Predefined Headings in a Multi-professional Electronic Health Record

Professionals’ Application, Aspects of Health and Health Care and Correspondence to Legal Requirements

ANNIKA TERNER

Department of Public Health and Caring Sciences

Uppsala University

Licentiate seminar Uppsala 2014-10-24
Abstract

Terner, A. 2014. Predefined Headings in a Multi-professional Electronic Health Record: Professionals’ Application, Aspects of Health and Health Care and Correspondence to Legal Requirements

The overall aim of this thesis was to investigate predefined headings in a Swedish county council multi-professional EHR system in terms of their shared application, what aspects of health and health care they reflected, and their correspondence to legal requirements. An analysis of 3 596 predefined headings, applied to 20 398 104 occasions by eight professional groups, was conducted. Less than 2% of the predefined headings were applied by all eight professional groups, whereas 60% were not shared at all between the professional groups. A classification of the predefined headings revealed that 13% were “Specialist terms”, which were the least ambiguous predefined headings, 46% were “Terms for specific purposes”, which are less ambiguous than the “Common words” (28%), which were the most ambiguous predefined headings according to the sociolinguistic method employed. The remaining predefined headings (13%) were sorted into “Unclassified headings”. A qualitative content analysis of the predefined headings yielded 23 subcategories grouped into five categories: Description of the patient, Health care process, Resources employed, Administrative documentation, and Development and research. A comparison of the 23 subcategories to the Patient Data Act showed, first, that 15 of 23 subcategories corresponded to four legal requirements, second, that there were legal requirements with a focus on patient rights that were not being met, and third, that there were eight subcategories of predefined headings that could not be attributed to the legal provisions of the Patient Data Act. In conclusion, the proportion of shared predefined headings in the EHRs was limited. The predefined headings in the multi-professional EHRs did not constitute a joint language for specific purposes. A meaningful structure comprising categories and subcategories of different aspects of health and health care as reflected in the applied predefined headings was identified. The structure reflected a wide range of health and health care. No subcategory corresponded to the three legal requirements concerning patient rights. Future research should include professionals’ and patients’ understanding of predefined headings, the correspondence of documented notes to predefined headings and how the documentation in the EHR has had an impact on patient safety.

Keywords: Electronic health records, Headings, Patient Data Act, Health care professionals

Annika Terner, Uppsala University, Department of Public Health and Caring Sciences, Disability and Habilitation, Box 564, SE-751 22 Uppsala, Sweden.
List of Papers

This thesis is based on the following papers, which are referred to in the text by their Roman numerals.


II. Terner A, Lindstedt H, Pless, M, Sonnander K. A Retrospective Analysis of Health, Health Care, and Legal Requirements as Reflected in Predefined Headings in an EHR (Submitted)
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## Abbreviations

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<td>EHR</td>
<td>Electronic Health Record</td>
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<td>EHRs</td>
<td>Electronic Health Records</td>
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<td>PDA</td>
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<td>SAG</td>
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Introduction

Good health and health care on equal terms for the entire population is the healthcare goal in Sweden according to the Health and Medical Services Act (1). Health records are an important tool for the documentation of health care and in exchanging health care information between health care professionals, as well as serving as a source of information for patients. In health care documentation the use of electronic health records (EHRs) has substantially increased during the first decade of the 21st century. In the EHRs large volumes of information on patient health and health care are documented by health care professionals. The information is expected to support the professional health service to deliver high-quality and safe services to patients. The context of this licentiate thesis is a multi-professional EHR used within health care in a county council in Sweden. In focus is the health care professionals’ application of the predefined headings in the EHR.

Health care in Sweden

According to the Health and Medical Services Act, the overall goal of all Swedish health care services is good health and health care on equal terms. The act also regulates the responsibility for health and health care (1). The Swedish healthcare system is decentralised, organised and managed on three levels: national, regional, and local. Overall policy, principles, and guidelines for health care are established at the national level by The Ministry of Health and Social Affairs, which also supervises and evaluates services and activities to secure attainment of national goals. The county councils at the regional level are responsible for providing and financing health care services. The municipalities at the local level are responsible for social welfare services, school health care, post-discharge services for persons with disabilities, and the elderly. Health care is mainly tax-financed (levied by county councils and municipalities and to a lesser extent by patient fees). County councils and municipalities have a considerable degree of autonomy (self-government) and have independent powers of taxation. However, each county council, as the main provider of health care on the regional level, has to organise and manage their health care so that all patients have access to high-quality health care in accordance with national policy, principles, and guidelines (2). To provide high-quality health care for each patient The National Board of Health and Welfare has emphasised the following six prerequisite domains for good care: Knowledge-based health care, Safe health care, Patient-centred health care, Effective health care, Equitable health care, and Accessible health care (3). Health care professionals are expected to document information in an unambiguous and complete way in order that professional collaboration and communication with patients are facilitated to provide high-quality care (4). Consequently, the information documented in health records is of utmost importance to good care and best practice.

Documentation in health care

Since the birth of modern medicine, there has been a need to document findings and interventions to ascertain continuity of care (5). The documentation has changed from the physician’s own handwritten paper notes (6-8) to an electronic tool for communication between health care professionals (7, 9-11), as well as an accessible electronic information tool for the patient (12-15). Previously, the documented information concerning patient health and health care was exclusively available for the professional group that had documented the information (16). However, an important factor that con-
tributes to the effectiveness of health care is communication between health care professionals (17). In the cooperation and collaboration between different parts of health care the same information is expected to be shared across all relevant professional groups and to the patient. This collaboration requires that the information is easy to find, accessible, and that the professional groups and the patient understand the information documented in the EHRs.

