# Using an OPEN UMS format for document flow formalization in medicine

**A A Ponomarev[1], E S Merker[2], I O Korneva[2]**

[1] Tomsk Polytechnic University, 30, Lenina Ave., Tomsk, 634050, Russia
[2] UMSSoft, Ltd, 157 Lenina Ave, Tomsk, 634050, Russia

**E-mail**: aaponomarev@tpu.ru

**Abstract:** The question about construction of medical documents by means of AURRORA MIS with the use of the Open UMS format is considered in the work. The approach suggested allows data storage in the electronic form suitable for generation of required statistical reports and different researches and preserves a possibility of correct data interpretation.

## 1.    Introduction

Attempts to organize an electronic document flow in medicine have been made since appearance of corresponding computer equipment. However, they are still limited by statistical data acquisition and databasing with further creation of a set of documents that allow a medical institution to report to controlling bodies. The questions of using these data for improving the quality of healthcare provided for a patient remain without attention. However, the databases can be used in both operation of regional situation centers and treatment planning for a patient.

The attempts of different developers to solve the problem within medical information systems (MIS) resulted in more than 700 software products, which more or less consider patient health data.

The normative basis concerning medical document flow implementable within MIS first determines formal requirements for its content, second, the functional capabilities, and third, efficiency of the solution. The question of the inner structure and architecture of an electronic medical record (EMR) are not considered.

There are difference sources of data on the health status of population. One should remember that a patient is an owner of his healthcare record, except for records from a hospital, from where the corresponding data are entered into the patient's ambulatory record after finishing the treatment in the hospital. Until recent time, patients had no access to their electronic healthcare records, though the Ministry of Health of the Russian Federation declared this possibility many times. As a result, the form of EMR was established in the end of 2013; the content of the EMR has been determined and includes 15 parts: "Patient measures", "Test results", "Physical examinations", "Diseases and Sequelas", "Medicine Prescription", etc. [1, 2]. Without considering the details, one can see that the solution suggested can be implemented in different ways [3, 4].

One of the ways is the use of the Open UMS format that has been designed by the "UMSSoft, Ltd." [5]. The concept suggested has been developed within the complex AURORA MIS. A fragment of its structure is shown in Fig. 1.

Open UMS is a database of electron medical records; it allows filing, storage, and extraction of electron medical documents. The database was developed to unify medical data and simplify

informatization of medical institutions according to the Russian model of medical data synthesis and analysis. The database corresponds to international standards for medical data storage and communication, as well as standards for storage and communication of healthcare profile data. Information from the database can be used for construction of medical and other information systems.

The Open UMS database is represented by three models: the model of basic concepts, document structure, and representation. A visual interpreter is an additional element; it transforms the content of the models to a human-readable form.

One of the main features of an Open UMS-based database is convertibility of its data into the International ISO 13606 and CDA formats.

## 2.       Definition

Open UMS is a concept of medical recording, management, storage, and extraction based on a unique technology. It uses *basic templates* (**BTp**), which consist of *basic terms* (**BT**), and is intended for management of medical data, i.e., data on a patient, a diagnostic and treatment process, related procedures and prescriptions, including interventions, surgery, and drug therapy. Open UMS is an open format for description of medical and other data required for creation of a medical document.

## 3.       Purpose of Open UMS

The format if purposed for creation of a medical document of any type and purpose. In the context of an electronic patient's card, it is intended for EMR generation.

A medical document is a record about actions performed (examinations, laboratory tests and instrumental examinations, etc.) and special data; it consists of parameters grouped according to the sense parameters (groups of parameters). A document can be composite, i.e., it can consist of other documents. In the interface form, it is displayed as a single document including all groups of parameters and parameters of all documents composed it.

The structure of an electron medical record (EMD) (or, in a more common sense, an electron personal healthcare record EPHR) in the Open UMS format keeps a commonly accepted EMD structure: a document has a medical record descriptor that consist of a standard set of notions and terms related to a patient (Name, ID, social characteristics) and a medical institution (data on a doctor, MPI, medical insurance, and other obligatory parameters from a paper analogue of the EMD). It should be noted that this "rigid", fixed part of EMD is matched with a similar part in the Open EHR archetype ontology. This makes an Open UMS medical record compatible with other EMR systems, even in the absence of some optional machine-readable coding representations, e.g., of Entry type.

The same principle is supported for the variable part of medical documents: if some data are not necessary during a period, they are "invisible" in a system of a foreign standard, as well as the absence of some data related to patient examinations does not prevent recognition of those parameters of a diagnostic and treatment process, shown in the EMR, that serve a basis for matching two formats.

