Does Information Quality matter?

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Abstract. Information quality has been proposed as one of the determining factors for perceived information system success. Fehrenbacher and Helfert have studied contextual factors of information system use (e.g. different user types, types of business activities supported, etc.) that influence the perceived importance and the trade-offs of information quality criteria. In this paper we will use their framework in a discussion of the findings from a study we conducted on the implementation of an electronic messaging system (e-messaging) in Norwegian healthcare aimed at supporting collaboration between different health care actors. The system has a high perceived success even though the information quality of the message content offers room for improvement according to health personnel using the system.

1 Introduction

In [1, 2] an evaluation of the use of an electronic messaging system is presented, that aims at improving the collaboration between hospitals and community care. The overall outcome of the qualitative evaluation is that, in the eyes of the users: "The introduction of e-messaging in Norwegian health care can be considered a success story in that it has led to more efficient, higher-quality and safer patient transitions"[1]. The evaluation study does not address information quality systematically, although some challenges with respect to this in the evaluated implementation are reported, especially in [1]. These challenges relate to missing or incomplete information (e.g. an updated medication list) and too little standardize message content (e.g. the discharge report), indicating that at least information quality is not perceived as optimal.

In [3] information quality is proposed as one of the independent variables that determine information system success. Especially in the case of the electronic messaging system, this seems very reasonable. A messaging system that exchanges messages with a questionable information quality cannot be expected to be a success.

In this paper we will address the question about the information quality of the messaging system in a more systematic way, and we discuss its relation to the systems success. The paper is structured as follows. In the next section will we introduce the concept of information quality. In the following section will we briefly describe our

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case and research method applied. After that, the results are presented, followed by a discussion of our findings.

2 Background

Information quality is multi-model concept, and many researchers have proposed different characteristics that identify it [4]. Research has furthermore demonstrated that information quality is a *subjective* feature, and can be referred to as: "...data or information that is fit for use" [5]. As is demonstrated in [5] is this assessment influenced by contextual factors, such as: the role of the person assessing information quality; the activity in which the information is used; the organizational context in which the information is used (which department or organizational unit), and available resources (for example time).

In this paper will we use the characteristics proposed in [5], because this list was derived from reviewing a large number of information quality frameworks. The characteristics included are listed in Table 1 below (the descriptions are adapted from [6], p.7).

TABLE I. INFORMATION QUALITY CHARACTERISTICS

Characteristic	**Description**
Accurate	The information is error free
Accessible	Information is easily accessible by authorized users, in the right format
Complete	The information contains all the relevant facts
Timely	Information is available when needed
Believable	Information can be trusted
Secure	Information cannot be accessed by unauthorized users
Consistently Representation	The same information is represented in the same way
Concise	Information is to the point

Fehrenbacher and Helfert showed, based on an extensive survey, that these characteristics are weighted based on the context. So, there seems to be a trade-off between them, As an example, they found that the characteristic *Timely* is weighted as being much more important than *Consistent Representation* by people involved in primary activities than by people involved in support activities([5], Table 9). As another example, IT people valuated the characteristic *Conciseness* as more important than *Completeness*, whereas non-IT people had the opposite assessment ([5], Table 8).

So, information quality is a multi-modal, subjective assessment, where contextual factors determine how the characteristics contribute to the overall outcome.

3 Method and Material

E-messaging system: The figure below, which is taken from [1], illustrates the exchange of messages supported by the system that we studied.