Electronic health records

To improve the quality of health care for patients the use of EHRs is current practice (18-19). According to the International Organization for Standardization an EHR is a repository of information regarding the health of a patient. The EHR is in computer processable form, stored and transmitted securely, and accessible by multiple authorised users. The EHR has a commonly agreed logical information model that is independent of EHR systems. The primary purpose of the EHR is the support of continuous, efficient, and quality integrated health care. The EHR contains information that is retrospective, concurrent, and prospective (20). However, there may also be serious risks, such as the complexity for the user regarding its paper-based equivalent, possible unpredictable technical breakdowns, and violation of patient integrity. On the other hand, the EHR represents huge opportunities for health care professionals and patients in terms of accessible, systematic, and comprehensive patient information. The EHR is expected to provide information about the patient when and where it is needed. (21-22) The quality and quantity of the information available to the health care professionals are presumed to have a significant impact on both the continuity and outcomes of health care (15). The EHR should be the main instrument for information and communication exchange for all health care professionals when providing health care (23-24). Hence, the EHRs must be clearly structured and searchable (25).

Modules, templates, and predefined headings in EHR

EHRs consist of different modules to handle health care documentation, medication, medical referrals, and health care management. The health care documentation modules contain templates (10, 26-28) that consist of predefined headings (9, 29). The templates and headings are predefined according to medical specialists’ and professional groups’ perceived needs of necessary information to provide high-quality health care. Hence, the templates and predefined headings aim to support the user to enter information in a structured way (22). The predefined headings structure the entered information into larger or smaller parts (30) and provide the parts with a context (31). Each heading briefly defines the content in each part as a label on a box (30). When recording, the user first chooses a template and then those predefined headings in the template she or he considers are the most appropriate for the information she or he wants to enter concerning the patient’s health and health care (32). The templates and predefined headings can to some extent meet the demands that the EHRs must be clearly structured and searchable (15-16, 29, 33-34).

Health record legislation

Before the Patient Record Act came into force in Sweden in 1986, regulations on documentation in connection with health care were contained in other statutes (35). The Patient Record Act determine which professional groups are obligated to establish health records, how health records should be handled, and what kind of information a health record should contain (36). In 2008 the Patient Record Act was replaced by Patient Data Act (PDA). The PDA decrees that information management in health care should be organised to meet the demands of high-quality health care and patient safety, as well as to promote a cost effective delivery of health care. It also decides the way in which personal data should be documented, treated, and stored so that the patients’ privacy is respected but also that they are protected against access by unauthorised persons. According to the PDA, health records are defined as written, pictorial, or tape-recorded information established or received in connection with the health care of patients. Further, the legislation rules that health records should be written in the Swedish language, be clearly formulated, and to be easily understood by the patient (12). With reference to information documented in the EHR, the following content is required according to the PDA: Patient
transmission of medical information. This can lead to errors and misunderstandings, affecting patient care. To overcome this challenge, a unified and standardized language for medical communication is essential. Such a language would ensure that clinical terms are consistently used, reducing ambiguity and improving the quality of care. The implementation of a common language for medical purposes has been a long-standing goal in healthcare systems, and advancements in technology have made it possible to achieve this goal.

### Semantic Interoperability

Semantic interoperability is crucial for harnessing the full potential of digital health technologies. It enables systems to understand and act upon information that is intended for another system, ensuring that data is shared, merged, and compared accurately. To achieve semantic interoperability, several preconditions must be met, including the use of a standardized clinical terminology with a commonly understood meaning. This standardization is necessary to enable health professionals to communicate effectively, ensuring that each patient is diagnosed correctly and receives appropriate care.

### Common Language and Language for Specific Purposes

Understanding the difference between common language and language for specific purposes is fundamental in the context of health care. Common language refers to the everyday language used in conversation, which can be vague and ambiguous. In contrast, language for specific purposes is designed for a particular field, aiming to be precise, nuanced, and concentrated in communicating within that field. This language is used by professionals to ensure everyone is on the same page, avoiding misunderstandings and errors.

In conclusion, achieving semantic interoperability and ensuring the use of a consistent clinical language are critical for improving patient care and health outcomes. By standardizing medical communication, we can enhance the quality and efficiency of healthcare services, ultimately leading to better patient outcomes.
a more districted meaning than the word’s original common meaning (70). This is likely to create confusion concerning the word’s original meaning and the new term’s interpretation (17, 40). The difference between words in common language and terms in language for specific purposes is that the former are more or less commonly intelligible, whereas the terms in language for specific purposes are designed consciously and in light of the latest scientific evidence (71).

Understanding of terms and words used in health care

Melander Marttala, a sociolinguist, proposed that to reflect a patient’s understanding of terms and words concerning health and medical conditions, a hierarchal triangular model can be organised with three levels pertaining to user group, ambiguity, and frequency of terms and words (72). (Figure 1)

![Figure 1. A hierarchal triangular model with three levels of terms and words about health and medical conditions. ST = Specialist terms, TSP = Terms for specific purposes, and CW = Common words (Modified from Melander Marttala, 1998, p.7).](image)

The top of the triangle comprises “specialist terms”, i.e. highly specialised scientific terms that only trained health care professionals can normally master. The middle level consists of “terms for specific purposes”, i.e. expressions such as injection, oedema, and artery that people in general may understand. The “common words”, i.e. common vocabulary applied when describing a disease, symptom, or parts of the body that most people in general are familiar with, is placed at the base of the triangle. The top of the triangle consists of few specific, consistent, and unambiguous terms while the base includes a large number of vague and ambiguous words. This model formed the basis for a classification that Melander Marttala employed in a study of conversations between physicians and patients (72). If patients’ understanding of terms and words used in the EHR is insufficient, they may not wish to read the EHR and may experience uncertainty and fear (13). Thus, it would be useful to help patients understand highly specialised terms by developing a system for translation into common words (14).

