

Ministry of Public Health of Ukraine
“Ukrainian Medical Stomatological Academy”

“APPROVED”

at the meeting of the Department
of Medical Informatics, Medical Biophysics

«27» August 2020

Minutes of the meeting of the Department

Head of Department  296LONRYD

METHODICAL GUIDANCE

IRUW&HQYHOL Directed work when preparing and during the practical session

Academic Subject	Medical Information Science
Module No 1	Fundamentals of Information Technology in the Health Care System. Treatment and analysis of medical and biological data
Topic	Coding and classification of medical and biological data.
Year of study	2
6SHFLDOLW\	Foreign Student Training (0HGFLQ6WRPDWRØRJ\
Number of academic hours	2

1. Relevance of the topic:

Two common medical coding classification systems are in use — the International Classification of Diseases (ICD) and the Current Procedural Terminology (CPT). ICD is the standard international system of classifying mortality and morbidity statistics, and it's used by more than 100 countries. The system is used by health care facilities to define diseases and allocate resources to provide care. According to the World Health Organization (WHO), 70% of the world's health care expenditures are allocated using ICD. The current version, ICD-9, features more than 16,000 codes for infections and parasitic diseases, neoplasms, and congenital malformations, as well as diseases of the digestive system, respiratory system, and nervous system.

2. The specific aims:

- To know the definition of coding and classification medical dates;
- To know methods of coding and classification;
- To have general knowledge of the topic studied;
- To understand, to remember and to use the knowledge received;
- To form the professional experience by reviewing, training and authorizing it;
- To be able to carry out laboratory and experimental work.

3. Basic knowledge and skills necessary to study the topic (inter-disciplinary integration).

Previous (providing disciplines)	Obtainable skills
Computer Science	distinguish types of information; explain the properties of the dates.

4. The tasks for students' individual work

4.1. The list of basic term, parameters, characteristics, which student should master while preparin for the class.

Term	Definition
Classification system	A groups concepts together for a specific purpose.
Disease coding systems	Systems assign a code or value to a specific entity.
Classification system	An organization of medical terms into categories.

4.2 Theoretical questions for the class (to the topic):

1. Medical classification
2. Medical coding
3. Mnemonic, hierarchical and Juxtaposition codes
4. Medical Classification Systems
5. Why do we need disease classification systems when using computers?
6. Does coding disease make a consultation longer?
7. ICPC – International Classification of Primary Care
8. ICD 10 – International Classification of Disease
9. SNOMED – Systemized Nomenclature of Medicine
10. MeSH – Medical Subject Headings
11. ATC – Anatomic Therapeutic Chemical Code
12. Logical Observation Identifiers, Names, and Codes

4.3 Practical work performing in class:

Test

1. WHAT IS THE CLASSIFICATION?

- a) distribution system objects with certain principles
- b) distribution system facilities on the grounds
- c) distribution system objects of classes on certain grounds
- d) distribution system objects concepts or terms
- e) distribution system objects definitions

2. WHAT CODE IS THE BASIS OF THE INTERNATIONAL CLASSIFICATION OF DISEASES (ICD- 10)?

- a) three-digit code
- b) two-digit code
- c) a six-digit code
- d) character code
- e) five-digit code

3. HOW IS THE LIST OF DIAGNOSTIC TERMS OR CONDITIONS LIST FOR LABORATORY RESEARCH?

- a) terminology
- b) test
- c) classification
- d) thesaurus
- e) combination

4. WHAT IS THE CODE USED IN THE CODING SYSTEM ICD FOR GENERALIZED RECORD OF THE PATIENT?

- a) numeric
- b) mixed
- c) character
- d) hierarchical
- e) comparing codes

5. WHAT IS THE CODING?

- a) It is the process of assigning an individual object or case to a class, or to a set of classes in the case of a multiaxial classification
- b) It is the process of converting analog data to a digital format
- c) It is the process of converting binary data to a decimal format
- d) It is the process of converting medical images to a digital computer data
- e) It is the process of assigning an individual number to the each disease

Practical work:

Task 1. Using the classifier decode the codes listed below diagnoses. The results add to a notebook in a table.

№	Code	Diagnose
1	A060	
2	I11	
3	I332	
4	T880	

Task 2. Using the classifier encoded listed below diagnoses. The results add to a notebook in a table.

