

MINISTRY OF HEALTH OF UKRAINE
ODESSA NATIONAL MEDICAL UNIVERSITY



APPROVED

Vice-Rector on Educational and Pedagogic Work

Prof. _____

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“30” *august* 2021

WORK PROGRAM
"MEDICAL INFORMATICS"

Level of higher education: second (master's)

Field of knowledge: 22 "Healthcare"

Specialty: 221 "Dentistry"

Educational and professional program: Dentistry

Odesa 2021-2022

Composed on the basis of the educational-professional program of the second level of higher education for the preparation of Masters in the specialty 221 "Stomatology" in ONMedU, approved by the Academic Council of ONMedU in 04.06.2020, Protocol #11.

The program was discussed at a meeting of the Department of Biophysics, Informatics and Medical Devices.

Protocol #1 from August 27, 2021

Head of the Department,



Professor L.S. Godlevsky

The program was approved at a meeting of the Cycle Subject Commission of Biomedical Science of ONMedU.

Protocol #1 from August 30, 2021

Head of the Cycle Subject Commission of Biomedical Science,



Professor O.L. Appelhans

The program was certified at a meeting of the Central Coordination and Methodological Council of ONMedU on August 30, 2021, Protocol #1.

1. Description of the discipline

Name of indicators	Characteristics of the discipline	
	full-time education	
The total number of: credits - 3.0 hours - 90 semantic subdivisions - 4	Mandatory	
	Year of study:	2, 3
	Semester	IV, VI
	Lectures	- hours
	Practice	40 hours
	Individual work	50 hours
	including individual tasks:	- hours
	Form of final control:	Test

2. The purpose and objectives of the discipline

Objective: Student acquisition of knowledge and formation of elements of professional competencies in the field of medical informatics, and improvement of basic PC skills and competencies of formalization, algorithmization of medical problems, classification of diseases and symptoms, processing of medical information by mathematical statistics using computer statistical programs.

Tasks:

1. Mastering the basics of modern information and communication technologies. Formation of skills and abilities: from computer analysis and processing of medical information, including biosignals, visual data, medical analysis data, etc., using the apparatus of mathematical statistics;

2. Mastering the methods of formalization and algorithmization of medical problems and acquaintance with mathematical models of biological and pathological processes;

3. Understanding the principles of solutions support programs and areas of their application in modern medicine. Knowledge of the principles of coding and classification in medicine;

4. Study of the principles of evidence-based medicine, acquaintance with medical information systems and electronic case histories;

The process of studying the discipline is aimed at forming elements of the following competencies:

- IC1 - Ability to solve complex problems and problems in the industry health care, which involves research and / or innovation using modern information technology and characterized by complexity and uncertainty of conditions and requirements.
- GC1. Ability to abstract thinking, analysis and synthesis.
- GC2. Ability to know and understand the subject area and professional activity.
- GC3. Ability to communicate in the state language.
- GC4. Ability to learn and master modern knowledge, use information and communication technologies; ability to search, process and analyze information from various sources.
- GC5. Ability to adapt and make an informed decision in a new situation.
- GC6. Ability to work in a team.
- GC7. Ability to work in an international context, to communicate in a foreign language.
- GC8. Ability to evaluate and ensure the quality of work performed.
- GC9. Ability to act on the basis of ethical considerations, socially responsible and consciously.
- SC1 - Ability to effectively use information and information technology in a medical context
- SC2 - Ability to use decision support systems in diagnosis
- SC3 - Ability to have the principles of formalization and algorithmization of medical problems, the principles of modeling in biology and medicine
- SC4 - Ability to promote health, address public health issues and work effectively in the health care system
- SC5 - Ability to use international classifications of diseases and symptoms in medical practice.
- SC6 - Ability to communicate effectively in a medical context
- SC7 - Ability to apply scientific principles of evidence-based medicine, methods and knowledge to medical practice and research
- SC8 - Ability to implement in the practice of treatment and prevention facilities methods and means of collecting, processing, transmission and storage of medical information using computers.
- SC9 - Ability to keep electronic medical records.

Expected learning outcomes. As a result of studying the discipline the student must:

Know: codes of international classifications of diseases and symptoms, principles of evidence-based medicine, laws of formal logic, decision-making methods. Methods of filtering and processing of biosignals.

