

ABSTRACT

The thesis is presented in 97 pages. It contains 2 appendixes and bibliography of 137 references. 41 figures and 6 table are given in the thesis.

Topic relevance. Developing a model for the selection of optimal strategies for prevention of community-acquired pneumonia (CAP) among the population of Ukraine, will allow to construct a model based on the prevalence of CAP etiology of the disease, thereby reducing the number of related deaths.

CAP is often a complication of diseases such as influenza and acute respiratory viral infections (ARVI), so that information about how the initial disease will spread will reduce the amount of CAP as their complications.

Simulation prevalence of influenza can be used to study how the different levels of vaccination costs population can be used to prevent the spread of disease, thereby reducing the total number of occurrence of secondary bacterial infections and also the number of related deaths. Furthermore, simulated propagation of influenza virus can be carried out research of how to implement the different levels of vaccination and quarantine can also help prevent the spread of influenza and, consequently, a decrease in number of complications and CAP deaths.

Thesis connection to scientific programs, plans, and topics. The thesis was prepared according to the scientific research plan of the Applied Mathematics Department of the National Technical University of Ukraine “Kyiv Polytechnic Institute.”

Research goal and objectives. The goal of this thesis is to development of mathematical models to select strategies to prevent community-acquired pneumonia among the population of Ukraine which is optimal and reduce the number of deaths.

To accomplish this goal, the following objectives were reached:

- familiarize with the literature on community-acquired pneumonia and the main causes of this disease;
- analyze existing models of infectious diseases;

- develop and explore on the basis of the research model as the incidence of community-acquired pneumonia complications of influenza and ARVI;
- analyze ways of prevention CAP;
- introduce a model developed preventive measures: quarantine and vaccination against influenza;
- develop and explore the software for CAP modeling software based influenza and URTI; and the introduction of quarantine measures and vaccination.

Object of research is community-acquired pneumonia as a complication of influenza and URTI; Prevention CAP.

Subject of research is mathematical models of the incidence of community-acquired pneumonia, as a secondary bacterial infection after suffering a flu and acute respiratory viral infections; introduction of quarantine and search for the optimal distribution of influenza vaccine in the population as a CAP prevention.

Methods of research. To solve the task, the following methods were used: methods of mathematical modeling (for the development of propagation models of community-acquired pneumonia in view of prevention of a disease), optimization techniques (for development with the problem of methods of model parameters and preventive measures) methods of the theory of algorithms and programming (for software implementation of the developed algorithms) methods of the theory of probability and mathematical statistics (for experiments).

Scientific contribution consists of the following:

- for the first time tasked to develop a mathematical model to select the strategy for the prevention of community-acquired pneumonia among the population of Ukraine which is optimal and reduce the number of deaths, which, in contrast to the existing ones takes into account the diseases contributing to occurrence CAP;
- improved the basic model of the spread of infectious diseases, which, unlike the existing ones, takes into account the occurrence of the disease contribute to CAP, which allows better predict the number of cases of community-acquired pneumonia, based on the etiology of the disease and thus to select the optimal strategy for the prevention and reduce the number of deaths.

Practical value of obtained results. The proposed model, which can be used to simulate the spread of influenza and ARVI, and appearance as complications, community-acquired pneumonia; It also seeks the best prevention strategy for CAP will lead to a reduction in death rate.

Approbation of the thesis results. Basic ideas and results of the research were presented at the collection of scientific works of staff member of P. L. Shupyk NMAPE 2015 and presented at the scientific conference of masters and post-graduate students "Applied Mathematics and Computing" PMK 2016 (Kyiv, 20-22 April 2016).

Publications. Thesis results are published in 2 scientific works:

– in paper “Optimum distribution of the flu vaccine for reducing the number of postinfluenza complications” in collection of scientific works of staff member of P. L. Shupyk NMAPE 2015;

– in paper “An approach to modeling of community acquired pneumonia incidence as complication of previous influenza and other acute respiratory viral infections” in proceedings of the report of the scientific conference of masters and post-graduate students "Applied Mathematics and Computing" PMK 2016.

Keywords: community-acquired pneumonia, pandemic influenza virus, secondary bacterial infections, ARVI, vaccination, quarantine.