№	Diagnose	Code
1	Fasciolopsiasis	

2	Chronic or unspecified duodenal ulcer with perforation	
3	Multifocal fibrosclerosis	
4	Congenital malformation of nervous system, unspecified	

Task 3. Put numbers from decimal to binary notation.

Decimal notation	Binary notation
28	
133	
4	

Task 4. Put numbers from binary to decimal notation.

Decimal notation	Binary notation
	100101
	1101
	110101

Content of the topic:

In health it is sometimes useful to group certain diseases or presenting complaints together in order to be able to study them in more detail. Classifications systems frequently use codes to group items together.

Medical coding is the process of assigning standardized medical codes (numerical, mnemonic, etc.) to patient medical charts. This coded information is used to: ensure of the insurance companies; government organizations (Medicare, USA); patients alike all receive accurate billing statements for medical services performed.

Advantages of coding medical data:

- Data reduction
- Standardized terminology
- Enabling statistical overviews and research
- Support of management and planning
- Coupling with decision-support systems

The term **classifying** has two different meanings:

- 1) the process of **designing** a classification;
- 2) the **coding** or **description** of an object by using codes or terms that are designators of the concepts in a classification.

We will use only the first meaning of classifying. Also a classification is an ordered system of concepts within a domain, with implicit or explicit ordering principles. A classification is based on prior knowledge and forms a key to the extension of knowledge.

Concepts are ordered according to generic relations: generic relations are relations of the type “A is a kind of B”, (for example, pneumonia is a kind of lung disease, where pneumonia represents the narrower concept and lung disease represents the broader concept).

Classifications contain concepts within a certain **domain**.

The **domain** can be defined as:

- The set of elements to which a variable or function is limited.
- Any area of interest that might be modeled, e.g., to create an information system.

Examples of domains are reason for encounter, diagnosis, and medical procedure. In this respect the International Classification of Diseases, 9th edition (ICD-9), is a classification of diagnoses. A classification allows one to compare findings collected in different environments. Classifying is done according to a single criterion: age; that is, age is used as a differentiating criterion.

In classifying diseases we deal with the following aspects, among others: anatomic location, etiology, morphology, and dysfunction. Each of these aspects can be used for a different ordering. Such an ordering throughout a classification is called an axis.

Multiaxial classifications use several orderings simultaneously. In the International Classification of Primary Care (ICPC), for instance, the diagnoses are classified along two axes, one for the organ system (an alphabetic character) and one for the components. ICPC has primarily been designed for epidemiological purposes.

One of the problems of uniform registration in health care is the **lack** of a common terminology. A **thesaurus** is a list of terms used for a certain application area or domain. Examples are a list of diagnostic terms or a list of terms for laboratory tests. For practical usage, thesauri that also contain a list of **synonyms** for each preferred term have also been developed. A restricted set of preferred terms used within an organization for a given purpose is called a **controlled vocabulary**.

In a **nomenclature**, codes are assigned to medical concepts, and medical concepts can be combined according to specific rules to form more complex concepts. This leads to a *large number of possible code combinations*.

The difference between a **classification system** and a **nomenclature** is that in the former possible codes are predefined, whereas in the latter a user is free to combine codes for all aspects involved.

The **retrieval** of records for patients whose data fulfill certain classification codes from a large database is **relatively easy**; retrieving records for patients stored by using a nomenclature is **more difficult** because of the high degree of freedom, leading to very complex codes.

Terminology for **coding** means that three basic elements are used in the so-called semantic triangle: (1) object, (2) concept, and (3) term.

1) **Objects**, also called referents, are particular things in reality, and they are concrete (e.g., the stomach), as well as abstract (e.g., the mind).

2) A **concept** is a unit of thought formed by using the common properties of a set of objects (e.g., an organ).

3) A **term** is a designation by a linguistic expression of a concept or an object in a specific language.

Coding is the process of assigning an individual object or case to a class, or to a set of classes in the case of a multiaxial classification. In most classifications, classes are designated by **codes**. Coding is, in fact, interpretation of the aspects of an object.

Example: coding gender Male = **m** Female = **f**

Different **types of codes** included:

- **Number codes** may be issued **sequentially**. This means that each new class will be given the next unused number. The **advantage** is that new classes can easily be added.