Be able:

- refer diseases and symptoms to the relevant code of international classifications and understand the meaning of disease codes and medical manipulations
- Build algorithms for medical problems, models of medical and biological processes
- Introduce information technology in medicine
- Build graphs, data charts in the field of medicine,
- to conduct statistical analysis of medical, including epidemiological data in special editors and programs.

Master the skills:

- Maintain medical records in electronic format
- Search for information in the materials of the Cochrane Collaboration
- Perform statistical analysis of data from medical and biological experiments
- Modeling of processes in biology and medicine by software.

3. The content of the discipline

Subsection 1. Fundamentals of information technology in the health care system. Basic concepts of medical informatics. Computer in the activities of the future doctor.

Topic 1. Safety. Input control. Introduction and structure of medical informatics.

- Safety precautions.
- Computer testing.
- Course objectives, course structure.
- Basic tasks and components of medical informatics (MIN).
- Data and information.
- Computer programs-applications in the health care system

Topic 2. Transfer of information. Network technologies. Basics of telemedicine.

- Communication, sender, channel, recipient. Receivers and converters of information. Information carriers. Properties of information. Entropy of information.
- Hardware and software communications. Internet. Communication in the health care system.
- Basic principles of telemedicine.
- General formulation of the task of the calculation and graphic work (CGrW).

Topic 3. Computer data: data types, processing and management.

- Information processing systems: user, input, user interface, data processing and presentation.
- Database management systems (DBMS). Data structure. DBMS functions. Data models. Data management Data storage. DBMS models. Types of models: hierarchical, relational and network type model.

Section 2. Medical data. Methodology of information processing and analysis.

Topic 4. Coding and classification.

- Classification: types, classification, definitions, goals, principles. Codes: coding, numerical and mnemonic codes, hierarchical and combinational codes, comparison codes History of classification and coding. Classification systems. Problems of classification and coding.

Topic 5. Analysis of biosignals Methods of processing biosignals.

- Registration, transformation and classification of biosignals. Types of signals. Stationary and non-stationary signals. Applied application of biosignal analysis.

Topic 6. Visualization of medical and biological data. Processing and analysis of medical images.

- Means of obtaining images. Medical image processing. Problems of image processing and analysis. Image transformation. General and local image transformation. Modern trends in image processing.
- Processing of two-dimensional and three-dimensional medical images.

Topic 7 Methods of biostatistics.

- Data description: qualitative nominal, ordinal and quantitative data. Estimation of parameters and testing of hypotheses. Statistical data analysis.
- Monitoring the implementation of the stage of calculation and graphic work.

Section 3. Medical knowledge and decision making.

Topic 8 Methods of decision support. Strategies for obtaining medical knowledge.

- Types of medical knowledge. Training people and "learning" computers. Decision support systems.
- Knowledge base. Information needs and ways to solve them. Types of decision support systems and medical knowledge base.

Topic 9. Formal logic in solving problems of diagnosis, treatment and prevention of diseases.

- Logical operations and truth tables. Logical operators and expressions. Algebra of logic. Binary number system and logic.

Topic 10. Formalization and algorithmization of medical problems.

- Basics of algorithmization of medical problems. Algorithms and their properties. Ways to present algorithms. Types of algorithms Drawing up the block diagram of a simple and branched algorithm Drawing up the block diagram of an algorithm with an internal cycle.

Topic 11. Clinical decision support systems. Forecasting tools. Modeling of decision support system.

- o Application of clinical decision-making systems. Types of systems.
- o Forecasting tools Support decision making with simple forecasting tools.

- ○ Presentation of decision support systems. Expert systems. Building a knowledge base and structuring. Reuse of ontologies. Modern architecture of decision making system.

Topic 12. Evidence-based medicine.

- ○ Use of evidence in making medical decisions. Sources of available evidence in medicine.

Section 4. Patient interaction systems, institutional information systems in health care.

Topic 13. Types of information systems in the field of health care. Hospital information systems and their development.

- Public health and health care. Modeling and models of the health care system (POPs) Information requirements.
- Hospital information systems (GIS): clinical use and technical implementation. History of GIS development. The future of GIS. GIS functions. GIS concept. GIS architecture. Application of GIS Examples of GIS. Data access and protection. Administrative management.
- Clinical systems in various areas of health care.

