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Implementation of Data on Medicinal Products in SQL-Based Relational Database

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Abstract: This paper presents the development methodology of the Recipe relational database on medicinal products, which includes a systematic management of data on indications, contraindications, adverse effects, precautions and interactions. The source of information is provided by the summaries of product characteristics of medicinal products (SmPCs). The code assignment and the preparation of data on indications, contraindication, adverse effects and precautions for the database input are carried out by means of the official World Health Organisation's ICD-10 coding system and the simultaneously created additional list of codes. A special list of codes was used for the representation of data on interactions, created on the basis of records contained in SmPCs. Each interaction description has its code of active substance, while a group of effects between which the interactions occur is fitted with ATC codes. The input into the database of medicinal products was made of the implemented data on drugs from ATC groups C07, C08 and C09 using a special program in the form of screen displays, specifically developed to this end.

Key-Words: information technology, data implementation, SQL database, ICD-10 list of codes, medicinal products, drug interaction

1 Introduction

Life expectancy continues to increase and the contemporary lifestyle causes an increasing number of diseases, i.e. mental, cardiovascular, malign and other. The consumption of drugs is growing and an increasing number of diverse medicinal products is present on the market. Due to such massive consumption of medicaments different drugs are often used concurrently, thus increasing the risk of interactions.

Wishing to systematically arrange the data on drugs and improve the skills of physicians and pharmacists an idea occurred at the Mariborske lekarne IT Department to systematically arrange the data on drugs, included in information technology. Similar databases already exist abroad and on the Internet [1], [2].

The above mentioned cardiovascular system diseases are prevalent in the developed countries in terms of reported cases and the most frequent cause of death. In pharmacy as a science and in pharmaceutical industry the interest is strong as well as investment in the development of new active substances in this field. Their existing numbers in the market are high with new being continuously launched.

The paper presents the integration of three categories of active substances used in treatment of cardiovascular diseases from ATC groups C07, C08 and C09 into the currently created Recipe database on medicinal products. Each group of active substances acts in a different physiological system. The inhibitors of adrenergic receptors act in the adrenergic system, the inhibitors of calcium channels act on calcium channels, whereas the preparations impacting the renin-angiotensin system act on the renin-angiotensin system. The above three groups are particularly important in treatment of hypertension, angina pectoris, arrhythmias, heart failure and acute myocardial infarction [3-7].

2 ICD-10 List of Codes

In adjustment of data on indications, contraindications, precautions and adverse effects the official coding system of the World Health Organisation, translated into Slovene is used , i.e. ICD-10 (WHO, The International Statistical

Classification of Diseases and Related Health Problems, 10th Revision) [8].

2.2 Structure of ICD-10

The basic structure of ICD-10 coding system (Fig. 1) represents a unified coding list of three-character categories. In the fourth character, each category may be further divided into up to ten subcategories. Used here are alphanumerical codes with an alphabetic character in the first place and numerals in the second, third and fourth place [9]. The codes range from A000 to Z999. The letter U is not used [9] and remains as a reserve for future data and changes as well as temporary classifications [10].

The classification is divided into twenty-one chapters (Fig. 1). The first sign of each code is a letter and each letter is linked to the relevant chapter, except letters D and H, used in two different chapters. Several different letters appear in four chapters (I, II, XIX and XX) in the first place of the codes. Each chapter has sufficient three-character categories to cover its content. All possible codes are not used, thus allowing subsequent revisions and expansions [9].

2.2.2 Four-character subcategories

Table 1 shows an example of disease coding in ICD-10. The four-character subcategories are used for identification of various sites of diseases, if the three-character code indicates only one disease or for identification of specific diseases, if the three-character code represents a category of conditions. The designation 8 in place number four is usually used for »other« conditions belonging to a concrete three-digit code. The designation 9 in place number four most frequently means the same as the title of the three-digit code, without any additional datum [9].

2.2.3 Unused codes

The codes U00-U49 may be used only for temporary classification of new diseases with unknown aetiology. Codes U50-U99 may be used in research work [9].