Development of terminologies in the EHR

A terminology is defined as a collection of terms in a language for specific purposes in a specific field (59). In health care there are different types of terminology that in clinical practice have been developed to meet specific needs (19, 24). Professional groups in health care have developed their own clinical terminologies as a part of their process to define the profession itself (5, 73). However, when different professional groups develop their own terminologies, different terms may be applied to the same concept (synonyms) (46, 54, 74-76). Correspondingly, the same term may be applied for slightly or even completely different concepts (homonyms) by different professional groups (46, 74). Furthermore, professional groups may be somewhat familiar with terminologies of other professional groups (77). In addition, medical specialties, including different professional groups, have developed their own clinical terminologies (78-80). Individual professional groups in certain medical specialties have also developed their own clinical terminology (81-83). With the purpose to provide the health care professionals with an efficient electronic tool, development of terminologies for the use in EHRs has taken place internationally, nationally, and locally. Internationally, the concept system Snomed CT can be seen as one example (84) and Contsys (85) as another. Nationally, efforts to define terms (such as
predefined headings for EHR documentation) intensified after the Swedish legislation passed a statute in 1986 stating that other health professional groups in addition to physicians must establish health records (36). Examples of professional groups nationally involved in such efforts are nurses, occupational therapists, and physiotherapists (86-88). Joint multi-professional work to establish a national list of shared predefined headings has also taken place (34). Furthermore, the Swedish National Board of Health and Welfare has been involved in the development of Swedish terms for use in EHRs (89-91). Locally, predefined headings are typically based on terms suggested by medical specialists and professional groups (32, 92), as well as nationally developed terms. These predefined headings are implemented in local EHRs and are applied by health care professionals. From this brief review, it follows that there is reason to believe that terminologies, and especially predefined headings, may differ between local health care providers, i.e. county councils.

Previous research

A large number of papers on topics related to EHRs and related areas have appeared in recent years. There are publications that theoretically describe the function (27) and preconditions for a well-functioning EHR (24), the expected benefits of EHR (22), and concerns about the future of EHRs (25). Several studies have been published by authors who are active in computer and system science, including biomedical engineering, information technology, and biomedical informatics, which mostly focuses on EHR systems. The secure management and transmission of information in EHR systems (93), EHR system architecture (94), EHR systems for homecare (95-96), and adoption of EHR systems (97) are a few examples of areas investigated. The purpose of the EHR as a supporting tool for a continuous, efficient, and quality, integrated health care is presented in a systematic review of research publications that reported that EHR promotes more complete and accurate documentation (15). This finding is also reported in a study describing that EHR improved the recording of pressure ulcers (98). Concerning EHRs and legislation, only one study was found. That reported insufficient correspondence of EHR to legislation (11). Several authors who discussed the semantic interoperability in EHRs (24, 28, 42-43, 46-47, 50) concluded that one crucial issue for semantic interoperability is the terminology used in the EHR. Different professional groups have developed their own terminologies (5). For example, the development and content of nursing terminology are described in several studies (33, 73-74, 99-101). When different profession-specific terminologies are applied concurrently, the occurrence of synonyms and homonyms becomes obvious. Synonyms are reported in studies showing that different terms were applied for the same condition (e.g., skin ulcers (75) or functional abilities of older patients (76)). An example of homonym is the term communication when applied for both verbal interchange of information and transportation (34). A literature review showed that both synonyms and homonyms were applied concerning patients’ functioning (102). Further, a study examining to what extent professional groups are familiar with the terminologies of other professional groups revealed that general practitioners found chiropractic and osteopathic terminology confusing, but that they were more familiar with physiotherapy terminology (77). Terminologies developed in medical specialties that include different professional groups have been discussed at length in several studies (78-80). Furthermore, descriptions and discussions of terminologies used by individual professional groups in certain medical specialties, such as physicians’ codes for excisions of skin lesions (81-82) and plastic surgeons’ standardised terminology for re-operations, (83) can be found in the literature. A study of terms and words concerning health and medical conditions used in conversations between physicians and patients revealed a distribution of 48.5% for “common words”, 40.1% for “terms for specific purposes”, 5.2% for “specialist terms”, and 6.1% for drug names (72). The majority of research on terminologies and terms in health care are limited to one health professional group or one medical specialty. With the purpose to support searching and finding documented notes in EHRs, predefined headings as terms have a crucial role. However, studies of applied predefined headings in EHRs are few. One of the few studies is a Swedish national pilot project showing that it was not possible to compare data from different sources because different headings were applied for the same concept (103). Further examples are retrospective analyses of predefined headings applied by physi-
cians and physiotherapists in Finland (31, 104). These studies showed that the headings reason for care, patient history, health status, follow-up care plan, and diagnosis were meaningful for the physicians (31) and that the physiotherapists’ decision-making process was difficult to follow in the EHR (104). In yet another study a comparison of headings in four physical examination templates from Sweden and Denmark revealed that a core set of headings for physical examination could be generated when compared with Snomed CT (92). To what extent predefined headings in EHRs were shared across professional groups was revealed in a Swedish inventory of 1,206 predefined headings reported by seven professional groups. The findings indicated that six headings were shared by all professional groups and that homonyms occurred in the reported headings (34). Studies concerning the ambiguity of predefined headings are scarce. The only available study reported that nurses in primary care interpreted headings differently (9). In summary, there is a lack of studies on different aspects of predefined headings, which constitute a significant part of clinical terminology in EHR systems.