- Numbers could be issued at **random** to avoid any patient-specific information is hidden in the code.

- Series of numbers can be **reserved** for sets of classes. Issuing this type of number is only of use with a fixed set of classes, that is, when no expansion of the set of classes is expected.

A **mnemonic code** is formed from one or more characters of its related class rubric. Advantages: this helps users to memorize codes. Disadvantages: for classifications with many classes this may lead either to long codes or codes with no resemblance to the class rubrics. Used for limited lists of classes.

Example - hospital departments are often indicated by a mnemonic code: ENT - Department of Ear, Nose, Throat, CAR - Cardiology, OB-GYN - Department of Obstetrics and Gynecology.

Hierarchical codes are formed by extending an existing code with one or more additional characters for each additional level of detail. A hierarchical code thus bears information on the level of detail of the related class and on the hierarchical relation with its parent class. This way of coding bears resemblance to the structure of hierarchical databases. This implies that patient data can be retrieved by using hierarchical codes at a certain level, even when significant extensions or modifications are made at lower levels. An *example* are the codes used in **ICD-9**.

Juxtaposition codes are composite codes consisting of segments. Each segment provides a characteristic of the associated class for each additional level of detail. *Application:* in **ICPC** a diagnostic code is formed by using a code consisting of one letter of the alphabet (a mnemonic code), followed by a two-digit number. *Example:* all codes with the character "D" are related to the tractus digestivus and all codes starting with an "N" describe disorders of the nervous system. In the example of ICPC, two independent characteristics are coded simultaneously, and each characteristic has its own position in the code.

Medical procedures can be classified with ordering principles: **action, equipment, aim, and anatomical site**. The combination of 100 anatomical sites with 20 different actions, 10 different instruments, and 5 different purposes results in a classification system with a potential of a 100,000 classes and codes.

A way to cope with it is the use of a **combination code**. By using a six-digit combination code consisting of four segments, with segments dedicated to action (2 digits), equipment (2 digits), aim (1 digit), and anatomical site (1 digit), respectively, a coding clerk has to distinguish only 135 codes, with which 100,000 combinations can be generated.

In value addition codes in general only powers of 2 are used as a representation of a data item or class. A several characteristics can be coded. But only one number instead of a segment for each characteristic is used as a code.

Example: we code the presence or absence of risk factors, such as:

$2^0 = 1$ for smoker / 0 for nonsmoker,

$2^1 = 2$ for overweight / 0 for no overweight,

$2^2 = 4$ for increased cholesterol / 0 for not increased cholesterol.

By using the codes 1 to 7 we can sum all the three risk factors mentioned above.

Taxonomy is the theoretical study of classification, including its basic principles, procedures, and rules. Taxonomy is concerned with classifications in general.

The term **classification** is used for the end product of the design process.

Nosology is usually defined as the science of the classification of diseases. Nosology is usually distinguished from **nosography**, which is the science of the **description of diseases**.

Difference between the definition and the description of disease: A disease definition gives only essential characteristics of the disease, whereas a description includes accidental characteristics.

Medical Classification Systems

- 1) ICD - International Classification of Diseases
- 2) ICPC - International Classification of Primary Care
- 3) SNOMED - Systematized Nomenclature of Human and Veterinary
- 4) DRG - Diagnosis Related Groups
- 5) MeSH - Medical Subject Headings
- 6) ATC - Anatomic Therapeutic Chemical Code

Why do we need disease classification systems when using computers?

Doctors are trained to write narrative accounts of their encounters with patients but computer systems are unable to use this type of information when performing tasks such as finding patients with a particular disease or on a particular drug. As an example, an attempt by GPs in Exeter using computers in the early 80's to identify all cases of patients with Otitis Media over a given period, grossly underestimated the incidence of this condition. This was because some GPs diagnosed Otitis Media, others "middle ear infection" and some simply wrote "OM" into their computer records. The system simply couldn't cope with the many different terms and didn't have the "intelligence" to know that they were all the same condition.

While computer systems are getting much better at dealing with different meanings, applying a single code to a condition like Otitis Media allows GPs to still record whatever they like in the clinical notes but the computer will "know" what the GP wants to indicate in each case. Classifying codes into different categories will further add clarity to this and assist in the retrieval and linkage of information.

