Electronic Messaging to Improve Information Exchange in Primary Care

Reporting from an Implementation and Evaluation Project in North Norway

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Abstract – **FUNNKe is a large-scale ongoing project aiming to assist in implementing secure broadband communication and support the use of electronic messages between community nursing service, general practitioners and local hospitals in the northernmost region in Norway. The main goal of FUNNKe is to establish electronic communication and information exchange in all sectors of health service delivery in the region. The FUNNKe-project has two distinct parts: The first is the actual implementation phase where the focus is to facilitate and support the municipalities to invest in and start using electronic messages for information exchange. The second part is an evaluation phase focusing on the implementation process, analysing the potential for time savings and perceived changes in quality of care. The evaluation study has a multi-method research approach using quantitative and qualitative methods. This paper describes the planned evaluation, the experiences so far, and reports some preliminary results.**

Keywords - telehealth; electronic messaging; large-scale implementation; community nursing service; evaluation; efficiency.

I. INTRODUCTION

Exchanging health information electronically has been a political goal in Norway since 1997 [1]. In 2010, the Norwegian Health Authorities introduced a strategic program to speed up the implementation process [2]. The main political goal was to improve cooperation between health providers and to improve continuity and integrated patient care. As part this initiative, several projects have been initiated in different parts of the country. In Helse Nord, the northern most health region, a project named FUNNKe was launched in 2010. The main goal of FUNNKe is to establish standardised electronic clinical information exchange in all sectors of the health service in the region. The underlying assumption is that standardised electronic communication will speed up and improve the quality of the information exchanged [3, 4]. And that this will lead to more efficient and high quality service delivery through improved cooperation and better continuity in patient care. Another implicit and common assumption is that the technology alone cannot improve the integration of care, but it can be an important facilitator [5]. FUNNKe aims to assist in implementing secure broadband communication and support the use of electronic messages in all 88 municipalities and four hospital units in the region. The planned e-messaging is between the community nursing services and general practitioners and the community nursing services and local hospitals. Electronic messages between hospitals and general practitioners are already in place and have been operative for several years. The messaging system is based on the ebXML Messaging Service specification (ebMS) and PKI (Public Key Infrastructure). The messages are standardised, fully integrated with electronic medical records (EMR) and sent in a secure national network; the Norwegian Health Network. The technological system has been through extensive risk assessments and has been approved by the authorities.

The FUNNKe-project offers knowledge, technological support, guidance and financial support to the local health services in implementing the messaging platform and start using the messages. Two letters of invitation have been sent to the primary health authorities in all municipalities: one in June 2010; and one in September 2011. Several meetings with local health authorities, community nursing service managers, general practitioners and technical staff have also been arranged to advertise the project and encourage participation. Information leaflets on how to get started, training manuals, and advice on how to organise the implementation process have been distributed and are available online via FUNNKe's web portal [6]. The project will run until December 2014.

The FUNNKe-project has two distinct parts: The first is the actual implementation process where the focus is to facilitate and support the municipalities to invest in and start using electronic messages. The second part is an evaluation phase focusing on assessing the implementation process and analysing the potential for time savings and effects on perceived quality of care of using electronic messages in a nursing care setting. This paper describes the planned evaluation, the experiences so far, and reports some preliminary results.

II. BACKGROUND

There is a considerable interest in implementing digital solutions to improve safety, quality and efficiency of health care provision. It is widely believed that introducing information and communication technology (ICT) systems in health combined with social and organisational changes will improve quality of health care provision, reduce costs and improve efficiency [7]. Little empirical evidence,

however, exists to substantiate many of the claims made in relation to large scale eHealth technologies [8, 9]. It has also been reported that research in this area is of poor quality [10, 11]. Black et al [8], for example, found in a recent systematic review of reviews that there is a large gap between the postulated and empirically demonstrated benefits of eHealth systems. In addition, they found that there is a lack of robust research on the risks of implementing these technologies and their cost-effectiveness has yet to be demonstrated. Despite this, the technology is frequently being promoted by policymakers and "techno-enthusiasts" as if this was given.

A. Information exchange in primary care

The number of patients living at home supported by the local nursing service is increasing. These patients are getting older, they often have multiple diagnoses, and are using a large number of different prescribed drugs [12]. Patients are increasingly being managed by a team of health professionals and this requires an effective communication and information transfer. Time spent on gathering patient level information in primary care nursing services can be substantial. Medication error for example, is one of the more serious challenges in health care in Norway [13, 14]. Limited access to patient information might be one reason for this [4]. Jensen et al (2003) found in a study that there was a discrepancy between what the general practitioners ordered and what the nurses administered in 90 percent of the cases [15].

