Predefined headings in a multiprofessional electronic health record system

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ABSTRACT

Background Applying multiprofessional electronic health records (EHRs) is expected to improve the quality of patient care and patient safety. Both EHR systems and system users depend on semantic interoperability to function efficiently. A shared clinical terminology comprising unambiguous terms is required for semantic interoperability. Empirical studies of clinical terminology, such as predefined headings, in EHR systems are scarce and limited to one profession or one clinical specialty.

Objective To study predefined headings applied by users in a Swedish multiprofessional EHR system.

Materials and methods This was a descriptive study of predefined headings (n=3596) applied by 5509 users in a Swedish multiprofessional EHR system. The predefined headings were classified into four term and word categories.

Results Less than half of the predefined headings were shared by two or more professional groups. All eight professionals groups shared 1.7% of the predefined headings. The distribution of predefined headings across categories yielded two-thirds "terms for special purposes" and "specialist terms" and one-third "common words" and "unclassified headings".

Discussion The indicated presence of profession-specific predefined headings and the conflict between ambiguity and comprehension of terms and words used as headings are discussed.

Conclusions The predefined headings in the multiprofessional EHR system studied did not constitute a joint language for specific purposes. The improvement of the quality and usability of multiprofessional EHR systems requires attention.

BACKGROUND

Health records are an important tool for documenting and exchanging healthcare information, as well as a beneficial means of communication between healthcare professionals.¹ Health records should also serve as a source of information for patients according to the Swedish Patient Data Act.² Applying multiprofessional electronic health records (EHRs) is expected to improve the quality of patient care and patient safety by providing unambiguous and complete information about patients' health to healthcare professionals when and where it is needed.³

The need of structure of Swedish patient health records

The first standardized form for health records in Sweden was introduced in 1863, establishing a more administrative approach to healthcare documentation. Concurrent with the large expansion of the primary care health centers in the 1960s

a common structure of health records was required in order to facilitate the communication of healthcare information between healthcare professionals. The objectives were to accomplish a uniform health record with contents which were clear, easily understandable, and searchable and to minimize extensive narrative notes. For that purpose the concept predefined heading—that is, a section title, was introduced as a national recommendation.⁴ Professional groups and clinical specialties have since then independently of each other developed predefined headings according to their own specific needs.⁵ When EHR systems were first introduced in the 1990s the new technology was considered a powerful tool for reaching the objectives already articulated in the 1970s. In EHR systems, electronic templates comprise headings, below which narrative text is entered by the professional.^{6,7} The basic structure of Swedish EHR systems comprises templates consisting of headings, predefined by professional groups and clinical specialists for inpatient and outpatient care.⁵ Consequently, a single template may include only a few or up to nearly 100 headings and subheadings predefined by each profession based on their perceived clinical-specific or profession-specific needs. Before entering a note, the user marks and clicks on that predefined heading in the template that he or she considers is the most appropriate one below which the narrative text should be entered. The predefined headings constitute the searchable units in Swedish EHR systems and are a part of the clinical terminology in the EHR system. The narrative text in EHR systems is not searchable. A typical sample from an EHR system, a physician's note, is presented in figure 1.

Clinical terminology: language, words and terms

A clinical terminology is defined as a collection of standard terms used in clinical practice to support the recording of complaints, signs, symptoms, circumstances, process of illness, interventions, results, diagnoses, and care-provider decisions.⁸ A clinical terminology can be seen as a clinical language made up of words and terms. Typical categories of language are "common language" and "language for specific purposes".^{9,10} The category "common language" is made up of *words* used in everyday language that are often vague and ambiguous.⁹ The category "language for specific purposes" comprises *terms* that are more consistent and less ambiguous. This category is applied by professionals in specific fields.^{9,10} The sociolinguist Melander Marttala proposed that all terms and words, including abbreviations, describing health and medical conditions, could be organized into a triangular model

Figure 1 A translated sample from a Swedish electronic health record system, a physician's note, with predefined headings, subheadings and narrative text (headings on the left-hand side and narrative text on the right-hand side). BMI, body mass index.