## 4.       Open UMS philosophy

The Open UMS format is an open format for data exchange and databasing. It assumes an open access to documents and a possibility of working with them via the Internet for both doctors and patients for any purposes. The Open UMS format allows document modification according to specific user's requirements, including a change in the context of a medical document. Medical data in the Open UMS format are loaded in the form of specified BTps, of a high clinical importance, with maintenance of the medical logic and the "paper record" logic and correspondence to traditions of doctor's work with medical documents. This increases the reliability of EMR data in the clinical point of view.

## 5.       Open UMS format nomenclature

Electron records related to a patient, the history of his visits to medical institutions are archived with the use of Open UMS instruments.

## 6.     Templates

Basic templates (BTp) is a ready form of a medical record that includes standard basic terms and spaces for filling with standard (with respect to standard terms) data. BTps allow data representation in a standard (in terms of accepted medical documentation standards) human-readable form; they can be matched with the corresponding Open HER archetypes.

## 7.     Open UMS format semantics

The Open UMS format is based on conceptions of the Russian medical school. The classical Russian medical school has formed certain standard approaches to creation, content, and interpretation of medical records during more than 100 years. Correspondingly, behavior patterns of doctors and nursing staff relative to medical documents have been formed. These patterns are reflected in the base of regulatory acts, reference materials, classifiers, and precedents; they have been transferred in the EMR form with preservation of their significance. Features of the Open UMS format are the total correspondence to the semantic basis of the Russian medical school, the use of commonly accepted terms, notations and order of medical documents. The Open UMS format uses the Latin alphabet for designation of all the terms and diagnostic procedures. In addition, reference material supported by the Open UMS format provides for matching with systems that uses well-known function-compatible data formats. Thus, due to codes accepted in foreign standards for medical records and the system of matching with the LOINC and SNOMED standard, the term "total cholesterol" becomes clear when requiring data on the diagnosis/treatment of a certain patient by a user of another format of medical records.

Open UMS medical records are based on BTs; they are constructed following the common clinical-anamnestic method of patient examination, which requires a quite large volume of different data and their combination in a special way individual for each doctor. Different types of data on a patient in a medical record are formed using a strictly organized interaction between BTp and BT. A BTp is an "owner" of BT (formed of them); in its turn, a BT has a dual level of owner-member relationship. In other words, a novel feature of the Open UMS format is an approach to EMR construction on the basis of assembling BTs into a BTp; a BTp in this case can be both an independent medical record in the case of BTp of a static class and an element of other BTPs.

The Open UMS format corresponds to common forms of medical knowledge accumulation, storage, and transfer. In addition, it suggests the use of pre-configured electronic forms of medical records. The strictly organized BTp system allows creation of special medical records of different purposes.

Let us consider a medical document "Physician profile" as an example. The doctor profile (BTp) Physician assumes the use of following BTps and BTs.

A. **OVT**. The Outpatient Visit Ticket BTp is filled with the standard passport data: name, sex, ID, address registered, social status, disability, card number, date of visit, date of the next visit. In addition, data on the physician, type of payment, insurance company, place of service, aim of visit, and the results are kept in this BTp. In the case of a trauma, its type is also pointed. The data on the certificate of temporal incapacity of work is filled.

B. **Complaints.** BTp has a full range of values, which allows formal representation of the presence and character of subjective symptoms.

C. **Anamnesis vitae**. A BTps included in all doctor profiles as a structure element. It consists of individual BTs and provides for information about Individual development, Living conditions, Previous diseases, Surgeries undergone, Marital status, Hereditary background. It includes such BTs as Gynecologic history, Present job; determines Social habits in the BTs Smoking, Alcohol (status), Drugs, Other social habits; includes the BT Blood transfusion, where the data on previous transfusions are entered.

D. **Pharmacological anamnesis.** The data on intake of drugs and hormonal preparations are entered in the dialog box of the BTp.