2.2.4 Coding of diseases

In each disease coding the »Diagnosis code finding « command is available in the ICD-10 software. The

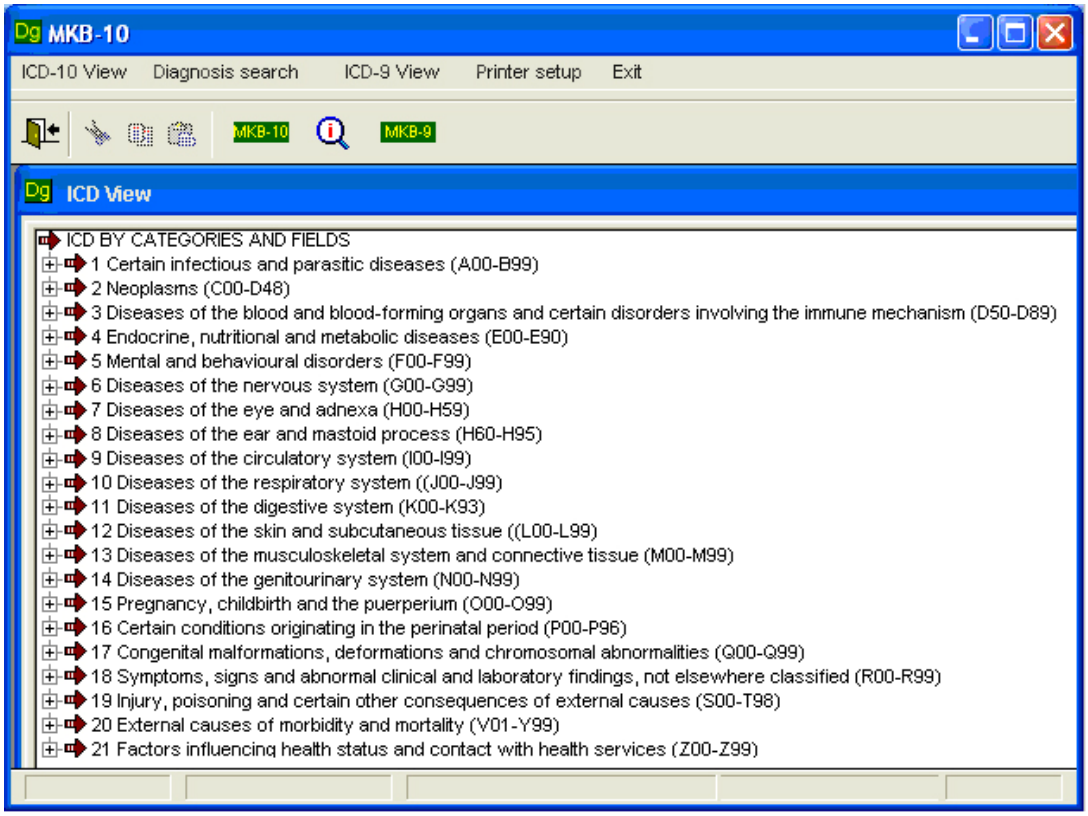


Fig. 1: Twenty-one chapters of ICD-10 classification

»Diagnosis code finding« is selected in ICD-10. A window opens where the desired diagnosis/disease is to be entered (a word or a character set) or the disease code. The next step is to select »Diagnosis« and a set of diagnoses is displayed containing a word or a character set that have been selected. The code may also be selected by means of the ICD-10 view, which is why it is important to know its structure.

First, the main category is to be found, in which the disease being sought is structured, followed by a subgroup and finally a list of three-character and four-character diagnosis is displayed.

2.2.5 Example of diagnosis code finding

If a code for unstable angina pectoris is to be found using the ICD-10 coding systems, the search may be made at two levels, i.e. using ICD-10 view (Fig. 2) or at the Diagnosis code finding level (Fig. 3).

