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Collect Once, Use Many Times: End-Users Don't Practice What They Preach

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Abstract. Data in an Electronic Health Record must be recorded once, in a standardized and structured way at the point of care to be reusable within the care process as well as for secondary purposes ('collect once, use many times' (COUMT) paradigm). COUMT has not yet been fully adopted by staff in every organization. Our study intends to identify concepts that underlie its adoption and describe its current status in Dutch academic hospitals. Based on literature we have constructed a model that describes these concepts and that guided the development of a questionnaire investigating COUMT adoption. The questionnaire was sent to staff working with patient data or records in seven out of eight Dutch university hospitals. Results show high willingness of end-users to comply to COUMT in the care process. End-users agree that COUMT is important, and that they want to work in a structured and standardized way. However, end-users indicate to not actually use terminology or information standards, but often register diagnoses and procedures in free text, and experience repeated recording of data. In conclusion, we found that COUMT is or procedures in practice.

Keywords. Electronic Health Records; Health Personnel; Data reuse; Collect once, use many times

1. Introduction

The common goal of healthcare providers is to provide the best possible care based on all available patient data and evidence from literature. Information technology, such as Electronic Health Records (EHRs) and decision support systems, can assist them in this challenging task but is, among other things, dependent on correct, complete, and timely data. The 'collect once, use many times' (COUMT) paradigm refers to the situation where the data is recorded once, in a standardized and structured way at the point of care so that data is reusable within the care process as well as for secondary purposes (use many times). Access to unambiguous data of good quality forestalls recollecting the same data over and over. Furthermore, this data can be used in decision support systems for example to provide medication alerts (interactions, allergies), generate automated discharge letters, do research, produce management reports, support reimbursement, and monitor quality (audits).

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Unfortunately COUMT has not yet been fully adopted in every healthcare organization. Possible explanations include user-unfriendly systems and protocols that do not support end-users to easily record reusable data; and characteristics of end-users themselves, such as their attitude and registration habits. There are several reasons why the end-users' attitude can be a barrier. End-users may be unaware of the reasons for and advantages of COUMT. Or, both end-users' awareness and capable systems are available but the end-users do not register data in the correct format for other reasons.

Although several studies have reported on factors related to EHR use, to our knowledge no study reported on factors related to adoption of COUMT by end-users. Therefore our main questions are 1) which concepts form the basis of COUMT? and 2) what is the current status of COUMT in Dutch academic hospitals?

2. Methods

To answer our questions we have 1) constructed a theoretical model that describes the concepts that underlie the adoption of COUMT based on previous literature, and 2) created a questionnaire that can investigate the adoption of COUMT in an organization. Our model and questionnaire were developed in the setting of the 'Point-of-care clinical data capture' program of The Netherlands Federation of University Medical Centers (NFU) [1]. In this program all eight university hospitals in The Netherlands cooperate to improve the adoption of COUMT.

2.1. Theoretical model for COUMT adoption

For our model we have searched the literature to find existing models on user acceptance of computer systems and behavior towards system usage. We used the search terms: user, acceptance, model, satisfaction, system, technology, and adoption. Additionally we searched the references of relevant articles identified with our search. Models and concepts relevant to our research question were selected by the researchers and based on consensus combined into one model.

2.2. Questionnaire

Based on the developed model we created a questionnaire. The goal of this questionnaire was to measure the end-users' attitude towards data registration habits that enable COUMT. For each concept in the model at least one statement was included in the questionnaire. Respondents were asked to indicate their agreement on a 5-point Likert scale ranging from (1= strongly) disagree to (5= strongly) agree. Additionally we added sixteen questions on demographics (e.g. age, function). We also asked the centers (not the respondents) to provide their organizational context (e.g. type of EHR, number of years in use, amount of attention for COUMT in center).

Based on feedback of six (medical, IT, and communication) professionals a draft of the questionnaire has been developed and it was sent as a pilot to the participants of two university hospitals. Based on the results of this pilot we removed questions that were vague or overlapping and we added questions that were reported to be missing.

Our target population was (a sample of) staff that worked with patient records or patient data from seven of the eight Dutch university hospitals. One hospital did not participate because similar research was performed shortly before the study period. Each potential participant received an invitation by email that included a link to the online questionnaire. The email was endorsed and signed by the NFU and local representatives of the hospitals. After two weeks a reminder was sent. The invitations were sent per center, between May and November 2015. All results of the questionnaire were analyzed with R [2].

3. Results

3.1. Theoretical model for COUMT adoption

We analyzed 35 relevant models and frameworks from the literature and combined all relevant concepts in one model, based on the two models that fit our scope best (i.e. Hsieh[3], Wixom and Todd[4]). The objective of the model of Hsieh is to explain the intention of physicians to use an EMR exchange system [3]. The model is based on the decomposed theory of planned behavior model extended with institutional trust and perceived risk. Wixom and Todd created an integrated model including beliefs and attitudes about the system itself, and beliefs and attitudes about using the system [4]. Their model is based on several models and theories including the technology acceptance model (TAM [5]), and user satisfaction literature. Both models, although having a different focus, have overlapping areas. Overlapping concepts such as perceived usefulness, perceived ease of use, attitude, and usage intention were used to combine the models.

