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Towards Citizen-Centred Care: Interim Results from an E-Prescription Case

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Abstract. Medication data is a crucial part of patient data. Medication data is stored in a centralized archive, and made accessible to health care professionals and citizens. Re-usability of medication data requires it to be not only interoperable, but also complete and reliable. We evaluated e-prescription data stored in a national archive. The data consists of 596 patients with 76411 e-prescriptions. The interim results show the data to be complete when stored, whereas data reliability would require more user training.

Keywords. health records, e-prescription, national health services, case study.

Introduction

Patient data and personal health data is recorded into various systems and with different user needs [1]. Besides patient data citizens record health data into various devices and services. At the same time the availability of better, interactive e-health services is needed to utilize potential, citizen generated data. At the moment, citizens have access to their own patient data in Finland. In this regard, medication data is crucial both to health care professionals planning and carrying out treatments and care as well as to citizens, for example in checking their medication and dosage information. Comprehensive and accessible medication data increases patient safety. The national e-health services enable e-prescription data access regardless of the health care organization where it was first recorded. The citizens have a portal for accessing their e-prescription data stored in the national archive. Citizens can also request a physician to renew a prescription via a portal that is a part of the national e-health information services.

Medication data is well structured and already utilizable in, for example, decision support systems (DSS). Physicians and pharmacists have various DSS-systems and integrated EHR system tools available. Similarly, citizens would need support tools to interpret their medication and medication interaction or other essential information. Moreover, up-to-date medication data would be more complete when citizens can enter additional medication information of other medicinal products they are using. Previously, we have conducted a systematic literature review of the structured patient data from a secondary user viewpoint [2, 3]. The review clearly demonstrated the requirements for patient data quality; these include completeness and compatibility of the data with data structures, and data consistency and reliability in regard to data

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retrieval. For example, there is evidence that using International Classification of Diseases (ICD) codes can increase both the completeness and reliability of EHR data content [4-6]. Data utilization in different systems and with various interfaces requires interoperable data, including personal health record (PHR) requirements. Recently it has been suggested that the different uses of patient data should be considered when defining data completeness [7]. If different data needs are addressed, the completeness of EHR data can be measured in comparison to the intended use. That is not only task dependent but also user dependent, as for example physician and citizens have different information needs.

In 2015, we carried out the first part of a study evaluating e-prescription data quality in the National Prescription Centre. In this paper, we give preliminary answers to our research questions: what is the quality of e-prescription data and is the data complete and reliable for user needs and, further, for secondary use purposes and developing digital services for both health care professionals and citizens.

1. Methods

The study was based on a quantitative analysis of e-prescription data. The analysis material was obtained at spring 2015, and the second author of this paper conducted the analysis using statistical analysis software. The analysis results were refined by all three authors.

The study materials included e-prescription data between 2012 and 2014 from all the patients whose prescriptions had been updated in November 2014. As a control group, we had patients whose prescriptions were not updated in November 2014. The gathered data consists of 596 patients with 76411 e-prescriptions. The control data has 600 patients with 39327 e-prescriptions. At the time of data retrieval, all public services providers had already integrated the e-prescription services.

The anonymised data covers structured prescription data, for example document identifiers, organization unit identifiers, prescription name, ATC-code, purpose of use, substance strength, prescribed quantity, dosage, dose form, route of administration, container, package data, and so on – in a total of 48 data elements. Data completeness was measured using quantitative comparison between different message types. Data reliability was evaluated as accuracy in regard to data specifications, as no more accurate measurement is currently available for comparison.

2. Results

Completeness of the medication data was analysed with quantitative comparison between message types and mandatory data elements. The data structure implemented for e-prescription orders consists of Boolean values and coded values to a degree, but a lot of the data is still entered as free text by the ordering physician. Much of the data entered into e-prescription is mandatory. A Boolean value indicating the start of a new medication order was entered in 92 % of the cases. In 80 % of these cases the Boolean had a *false* value, indicating the prescription order was a continuation of patient's ongoing medication. However, the Boolean value for permanent medication was entered only in 62 % of the cases. Data covering permanent medication is being entered differently in various hospital districts, with data entries ranging approximately from

40 % to 1 % of all entries within a district. Similarly, a Boolean indicating that a prescription order concerns a narcotic product was entered in 68 % of the prescriptions and in 98 % of these, the value was *false*. Still, the ability to control narcotic prescriptions and to avoid several simultaneous and overlapping prescriptions to a patient was one of the implementation goals of the e-prescription services.

The e-prescription is based on the HL7 messaging standards, where the original prescription order and all changes concerning the data content are handled as individual messages. The completeness of prescription data varied between message types. In this paper, we discuss five of the 13 message types: prescription orders, pharmacy's preparation dispensing messages, prescription invalidation messages, prescription correction and renewal messages (see Table 1). Of the data elements, ATC-codes, medicinal preparation type codes, purpose of medication use, and dosage instructions for patient are scrutinized. The numbers cover instances of specific documented data elements in comparison to total number of prescriptions (="All data").