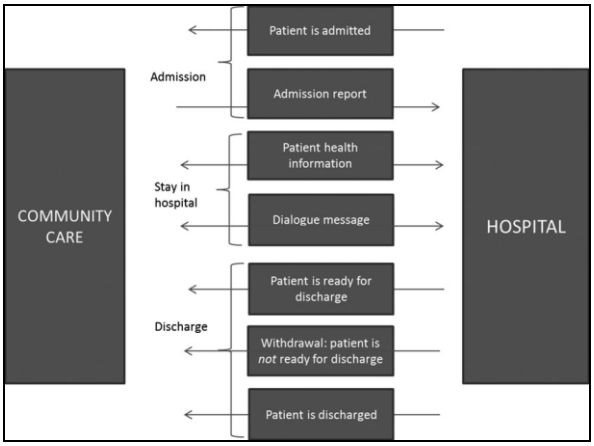

Fig. 1: Messages exchanged by e-messaging system

E-messaging has been introduced nationwide in Norwegian healthcare. The development and implementation of the e-messaging system was initiated by national healthcare authorities [7] to improve information exchange and communication between community healthcare services, GPs, and hospitals. The implementation of the e-messaging system followed the acknowledgment that communication and information exchange between the providers was predominantly done orally, either via telephone or in face-to-face meetings, as well as via fax or postal letters. This meant that the communication of important patient information could be slow and fragmented and that healthcare workers found it difficult to make contact with one another. As a result, insufficient understanding of patients' needs could arise, jeopardizing the quality of care [8, 9]. The e-messaging system was consequently introduced to "secure seamless patient trajectories across the health and care sector through electronic all-to-all communication" [7 p. 6].

The e-messaging system was developed as a module that could be integrated with the various electronic patient record (EPR) systems in use in Norway, among which there are substantial variations. Community healthcare services throughout the country use three EPR systems, while hospitals use two EPR systems. Because these systems are not integrated, information cannot be exchanged automatically between them. However, the e-messaging system enables users to exchange some of the information stored in the EPRs. When composing a message, a user can retrieve some of the content of the message directly from an EPR. Thus, it is not necessary to re-type information. Furthermore, information contained in a received message can be stored in an EPR. This integration of the e-messaging system with various EPR systems facilitates the implementation of the legal requirement that patient information must be exchanged when necessary [10].

Healthcare setting: One large university hospital and three adjacent municipal homecare units were used as a setting for our study. The hospital and one of the municipalities were strategically selected because they had the longest experience with e-messaging. The other two municipalities were randomly selected. As for the information infrastructure, the e-messaging solution is integrated into the providers' electronic patient record (EPR) systems. The staff started to use the e-message system progressively over the period 2011–2013.

Study design: Semi-structured interviews were conducted with 41 healthcare personnel with a focus on their experiences with e-messaging in patient transitions beween hospital and municipal-based home care services.

Data material: The data collection took place beween February and November 2014. The inclusion criterion was that informants must have worked for a minimum of six months to gain a certain level of experience with e-messaging. Staff were handed written information about the study and recruited by their managers. Authors Melby, Hellesø and Brattheim participated in the data collection.

The informants were either interviewed individually or together in groups of 2, 3 or 4. Nurses constituted the largest group of informants whereas a few others were key personnel either working with e-messaging in care situations or involved with implementation and support of e-message system The interview guide focused on three main issues related to the e-messaging system: its efficiency, its influence on the quality of care and its con- sequences for patient safety. The interviews lasted 30–60 minutes and were audio-recorded and later transcribed verbatim by student assistants. Once transcribed, data were coded by hand to identify themes and pattern of themes. More in-depth descriptions of the analysis have been reported in [1].

Ethical issues: Approval was granted by the Norwegian Social Science Data Services. Written informed consent was obtained from all the participants.

4 Results

In [1] several positive effects of the introduction of the e-messaging system are reported, that can be related to some of the information quality characteristics listed in Table 1. First, information on the patient's illness history is more easily available for those who need it, and there is less need to spend time in phone cues searching for information. This indicates that *accessibility* is improved. Furthermore, it is noted that in the new situation, information on the patients' health status is provided to the hospital unsolicited by sending an admission report by community care. Before the introduction of the e-messaging system, hospital nurses had to call community care nurses to obtain this information. This indicates a positive effect on *timeliness*.

However, the interview data also shows negative effects on some of the information quality characteristics. Let us look at the interview excerpt below, taken from an interview with a community care nurse, when talking about the admission report message.