Rationale for this thesis

According to the Health and Medical Services Act, the goal of the Swedish healthcare system is good health and equal access to health services for everyone. Health care documentation and exchange of health care information between health care professionals and to patients are accomplished by using health records. The health record is an important tool for the provision of high-quality health care. EHR systems are increasingly being used in health care documentation, which affects a large number of patients and professionals. According to the Swedish PDA, the EHR serves as an important instrument for documentation and exchange of health care information as well as a source of information for patients. The EHR needs to be available, functional, uniform, clear, easily understandable, and searchable in order to serve as an efficient tool for health care. Health care professionals are expected to document information concerning patients’ health and health care that is unambiguous and complete and easily accessible, so that professional collaboration and communication with patients are facilitated, which, in turn, helps provide high-quality care. The Swedish EHR is multi-professional and the searchable predefined headings in the templates constitute a part of the clinical terminology. In Sweden, predefined headings are typically locally composed of terms suggested by medical specialists and professional groups and nationally developed terms. Thus, there is no common set of predefined headings. Studies of predefined headings in multi-professional EHR systems are scarce. Further, knowledge is needed on whether predefined headings constitute a joint language for specific purposes, what aspects of health and health care they reflect, how they are shared across health care professionals, and how they correspond to legal requirements.
Overall and specific aims

The overall aim was to investigate predefined headings in a Swedish county council multi-professional EHR system in terms of their shared application, what aspects of health and health care they reflected, and their correspondence to legal requirements.

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

Study II
The aim was to study health, health care, and legal requirements as reflected in predefined headings as applied by users in a Swedish multi-professional EHR. Two research questions were addressed:
- What aspects of health and health care do predefined headings reflect?
- Do the aspects of health and health care as reflected in predefined headings correspond to the requirements of the Swedish PDA?
Methods and materials

Overview of the studies

An overview of Study I and II, covering design, material, data collection, and data analysis, is presented in Table I.

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Material</th>
<th>Data collection</th>
<th>Data analysis</th>
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<tbody>
<tr>
<td>I</td>
<td>Descriptive</td>
<td>Applied predefined headings (n=3 596)</td>
<td>Database extraction</td>
<td>Classification and descriptive statistics</td>
</tr>
<tr>
<td>II</td>
<td>Exploratory descriptive</td>
<td>Applied predefined headings (n=3 596)</td>
<td>Database extraction</td>
<td>Conventional qualitative content analysis</td>
</tr>
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</table>

Design

The design for study I was descriptive and for study II an exploratory descriptive design was followed.

Material

The studies were carried out in a county council in central Sweden that had implemented a multi-professional EHR for all health care service divisions, except for dentistry. The service divisions consisted of a university hospital, a county hospital, primary health care, and the division responsible for habilitation and assistive technology services in the county. The EHR consisted of modules for health care documentation, medication, and health care management. The module for health care documentation comprised templates consisting of predefined headings. The predefined headings in the EHR system’s module for health care documentation, applied during a 12-month period in 2007, were included. Since 2007, no major revisions of the predefined headings have taken place. The predefined headings were applied by a total sample made up of all active health professional groups in the four health care service divisions obligated to document according to the Swedish PDA. The professional groups included in the study were dieticians, medical social workers, occupational therapists, physicians, physiotherapists, psychologists, registered nurses, and speech and language pathologists. These groups represented 66% (n=5 509) of all users (n=8 348). Predefined headings applied by health professional groups not found in all four divisions (e.g., dentists, midwives, optometrists, and research nurses) were excluded.

Data collection

When recording, the professionals initially chose a template and then they applied the predefined headings in the template that they considered the most appropriate for the information they entered into the EHR. All applied predefined headings are consecutively stored in a local database. For the purpose of collecting data, access to the database was obtained from the chief medical officer (the owner of the EHR system) as well as the county council’s lawyer. The following search terms were used to obtain the unit of analysis: predefined heading, professional group, number of professionals, and number of notes. The unit of analysis consisted of 3 596 predefined headings, applied to 20 398 104 occasions by the eight professional groups. The applied predefined headings collected during the study consisted of single terms, multiple terms, expressions, or phrases and were compiled in alphabetical order in a spreadsheet program.
Data analysis

Study I

Predefined headings shared across professional groups
To examine to what extent the predefined headings were shared across the eight professional groups these headings were calculated and described in the spreadsheet program. The spreadsheet program was also used for calculating and describing the proportions of shared predefined headings across the professional groups in the EHR system.

Distribution of predefined headings across categories
To determine how the predefined headings were distributed across categories, which reflects the ambiguity of each heading, the headings were strictly classified according to the same procedure Melander Marttala employed in a study of conversations between physicians and patients (72). To classify the predefined headings the Swedish Academy Glossary (SAG) (105) and a medical health care dictionary (106) were used. The category “common words” included those predefined headings that occurred in the SAG (105) without any explanation. The predefined headings in SAG (105) that had one or more explanations, or a note showing which specific field it belonged to were classified as “terms for specific purposes”. “Specialist terms” included those predefined headings not found in the SAG (105) but in the medical health care dictionary (106). Some predefined headings were not found in the SAG (105) or in the medical health care dictionary (106) and were therefore not possible to classify according to the Melander Marttala procedure (72). For those non-classifiable predefined headings, an additional fourth category “unclassified headings” was created. All authors discussed the classification until consensus was reached. Every tenth heading was reviewed a second time to ensure the quality of the classification procedure. This procedure showed that 10% of the headings were incorrectly classified. The total number of predefined headings per category was calculated and described.

Distribution of categories of predefined headings shared across professional groups
The number of predefined headings per category shared by all professional groups was calculated and described. The proportion of predefined headings per category and professional group was also calculated and described.

Study II

Aspects of health and health care as reflected in predefined headings
To acquire new insights in an area in which knowledge is still growing a conventional qualitative content analysis was used (107) to analyse what aspects of health and health care the predefined headings reflected. The present author read through all the predefined headings in the spreadsheet several times to acquire an overall sense of the content (107). The reading resulted in the decision to modify the analysis by treating the predefined headings as codes because they consisted of single terms, multiple terms, expressions, or phrases. Thereafter, the predefined headings were sorted by the author into subcategories. Following repeated discussions with co-authors of study II, the author merged or rearranged the subcategories. The predefined headings (e.g., specifications of predefined headings, combinations of predefined headings, and some abbreviations and proper names) that could not be sorted into any subcategory (n=192) were excluded from the analysis. The author compared and aggregated the subcategories into categories. Examples of categorised predefined headings are presented in table II. All authors discussed the categories and the denominations chosen for the subcategories and categories until consensus was reached.
Table II. Examples of categorised predefined headings.