Table 1. Examples of e-prescription data completeness (abbreviations: o=order, m=message, r=request)

Message type	Messages (N)	ATC-codes	Preparation type	Purpose	Dosage instructions
Prescription o.	20616	20109	20246	14824	20616
Dispensing m.	35490	34694	35098	--	--
Invalidation m.	423	416	413	273	273
Correction m.	321	314	315	257	257
Renewal r.	9711	--	--	--	--

ATC-code is currently used to identify the ordered medication, and it covers 97 % of all prescription orders. Analysis of the orders with missing ATC-code entries revealed that typically these orders concerned medicinal preparations that were manually prepared in the pharmacy. Four remaining orders with missing ATC-codes were prescription orders entered by the pharmacist, when the ordering physician had made the actual order in paper or by phone. The medication preparation type code indicates not only the nature of the preparation, but also other preparation details, such as substance strength, package data, dosage form and so on. This data is available in the Pharmaceutical Database. Preparation type covers 98 % of all prescription orders.

In the interim results, data reliability was evaluated in regards to current data specifications and documenting guidelines. The documenting practices clearly varied between different message types. For example, the purpose of medication use was documented in 72 % of the orders. In comparison, the preparation dispensing messages by pharmacies include ATC-codes and preparation type codes, but not the purpose of use or dosage instructions. Similarly, prescription invalidation messages should include all the prescription data and additionally the reason for invalidation, although our analysis shows that only a part of the prescription data is entered. Reasons for invalidation seem to be in line with the specifications. Most typically the prescription was invalidated because of new patient care decisions (88 %), and to a lower degree because of technical mistakes (8 %). In one case, the prescription invalidation was made due to incorrect information given by a patient. Current specifications state that a valid prescription should be invalidated (or marked as fully dispensed) when the medication is ended or the preparation changed. Prescription correction messages should include the prescription data and additionally document the corrections made. Over 97 % of the correction messages include ATC-codes and preparation type codes,

but only 80 % purpose of use and dosage instructions. Most typically a prescription was updated because of being out of date (84 %), and to a lesser degree because of new patient care decisions (9 %). Reasons of correction were missing in 151 correction messages. The highest amount of invalidations and corrections without physician's reasoning documented all originate from same hospital district.

Prescription renewal can be made in a pharmacy or via citizen's own portal providing access to their health care data. Prescription renewal seem to function solely based on prescription document identifiers as even ATC-codes are missing in the data content although ATC-codes are currently used to link continuous medication. Thus, prescription renewal data is not usable for evaluation or research purposes. Only the quantity of documented renewals is assessable.

3. Discussion

Based on our study, e-prescription data is complete when stored. However, the reliability of the data varies between different message types. The prescription order and preparation dispensing messages are the most completely documented. To increase re-usability of e-prescription data, the data structure development would benefit from extending beyond the concept of prescription solely as a document for dispensing medication. Instead, prescription data should be aligned with other structural data regarding patient medication orders. Especially substance quantity and dosage information need to be structured further to support automated system functions, such as calculating the total quantity or translating physicians' dose descriptions to patient-friendly phrases or in using automatic dose distribution services by a pharmacy. Similarly, decision support would benefit from increased structuring of prescription data. Currently, e-prescription data and all other medication data are stored in different archives, but can be utilized for decision support integrated in most patient information systems.

Pharmacotherapy is a key part of patient treatment. Centralized storage of medication data and accessibility of that information in any health care organization will particularly improve patient safety. At the moment e-prescription attempts to cover basic medication data "with patient-understandable" language. The demand for double documenting may be one reason why the purpose can be omitted; the purpose of medication use was documented only in 72 % of the orders and not at all in some message types. The physician documents medication purpose using ICD-10 codes, but currently e-prescription allows only free text entry with layman's terms. The difference between various message types can be also explained with user groups. Regarding dispensing data, information intended to guide patients' use of the ordered medicinal preparation are not needed in pharmacy bookkeeping that covers preparation substance strength, quantity, and package data etc. As the rest of the pharmaceutical data and for example diagnosis codes are available also for patients to browse, the suggested layman's terms can be insufficient even for citizens. Uncommon phrases may cause a patient to misunderstand their instructions, especially if no synonym terminology covering professional and layman terms is made available.

An access to the prescription data is already a benefit for the citizens, as they can now inspect up-to-date prescription information. However, due to technical service implementation and user right issues, especially the dosage information is not necessarily up-to-date, which can cause uncertainty to a citizen inspecting the data via

the citizen portal. A typical cause for this is that a physician has updated dosage information into the EHR system used in the organization, but not into the Prescription Centre that is a separate service. Similarly, when nurses update medication data by the order of a physician into a local EHR, they have limited user rights in the Prescription Centre, which causes the e-prescription data to be out of date.

Quality differences between hospital districts are generated by different documenting practices and patient information systems in use. For example, there were variations in documenting permanent medication and preparation substance strength. Messaging standard types increased the differences between data content and lessened the comparability of the data. Our results suggest that reliability of e-prescription data could be increased by further user training. National level guidelines for structured documenting should be emphasized and promoted to decrease differences between hospital districts and professional groups. At the same time, the amount of structured data content should be increased in comparison to free text data entry. With the re-use focus, medication data constitutes a core in decision support and adverse event tools integrated in EHR systems. Additionally, prescription data that covers also dispensing message data provides new potential for evaluating patients' real use of medication as well as commitment to care.

From a patient's point of view, the data content in the citizens' portal should be developed further, besides which the quality of the "translated" data content should be evaluated. Citizens need more diverse tools within the portal; their needs are not met only by making information accessible, but instead tools for entering their own health data would provide more up-to date information also to the physician. However, more explorations are needed regarding citizens' needs and also regarding meaningful use of citizen generated information for the primary and secondary use purposes in health care. Consequently, better interactive and citizen-centred e-health services could be based on such confirmed benefits.

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