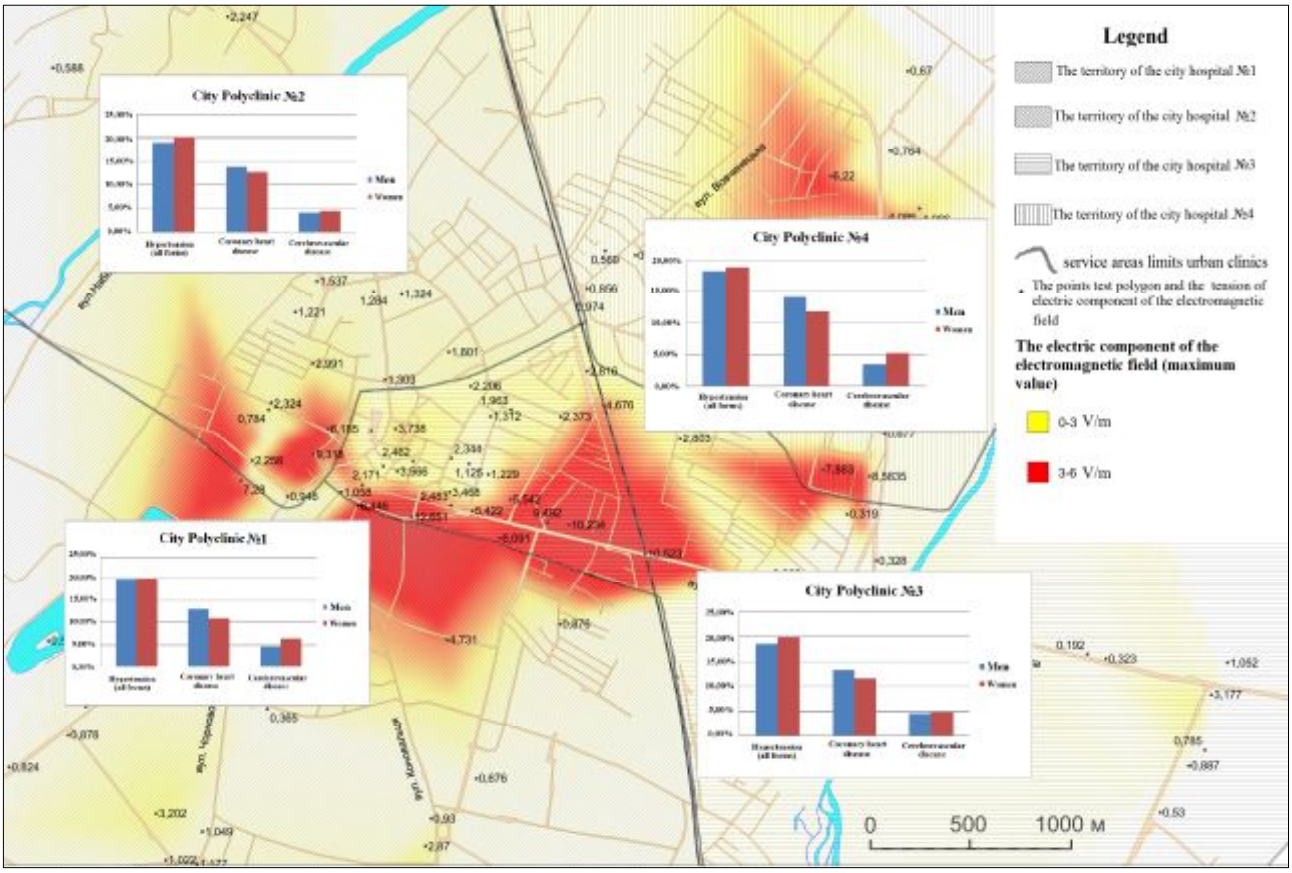

Figure 4 – Map of the influence of the maximum values of electric component of electromagnetic fields on diseases of the cardiovascular system of men and women living in urbanzone site. Ivano-Frankivsk

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ВОЗДЕЙСТВИЕ ЭЛЕКТРОМАГНИТНЫХ ПОЛЕЙ ТЕХНОГЕННОГО ПРОИСХОЖДЕНИЯ НА ЗАБОЛЕВАЕМОСТЬ СЕРДЕЧНО-СОСУДИСТОЙ СИСТЕМЫ У ЖИТЕЛЕЙ УРБАНИЗИРОВАННОЙ ТЕРРИТОРИИ ГОРОДА ИВАНО-ФРАНКОВСКА

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На основе анализа литературных данных обоснована актуальность исследования влияния электромагнитных полей техногенного происхождения радиочастотного диапазона на адаптационную способность сердечно-сосудистой системы человека, определено влияние электромагнитных полей техногенного происхождения как физический фактор среды, который влияет на социальную составляющую экологической безопасности урбанизированных территорий и представляет значительный научный интерес. Использован статистический метод, метод построения экологических карт и мониторинг воздействия электромагнитных полей техногенного происхождения на социальную составляющую экологической безопасности урбанизированной территории. Наибольшее влияние на адаптационные механизмы сердечно-сосудистой системы жителей урбанизированной территории имеют максимальные значения плотности потока энергии электромагнитного поля и напряженности электрической составляющей электромагнитного поля. Электромагнитные поля техногенного происхождения больше влияют на медицинскую этиологию гипертонической болезни и цереброваскулярных болезней и вызывают меньшее влияние на возникновение ишемической болезни сердца. В результате идентификации экспериментальных и статистических данных установлены некоторые закономерности взаимосвязи между напряженностью электромагнитного поля радиочастотного диапазона и болезнями сердечно-сосудистой системы человека.

Ключевые слова: электромагнитные поля, заболевания сердечно-сосудистой системы человека, урбосоциоекосистема, социальная составляющая экологической безопасности.