<table>
<thead>
<tr>
<th>Code</th>
<th>Subcategory</th>
<th>Category</th>
</tr>
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<tbody>
<tr>
<td>Elbow</td>
<td>Physical structure</td>
<td>Description of the patient</td>
</tr>
<tr>
<td>Oedema</td>
<td>Ill health</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>Intake of food and drink</td>
<td></td>
</tr>
<tr>
<td>Spirometry</td>
<td>Activities and tools for investigations and evaluations</td>
<td>Health care process</td>
</tr>
<tr>
<td>Surgery</td>
<td>Care interventions</td>
<td></td>
</tr>
<tr>
<td>Injection needle</td>
<td>Equipment and material</td>
<td>Resources employed</td>
</tr>
<tr>
<td>Put on waiting list</td>
<td>Care management</td>
<td>Administrative documentation</td>
</tr>
<tr>
<td>Consent</td>
<td>Research participation</td>
<td>Development and research</td>
</tr>
</tbody>
</table>

Aspects of health and health care as reflected in predefined headings corresponding to legal requirements

Each subcategory was compared with seven legal requirements in the PDA to examine how different aspects of health and health care as reflected in predefined headings corresponded to the PDA requirements. The legal requirements were Patient identity, Background information for health care, Information concerning diagnosis and reason for interventions, Information on the interventions performed and planned, Information provided to the patient, Statements made in the selection of treatment options, and Possibility of a new medical assessment, i.e. a second opinion. To arrive at a deeper understanding of the legal requirements and, in turn, support the comparison of the subcategories to the legal requirements, regulations (108) and a handbook (109) published by the National Board of Health and Welfare were thoroughly read. The authors discussed the comparison of the subcategories to the legal requirements. This process was then repeated several times until consensus was reached.

Ethical considerations

The studies were reviewed by the Regional Ethical Review Board in Uppsala, Sweden. Because of the nature of the studies, the decision of the board was that the studies did not require formal approval (Dnr 2009/186).
Results

Study I

Predefined headings shared across professional groups

Only 1.7% of the applied predefined headings were shared by all eight professional groups while 59.3% of the predefined headings were not shared at all. Thus, 40.7% of the predefined headings were shared by two or more professional 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 table III.

Table III. Distributions of shared predefined headings (n=3,596) in proportion to the number of headings applied by each professional group.

<table>
<thead>
<tr>
<th>Professional groups</th>
<th>Dieticians</th>
<th>Medical social workers</th>
<th>Occupational therapists</th>
<th>Physicians</th>
<th>Physiotherapists</th>
<th>Psychologists</th>
<th>Registered nurses</th>
<th>Speech and language pathologists</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dieticians</td>
<td>100.0</td>
<td>26.9</td>
<td>22.3</td>
<td>8.0</td>
<td>12.5</td>
<td>24.9</td>
<td>8.7</td>
<td>29.8</td>
</tr>
<tr>
<td>Medical social workers</td>
<td>46.1</td>
<td>100.0</td>
<td>47.4</td>
<td>15.0</td>
<td>24.0</td>
<td>57.7</td>
<td>17.0</td>
<td>44.5</td>
</tr>
<tr>
<td>Occupational therapists</td>
<td>45.3</td>
<td>56.2</td>
<td>100.0</td>
<td>12.7</td>
<td>34.9</td>
<td>46.7</td>
<td>15.2</td>
<td>51.7</td>
</tr>
<tr>
<td>Physicians</td>
<td>59.2</td>
<td>64.3</td>
<td>46.0</td>
<td>100.0</td>
<td>36.0</td>
<td>59.8</td>
<td>53.3</td>
<td>49.1</td>
</tr>
<tr>
<td>Physiotherapists</td>
<td>55.1</td>
<td>61.4</td>
<td>75.5</td>
<td>21.5</td>
<td>100.0</td>
<td>58.6</td>
<td>22.1</td>
<td>55.5</td>
</tr>
<tr>
<td>Psychologists</td>
<td>53.5</td>
<td>72.4</td>
<td>49.4</td>
<td>17.5</td>
<td>28.7</td>
<td>100.0</td>
<td>19.8</td>
<td>54.3</td>
</tr>
<tr>
<td>Registered nurses</td>
<td>67.3</td>
<td>76.4</td>
<td>57.6</td>
<td>55.9</td>
<td>38.8</td>
<td>71.0</td>
<td>100.0</td>
<td>55.5</td>
</tr>
<tr>
<td>Speech and language pathologists</td>
<td>32.2</td>
<td>28.1</td>
<td>27.5</td>
<td>7.2</td>
<td>13.7</td>
<td>27.3</td>
<td>7.8</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The professional group who applied the most predefined headings was the registered nurses (n=1,890), who applied the headings seven times more than the dieticians (n=245) who applied the least number of headings. Seven of the eight professional groups shared most of their predefined headings with registered nurses. The eighth group, occupational therapists, shared most of their predefined headings with physiotherapists. Overall, the physiotherapist group shared least of their predefined headings with the other professional groups. The largest proportions of shared predefined headings were found among two groups: the medical social workers, who shared more than three quarters of their predefined headings with registered nurses, and the occupational therapists, who shared three quarters of their predefined headings with the physiotherapists. The minimum proportions of shared predefined headings were found among physicians, who shared less than a tenth of their predefined headings with speech and language pathologists and dieticians. Registered nurses also shared less than a tenth of their predefined headings with speech and language pathologists and dieticians. Pair wise, medical social workers and psychologists, as well as physicians and registered nurses shared between themselves more than half of their predefined headings.

