

ABSTRACT

The thesis is presented in 95 pages. It contains 5 appendixes and bibliography of 32 references. 23 figures and 15 tables are given in the thesis.

Topic relevance. Cervical cancer ranks second among cancer of women of reproductive age in Ukraine, and leads to more than two thousand deaths per year. Recent studies have shown that human papillomavirus (HPV) is one of the main causes of cervical cancer. According to the National Cancer Institute, before reaching age of 50 years, at least 80% of women have or have had HPV. Cervical cancer is often asymptomatic until later stages, so important is the implementation of the program of regular examinations (screening) aimed at the timely detection of abnormal cells.

It is critical to develop the mathematical methods of optimization of screening strategies and detection of cervical cancer in the early stages to reduce the total number of cases of cervical cancer and fatal consequences associated with it.

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» and Department of Virology research of Shupyk NMAPE 0115U002161 «Оптимізація стратегій діагностики, профілактики та лікування вірусних інфекцій, на основі клініко-лабораторних, фармакоекономічних та фармакоепідеміологічних досліджень».

Research goal and objectives. The thesis aim is the search for optimal strategies for prevention of cervical cancer based on developed mathematical models of the natural development of the disease.

Object of research is the incidence of cervical cancer in Ukraine.

Subject of research is modeling the spread of disease in the population, information technology prediction of cancer of the cervix and the effectiveness of screening strategies.

Methods of research. To solve the task, the following methods were used: methods of mathematical statistics to analyze the initial population data, methods of curve-fitting to find the transition matrix Markov chain, Monte Carlo method to find the optimal model

parameters.

Scientific contribution consists of the following:

- developed mathematical model of the spread of disease and the prevention of cervical cancer and its consequences for Ukraine available statistical data for the first time;

- developed the mathematical model of the incidence and prevention of cervical cancer and its effects, taking into account possible impacts as a result of implementing preventive examinations;

- got optimum strategy checkups for various combinations of medical tests, given the statistics on Ukraine.

Practical value of obtained results. Based on found optimal strategies can be implemented general state system of preventive examinations in Ukraine, to reduce the number of cases of cervical cancer and the consequences associated with it.

Approbation of the thesis results. Modeling utility functions published at Odessa Medical Journal (issue 6). Built screening strategies for different tests, and flow model of abnormalities of the cervix published in: Value in health: the journal of the International Society for Pharmacoeconomics and Outcomes Research (Volume 18, Issue 7).

Publications.

- paper «Analytical representation of utility function of cervical screening strategies in its evaluation with 'Cost-utility' method»;

- paper «Construction Of Simulation Techniques For Development Of Optimal Cervical Cancer Screening Strategies: Experience Of Ukraine»;

- article «Математичне моделювання функцій корисності основних стратегій скринінгу патологій шийки матки»;

- paper «Математична модель профілактичних оглядів населення України для виявлення патологій шийки матки».

Keywords: HPV, cervical cancer, Monte-Carlo, Markov chain, optimization, screening strategies.