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MATHEMATICAL MODELING IN PREDICTING THE EFFECTIVENESS OF ANTI-TUBERCULOSIS TREATMENT BASED ON BIOCHEMICAL MARKERS OF TUBERCULOSIS

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Introduction. Today it is necessary to create new methods for studying and predicting the course of diseases. One of these tools is the construction of a mathematical model. **The purpose** of the study was to make a mathematical model for predicting tuberculosis treatment effectiveness based on determining the levels of Human-beta-defensin-1, ferritin and interleukin-6. **Materials and methods.** The study included 44 patients with pulmonary tuberculosis. **Results.** To predict the effectiveness of anti-tuberculosis treatment based on the level of HBD-1, the equation was obtained:

A = 0.63877*Def1 - 0.09831*Def2 – 9.18519

B = 0.3405*Def1 + 0.4666*Def2 – 23.5351

For ferritin, the equation was obtained:

A = 0.63877*Fer1 - 0.09831*Fer2 – 9.18519

B = 0.3405*Fer1 + 0.4666*Fer2 – 23.5351

For IL-6, the equation was obtained:

A = 0.01538*IL6-1 + 0.13728*IL6-2 – 3.38667

B = -0.0563*IL6-1 + 0.7154*IL6-2 – 50.9235

Conclusions. Based on a study of the relationships between the effectiveness of tuberculosis treatment and the levels of Human-beta-defensin-1, ferritin and interleukin-6, a mathematical model was built that allows predicting the effectiveness of anti-tuberculosis therapy based on determining the data of biochemical markers at the beginning of treatment and after 60 days of anti-tuberculosis therapy with specificity and sensitivity of at least 88%. **Keywords:** mathematical model, anti-tuberculosis treatment, human-beta-defensin-1, ferritin, interleukin-6.

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A MULTI-AGENT SYSTEM FOR MODELING TUBERCULOSIS TRANSMISSION

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Introduction. Forecasting epidemiological processes holds immense importance as it allows for understanding and anticipating future disease and epidemic trends. **The aim** of the study was the development of a multi-agent system for simulating the transmission of tuberculosis infection. **Materials and methods.** The primary aim of this study was to develop a model that accurately simulates the transmission of tuberculosis within an urban setting. The modelling process itself is characterized by a series of key stages, including initialization of the city, calibration of health parameters, simulation of the working day, propagation of the spread of infection, the evolution of disease trajectories, rigorous statistical calculations, and transition to the following day. **Results.** The model's results exhibit stability and lack of significant fluctuations. The statistical values obtained for infected, latent, and recovered individuals align well with known medical data, confirming the model's adequacy. The simulation time for a model with 100,000 agents is approximately 30 minutes, enabling parallelization of processes for modeling multiple cities, regions, or countries. This opens the possibility of using computer clusters and optimizing TB prevention strategies based on reinforcement learning neural networks. The proposed model allows for not only statistical data but also individual-level analysis of the tuberculosis spread by specific agents. **Conclusion.** The proposed model allows for tracking and analyzing the life and behavior of each individual agent, enabling a thorough assessment of tuberculosis infection spread and the development of prevention strategies. **Keywords:** resident; multi-agent modeling; tuberculosis; geo-object; GeoCity.