Slovak medical terminology
Is a worldwide interoperability in medicine possible?

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Abstract. We have identified the key role of the importance of national medical terminologies and the key role of syntactic tools in the creation of electronic health record. We propose actions to achieve full semantic interoperability across not only European but global worldwide health systems. The health is not a privilege of English speaking people.

Keywords: Electronic Health Record, Medical Terminology, Semantic Interoperability, eHealth

1. Introduction

The specific natural communication tool of the man is the language. The elements of the languages are organized in vocabularies, dictionaries, lexicons, thesauri, encyclopaedias etc. [28, 35, 38, 55, 61]. There is no science or human activity for which the communication is so important as it is for medicine and health care [29, 30]. Therefore, medicine has always paid an extraordinary attention to ontology and terminology [22, 24, 27, 38, 44, 47, 49, 53, 60, 66]. There is, however, a considerable disunity in the field of medical terminology on the meaning of several concepts, terms, names including the names of drugs [20, 33, 36, 50, 69].

In the era of information communication technology man's powerful tool is the **computer science** [11, 23, 30, 31, 34, 37, 43, 45]. It enables to carry out the healthcare more effectively than ever before. In medicine and healthcare, during the implementation we encounter, however, with many barriers that make the understanding between the **man – machine – man** difficult if not impossible. The machine does not understand neither concepts nor terms without coding. The man, other hand, does not understand encoded concepts or terms in a strange language. Therefore, there must be a way of translating concepts into a digital form [encoding] and even a way of translating encoded concepts from a source language into a target one. There are, in our opinion, only one way how to try to solve this problem – each participant of the Unified Medical Language System must posses their own national coded terminology – e. g. translation of SNOMED CT. Thus can be obtained a national dictionary – a system of encoded concepts or terms with their semantic meanings. Their aim is to generate machine/understandable representations of medical concepts. This would facilitate its adoption as the standard for medical knowledge representation in biomedical informatics [40].

For more than 15 years, the European Commission has recognized the importance of **terminologies and interoperability** by funding research in these fields. The roots of policy efforts to improve interoperability are grounded in the European eHealth Action Plan of 2004 and are followed by number of joint activities with Member States, supported by European projects. One of such projects, the SemanticHEALTH, have elaborate a roadmap that point to various challenges and the respective domains where action is required on the path to achieving semantic interoperability in support of European health services. A policy of incremental steps and a focused, modest approach to terminology development in an open, collaborative environment is the ultimate recommendation following from the project's work [3, 4, 23, 58].

The issues of **technical standardization are no longer the most prominent ones** in realizing the interoperability. The most challenging part still to achieve is semantic interoperability of Electronic Health Record systems. It plays a prominent role in the recently published Recommendation on Interoperability of Electronic Health Record Systems (COM(2008)3282). It calls not only for interoperability at regional and national level but also at EU level – a goal which realistically might take another **20 years** to be fully achieved [58].

As far as we know, however, there are no studies on interoperability between medical terminologies in the countries of the Slav community. It is, therefore, an important challenge to form prerequisites, – organizational, institutional as well as personal ones – for the development of semantic and syntactic tools enabling the interoperability between the languages of member states of EC and Slav languages.

2. What does semantic interoperability mean?

According to the Recommendation of EC semantic interoperability [58] means ensuring that precise meaning of exchanged information is understandable by any other system or application not initially developed for this purpose, whereas computer interoperability of electronic health record means the ability of two or more electronic health record systems to exchange both computer interpretable data and human interpretable information and knowledge [58].

There are **four levels of interoperability,** two of them relating to semantic interoperability (SIO). To explain and distinguish the 4 different levels, consider the following scenario [58]: 50-year old patient recently moved from Slovakia to Ireland to take up his new job. A few weeks after arrival, he falls ill, consults his local (Irish) general practitioner (GP) and is transferred to the next hospital for further tests. Depending on the level of established SIO the hospital has to initiate the following steps:

Level 0 – no interoperability at all: The patient has to undergo a full set of lengthy investigations for the doctor to find out the cause of his severe pain. Unfortunately, results from the local GP as well as from his Slovak GP are not available at the point of care within the hospital due to the missing technical equipment.

Level 1 – technical and syntactical interoperability: patient's doctor in the hospital is able to receive electronic documents that were released from the Slovak GP as well as his local GP upon request. Widely available applications supporting syntactical interoperability (such as web browsers and email clients) allow the download of patient data and provide immediate access. Unfortunately, none of the available doctors in the hospital is able to translate the Slovak document and only human intervention allows interpretation of the information submitted by the local GP to be added into the hospitals information system.