Anamnesis	
Contact cause	Seeks the surgery for swollen legs since a couple of days and slight breathlessness.
Heredity	Father died of heart attack
Former health issue	2002 surgery. Cemented hip prosthesis right
On-going health issue	Hypertension
Current health issue	Describes slight breathlessness on exertion since last week, experiences that the socks are tightening over the ankles already in the morning. Need to get up several times at night to urinate.
Hypersensitivity	Not known
Status	
Heart/circulation	Neck veins slight stasis Pitting oedema over the ankles Extra tone audible 100 beats/min (60–90)
Rhythm	
Rate	
Lungs/respiration	Rattle left side
Abdomen	No remarks
Height	182 cm (50–200)
Weight	96 kg (0–300)
BMI	29.0 kg/m ² (22–30)
Assessment	
Assessment health issue	Suspected heart failure
Interventions	
Investigation	Referral echocardiography within 24 h
Diagnoses & action code:	Main diagnosis: I509 Heart failure, unspecified

with three levels. The top of the triangle comprises “specialist terms”—that is, highly specialized terms that only trained healthcare professionals can master. The middle level is made up of “terms for specific purposes”—that is, expressions such as *injection*, *edema*, and *artery* that people in general may understand. “Common words”—that is, common vocabulary applied when describing a disease, symptom, or parts of the body, which most people in general are familiar with, is placed at the base of the triangle. The top of the triangle contains a few consistent and unambiguous terms and the base contains a large number of vague and ambiguous words.¹¹ (figure 2).

Clinical terminologies across and within professions

The content of clinical terminologies may differ across healthcare professions. For example, it has been shown that anatomists, pathologists, electrocardiographists, cardiac imagers, and clinicians use different denominations of left ventricular walls.¹²

Figure 2 A triangular model with three levels of terms and words, “specialist terms”, “terms for specific purposes”, and “common words”, pertaining to health and medical conditions (modified from Melander Marttala, ¹¹1998, p.7).

Another example concerns the documentation of skin ulcers, in which different professions use various clinical terminologies and thus the characteristics of skin ulcers cannot be reliably assessed retrospectively.¹³ Several attempts have been made to develop shared clinical terminologies in order to meet clinical-specific or profession-specific needs.^{14–16} Examples of terminologies developed for clinical-specific needs—that is, across professions, are a classification of breast imaging,¹⁷ and a terminology for location of myocardial infarcts.¹² Moreover, nursing terminology in the USA,¹⁸ the integration of nursing terms into National Health Service’s Read Codes in the UK,¹⁹ and predefined headings for nursing documentation in Sweden²⁰ are all examples of clinical terminologies developed within a profession.

Ambiguity of terms in clinical terminologies across and within professions

To avoid ambiguity of terms in clinical terminologies it is necessary to ensure that the precise meaning of the exchanged information is shared by those concerned. Ambiguity of terms in clinical terminologies is reported, both across and within professions. In a survey of lists of terms, in which textual descriptions were compiled by different professional associations, identical terms in the lists were found across the professions, but with different textual descriptions.⁵ Empirical studies have demonstrated ambiguity of terms applied across professions.^{21–22} In one study general practitioners reported that chiropractic and osteopathic terminologies were more often confusing than physiotherapy terminology, which was more familiar to the practitioners.²¹ In another study clear differences were found in the understanding of medical and psychological terms across physicians, registered nurses, and other health professions.²² Ambiguities of terms within a profession were noted in a study of recommended terminologies for nursing. The results showed that the same term for different concepts (homonym), or different terms for the same concept (synonym), occurred in the recommended terminologies.²³ Another example of ambiguities of terms applied within a profession is given in an empirical study of communicating and evaluating care, which showed that registered nurses used homonyms.²⁴

Semantic interoperability and EHR systems

Semantic interoperability is defined as follows: the precise meaning of information can be comprehended by both humans and computer programs²⁵ and the information exchanged is unambiguous.^{26–30} EHR systems and system users depend on semantic interoperability to function efficiently.²³ A common clinical terminology is, according to Ferranti, Musser, Kawamoto, and Hammond, required to achieve semantic interoperability in an EHR system.³¹ However, if predefined headings (a part of a clinical terminology) in EHR systems differ across professions and consequently may be ambiguous, semantic interoperability is hampered.³² From this it may follow that improvement in quality and usability of healthcare information is less likely to take place.³³

Problem

Multiprofessional EHR systems are increasingly being used in healthcare, which affects a large number of patients and professionals. In order to be an efficient tool EHRs need to fulfill a variety of requirements, such as being available, functional, uniform, clear, easily understandable, and searchable. Empirical studies of clinical terminologies in EHR systems are scarce and the few studies available are limited to one profession or one clinical specialty. The Swedish EHR is multiprofessional and the searchable predefined headings in the templates constitute a part of the clinical terminology. To our knowledge, there are no empirical studies of applied predefined headings in a multiprofessional EHR system that include multiprofessional groups.