Other potential benefits of using coding and classification systems include:

- supports audit, training and research within GP practices due to the ability to retrieve high quality information quickly;
- supports the identification of patients suitable for preventative medicine interventions such as immunization or screening programs;
- allows practices to quickly establish a disease register for coded conditions;
- supports the linkage of particular signs and symptoms with outcomes e.g. how many cases of patients who present with weight loss in General Practice are eventually diagnosed with a malignancy;
- supports the exchange of information with Public Health and Hospital information systems;
- supports the exchange of information with GPs from other countries using different languages;
- Can provide the information required to run decision support systems which can assist GPs in making correct diagnoses and better management decisions
- supports the management of chronic disease by assisting with the formation of disease registers, disease management protocols and recall;
- supports more efficient organization of electronic patient records e.g. all consultations on an individual patient for a condition such as Asthma can be filtered out and examined in isolation from all other consultations;
- allows the rapid retrieval and organization of information.

Does coding disease make a consultation longer?

Ideally coding and classification systems should work in the background and GPs using IT systems should be virtually unaware that they are in fact coding diseases, drugs, investigations and other items. In modern computer applications, once an item is selected from a drop down menu it will be coded correctly by the software and there is no need for the GP to remember codes or refer to a coding document.

Other software applications offer search tools within the software so that when the GP types the first few letters of the disease, the application will offer a list of matches from a list of the codes embedded within the system. Selecting the nearest match also selects the code and links it to the patient's record.

Medical Classification Systems

ICPC-2 – English
International Classification of
Primary Care – 2nd Edition
Wonca International
Classification Committee
(WICC)



Process codes

- 30 Medical Exam/Eval-Complete
- 31 Medical Examination/Health Evaluation-Partial/Pre-op check
- 32 Sensitivity Test
- 33 Microbiological/Immunological Test
- 34 Blood Test
- 35 Urine Test
- 36 Faeces Test
- 37 Histological/Exfoliative Cytology
- 38 Other Laboratory Test NEC
- 39 Physical Function Test
- 40 Diagnostic Endoscopy
- 41 Diagnostic Radiology/Imaging
- 42 Electrical Tracings
- 43 Other Diagnostic Procedures
- 44 Preventive Immunisations/Medications
- 45 Observe/Educate/Advice/Diet
- 46 Consult with Primary Care Provider
- 47 Consultation with Specialist
- 48 Clarification/Discuss Patient's RFE
- 49 Other Preventive Procedures
- 50 Medical-Script/Reqst/Renew/Inject
- 51 Incise/Drain/Flush/Aspirate
- 52 Excise/Remove/Biopsy/Destruction/Debride
- 53 Instrument/Catheter/Intubate/Dilate
- 54 Repair/Fixate-Suture/Cast/Prosthetic
- 55 Local Injection/Infiltration
- 56 Dress/Press/Compress/Tamponade
- 57 Physical Medicine/Rehabilitation
- 58 Therapeutic Counselling/Listening
- 59 Other Therapeutic Procedure NEC
- 60 Results Tests/Procedures
- 61 Results Exam/Exam/Record

Blood, Blood Forming
Organs and Immune
Mechanism B

- B02 Lymph gland(s) enlarged/painful
- B04 Blood symptom/complaint
- B25 Fear of aids/HIV
- B26 Fear cancer blood/lymph
- B27 Fear blood/lymph disease other
- B28 Limited function/disability
- B29 Symp/compl lymph/immune other
- B70 Lymphadenitis acute
- B71 Lymphadenitis non-specific
- B72 Hodqkin's disease/lymphoma
- B73 Leukaemia
- B74 Malignant neoplasm blood other
- B75 Benign/unspecified neoplasm blood
- B76 Ruptured spleen traumatic
- B77 Injury blood/lymph/spleen other
- B78 Hereditary haemolytic anaemia
- B79 Congen.anom. blood/lymph other
- B80 Iron deficiency anaemia
- B81 Anaemia, Vitamin B12/folate def.
- B82 Anaemia other/unspecified
- B83 Purpura/coagulation defect
- B84 Unexplained abnormal white cells
- B87 Splenomegaly
- B90 HIV-infection/aids
- B99 Blood/lymph/spleen disease other