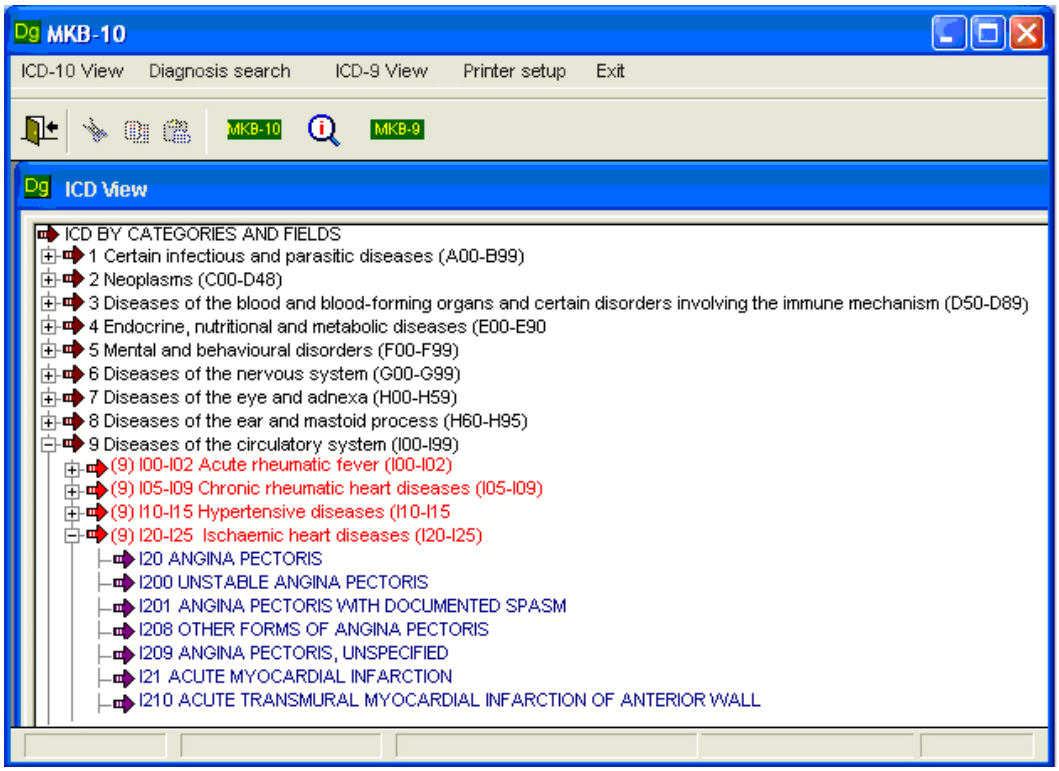


Fig. 2: ICD-10 view

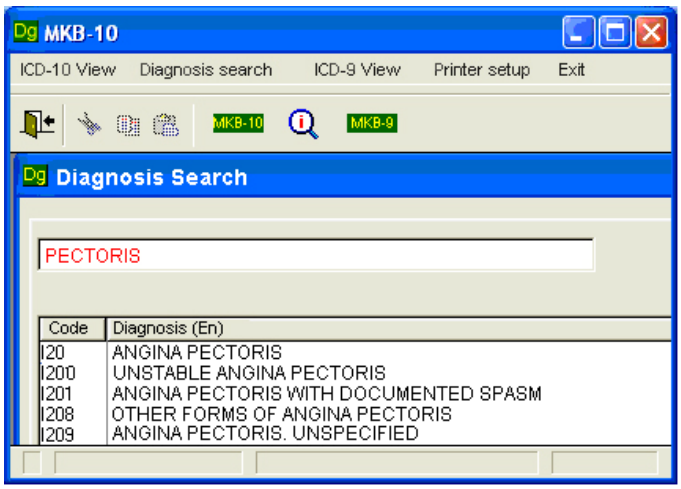


Fig. 3: Diagnosis code finding

In the ICD-10 (Fig. 2) view a group is sought in which the desired disease is structured. This is group »9 Diseases of circulatory system«. After the selection, a list of ten subcategories is displayed (marked in red) to select the adequate group. In this case it is »I20–I25 Ischaemic heart diseases«. A new set of coded diagnoses is displayed. The correct diagnosis for the sought disease is »I200 Unstable angina pectoris«. A faster way of search is allowed by Diagnosis code finding (Fig. 3). In the window which opens »pectoris« is to be written, «Diagnosis« selected and a set if coded diagnoses is displayed, containing the word which was entered. The appropriate diagnosis is selected.

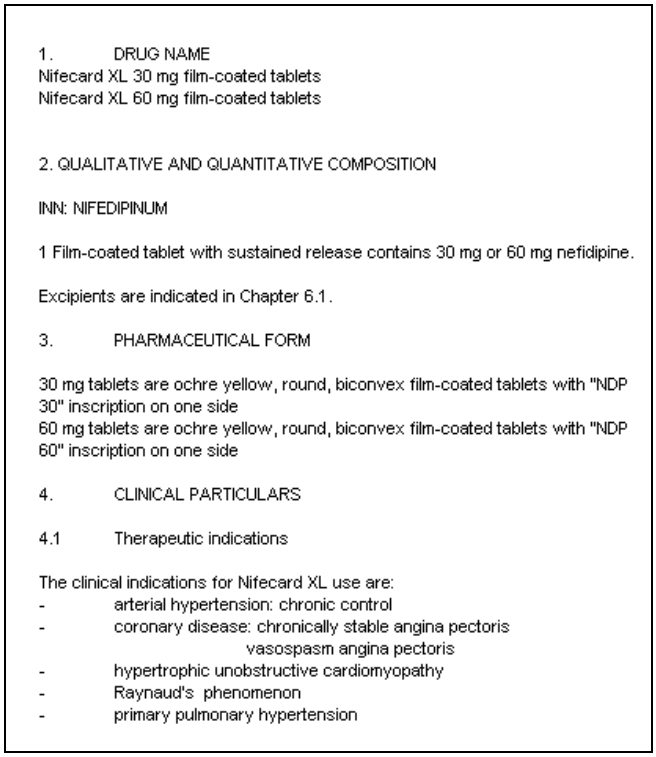
3 Summary of Product Characteristics - SmPC