Level 23 – partial semantic interoperability: The Irish hospital doctor is able to securely access, via the Internet, parts of patient's Electronic Health Record released by his Slovak GP as well as by the local GP that he had visited just hours earlier. Although both documents contain mostly free text, fragments of high importance (such as demographics, allergies, diagnoses, and parts of medical history) are encoded using international coding schemes, which the hospital information system can automatically detect, interpret and meaningfully present to the attending physician.

Level 3 – full semantic interoperability, co-operability: In this ideal situation and after a thorough authentication took place, the Irish hospital information system is able to automatically access, interpret and present all necessary medical information about the patient to the physician at the point of care. Neither language nor technological differences prevent the system to seamlessly integrate the received information into the local record and provide a complete picture of the patient's health as if it would have been collected locally. Further, the anonymous data feeds directly into the tools of public health authorities and researchers.

It must be kept in mind that SIO implementation also depends on social, cultural and human factors within respective organisation, region and country, system and time period.

3. Classification, Nomenclatures and Thesauri

Statistically reliable data based on qualified **classifications** are essential for an efficiently regulated Health Care System [35, 38, 55, 61]. Appropriate classifications help to unite various medical terms. [5, 42, 51, 52, 68], There are many classification systems in medicine and Health Care Systems, as follows

ICD [10] – International Classification of Diseases released by the World Health Organization [WHO] serves globally as a diagnosis related classification and is the basis for internationally comparable mortality. However,

many countries have issued their own version of ICD. For example Deutsches Institut für medizinische Dokumentation und Information [DIMDI], in GB ICD-9 is still in use and so on.

There are also versions of ICD-10, such as **ICD-O-3** – a special adaptation for the documentation of tumours, **ICF** – International classification of Functioning, Disability and Health. It is a result of medical progress and the rising life expectancy age, chronic illnesses and the treatment of persons with permanent defects. The concept of "disease" itself is no longer sufficient to describe the population's state of health etc. [67].

MeSH – the Medical Subject Headings, a medical thesaurus published and annually updated by the US National Library of Medicine (NLM) in Bethesda (Maryland, USA). It is used for cataloguing library holdings and indexing databases that are produced by the NLM (e. g. MEDLINE). Since a comparable thesaurus is missing, the MeSH has been translated into many languages including Slovak and among others also German [46].

UMLS – United Medical Language System that includes medical terms and semantic relations between them. The terms originate from about 100 heterogeneous conceptual order systems and medical nomenclatures of many languages. DIMDI for example supplies extensive German-language vocabularies to the UMLS annually and, in the meantime, has made German second most frequent language in the Metathesaurus [64].

SNOMED CT® (Systemized Nomenclature of Medicine Clinical Terms) & **IHTSDO** (International Health Terminology Standards Development Organization in Copenhagen [Denmark] was formed in 1991 by USA's SNOMED RT and UK's CTV3 (Read codes). SNOMED CT owned by the College of American Pathologists [Northfield, DC] [32,52, 56, 57].

SNOMED CT® is a comprehensive clinical terminology that provides clinical content and way of expressing for **clinical documentation and reporting**. It can be used to code, retrieve, and analyse clinical data. The terminology comprises concepts, terms and relationships with the objective to precisely represent clinical information across the scope of health care. Content coverage is divided into 19 hierarchies (e. g. clinical finding, procedure, observable entity etc.).

SNOMED CT provides a **standard for clinical information**. Software application can use concepts, hierarchies, and relationship as a common reference point for data analysis. SNOMED CT serve as a foundation upon which health care organizations can develop effective analysis applications to conduct <u>outcomes</u> research, evaluate the quality and cost of care, and design effective treatment guidelines.

Standardized terminology can provide benefits to clinicians, patients, administrators, software developers and payers. Clinical terminology can assure/offer health care providers more easily accessible and complete information pertaining to the health care process (medical history, illnesses, treatment, laboratory results, etc.) <u>and thus can</u> result in improved patient <u>outcomes.</u> A clinical terminology can allow a health care provider to identify patients based on certain coded information in their records, and thereby facilitate follow-up and treatment.

We would like to inform you about **<u>some problematic issues</u>** with which we are often encountered in the creation of Slovak medical terminology and translation of SNOMED CT®.

The vocabulary used to describe terminologies, ontologies, and classification systems has always been a source of confusion, since different authors used the same words differently.[58]

4. Unified medical languages and communication barriers

Most considerations about eHealth are based on a false assumption that there exists an **unique international terminology** (Latin-Greek or English) and it is only a question of time, when all countries will accept and employ it. The history, however, teaches us that there is no nation that renounces its mother tongue <u>of its own free</u> will, even if it would be for it favourable [29, 30].

Unfortunately, the health care administrators and health care providers are not aware of all real requirements in computerization of medicine and health care system. There are many obstacles that hinder the employment of computers and the implementation of information systems in practice.