Topic 14. Individual medical cards. Structuring the content of electronic medical records (EMC).

- Traditional and electronic medical records (electronic medical history, development history. Data entry structure: dynamics, interface, consumer adaptations. General structure of EMC. Implementation of EMC. Use of EMC data.

Topic 15. Information resources of the health care system.

- Information resources of the health care system. Characteristics and features of information resources of the health care system. Open access health information networks. Information resources. Administrative systems. Registers. Epidemiological surveillance. Banks of organs, tissues and blood. Use of information resources in evidence-based medicine.

Topic 16. Protection of calculation and graphic work.

- Submission of the final version of the project on separate reflections of own assessment of strengths and weaknesses.

Topic 17. Ethical and legal principles of information management in the health care system.

- Information protection - security, privacy and confidentiality of medical information systems. Threats. Selection of necessary measures to protect information. Legislation and regulation.

4. The structure of the discipline

Name the topics	Number of hours			
	In total	including		
		L	P/S	ISW
1	2	3	4	5

Section 1. Fundamentals of information technology in the health care system. Basic concepts of medical informatics. Computer in the activities of the future doctor.				
Topic 1. Safety. Input control. Introduction and structure of medical informatics.	3,0		2,0	1,0
Topic 2. Transfer of information. Network technologies. Basics of telemedicine.	4,0		2,0	2,0
Topic 3. Computer data: data types, processing and management.	8.0		4.0	4.0
Section 2. Medical data. Methodology of information processing and analysis.				
Topic 4. Coding and classification of medical and biological data.	5.0		2.0	3.0
Topic 5. Analysis of biosignals. Methods of processing biosignals.	9.0		4.0	5.0
Topic 6. Visualization of medical and biological data. Processing and analysis of medical images.	5.0		2.0	3.0
Topic 7. Methods of biostatistics. . Application of statistical methods for processing the results of medical and biological research.	9.0		4.0	5.0
Section 3. Medical knowledge and decision making.				
Topic 8. Methods of decision support. Strategies for obtaining medical knowledge.	4.0		2.0	2.0
Topic 9. Formal logic in solving problems of diagnosis, treatment and prevention of diseases.	4.0		2.0	2.0
Topic 10. Formalization and algorithmization of medical problems.	4.0		2.0	2.0
Topic 11. Clinical decision support systems. Forecasting tools. Modeling of decision support system.	5.0		2.0	3.0
Topic 12. Evidence-based medicine.	5.0		2.0	3.0

Section 4. Patient interaction systems, institutional information systems in health care.				
Topic 13. Types of information systems in the field of health care. Hospital information systems and their development.	5.0		2.0	3.0
Topic 14. Individual medical cards. Structuring the content of electronic medical records (EMC).	4.0		2.0	2.0
Topic 15. Information resources of the health care system.	6.0		2.0	4.0
Topic 16. Protection of calculation and graphic work.	6.0		2.0	4.0
Topic 17. Ethical and legal principles of information management in the health care system. test	4.0		2.0	2.0
Individual tasks	-	-	-	-
Total hours	90.0		40,0	50,0

5. Topics of lectures - Not provided

6. Topics of practical classes

№	Topic	Hours
1	Safety precautions. Input control. Introduction and structure of medical informatics.	2

2	Information transfer. Network technologies. Basics of telemedicine.	2
3	Computer data: data types, processing and management.	4
4	Control of assimilation of the content module 1.	2
5	Coding and classification.	2
6	Analysis of biosignals. Methods of processing biosignals.	2
7	Visualization of medical and biological data. Processing and analysis of medical images.	2
8	Formal logic in solving problems of diagnosis, treatment and prevention of diseases	4
9	Formalization and algorithmization of medical problems	2
10	Methods of biostatistics.	4
11	Clinical decision support systems. Forecasting tools. Modeling of decision support system.	2
12	Evidence-based medicine.	2
13	Control of execution of a stage of settlement and graphic work	2
14	Types of health information systems. Hospital information systems and their development.	2
15	Health Resource Information Resources	2
16	Ethical and legal principles of information management in the health care system	2
17	Protection of calculation and graphic work. Test	2
	TOGETHER	40