In developing the Recipe database the data was solely obtained from the Summaries of Product Characteristics (SmPCs) from the web address [11]. Each SmPC may be identical for a drug with the same active substance, the same proprietary name yet a different content of the active substance.

3.1 Structure of SmPC

SmPC is divided into ten main chapters, of which some are further divided into two subchapters. Fig. 4 shows part of SmPC for Nifecard® XL drug.

1. Drug name
   - Here, proprietary names of the drug are indicated.
2. Qualitative and quantitative composition
   - Content of specific pharmaceutical form (tablet, capsule, ampoule,…).
3. Pharmaceutical form
   - Indication of pharmaceutical form, colour, shape, specific characteristics,…
4. Clinical particulars
   - Therapeutic indications.
   - All indications of the drug are mentioned.
   - Posology and method of administration:
     A detailed description of the method of administration for treatment of individual diseases and what we should pay attention to in drug application, particularly special warnings concerning the application by children, elderly, patients with hepatic or renal insufficiency.
   - Contraindications:
     The conditions are indicated in which the drug must not to be taken.
   - Special warnings and precautions for use:
     This chapter contains all conditions in which a drug must be administered with care or conditions in which no experience with drug application exists. All precautions are also indicated to be observed in application.
   - Interaction with other medicinal products and other forms of interaction:
     All substances are indicated or groups of substances which may cause undesired interactions. The types of interactions are described and the interactions with food, alcohol or any other substance indicated, which may provoke an interaction.



1. DRUG NAME
Nifecard XL 30 mg film-coated tablets
Nifecard XL 60 mg film-coated tablets

2. QUALITATIVE AND QUANTITATIVE COMPOSITION

INN: NIFEDIPINUM

1 Film-coated tablet with sustained release contains 30 mg or 60 mg nefidipine.

Excipients are indicated in Chapter 6.1.

3. PHARMACEUTICAL FORM

30 mg tablets are ochre yellow, round, biconvex film-coated tablets with "NDP 30" inscription on one side
60 mg tablets are ochre yellow, round, biconvex film-coated tablets with "NDP 60" inscription on one side

4. CLINICAL PARTICULARS

4.1 Therapeutic indications

The clinical indications for Nifecard XL use are:
- arterial hypertension: chronic control
- coronary disease: chronically stable angina pectoris
  vasospasm angina pectoris
- hypertrophic unobstructive cardiomyopathy
- Raynaud's phenomenon
- primary pulmonary hypertension

Fig. 4: Part of SmPC of Nifecard® XL drug [11]

   - Pregnancy and lactation:
     The results of pre-clinical studies may be indicated, most frequently of teratogenicity. Furthermore, warnings are indicated as well as the possibility of use during pregnancy and breast-feeding.
   - Effect on ability to drive and use of machines:
     The effect is described of the drug on psychophysical abilities of a patient or abilities to drive and use of machines.
   - Undesirable effects:

All undesirable effects are indicated which may occur in drug application: severe, mild, frequent, rare.

- Overdose:
  The signs and symptoms are identified of a drug overdose as well as emergency measures if such overdosage occurs.

5. Pharmacological properties
- Pharmacodynamic properties:
  The mechanism of drug action is described as well as all its pharmacodynamic properties. Indicated are also clinical studies conducted in this field.
- Pharmacokinetic properties:
  Information on biological applicability, absorption, protein connection and distribution, metabolism, removal and elimination of drug.
- Preclinical safety data
  Data on preclinical tests, primarily toxicity test, teratogenicity test, mutagenicity test, carciniogenicity test and other tests.