You can attach the note written in our EPR system [Gerica] If it states the reason why a patient is admitted, then you can just use that instead of writing your own. You can write your own, if you want, that is your own choice (...) there the hospital can see how big the need for help is based on the ADL. If it is updated. That is a little challenge in the middle of all this. There was a big fokus on that when we started but now it has moved a bit to the back. The ADL is not in focus but is rather important. (SH 12/2 community care nurse)

So, the reason for admission can be taken from the EPR used in the community care setting, but it is unclear whether it has been properly updated. It can also be filled out by the nurse. Two characteristics are in play here. First of all, can *believability* be questioned, when it is unclear what the source of the ADL is. Secondly, it could be error prone, when taken from the EPR where it has not been updated properly.

In the next interview excerpt, the focus is on the patient health information message, and is taken from an interview with a hospital nurse.

Community care likes to have more concise information: what is the background? What are our assessments? What do we think? What are the plans? It is very important that these are included in the patient health information (...) So I think that we - and community care - can be better at being concise, being more informative in the messages. (...) I see some of the patient health information messages coming from here that are terrible. They only state the planned discharge date, and that is not very informative for community care. (AP 04, hospital nurse)

In this excerpt, it is clear that *conciseness* and *completeness* are at stake. Message content - at least in the case of the patient health information messages - happens to be little to the point and/or incomplete.

The last interview excerpt is taken from an interview with two community nurses, discussing discharge messages received from the hospital.

Nurse A: I have seen some discharge reports that were not very good. Some in which almost nothing was stated. Some can be empty, while in others there is very little about how we should follow up [the patients] based on what is done in the hospital.

Nurse B: it doesn't say what they have concluded. It just says what they have done: "He has got liquid and did the examinations". There is no conclusion based on the whole stay. Often.(NH 21/2, community care nurse)

Here are there three characteristics at stake. First of all is there *completeness*. As noted are many discharge reports little informative. Next, there is the issue of *conciseness*. As noted by the second nurse, is information provided that is not at all to the point, while the critical information - a conclusion - is missing. And finally, the characteristic of *consistent representation* is in focus here. It is stated that the discharge report is far from standardized, in both form and content.

The table below summarized the findings we presented, where a '+' indicates a positive effect and a '-' a negative effect.

TABLE II. EFFECTS OF E-MESSAGING SYSTEM ON INFORMATION QUALITY CHARACTERISTICS

Characteristic	Effect
Accurate	-
Accessible	+
Complete	-
Timely	+
Believable	-
Consistently Representation	-
Concise	-

5 Discussion and conclusion

A more systematic investigation of information quality in the e-messaging system, made clear that from a user's perspective a number of characteristics making up information quality, can be discussed. Not less than five out of seven of the characteristics are assessed as less than optimal. If information quality is a determining independent variable for perceived information systems success, it is difficult to explain the success of the e-messaging system given the problematic state of its information quality.

First of all, we must note that the assessment of the different information quality characteristics by the informants was more a moderated way to problematize some of the aspects of information quality than a strict categorization into 'good' and 'bad' quality. So, even though problems in relation to for example *completeness* were identified, the data does not warrant the conclusion that information exchanged was useless due to a lack of completeness. Our study design does not enable us to distinguish between 'good enough to be useful' and 'not good enough to useful'.

Secondly, the systems success could also be partly explained by the simple fact that it replaced a work practice that was so inefficient and ineffective, that everything was better than the old way of doing it.

But having said that, our results could also point into the direction proposed by [5]. The context in which the system is applied leads to tradeoff between the characteristics. In the context of collaboration and coordination of work between hospitals and community care when transferring patients, the characteristics of *accessible* and *timely* are more important than having optimal *completeness* or *conciseness*. This might be related to the time constrained nature of this type of work. It is most important to have the information that the patient will be transferred to the hospital or back home as soon as possible, because that drives the planning logistic on both sides of the collaboration. Having available complete and concise information on the patient's status is needed, but not critical to drive the logistics.

For further research, it would be interesting to see if and how these less than optimal characteristics are prioritized among themselves. Is *believability* for example more or less important than *completeness* in this context? Such insights could inform the further development of the e-messaging system, and help in making decisions about which parts to improve first. Besides that, it would be interesting to see how these prioritizations change when another context is considered? If the e-messaging

system would be used to support the referral process, for example, would we see the same prioritizations or not?

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