OBJECTIVE

The aim was to study predefined headings applied by users in a Swedish multiprofessional EHR system. The research questions were (1) To what extent are predefined headings shared across professional groups? (2) How are the predefined headings distributed across term and word categories (“specialist terms”, “terms for specific purposes”, and “common words”)?

MATERIALS AND METHODS

This was a descriptive study of applied predefined headings in a Swedish multiprofessional EHR system.

Material

The study was carried out in Uppsala County Council with five healthcare service divisions. In four of these divisions, a multiprofessional EHR system was fully implemented. The EHR system comprised templates consisting of predefined headings. The users only applied one or several of the predefined headings in the templates that they felt were required for the narrative text they were about to enter into the EHR. All entered notes including applied headings were consecutively stored in a database. During a 12-month period, all predefined headings in the EHR system, applied by a total sample comprising all active healthcare professionals in the four healthcare service divisions and obligated to document according to the Swedish Patient Data Act,² were included. Predefined headings applied by dieticians (n=43), medical social workers (n=176), occupational therapists (n=137), physicians (n=1788), physiotherapists (n=266), psychologists (n=171), registered nurses (n=2886), and speech and language pathologists (n=42) were included, representing 66% (n=5509) of all system users (n=8348).

Procedure and data collection

The first author obtained access to the database from the owner of the EHR system. The following keywords were used:

“heading”, “profession”, “number of professionals”, and “number of records”. The collected data, 3596 predefined headings applied on 20398104 occasions during a 12-month period, were compiled into a single matrix in a spreadsheet data file. The data comprised predefined headings and subheadings presented on the left-hand side in figure 1. The study was reviewed by the regional ethics review board in Uppsala, Sweden (Dnr 2009/186).

Data analysis

The spreadsheet data file was used for calculations and descriptive statistics.

Predefined headings shared across professional groups

The number of predefined headings shared across professional groups and the proportions of shared predefined headings across the groups in the EHR system were calculated and described.

Distribution of predefined headings across term and word categories

The collected predefined headings applied in the EHR system were classified into term and word categories to reflect the ambiguity of each heading. The headings were classified by the first author according to the three categories employed by Melander Marttala,¹¹ and an additional category. The Swedish Academy Glossary³⁴ and a medical healthcare dictionary³⁵ were used in the classification. Predefined headings that occurred in the Swedish Academy Glossary without any explanation were classified as “common words”. “Terms for specific purposes” had one or more explanations, or a note, showing to which language area it belonged (eg, <med.> for the medical area). Predefined headings not found in the Swedish Academy Glossary but in the medical healthcare dictionary were classified as “specialist terms”. The Swedish language includes composite words (eg, *patient safety* becomes *patientsafety*). When classifying such predefined headings, the composite words were classified one by one. The most complex word/term determined the category for the heading (eg, *patient* was classified as “terms for specific purposes” and *safety* was classified as “common words” and therefore the heading *patientsafety* was classified as “terms for specific purposes”). Those predefined headings that were not found in the Swedish Academy Glossary³⁴ or in the medical healthcare dictionary³⁵ were classified into an additional fourth category—namely, “unclassified headings”. This procedure was strictly followed. To ensure the quality of the classification procedure every 10th heading was reviewed a second time by the first author. In that review, 45 predefined headings (10%) were found to be incorrectly classified. The total number of predefined headings per term and word category and the number of predefined headings per term and word category shared by all professional groups were calculated and described. Further, the proportion of predefined headings per term and word category and professional group was calculated and described.

RESULTS

Predefined headings shared across professional groups

In total, 40.7% (n=1465) of the predefined headings applied in the multiprofessional EHR system were shared by two or more professional groups and only 1.7% (n=62) of the predefined headings were shared by all eight groups. The professional groups shared predefined headings to a varied extent. The distributions of the shared predefined headings proportional to the number of headings applied by each professional group are presented in figure 3.