Our final 31-concepts model is depicted in Figure 1. The three main outcome measures of our model are behavior, usage intention, and attitude. These concepts describe the willingness of end-users to adopt COUMT (attitude and intention) and the



Figure 1. Model of concepts concerning the adoption of and attitude towards COUMT. Main outcome measures shown in grey.

self-reported actual actions the end-users take (behavior). The intention is influenced by the attitude of the end-users as well as other organizational and interpersonal concepts. Attitude is based on: awareness, compatibility, perceived usefulness, and perceived ease of use. The last two are based on satisfaction that follows from perceived quality based on specific aspects of the information and the system.

3.2. Questionnaire

The pilot questionnaire consisted of 78 questions (62 statements and 16 general questions). After the pilot the number of statements was reduced to 59. In total 6888 respondents filled in at least a part of our questionnaire of which 5011 worked with patient data or patient records. Of our respondents 74.8% were female, and the mean age was 43.9 (sd=11.5), both are in line with the national average in healthcare. Most respondents were nurses (32.7%), specialists (19.4%), or administrative staff (14.5%). In Table 1 the scores of the seventeen statements directly corresponding to the three outcome measures of our model (attitude, usage intention, and behavior) are reported.

Statements on the willingness of end-users to COUMT in the care process all score 3.8 or higher (reuse for research and management slightly lower at 3.4). End-users agree that it is important to record patient data correctly at the point of care (4.3). They also want (4.1) and like (4.1) to work in a structured and standardized way. End-users indicate that they record data in such a way that others can reuse the data (4.0), and that they reuse data as much as possible (3.9). However, they state that they do not actually use information standards and thus register diagnoses (2.5) and procedures (2.9) in free text. Pain scores (3.8) and vital signs (4.1) score better in this respect. End-users state that in practice they collect the same data multiple times for different purposes (3.6).

Statement	Min	Avg	Max
Willingness to comply to COUMT (4 statements on attitude followed by 2 on intention)			
I like to document in free text	3.7	3.8	3.9
I like to work in a structured and standardized way	4.0	4.1	4.1
It is important that patient data can be used by managers and researchers	3.3	3.4	3.6
It is important to correctly register patient data right during patient contact	4.2	4.3	4.3
I want to reuse as much patient data as available	3.8	3.9	4.1
I want to document in a structured and standardized way	4.0	4.1	4.2
Actual behavior (11 statements on behavior)			
I document many data double (in multiple systems)	2.9	3.6	3.8
I document as much data as possible in a structured and standardized way	3.5	3.7	3.9
I reuse as much available data as possible	3.9	3.9	4.0
I document in such a way that others can use/reuse my data	3.9	4.0	4.1
I document an allergy in a structured and standardized way as soon as there is	3.4	3.6	3.9
new information			
I document medication in a structured and standardized way as soon as there is	2.9	3.4	4.0
new information (P)			
I document all diagnosis with a standardized list instead of free text (P)	2.0	2.5	3.3
I document all procedures with a standardized list instead of free text (P)	2.4	2.9	3.4
I document the pain score in a structured and standardized way as soon as there	3.6	3.8	4.0
is new information (N)			
I document vital signs (e.g. pulse, blood pressure, respiratory rate, awareness) in	3.9	4.1	4.4
a structured and standardized way as soon as there is new information (N)			
I document the risk of falling in a structured and standardized way as soon as	3.2	3.3	3.7
there is new information (N)			

Table 1. Score of the 17 statements that correspond to the model concepts attitude, usage intention, and behavior (Figure 1). Reported are the general average and the minimum and maximum hospital average. All outcomes reported on a 5 point Likert-scale (ranging (strongly) disagree - (strongly) agree). The five highest average scores are shown in **bold** font. Questions for nurses only are marked (N) and for physicians only (P).

4. Discussion

We developed a 31-concepts model describing concepts that influence the adherence to correct documentation according to the COUMT paradigm. Using a questionnaire based on this model we found that end-users think that COUMT is important and they are willing to adopt it. However, in practice end-users do not record patient data in a structured and standardized format which is essential for COUMT.

Our model builds on existing models from literature and is extended to measure end-user perceptions on COUMT. Previous models have looked at systems use in general (e.g. TAM) or specific areas of EHR use (e.g. only EMR exchange systems. Our proposed model focuses on the correct recording of patient data in the EHR, and includes both technical aspects, as well as human interactions and personal beliefs. Therefore our model can be used to monitor both the technical and the social aspects of the process. Our model can be used when healthcare providers or institutions want to investigate the status of COUMT in their organization.

The inclusion of seven of the eight Dutch university hospitals enables us to give a general overview on the state of COUMT in Dutch university hospitals. Additionally we have a large and varied database of respondent data that we can use to validate the model. A potential weakness of the study is the varying response rate per hospital. As answers to the questions in the questionnaire are self-reported we cannot make statements on the actual adoption of COUMT. We plan for future research measuring COUMT in practice where we intent to measure completeness and reusability of data with newly developed indicators. Our current self-reported results can provide a context for these results. Future analyses are planned to validate our model and find associations between the concepts that can identify barriers and success factors for optimizing the adoption of COUMT. These results can assist healthcare organizations and professionals to adopt COUMT in their daily practice. We will assess the generalizability of our model and questionnaire to non-university hospitals within and outside of the Netherlands.

In conclusion we found that COUMT is well adopted in mind within Dutch university hospitals, however not yet in practice. We have built a model that shows the underlying concepts that influence COUMT. This model is intended to further understand the COUMT paradigm, to support its implementation, to measure its state of affairs in an organization, and to identify barriers and find solutions to optimize the adoption of COUMT. The questionnaire can assist healthcare providers and organizations in these processes.

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