

EMERGENCY CALL PATTERN IN PETROZAVODSK

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The aim of the study is to analyze the emergency call distribution for Petrozavodsk, Russia, to obtain quantitative disease estimates and to assess the effect of environmental factors on them.

The study was based on medical statistical data and geophysical and geochemical monitoring. Environmental factors, such as magnetic storms and air and urban soil pollution, were assessed. The impersonified catalogue of emergency calls of Petrozavodsk Ambulance from 2015.1.1 to 2017.12.19, database of geomagnetic field variations at Petrozavodsk Geophysical Observatory, data on Kp index monitoring at the Laboratory of Tesis X-ray Astronomy at Lebedev Physical Institute, and the results of geochemical soil sampling in Petrozavodsk were used. Emergency call and geomagnetic activity distributions were constructed and processed in MATLAB computer mathematics system and Qgis software package. Analytical results were demonstrated on cardiovascular diseases.

The number of emergency call for patients with cardiac diseases in 2015-2017 is at about the same level. Seasonal factors affect the time distribution trends of calls for patients with essential hypertension, stenocardia and ischemic cardiac disease and do not affect the distribution trends of myocardial infarction and cerebral crisis. Time distribution spectra display a 25.6 day cycle similar to a geomagnetic activity period, two- and one-week cycles and cycles with periods of about 6, 4 and 3 days. Emergency calls for patients with myocardial infarction reflect the gender and age of the patients. The number of calls on weekends is typically low. On week-days, the number of calls at rush hours is maximum. The number of calls on days close to magnetic storms is not necessarily great. An elevated number of calls on these days for patients with stenocardia and myocardial infarction is observed.

The spatial distribution of the number of emergency calls were obtained using the Ambulance Geoinformation System. The system constructs the spatial distributions of the number of emergency team calls with known diagnoses for the streets and blocks of the city and is used to compare call frequency with district factors. With its help the link of distribution of quantity of calls of ambulance with diagnoses of cardiovascular diseases, bronchial asthma, vegeto-vascular dystonia, new growths, other diseases on districts of the city with the soils contamination indicated by the environmental hazard index –a total of the weighted average concentration values of As, Pb, Zn, Cd, Co, Cu, V, W is studied. No significant correlations between these values have been revealed.

3, 6-daily cycles in the analyzed ranges can be connected to thyroid gland hormone activity and a 4-day cycle to glucocorticoid hormone activity. Circadian rhythms are either thought to be general or to be due to the unwillingness of people to be sent to hospital or call for a doctor on weekends. In case of myocardial infarction, when help is needed urgently, the latter factor does not work, and a one-week cycle in the spectrum, showing the time dependence of the number of calls, is displayed.

This fact and the weekend effect can be understood, based on the properties of hydrocortisone. Stress from production activity stimulates the supply of the hormone into the blood, which rushes to the heart and muscles. When the heart fails to cope with the rush of blood, a cardiac disease becomes more acute.

As the hydrocortisone level in the blood on weekends and holidays declines, the number of emergency calls for patients with cardiovascular diseases decreases.

Peaks in the daily emergency call dynamics distribution on week-days are interpreted to be due to air pollution with car gases at rush hours (9-10 a.m., 1-2 and 6-7 p.m.) and an approximately one-hour delay caused by progress in disease and the need to apply for a doctor.

The emergency call distributions analyzed are highly informative, showing the complete dynamic disease pattern of the urban population.

Keywords: diseases, emergency call, patient, diagnose, magnetic storms, contamination