7. Independent work

№	Name of the topic / types of tasks	Number of hours

1.	Information technologies in medicine and biology	5
2.	Elements of correlation and analysis of variance. Its application to the analysis of medical and biological information.	8
3.	Medical information systems.	5
4.	Creation and use of databases in medicine.	7
5.	Development of EU knowledge bases.	5
6.	"Virtual doctor": The Great Medical Encyclopedia (CD) The Great Family Health Encyclopedia (CD) Encyclopedia of Medicinal Plants (CD) Surgery in Questions and Answers (CD) 10,000 patient care tips (CD)	10
7.	Execution of calculation and graphic work	10
	Together	50

8. Individual tasks

Not provided

9. Teaching methods

Practical classes: story, explanation, conversation, instruction, discussion, debate, discussion of problem situations, situational learning, illustration (including multimedia presentations), demonstration, method of direct observation, presentation of the results of own research; exercises; training exercises; creative exercises; solving computational problems, practical work; performing experiments; project method (design);

Independent work: independent work with a textbook, independent work with a bank of test tasks, independent work with computer programs.

10. Methods of control and criteria for evaluating learning outcomes

Ongoing control: oral examination, testing, assessment of practical skills, problem solving, assessment of activity in the classroom.

Final control: oral test, testing.

The structure of the current assessment in the practical lesson:

1. Assessment of theoretical knowledge on the topic of the lesson:
 - methods: survey,
 - maximum grade - 5, minimum grade - 3, unsatisfactory grade - 2.
2. Assessment of practical skills and literacy when working with computer programs on the topic of the lesson:
 - methods: assessment of the correctness of practical skills
 - maximum grade - 5, minimum grade - 3, unsatisfactory grade - 2;

Criteria for current assessment in the practical lesson:

«5 »	The student is fluent in the material, takes an active part in discussing and solving a situational clinical problem, confidently demonstrates practical skills during the examination of a sick child and interpretation of clinical, laboratory and instrumental studies, expresses his opinion on the topic, demonstrates clinical thinking.
«4 »	The student is well versed in the material, participates in the discussion and solution of situational clinical problems, demonstrates practical skills during the examination of a sick child and interpretation of clinical, laboratory and instrumental studies with some errors, expresses his opinion on the topic, demonstrates clinical thinking.
«3 »	The student does not have enough material, uncertainly participates in the discussion and solution of the situational clinical problem, demonstrates practical skills during the examination of a sick child and interpretation of clinical, laboratory and instrumental studies with significant errors.
«2 »	The student does not have the material, does not participate in the discussion and solution of the situational clinical problem, does not demonstrate practical skills during the examination of a sick child and the interpretation of clinical, laboratory and instrumental studies.

The student is admitted to the test if he meets the requirements of the curriculum and if for the current educational activity he received at least 3.00 points

Credit structure

The content of the evaluated activity	Points
Testing	1
Answer to theoretical questions.	3
Practical task	1

The final control in the form of tests is evaluated on a two-point scale:

- grade "credited" is given to a student who has completed the curriculum of the discipline, has no academic debt; level of competence - high (creative);
- the grade "not credited" is given to a student who has not fulfilled the curriculum of the discipline, has an academic debt (average score below 3.0 and / or absences); level of competence - low (receptive-productive).

11. Distribution of points received by applicants for higher education

The grade for the discipline is 50.0% of the grade for current performance and 50.0% of the grade for credit.

The average score for the discipline is translated into a national grade and converted into scores on a multi-point scale.

Conversion of the traditional grade for the discipline in the 200-point is carried out by the information and computer center of the university program "Contingent".

Table for conversion of traditional assessment into multi-point:

National grade for the discipline	The sum of points for the discipline
«5»	185 – 200
«4»	151 – 184
«3»	120 – 150

Points from the discipline are independently converted into both the ECTS scale and the four-point scale. ECTS scale scores are not converted to a four-point scale and vice versa. Further accounts are carried out by the information and computer center of the university.

Conversion of traditional assessment in the discipline and the amount of points on the ECTS

ECTS score	Statistical indicator
A	The best 10% of students
B	The next 25% of students
C	The next 30% of students
D	The next 25% of students
E	The next 10% of students

The ECTS scale is given by the ONMedU educational subdivision or the dean's office after ranking the grades in the discipline among students studying in one course and in one specialty. According to the decision of the Academic Council, the ranking of students - citizens of foreign countries is recommended to be carried out in one array.

