SCIENTIFIC-METHODICAL APPROACH TO MODELING IN EPIDEMIC DEVELOPMENT

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Throughout the history of humanity time to time epidemics and pandemics were observed in multiple territories. They lead to mass illness, a large number of deaths and serious social upheavals. In modern conditions the society concerned that new viruses may appear and begin to spread more and more with significant pandemic potential.

In this case the main task of the state is to save the lives of citizens, reducing the impact on public health by the pandemic and to minimize disruption of public services. That is why, research on the occurrence of epidemic process in the population is important.

The aim of this study is to construct a model of an epidemic process and followed her approbation.

During the occurrence of epidemic complications, failures in the health care are observed, especially when the number of affected people become extremely large. In such cases, the possibility of available forces and means to combat disease are limited and it exists risk of development of critical scenarios. Therefore, conducting leading research in analysis and forecasting of possible epidemic scenarios is an important stage of research, that allows early to assess the extent and impact of the epidemic, and usually they are carried out with the use of mathematical and computer modeling of epidemic processes.

SIR-models are the highest prevalence to simulate epidemic processes. This involves, that initially the patient is in the «Susceptible» group, in the case of disease, he can move in the «Infected» group, and after a certain time they passes «Removed» group. In this case, the susceptible person is in contact with an infected person, who can give an infection him with chance β. Every infected person carries contacts c per unit time, respectively, the percentage contact, that during time the infection is carried out, is in contact with $c * \beta$. Usually the population is presented, as susceptible patients and infected as well as those who recovered and have immune, therefore it is necessary to take into account in the model. Another important aspect of the modeling process is the speed of recovery, which requires the addition of this parameter in the model, after that it can be considered final.

For the formation model, we used a computer simulation program Vensim, which created a "container" for the states (Susceptible, Infected, Removed) and Ways to "movement." In the system Vensim this tool is called "stream» (contamination – infection, recovery – convalescence). Also this model includes parameters (number of contacts, chance of infection with a single contact and duration of the disease) and formulas. As a result the model building we obtained its flowchart (Fig. 1).

To check of working capacity model we introduce to the initial values. Given that the example is the Kharkiv, the model includes the following statistics: the population of 1.5 mil. people, that is the number of susceptible persons. Another condition is that the number infected is stuffed with a person, the number of contacts per day is 5, the probability of infection – 0.1 (10%) and recovery time – 10 days.

As a result of the use of the model we have established the number of susceptible, infected and removed persons, which makes it possible to predict the development of the epidemic process (Fig. 2).

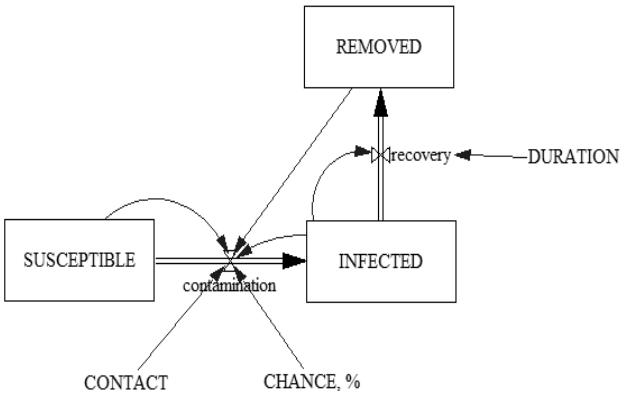

Fig.1. SIR-epidemic model

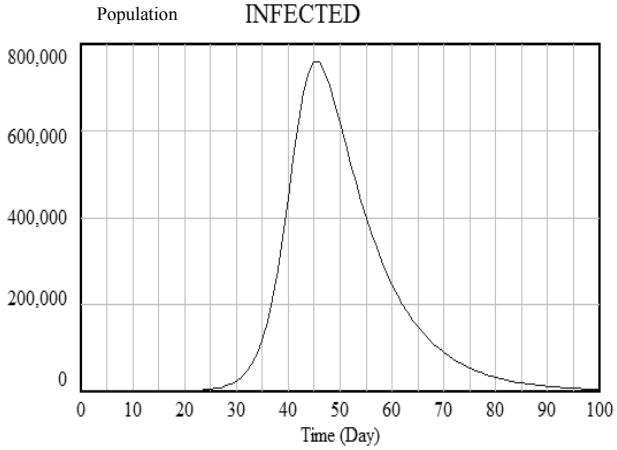

Fig. 2. The results of the analysis of the number of infected people in the base model SIR-model

Conclusions: Due to the construction of a computer model of the epidemic process we obtain graph the number of infected persons. In accordance with the graph, present epidemic is of limited duration. In this, a significant increase in the number of infected people is observed on day 35 from the appearance infection, and the maximum number of infected is observed on the 45th day and it includes759 351 people, followed by the number of infected people is reduced to a complete cessation of identifying new cases.