Distribution of predefined headings across categories

The predefined headings were classified into four categories: “common words” (28%), “terms for specific purposes” (46%), “specialist terms” (13%), and “unclassified headings” (13%).

Distribution of categories of predefined headings shared across professional groups

The predefined headings shared by all groups (n=62) were classified as “common words” (n=32), “terms for specific purposes” (n=29), and “unclassified headings” (n=1).
The distributions of the categories “common words”, “terms for specific purposes”, “specialist terms”, and “unclassified headings” in proportion to the number of headings applied by each professional group are presented in Table IV.

Table IV. Distributions of the categories “common words”, “terms for specific purposes”, “specialist terms”, 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=1 802), physiotherapists (n=1 076), psychologists (n=527), registered nurses (n=1 890), and speech and language pathologists (n=265) (in percent).

<table>
<thead>
<tr>
<th>Professional groups</th>
<th>Common words %</th>
<th>Terms for specific purposes %</th>
<th>Specialist terms %</th>
<th>Unclassified headings %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dieticians</td>
<td>49.8</td>
<td>42.0</td>
<td>5.7</td>
<td>2.5</td>
</tr>
<tr>
<td>Medical social workers</td>
<td>44.3</td>
<td>49.5</td>
<td>0.7</td>
<td>5.5</td>
</tr>
<tr>
<td>Occupational therapists</td>
<td>41.6</td>
<td>47.2</td>
<td>4.0</td>
<td>7.2</td>
</tr>
<tr>
<td>Physicians</td>
<td>29.4</td>
<td>48.5</td>
<td>12.3</td>
<td>9.8</td>
</tr>
<tr>
<td>Physiotherapists</td>
<td>29.2</td>
<td>41.8</td>
<td>12.7</td>
<td>16.3</td>
</tr>
<tr>
<td>Psychologists</td>
<td>43.1</td>
<td>48.4</td>
<td>1.1</td>
<td>7.4</td>
</tr>
<tr>
<td>Registered nurses</td>
<td>30.9</td>
<td>47.2</td>
<td>10.5</td>
<td>11.5</td>
</tr>
<tr>
<td>Speech and language pathologists</td>
<td>43.0</td>
<td>49.4</td>
<td>3.4</td>
<td>4.2</td>
</tr>
</tbody>
</table>

Dieticians applied the most “common words”, whereas physiotherapists, physicians, and registered nurses applied the fewest “common words”. Overall, the professional groups applied “terms for specific purposes” from 41.8% to 49.5%. Physiotherapists, physicians, and registered nurses applied the most “specialist terms”, whereas medical social workers and psychologists applied the fewest “specialist terms”. Finally, physiotherapists applied the most “unclassified headings” and dieticians the fewest.

Study II

Aspects of health and health care as reflected in predefined headings

The qualitative content analysis yielded a structure of five categories and 23 subcategories (Table V).

Table V. Categories and subcategories of predefined headings reflecting health and health care.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Subcategories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of the patient</td>
<td>Activities in daily life, Current functioning, Current state of health, Environment and financial situation, Health history, Ill health, Intake of food and drink, Lifestyle related to health, Person identification, &amp; Physical structure</td>
</tr>
<tr>
<td>Health care process</td>
<td>Activities and tools for investigations and evaluations, Statement of assessments, Goals to be attained, Planning of actions, Care interventions, &amp; Outcomes of actions</td>
</tr>
<tr>
<td>Resources employed</td>
<td>Medical specialties, Health care professionals, &amp; Equipment and material</td>
</tr>
<tr>
<td>Administrative documentation</td>
<td>Care management, &amp; Forms related to care</td>
</tr>
<tr>
<td>Development and research</td>
<td>Quality registries, &amp; Research participation</td>
</tr>
</tbody>
</table>

The first category in table V (Description of the patient), which included 10 subcategories, focused on the individual and the subject of health care. The second category (Health care process) focused on the steps from ascertaining the individual’s health state, via influencing the individual’s health state to the outcomes of health care actions and included six subcategories. The third category (Resources employed), made up of three subcategories, focused on the use of resources in performing health care. The fourth category (Administrative documentation) focused on the administrative support in the provision of health care and included two subcategories. The fifth category (Development and research)
contained two subcategories and focused on the individual’s participation as a means to increase quality of health care. The analysis also revealed that synonyms or similar terms were applied as predefined headings.

Aspects of health and health care as reflected in predefined headings corresponding to legal requirements

The comparison of the subcategories to the PDA showed that 15 of 23 subcategories corresponded to four legal requirements (Patient identity, Background information for health care, Information concerning diagnosis and reason for interventions, and Information on the interventions performed and planned) of the seven legal requirements in the PDA. For three legal requirements in the PDA (Information provided to the patient, Statements made in the selection of treatment options, and Possibility of a new medical assessment, i.e. a second opinion), no corresponding subcategories were found. Eight subcategories did not correspond to any legal requirement.
Discussion

The overall aim of this thesis was to investigate predefined headings in a Swedish county council multi-professional EHR system in terms of their shared application, what aspects of health and health care they reflected, and their correspondence to legal requirements. Several research questions guided the present thesis. These questions concerned to what extent predefined headings were shared by different health professional groups. In addition, the studies explored the ambiguity of the applied predefined headings, and what aspects of health, health care, and legislation the predefined headings reflected.

Main findings

Less than 2% of the predefined headings were applied by all the professional groups; 60% of the headings were not shared at all between the professional groups. The analysis showed that the distribution of the applied predefined headings across term and word categories was two-thirds for the categories “terms for specific purposes” and “specialist terms” and one-third for the categories “common terms” and “unclassified headings”. A structure emerged consisting of 23 subcategories classified into five categories based on aspects of health and health care. Fifteen of these subcategories corresponded to four legal requirements. No subcategory corresponded to the legal requirements concerning patient rights and eight subcategories did not correspond to any legal requirement in the PDA.