6. Pharmaceutical particulars
- List of excipients
- Incompatibilities
- Shelf life
- Special precautions for storage
- Nature and contents of container
- Instructions for use and handling

7. Marketing authorisation holder
8. Marketing authorisation number
9. Date of first authorisation
10. Date of last revision of the text [11]

4 Data input process

Data input was made using the coding system of the World Health Organisation - ICD-10 translated into Slovene (ICD-10, International Classification of Diseases) in an electronic format. It is intended to direct review of codes and descriptions of diseases in computer application and it also provides a possibility of integration into the information systems at health care institutions for disease coding purposes. The classification is divided into twenty one groups with each disease being designated with a code. The codes are alpha numerical, ranging from A00.0 through Z99.9. A breakdown by categories is available as well as a list of categories containing a specific word or a set of letters to provide a two-way search (code/diagnosis, diagnosis/code). The coding system contains all codes and category names, but no notes, explanations and instructions for a correct use of the classification.

For the data input purposes all summaries of product characteristics (SmPC) were carefully checked. Every indication, contraindication, adverse effect and precaution, recorded in the SmPC, was identified and assigned a relevant code.

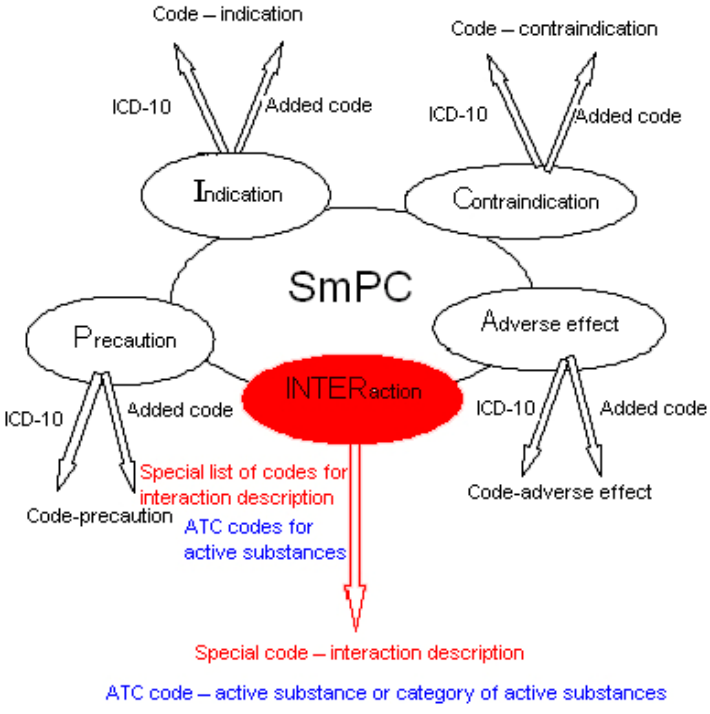


Fig. 5: Data input process algorithm

The code is taken from the ICD-10 list of codes. If no code can be found by means of the above list of codes for a specific indication, contraindication, adverse effect or precaution ('IKNO'), new six-character codes were added, mainly in precaution and adverse effect coding. A special list of codes was used for interaction coding, which was created as one of the records contained in the SmPCs. The most critical moment was recording or transformation of the text from SmPC into a code, hiding in it an indication, contraindication, adverse effect, a precaution ('IKNO') or an interaction in a WHO code or a code that has been added. In the identification of records in the SmPC and code assignment, the data from professional literature was used to find the correct code for each 'IKNO'. First, the relevant data was recorded in a table (Microsoft Word) and then the persons responsible for each category of information made the input of the data using the computer software into the above mentioned SQL relational database.

5 Conclusion

The Recipe database on medicinal products provides a helpful tool for the users. Similar databases exist in other countries and on the Internet [1-2], but this is a database on medicinal products in Slovene language, containing the data on drugs [11], registered in Slovenia.

Its usefulness is demonstrated at several levels. It offers quick access to the desired information, as the reading SmPCs is very time consuming. It is convenient for both, physicians and pharmacists because of its very fast and efficient search of major interactions and combinations of drugs. It also provides a rapid overview of indications, contraindications, adverse effects and precautions for each drug. In dispensing medicinal products the applicability of the software is demonstrated in automatic reference to interactions [12] between a combination of dispensed medicinal products. Pharmacists will also have an overall view of the data on 'IKNO' of each drug allowing them more efficient work. Physicians, on the other hand, will find it useful mainly in prescriptions writing. Many patients take various drugs concurrently which increases the risk of interactions between the active substances. This software will allow identification and successful exclusion of such interactions [13]. A physician will also be able to simply select a drug not causing any such side effects but having the desired indication.

A problem which occurred in the implementation of the project lied in the assignment of certain codes, where the information could not explicitly be given. In such case, a user will have to use the SmPC, accessible in the software. It may also happen that a specific code is used as an indication and a contraindication, which may create some confusion. In this case, a special note will flash, directing the user to the SmPC for a detailed explanation.

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