Figure 3 Distributions of shared pre-defined headings (n=3596) in proportion to the number of headings applied by each professional group, dieticians (n=245), medical social workers (n=420), occupational therapists (n=498), physicians (n=1802), physiotherapists (n=1076), psychologists (n=527), registered nurses (n=1890), and speech and language pathologists (n=265) (in per cent).

Seven of the eight professional groups shared most of their predefined headings with registered nurses. The eighth group, occupational therapists, shared most of its predefined headings with physiotherapists. Physiotherapists overall shared least number of their predefined headings with other professional groups. The largest proportions of shared predefined headings were found among medical social workers, who shared 76% of their predefined headings with registered nurses, and occupational therapists, who shared 76% of their predefined headings with physiotherapists. The minimum proportions of shared predefined headings were found among physicians, who shared only 7% of their predefined headings with speech and language pathologists and 8% with dieticians. Registered nurses shared only 8% of their predefined headings with speech and language pathologists and 9% with dieticians. The following pairs—

medical social workers and psychologists, as well as physicians and registered nurses, shared between themselves more than 50% of their predefined headings.

Distribution of predefined headings across term and word categories

The predefined headings applied in the multiprofessional EHR system were classified into four term and word categories. Most predefined headings were classified as “terms for specific purposes” (46%, n=1639) followed by “common words” (28%, n=1016). The fewest number of predefined headings was classified as “specialist terms” (13%, n=464) and “unclassified headings” (13%, n=477). The predefined headings shared by all groups (n=62) were classified as “terms for specific purposes” (n=29), “common words” (n=32), and “unclassified headings”

($n=1$). The distributions of the four categories in proportion to the number of headings applied by each professional group are presented in figure 4.

Physiotherapists (12.7%), physicians (12.3%), and registered nurses (10.5%) applied the most “specialist terms” while medical social workers (0.7%) and psychologists (1.1%) applied the fewest. The eight professional groups applied “terms for specific purposes” from 42.0% to 49.5%. Dieticians (49.8%) applied the most “common words” while physiotherapists (29.2%), physicians (29.4%), and registered nurses (30.8%) applied the fewest. Of all “unclassified headings”, physiotherapists (16.2%) applied the most and dieticians (2.4%) the fewest.

DISCUSSION

The county council from which data were retrieved had fully implemented a joint multiprofessional EHR system in four healthcare divisions. In this study all EHR system predefined headings applied by employees in eight selected professional groups, which represented more than half of all system users, were included. The data comprised 3596 predefined headings applied on 20398 104 occasions. The narrative text was not included in the study.

Predefined headings shared across professional groups

In this study the extent of a shared clinical terminology was described by analyzing to what extent professional groups shared predefined headings. The results showed that only 1.7% of the predefined headings were shared by all eight professional groups and less than half (40.7%) of all applied predefined headings were shared by two or more groups. Hence, 59.3% of the predefined headings were not shared at all. Typically, clinical terminologies are developed to meet profession-specific needs.^{14 16} It is suggested that each group had incorporated their own specific clinical terminology as predefined headings into the multiprofessional EHR system. These results reflect the developing process of terminologies in Sweden. In this study, professional groups mutually shared predefined headings in different ways. Seven of the eight professional groups shared

most (39–76%) of their applied predefined headings with registered nurses. The registered nurses, who are at the forefront of the healthcare organization, need to communicate with all professions to fulfill their assignments and thus may be familiar with, and have started to apply, some of the predefined headings typically applied by other professional groups. Alternatively, the other professional groups, for reason of their close communication with registered nurses, applied some of the registered nurses’ predefined headings. Two pairs—four professional groups—mutually shared more than 50% of their predefined headings between themselves—that is, the pair registered nurses and physicians and the pair medical social workers and psychologists. It is suggested that these groups mutually shared more predefined headings than other groups because their areas of expertise to some extent overlap.

Distribution of predefined headings across term and word categories

The first author applied the data analysis model used by Melander Marttala in a study of mutual understanding between physicians and patients. Melander Marttala classified terms and words concerning health and medical conditions into three term and word categories from video-recorded conversations.¹¹ The classification procedure was described in detail and was easy to follow. Predefined headings that did not fit into any of the three categories were classified as “unclassified headings”. In the check of incorrectly classified headings, only 10% of the headings were found to be incorrectly classified, which was considered as an acceptable misclassification rate. All predefined headings with multiple meanings in the Swedish Academy Glossary were classified as “terms for specific purposes”, although such predefined headings could be appraised as everyday language. An example is the heading *drink*, which, because it has multiple meanings, both a noun (a drink) and a verb (to drink), was classified as “terms for specific purposes”. By an alternative classification procedure, these predefined headings might have been classified as “common words”.