Shared predefined headings

In the analysis of the EHR it was found that shared terms were applied to a very small extent (I). These results correspond to the inventory of predefined headings reported by seven professional groups in which less than 1% of the headings were shared by all professional groups (34). The findings were also compatible with the Swedish national pilot project, where data were not possible to compare from different EHR systems, in which different headings were applied for the same concept (103). The results of study I suggest that clinical terminologies that were developed by each health professional group have been incorporated into the EHRs examined in this study. This corresponds to the results of previous studies (34, 75-76). However, all terms applied in the EHRs cannot be expected to be shared because each professional group has unique terms or words that are not used anywhere else. There are, of course, situations when only one professional group is involved in the health care of a particular patient. In such cases no predefined headings need to be shared. Yet, for patients with several consultations across professional groups, a larger extent of shared headings than were actually observed would probably improve an extended use of documented available patient information. Further, in study I synonyms could be assumed to exist among the predefined headings not shared. This assumption is strengthened by the results reported in the national pilot project (103) and in other studies (75-76). Furthermore, homonyms would likely have been detected among the predefined headings shared by two or more professional groups because homonyms were observed in the inventory of predefined headings reported by seven professional groups (34).

Ambiguity of predefined headings

All word and term categories according to the model proposed by Melander Marttala were observed in study I. The proportional distribution of the categories noted in study I did not concur with the results reported in a study of conversations between physicians and patients (72). According to the results of study I, the proportional distributions of both “specialist terms” and “terms for specific purposes” were larger than the proportional distributions of these categories in Melander Marttala’s study (72). The proportional distribution of “common words” was therefore smaller than the same category in Melander Marttala’s study. This finding, however, was not unexpected because the two studies had different objectives. Melander Marttala’s results reflect terms and words concerning health, as well as medical conditions employed in conversations between physicians and patients (72). Thus, her study
can be assumed to contain more “common words” because it was based on spontaneous spoken conversations. In study I, however, the headings were intentionally predefined with the purpose to structure the entered information, something that requires unambiguous terms. In addition to the word and term categories proposed by Melander Marttala, the analysis in study I produced a fourth category, namely “Unclassified headings”. This category included headings consisting of abbreviations, proper names, or other letter combinations not possible to find in either the SAG or the medical health care dictionary. There is reason to believe that these unclassifiable headings are unique to special professional groups. This is especially of concern because it cannot be ruled out that the information documented using these predefined headings could be useful and even of vital importance to other professionals caring for a specific patient. The Swedish PDA edicts that health records established within the healthcare system should be written in the Swedish language, be clearly formulated, and easy for the patient to understand (12). Concerning terms and words applied as predefined headings, there is a dilemma when choosing between ambiguous and unambiguous terms because the headings have to be comprehensive for both the health care professionals and the patient to meet the requirement of the PDA. Previous authors believe that it could be difficult for patients to understand terms ambiguous to them such as “trans rectal ultrasound” which are assumed to be unambiguous for health care professionals (32). When patients get the opportunity to read their own EHR, the question is whether they will accept specialist terms and search explanatory information to understand these terms.

A structure of aspects of health and health care

In study II the analysis of the predefined headings revealed a meaningful structure that included five categories and 23 subcategories on health and health care aspects. Health care professionals’ obligations and health care management are primarily met because the structure enables a detailed monitoring of each patient and offers conditions for management control. In clinical terminologies developed by health care professionals describing the patient typically reflect the perspective of a particular professional group or medical specialty (78). In study II the category Description of the patient consisted of a comprehensive list of subcategories describing the patient in relation to health care. The subcategories included in the category Health care process provided an account of the health care professionals’ work process as found in, e.g., the nursing process (33), the physiotherapy process (87), and the occupational therapy process (86). Four of six subcategories (Statement of assessments, Goals to be attained, Care interventions, and Outcomes of actions) corresponded to the content of an inventory of predefined headings reported by seven professional groups in Sweden (34); these four subcategories also corresponded to a study of physiotherapists’ headings and notes in EHRs in Finland (104) and to the Danish Basic EHR model (28). More than half of the subcategories found in study II were consistent with a previous review of research on definition, structure, content use, and impacts of an EHR (15). The subcategory Environment and financial situation is an example of a subcategory not previously reported. This subcategory focuses on the context of the individual. However, the categories Resources employed, Administrative documentation, and Development and research, which represent information for health care management and research, have not been described in studies on EHR content. One explanation for this is that previous studies have primarily focused on a definitive part of an EHR such as physical examination (92) or the work process of a professional group (86). However, the objective of study II was to investigate the complete health care documentation module in a multi-professional EHR. The EHR system under investigation also included a special module for health care management. This module was not included in the data collection process of study II. However, this suggests that information concerning resources employed, administrative documentation, and development and research are noted in different parts of the EHR system, all of may limit the search ability and usability of the EHR. The analysis in study II also revealed that synonyms or similar terms were applied as predefined headings. This confirmed the assumption reported in study I and corresponds to previous studies (75-76, 103). The synonyms and similar terms will most likely restrict the search ability and usability of the EHR.
Aspects of health and health care correspondence to the PDA

According to the PDA, management of information in health care should be organised to meet the demands called for by high-quality health care and patient safety, as well as to promote a cost-effective delivery model of health care. Health care professionals decide what aspects of information they document (40), a task that is accomplished by applying predefined headings when keeping notes in the EHR. The subcategories describing the different aspects of health and health care as reflected in the predefined headings did not meet all legal requirements in the PDA. This finding corresponds to a study of EHRs in Finland based on EHR notes in primary health care, which also reported insufficient correspondence to legal requirements (11). The legal requirements that were not met in study II concerned patient rights. These legal requirements concerned Information provided to the patient, Statements made in the selection of treatment options, and the Possibility of a new medical assessment (12). Because the data used in the analysis were restricted to predefined headings, it cannot be ruled out that this information may be found in EHR notes under any predefined heading. This circumstance hampers the search ability and usability of the EHR for patients and health care professionals. The structure of the EHR seems to be primarily based on the needs of health care professionals in accordance with conclusions reached by previous authors (13). This view is strengthened by the present finding that those legal requirements that corresponded to the subcategories found in the studied EHRs concerned information reflecting the needs of health care professionals (Patient identity, Background information for health care, Information concerning diagnosis and reason for interventions, and Information on interventions performed and planned). Further, eight of the subcategories did not have any corresponding legal requirement. These subcategories appeared in the following categories: Resources employed, Administrative documentation, and Development and research. These subcategories reflect the needs of health care management and research. Previously, the health record was a tool for professionals only (16). Regrettably, the results of study II suggest that the situation remains the same today.