The **communication barriers** are various, as follows:

▪ **linguistic regional barriers** – there are about 3000 thousand languages in the world [without dialects]` the question is: should all the nations have their own medical terminology?

▪ **interpersonal barriers** – doctor/patient, doctor/other health professionals (it is difficult for the layman to understand many professional terms: should be the medical terms for the patient's sake expressed in colloquial language?)

▪ **interdisciplinary barriers** – each science has its own language as one of its main characteristics, has its own tools and rules; the language has a function as the organizer of the knowledge etc. (the are more than 100 medical disciplines or branches with their own terminologies; e. g. Terminologia anatomica, Nomina histologica and Nomina embryologica, which act as standards in their fields [1,8, 10, 13 – 18, 21, 22, 39, 48, 54, 59, 62, 70, 71]. These terminologies are available only in Latin and English and their worldwide adoption is subject to the addition of terms from other languages; on the other hand, Nomina anatomica, the previous standard, has been widely translated)

▪ **legislative barriers** – there are many conventional nomenclatures, classifications and other systems reached by mutual achievement between professional or scientific associations, e. g. example Systѐme International of Units and Quantities – SI, International Union of Pure and Applied – IUPAC International Federation of Clinical Chemistry etc.

▪ **Alphabetical differences** – Cyrillic, Chinese etc. scripts

▪ However, the main problem that could be most easy solved is the discrepancy between **US and European terminologies and standards**

A medical terminology enables the employment of information and communication technology in making the health care system more effective and economically favourable.

Based on the SNOMED CT® every language can formulate its own medical terminology, i. e. its own **extension** of the core. A number of incorrect and misleading terms are to be replaced. Each term must have a unique code number and must be supplied with a national equivalent. The use of eponyms is discouraged, but a list of well known ones should be appended to facilitate accessibility of older literature. Relevant suggestions about amendments are eagerly awaited and a broad basis of endorsement among the medical scientific world is hoped for.

The nomenclature is presented either per system or organ or according to the main domains of the medical science and health care. An alphabetic index follows medical terminology as well as English and Latin medical terminology list. These translation products should be edited in form of national terminological dictionaries [41, 42].

The creation of coded national medical terminology is, however, only one part of the problems. If we have a dictionary, it does not mean, that we are able to form sentences, statement, judgements and so on. Each interested party or the system as a whole must have available **syntactic tools** for forming electronic health records and similar products.

We consider the work on the creation of **national coded medical terminology** as a starting point for any further activities associated with the computerization of the healthcare system.

The **National eHealth Strategy** included in the implementation priorities for eHealth development in Slovakia a possibility of the existence of the **national terminology** as a prerequisite, something for granted, but which really in a consistently and coded form does not exists.

The most important issues of the National eHealth Strategy comprise these tasks:

■ development of the National Healthcare Information System

■ healthcare related national portal for both, professionals and public

■ upgrading the network of national healthcare providers with provisions for domestic and international interoperability

■ citizen and professional electronic health identification cards

■ ePrescription/e-Medication

■ active participation in development of electronic health record in close cooperation with EuroRec and ProRec Center Slovakia

■ telemedicine and independent living

■ ICT supported home – health and social – care systems [65]

■ knowledge based advisory and decision support (expert) systems for general practitioners, clinicians, and management

■ introduction of the surveillance systems with regard to clinical practices, patient, safety, and quality of care certification of clinical guidelines

■ application of ICT and healthcare related standards (from CEN TC_{251} and ISO_{215}, SNOMED CT, HISA, DICOM, …)

5. Summary and propositions

As the most important tasks in the field of the computerization of eHealth we can consider:

1. **Unification of International systems** of terminology, nomenclature and classification (SNOMED CT, MeSH, ICD, SI etc.) and their worldwide acceptance. Unfortunately, disunity of expression of names of units and quantities still persists mainly in physics, chemistry and biochemistry, e. g. of the names of measures, weights, lengths etc.

2. Creation of a system of **coded unified and certificated national medical terminology** as a whole and according it particular domains (biology and genetics, anatomy, histology, embryology, individual disciplines of clinical medicine and paramedical sciences and so on); elaboration of a database of preferred medical terms and of their synonyms and eponyms.

3. Inclusion of the medical terminology in the national thesauruses (Corpus) and coordination of terms from other related discipline ("exact" sciences, as biophysics, biochemistry and molecular biology, "metatheoretical" sciences, as biomathematics, biostatistics, etc., psychology, sociology, ethics etc.).

4. Establishment of an **Expert Committee for settlement of a Consensus between Slave nations** in the field of coded medical terminology that will enable interoperability between them in terms of worldwide medicine without frontiers.

5. Putting a section (column) in the web side of JULS with editorial board as an informal body devoted to the **international questions of medical terminology.**

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