E.  **Allergic anamnesis.** There is a BT Allergic anamnesis within the BTp Physician. It takes a wide maximally full spectrum of values that allows one to detect not only the allergic load but also detail parameters of the allergy if there is. The BT includes pre-configured answers: Diathesis in the childhood (type); Intolerance to: medication (aminoglycosides, aspirin, B vitamins, macrolides, penicillines, pyrazole, tetracyclines, novocaine, sulfanilamides, NSAID), foods (strawberry, apples, crabs, fish, citrus fruits, chocolate, eggs, nuts); household chemistry (dyes, lacquers, laundry powders, cleaning means, cosmetics, perfume); household allergens (book and house dust); pollen allergens (tree pollen, grass and cereal flowering, flower pollen); cold. A possibility of allergy type detection is implemented in the BTp (single cases or diagnose); allergy manifestation (asphyxia, anaphylactic shock, skin eruption, conjunctivitis, sneezing, rhinitis, urticaria, Quincke's edema, skin itch); specific nosology (seasonal pollen allergy, seasonal rhinitis, seasonal asthma). If the case of dispensary observation, an allergist has a possibility of entering the year and nosology (concerning allergic rhinitis, bronchial asthma, neurodermatitis, atopic dermatitis, seasonal pollen allergy, and urticaria).

F.  **Anamnesis morbi**. The BT includes data on the case and history of the current disease.

G.  **Status presence**. The BTp consists of the following BTs: General condition; Neuropsychic status; RHR; Temperature; Blood pressure; Height; Weight; Constitution; Musculoskeletal system; Joints; Subcutaneous fat; Lymph nodes, etc.
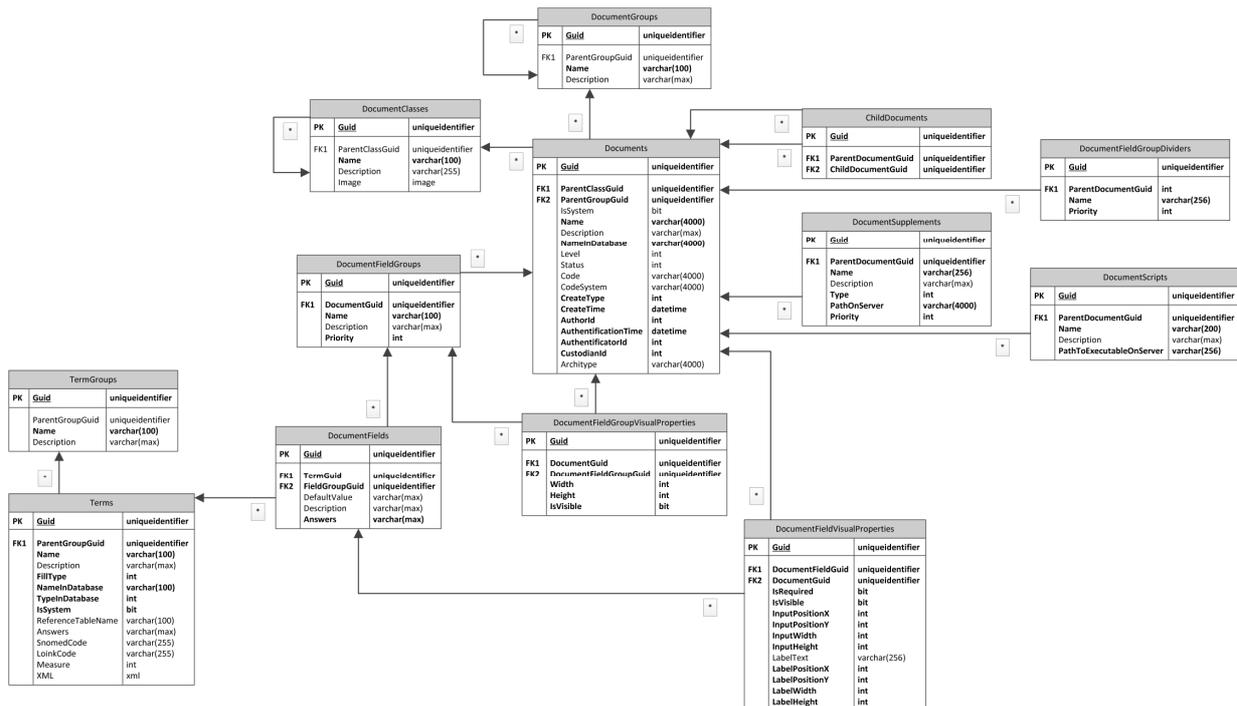


**Figure 1.** The open UMS BD structure

## 8.  Conclusions

The approach suggested allows final implementation of MIS interfaces, neglecting the physical implementation of storage inside a database, since the architecture suggested not only organizes the inner structure of the BD, which allows generation of required reports, but also allows automated construction of interfaces for working with source documents [6].

More than 200 BTps and about 1000 specialized documents have been developed by now and are supported in the system. The suggested approach to storage of medical and other data allows the context of documents in the system to be adopted depending on the institution profile without

involvement of the developers, using [7]. This approach allows a decrease in the cost of the system implementation.

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