Methodological considerations

Strengths and limitations

The analyses were based on a retrospective, large set of material comprising 3 596 predefined headings applied by eight professionals groups (n=5 509) on 20 398 104 occasions in four of five health care service divisions in a county council in Sweden. To our knowledge, this is the first study of its kind with regards to size of the material and the number of health care professional groups. Study I and II focused on an EHR in one county council. Because there is no EHR system shared by all county councils in Sweden and because health care services between county councils differ, the present results may not be applicable to other EHR systems. On the other hand, the results are supported by previous studies, indicating that the findings were generally applicable with respect to ambiguity, limited sharing of predefined headings, aspects of health and health care as reflected in the applied predefined headings, and limited correspondence to legal requirements. Predefined headings are crucial in supporting health care professionals when they document and search previously documented notes in EHRs. Thus, because research on predefined headings is limited, further investigation should be undertaken. However, the content of the information in the documented notes was not investigated here, which constitutes a limitation of the study. From this, it follows that the analysis of the ambiguity of the applied predefined headings and their correspondence to the legal requirements of the PDA might have revealed different results if the documented notes had been studied as well. Search ability, however, is hampered when it is not clear to the user where to find the documented information needed. The classification procedure employed by Melander Marttula was chosen for the analysis of ambiguity of predefined headings. The reason for this choice was that the procedure had previously been used in a study of terms and words on health and health care and was well described. The analysis procedure involved using SAG and a medical dictionary. A limitation of this procedure is that predefined headings with multiple meanings in SAG were classified as a “term for specific purposes”. Everyday words that contain several meanings were therefore classified as “term for specific purposes”, which probably resulted in an underestimated proportion of “common words”. Alternatively, the ambiguity of the
predefined headings could have been studied by asking health care professionals how they experienced the ambiguity of the predefined headings in the EHRs. This course of action might have yielded a more detailed result. That the data were collected during 2007, just before the PDA came into being in 2008, might be regarded as a limitation. However, in 2004 the Swedish government decided to prepare a draft for the PDA that resulted in a published proposal in 2006 (110). This proposal was widely discussed and the proposed requirements regarding information in the EHR did not change until the act was enforced in 2008. Thus, there were possibilities that already in 2007 predefined headings were included in the EHR to meet the legal requirements in the coming PDA. The analysis of the correspondence of legal requirements to predefined headings was based on subcategories related to health and health care and not on the predefined headings. It is possible that additional correspondence to legal requirements might have been revealed using this alternative procedure. The procedure used was preferred because it was manageable and systematic.

Trustworthiness

In Study I the predefined headings were classified according to a sociolinguistic model and in Study II the predefined headings were analysed by a conventional qualitative content analysis. Both types of analysis can be seen as qualitative content analysis (107, 111). In qualitative studies trustworthiness is important. Trustworthiness can be demonstrated by establishing the following four strategies: credibility, dependability, transferability (112), and confirmability (113). Credibility refers to how well the research methods address the intended focus of the study (113). In the present studies credibility was strengthened by collecting a large variety of data in the form of all predefined headings applied by eight professional groups in a multi-professional EHR. In study I the material was analysed by a sociolinguistic model that had previously been employed in a similar setting and thus considered suitable relative to the aim of the study (I). In study II the analysis of the material was secured because the author had ample experience of the EHR. Dependability concerns how consistent the results are for the collected data (113). The research processes in both studies were transparently described. Transferability refers to the extent to which the results in a study can be transferred to another similar context or situation in a new research context (113). The setting for the studies has been thoroughly described and to which extent the results can be transferred to other similar settings is up to the reader to decide. Confirmability concerns the extent to which the results in a study are derived from the data collected and not from the authors’ preconceptions (113). The author, who has vast experience of EHRs, collected, analysed, and compared the data in the two studies. During the research processes, all authors thoroughly discussed data collection, analysis, and comparisons in order to avoid bias.

Conclusions

In the EHR investigated the proportion of shared predefined headings was limited. The predefined headings in the multi-professional EHR studied did not constitute a joint language for specific purposes. A meaningful structure comprising categories and subcategories of aspects of health and health care as reflected in the applied predefined headings was identified. The structure represented a wide range of health and health care. A majority of the subcategories corresponded to the legal requirements in the PDA. No subcategory corresponded to the three legal provisions on patient rights, however. Eight subcategories did not correspond to any of the legal requirements in the PDA.

Clinical implications

The present results indicate that the improvement of the search ability and usability of multiprofessional EHRs requires careful attention. It is necessary to ensure compliance with the PDA, particularly regarding the legal requirements expressing patient rights.
Future research

To increase our knowledge about the EHR the search ability and usability for professionals would be important to investigate. Asking health care professionals concerning their understanding of predefined headings in the EHR would be a key component. The EHR is also an important information tool for patients and thus search ability and usability for patients should be studied. An essential line of future research would be to compare the predefined headings to the documented notes in order to investigate whether the notes are properly labelled. The information in the EHR is expected to support high-quality health care and patient safety for all. A vital focus of research is to investigate to what extent and how documentation in the EHR has had an impact on patient safety.
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