ABSTRACT

The thesis is presented in 74 pages. It contains 4 appendixes and bibliography of 38 references. 7 figures and 2 tables are given in the thesis.

Topic relevance. Use of injection drugs is one of the main ways of human immunodeficiency virus (HIV) transmission in many populations. Metadon and buprenorphine maintanance therapy is often used to control HIV spreading among the injection drug users. But in many places average waiting time before entering therapy programs is almost 6 months. Different restrictions — financial, ethical and legislative — are limiting the number of people in this programs. Implementation and development of maintanance therapy programs is often stoped because of economical and ethical reasons. Therefore, it is of high importance to provide a steady scientifical ground and researches of maintanance therapy impact on HIV and other deseases infection rates in complex social and econimical situatioin in Ukraine, to measure the level of maintanance therapy efficiency in injection drug abuse prevention and forecasting it's economical and social impact.

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 develop mathematical methods for modeling maintanance therapy efficiency in HIV prevention among injection drug users population.

To accomplish this goal, the following objectives were reached:

– systematize existent models for measuring maintanance therapy effects on different social and economical parameters, first of all the HIV infection rate;

– develop a model of a HIV infection and prevention suitable for existing statistical data;

– research and develop methods for solving the task of and implement them;

– carry out experiments using primary data.

Object of research is mathematical model of replacemetn therapy impact on HIV

prevention among injection drug users

Subject of research is social and economical parameters of efficiency of the maintanance therapy among injection drug users for HIV prevention

Methods of research. To solve the task, the following methods were used: To accomplish the goal following methods were used: optimisation methods (to develop methods of finding the optimal model parameters); algorithms and programming techniques (for implementing the computational framework of the research); probability and statistical methods (for developing a mathematical model and carrying out the experiments).

Scientific contribution consists of the following:

– for the first time, the task of developing the mathematical model of HIV infection and prevention for the existing in Urkraine statistical data is set;

– model of HIV infection spread among different subpopulations are enhanced, which differ from the existing ones in that they take into account cross-infections with other common deseases, number of therapy sites and their availability, which is appropriate for the structure of the existing data;

– model's parameters identification methods are enhanced, which differ from the existing ones in that they use time series analysis, which was previously used only for seasonal deseases data.

Practical value of obtained results. Proposed mathematical model and computational methods are useful for conducting efficient researches on maintanance therapy taking into account different epidemiological (cross-infections), social and economical (availability of therapy) parameters. This model, computational methods and software simplify statistical data processing and predicting of optimal economical parameters of maintanance therapy.

Approbation of the thesis results. Basic ideas and results of the research were presented at the International scientific conference named after T. A. Taran «Intelectual data analysis» (2016).

Publications. Thesis results are published in 2 scientific works:

– in 1 paper in scientific journals included in the List of Professional Scientific Journals of Ukraine (technical sciences);

– in 1 paper in proceedings of international scientific conferences.

Keywords: maintanance therapy, HIV, HIV infection, HIV prevention, Zaric-Brande-Barnett model, time series, ARIMA, VARMA, economical modeling.