- PROCESS CODES**
- SYMPTOMS/COMPLAINTS**
- INFECTIONS**
- NEOPLASMS**
- INJURIES**
- CONGENITAL ANOMALIES**
- OTHER DIAGNOSES**

Fig 5.1 ICPC-2

ICPC – International
Classification of Primary Care

This classification system is used in all GPIT certified GP software systems. It receives a lot of criticism from GPs here as it has far fewer diagnosis codes than other systems such as ICD 10. ICPC-2 however was not designed to be simply a disease classification system. One of its principle aims was to capture the interaction or “episode of care” between the GP and the patient. It was designed to be structured around the SOAP (S for subjective information, O for objective Information, A for assessment and P for plan) method of recording consultation information. It therefore offers codes for various components of the consultation such as presenting complaints and investigations carried out, as well as final diagnosis.

ICPC-2 has a biaxial structure. The first axis which is primarily orientated around one of the 17 body systems on

offer is represented by a letter. D is for digestive and B is for Blood for example. The second axis is represented by a number which covers the seven components (presenting symptoms, diagnosis etc) contained in each of the body systems. The result is a simple code with one letter and two digits unique to each item on the list of around 1300 items.

ICPC has been in existence since 1987 and has been adopted by WONCA for use within general practice and primary care. It is also recognized by WHO as a related classification for use in primary care, in the WHO “Family of Classifications”. It is widely used across Europe and has been translated into 22 languages so far.

ICD 10 – International Classification of Disease

(<http://apps.who.int/classifications/icd10/browse/2010/en>)

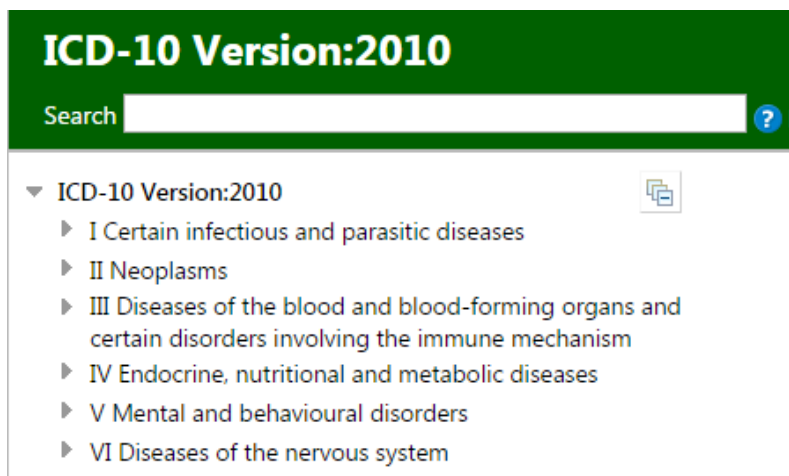


Fig 5.2 ICD 10

The ICD classification system started out as a method of classifying cause of death in the late 19th century. It has evolved now into an extremely rich classification system covering signs, symptoms, procedures, social circumstances and causes of injury as well as diseases. ICD is published by the WHO and is widely used across the world, primarily for the recording of morbidity and mortality statistics.

While it is excellent in this role, it is perhaps too detailed for use by GPs

and does not cope well with many of the undefined conditions found in general practice. ICD 10 is however available in most Irish GP software systems and can be used either alone or in conjunction with ICPC-2.

SNOMED – Systemized Nomenclature of Medicine

SNOMED is a systematic, computer-processable collection of medical terms, in human and veterinary medicine, to provide codes, terms, synonyms and definitions which cover anatomy, diseases, findings, procedures, microorganisms, substances, etc. It allows a consistent way to index, store, retrieve, and aggregate medical data across specialties and sites of care. Although now international, SNOMED was started in the U.S. by the College of American Pathologists (CAP) in 1973 and revised into the 1990s. In 2002 CAP's SNOMED Reference Terminology (SNOMED RT) was merged with, and expanded by, the National Health Service's Clinical Terms Version 3 (previously known as the Read codes) to produce SNOMED CT.

SNOMED was designed from its inception with complex concepts defined in terms of simpler ones. For example, a disease can be defined in terms of its abnormal anatomy, abnormal functions and morphology. In some cases, the etiology of the disease is known and can be attributed to an infectious agent, a physical trauma or a chemical or pharmaceutical agent.