The data analysis procedure used was selected because it was the only analysis procedure found to have been previously

Figure 4 Distributions of four term and word categories “specialist terms”, “terms for specific purposes”, “common words”, and “unclassified headings” in proportion to the number of headings applied by each professional group, dieticians ($n=245$), medical social workers ($n=420$), occupational therapists ($n=498$), physicians ($n=1802$), physiotherapists ($n=1076$), psychologists ($n=527$), registered nurses ($n=1890$), and speech and language pathologists ($n=265$) (in per cent).

employed in a partly similar setting and thus considered suitable to the objective of the study. Unambiguity of terms in a shared clinical terminology is required for semantic interoperability in EHR systems. Abbreviations, which are a common cause of confusion, were present in all four term and word categories and did not stand out in the analysis of data. The professionals were not asked about how they understood the predefined headings they applied, which might have provided additional information—for example, if two or more professional groups applied homonyms or synonyms.

It can also be discussed whether sorting into these categories truly reflected the ambiguity of the predefined headings in the EHR system studied. In healthcare more “specialist terms” and fewer “common words” are expected to facilitate mutual understanding, as the “specialist terms” are more consistent and unambiguous than “common words”.⁹ It could be expected that a professional group that applies a large number of “specialist terms” shares a high level of mutual understanding in the EHR system. On the other hand, “specialist terms” can be incomprehensible to other professional groups and patients. However, the registered nurses, the physicians, and the physiotherapists, who applied the largest number of “specialist terms” and the smallest number of “common words”, were likely to share more mutual understanding within their groups. Further, the dieticians who applied the largest number of “common words” could be expected to run a higher risk of ambiguity within their own professional group. Dieticians applied a large number of “common words” as predefined headings, perhaps because people in general are familiar with the focus of their area of expertise, which is food and related functions. In this study the dieticians’ distribution of predefined headings to the term and word categories corresponded to Melander Marttala’s triangular model.¹¹

The classification of all predefined headings in the multiprofessional EHR system into categories did not correspond to the triangular model.¹¹ The category “terms for specific purposes” (45%) found was much larger than the category “common words” (28%). This finding seems reasonable in that the EHR system is mainly a tool for communication between healthcare professionals, and not for communication with patients. However, according to the Swedish Patient Data Act,² the health record should also serve as a source of information for the patients. Therefore, the clinical terminology, including predefined headings applied in the health record should be as comprehensible as possible for patients as well. The dieticians seemed to be the group that best met this requirement for comprehensibility in the current EHR system.

Furthermore, there is a conflict concerning ambiguity and comprehensibility of “specialist terms” and “common words”. “Specialist terms” can be believed to promote mutual understanding within a professional group or a specialty because they are unambiguous. However, they can at the same time be incomprehensible and thus exclusionary to other professional groups and patients. Whereas “common words” can be inclusionary because they are comprehensible and familiar to all professional groups and patients, despite the fact they are ambiguous. When developing clinical terminologies for EHR systems this conflict must receive attention.

Language for specific purposes

All languages consist of “common language” and “language for specific purposes”. The category “language for specific purposes” is typically applied by professionals in a specific field.^{9 10} Healthcare is one such field that can be expected to have a shared “language for specific purposes”. Because only 1.7% of

the predefined headings were shared by all eight professional groups, the predefined headings in the multiprofessional EHR system did not constitute a joint “language for specific purposes”. Consistent with the results of Zeleznik and colleagues, it seems that a number of languages were used because each professional group employed their own clinical language.¹³

CONCLUSIONS

The predefined headings in the multiprofessional EHR system studied did not constitute a joint language for specific purposes. Less than half of the predefined headings were shared by two or more professional groups. All eight professional groups shared 1.7% of the predefined headings. The distribution of predefined headings across categories yielded two-thirds “terms for special purposes” and “specialist terms” and one-third “common words” and “unclassified headings”. The results indicate a need of further detailed studies of, for example, what aspects of health the predefined headings reflect. The improvement of the quality and usability of multiprofessional EHR systems requires attention.

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