12. Questions for final control

1. Medical information and its types.
2. The subject and object of study of medical informatics.

3. The task of medical informatics.
4. Information processes and flows in medicine.
5. The model, its types (biological, physical, cybernetic, mathematical).
6. Modeling as the main method of studying objects in biology and medicine.
7. Prediction in medicine. Types of the forecast.
8. Formalization of medical tasks.
9. Examples of building models in medicine.
10. Medical information systems.
11. Methods of identification information processes
12. The basic directions of development of information technologies.
13. Use of medical information resources.
14. A random event. The probability of a random event and its empirical counterparts;
15. Elements of the theory of probability. Bayes formula.
16. The laws of distribution of random variables and their characteristics.
17. Empirical laws of distribution.
18. Statistical methods of processing the results of biomedical research.
19. Testing of statistical hypotheses.
20. Databases in medicine.
21. Database management systems.
22. Automated systems of medical history.
23. Logical operations: negation; Conjunctions; Disjunction; Implication; .
24. Expert systems, their types.
25. Formal models of the representation of knowledge in medical expert systems: the type of production rules, the type of the grid, the type of the frame.
26. Mechanisms of logical inference in the expert system (direct and reverse.
27. Computer information networks, types.
28. Basic concepts of the global computer network INTERNET.
29. Browser programs, examples.
30. Personal Computer. Hardware components of the PC.
31. PC software and its types.

32. Operating system and its functions.
33. File system (file, file types, folder, folder types, full file name).
34. Text preparation systems, their functions and capabilities.
35. Processing of biomedical data by means of spreadsheets.

13. Methodical support

1. Working program of the discipline
2. The syllabus of the discipline
3. Textbooks:
 - Godlevsky LS, Bayazitov MR, Mandel OV, Marchenko SV, Bidnyuk KA, Lyashenko AV Telemedicine technologies in the health care system Educational-methodical manual Odessa-2020 (375 pages)

 - Godlevsky LS, Mandel OM, Zhumatiy PG, Prybolovets TV, Novikov VP, Marchenko SV, Matsko OM, Danilyuk OY, Tatarchuk TV, Ponomarenko AI, Bidnyuk KA "Extended terminology for the course of medical informatics" - Textbook, Odessa: Odessa National Medical University, 2017, 72 p.4. Multimedia presentations
5. Development of a collective project. Organization of joint work with documents.
6. Methodical development of practical classes
7. Electronic bank of test tasks by divisions of the discipline.

14. Recommended Literature

Main

1. Measuring Health Informatics In Bits and Bytes - A Competency Based Digital Approach / Saji Mathew Perinjelil. INDEPENDENTLY PUBLISHED, 2019. EAN:9781796247657. ISBN:1796247650
2. Clinical Decision Support Systems: Theory and Practice - 3rd Edition/ Eta S. Berner (Ed.), M.J.Ball. Springer International Publishing - Kindle Edition, 2016. ISBN-13: 978-1402048562. ISBN-10: 1402048564
3. Health information management : concepts, principles, and practice / Pamela K Oachs, Amy Watters. Chicago, Illinois, American Health Information Management Association. 2021

Additional

1. Howick J. The Philosophy of Evidence-Based Medicine. Oxford : Blackwell-Wiley, 2011. 238 p.
- 2.
3. Health Information: Management of a Strategic Resource / Mervat Abdelhak PhD RHIA FAHIMA, Sara Grostick MA RHIA FAHIMA, Mary Alice Hanken PhD CHPS RHIA, Ellen B. Jacobs MEd RRA. Saunders, 2015. ISBN 10: 1416030026 / ISBN 13: 9781416030027
4. Practitioner's Guide to Health Informatics / Mark L. Braunstein. Springer International Publishing, 2012. ISBN: 978-3-319-17661-1, Electronic ISBN: 978-3-319-17662-8.
5. Integration of Medical and Dental Care and Patient Data / Valerie Powell, Franklin M. Din, Amit Acharya, Miguel Humberto Torres-Urquidy. Springer International Publishing, 2012. ISBN: 978-1-4471-2184