Diseases and procedures are ordered hierarchically and are further referenced back to more elementary terms.

MeSH – Medical Subject Headings

The MeSH classification is developed and maintained by the National Library of Medicine (NLM) in the USA. It is generally used to index the world medical literature. Within the hierarchy of MeSH, a concept may appear as narrower concepts of more than one broader concept. *Example:* Pneumonia is listed as a respiratory tract infection as well as a lung disease.

ATC – Anatomic Therapeutic Chemical Code

ATC has been developed for the systematic and hierarchical classification of drugs. ATC is an acronym for anatomical (A), the organ system in the body for which the drug is given; therapeutic (T), the therapeutic purpose for which the drug is used; and chemical (C), the chemical class to which the drug belongs.

In the early 1970s, the Norwegian Medicinal Depot expanded the existing three-level anatomic and therapeutic classification system of the European Pharmaceutical Market Research Association and added two chemical levels. Later, the WHO Drug Utilization Research Group accepted the ATC classification as a standard. Presently, the WHO Collaborating Center for Drug Statistics Methodology in Oslo is responsible for maintaining the ATC codes.

The **advantages** of the ATC are as follows:

- 1) It identifies a drug product, including the active substance, the route of administration, and if relevant, the dose;
- 2) It is therapeutically as well as chemically oriented, a feature that most other systems lack;
- 3) Its hierarchical structure allows for a logical grouping;
- 4) It is accepted as the international WHO standard for drug utilization research.

A **disadvantage** is that it does not cover combination products, dermatological preparations, and locally compounded preparations

LOINC – Logical Observation Identifiers, Names, and Codes

LOINC was developed by Regenstrief Institute, Inc., in 1994. This system of clinical terminologies was designed for point of care services conducted via electronic transactions. The system was created as a response to the demand for electronic movement of clinical data from laboratories that produce the data to hospitals, physicians' offices, and payers who use the data for clinical care and management purposes. Highlights of the LOINC (Regenstrief, 2007) system include:

- the LOINC laboratory terms set provides a standard set of universal names and codes for identifying individual laboratory and clinical results;
- LOINC codes allow users to merge clinical results from many sources into one database for patient care, clinical research, or management;
- the LOINC database currently contains about 41,000 observation terms;
- nearly 31,000 of these observational terms relate to laboratory testing;
- each record in the LOINC database identifies a clinical observation and contains a formal, six-part name, a unique name for tests identifying code with check digit, synonyms, and other useful information;
- LOINC records apply to all tests with equivalent clinical results. They are not unique per company.

Tasks for self-check:

Task 1:

1. WHAT ADVANTAGES OF CODING MEDICAL DATA IN A COMPUTER?
 - a) Standardized terminology
 - b) Enabling statistical overviews and research
 - c) Coupling with decision-support systems
 - d) Data reduction
 - e) All answers are right
2. THE CT IN SNOMED CT REFERS TO:
 - a) Care Terminology
 - b) Clinical Terms
 - c) Critical Terms
 - d) Computerized Terminology
 - e) Right answer not present
3. WHAT ORGANIZATION MAINTAIN THE ICD-9-CM CODING SYSTEM?
 - a) U.S. National Center for Health Statistics
 - b) World Healthcare Organization
 - c) World Organization of National Colleges, Academies and Academic Associations of General Practitioners/Family Physicians
 - d) American Psychiatric Association

e) British National Health Service

4. THE SEMANTIC TRIANGLE FOR CODING CAN BE FORMED WITH FOLLOWING THREE BASIC ELEMENTS:

a) categories/subcategories/subclassifications

b) columns/subcolumns/minor columns

c) object, concept, term

d) procedures/encounters/diagnoses

e) categories, classifications, subclassifications

5. WHAT DEFINITION OF THE TERM AS THE CODING BASIC ELEMENT?

a) It is a particular things in reality, and they are concrete (e.g., the stomach), as well as abstract (e.g., the mind)

b) Right answer not present

c) It is the natural language text without restrictions on format and word choice

d) It is a unit of thought formed by using the common properties of a set of objects (e.g., an organ)

e) It is a designation by a linguistic expression of a concept or an object in a specific language

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Additional.

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The methodical guidance has been completed by **S.Y. Olenets**