Inadequate cooperation is claimed to be one of the main challenges the Norwegian health care system is facing [16]. Transfer of patient information and communication in primary care has long been a neglected area [17]. Information transfer both between hospitals and primary care services and within the primary care sector still mostly uses traditional means such as telephone, fax, written notes and verbal communication with the patients themselves. Timey transfer of relevant patient data about diagnostic findings, treatments, and arrangement of post-discharge follow-up may improve continuity of care and patient outcomes. By contrast delayed, inaccurate or lack of information transfer between health care providers may have substantial implication both for patient safety, provider satisfaction and resource use [18, 19]. For example, Kripalani et al found in a recent review that the availability of discharge summaries in primary clinics were low affecting the quality of care in 25% of follow-up visits [3]. About half of adults experience a medical error after hospital discharge, and 19% - 23% suffer an adverse event, most commonly an adverse drug event [20]. Bakken et al. [21] found in a study carried out in Norway, that most general practitioners did not have routines for informing the primary care nurses about changes in patient medication. They also lacked information on how many of their patients the home care nurses had in their care.

It is widely believed that standardised digital solutions will improve both efficiency and quality of care [22]. Several authors have pointed out that lack of common infrastructure is one of the main causes of deficit in information transfer both within and between health care levels [23, 24]. A standardised platform for e-messages is now underway in the Helse Nord region assisted by the FUNNKe-project.

As far as we know, there exists no research on how large-scale ICT implementation processes in primary health care settings should be managed and organised to become successful. Furthermore, research on how electronic messaging between primary care nurses and general practitioners affects quality of care and the efficiency potential in the nursing service is also lacking. Obtaining a scientific-informed perspective on these issues can reduce unrealistic expectations. This might also promote long-term progress and help identifying areas with greatest potential for benefits, suggest priorities for further implementations, and help guide implementation processes in other parts of Norway.

The objectives of the evaluation are to understand the implementation process and to establish if electronic communication between nursing services and general practitioners increase efficiency and improve quality in terms of more continuity and better integrated care pathways. The objectives are: to analyse if frequency and pattern of use is influenced by size, location, living conditions and financial situations in the municipalities affect use; to establish if electronic messaging between nursing services and general practitioners has potential to increase efficiency and improve quality of care; and finally, to provide knowledge of the implementation process that can be used for further development and use.

III. MATERIALS AND METHODS

The evaluation study has a multi-method research approach using both quantitative and qualitative methods. The first part is using quantitative methods to analyse the pattern of use and efficiency potential, and the second part uses qualitative research methods to evaluate the implementation process. The data will be collected using the following strategies: prospective logging of messages; prospective case control study design; a survey using questionnaires and in-depth interviews.

A. Logging of e-messages

This part of the project will look into how the health care providers use electronic messaging in the nursing service. Is frequency and pattern of use influenced by size, location, living conditions and financial situations in the municipalities? Will the smaller communities use electronic messaging differently from the bigger ones? And what characterise communities with a high usage rate? These questions will be answered by analysing message logs and municipality characteristics.

Prospective logging of messages including data on sender, recipients and purpose will form the basis for analysing frequency and the pattern of use. All messages in the region will be logged. Frequency of use, sender, where the messages are sent (recipients) and type of messages will be collected over a period of one year. This will also give us insight into how usage develops over time

and with experience. Seventeen municipalities using e-messaging will be included in this analysis starting after three months of regular use.

B. The time saving potential

In this part of the project, we analyse the effect of electronic messaging on efficiency. The efficiency potential at the local nursing service will be analysed by measuring time savings. The time the nurses spend on the phone collecting patient information from other health care providers and the time spent on reading and writing messages will be will be obtained and registered.

The study design chosen for this part of the evaluation project is a prospective case control study design at the municipality level. This design is suited to estimate the effectiveness of an intervention as it is reflected in routine health care practice. We are interested in analysing the effect of e-messaging in everyday nursing practice.

Specified phone bills from the telephone operators (Telenor and Netcom) will be obtained and used to investigate difference in time costs. The bills will be obtained by the owners of the phone numbers and forwarded de-identified to the researchers. Specified phone bills will provide information about the number of calls, duration and price. We will be able to register who the recipients are (by recognizing general practitioners' and other health care providers' phone numbers) and the duration of the call (waiting and conversation). This will give an estimate on time spent on collecting and confirming patient information. The time spent on reading and writing messages by the nurses will be registered manually using a pre-designed registration form.

A pragmatic approach to sample size calculation is adopted as we want to include as many of the local nursing services as possible. We have invited 20 community nursing services to participate (only one municipality has more than one nursing service unit). We did expect a high no-response rate, hoping to include at least 10 community nursing services. So far 6 nursing services have agreed to participate. The nursing services are divided into smaller units ranging from four to seven units (areas) in each service. The data will be analysed using units (areas) adjusted for number of patients. The outcome measures therefore are number of calls per unit and time spent on the phone per unit. So far we have 31 units to include for analysis. Data have been collected before start-up (at baseline) and will be collected after one year of use. Three of the nursing services have more than one year of experience and will be used for comparison at baseline.

1) Data analysis

The objective above will formally have the form of null hypotheses stating that electronic messaging has no effect on efficiency. Parametric and non-parametric analyses will be used to analyse potential differences. We will use multilevel analysis to adjust for variation within municipalities and nursing services. Regression models will be used to analyse pattern and frequency of use. Additional analyses will be performed for each dimension of the models in order to verify the sensitivity of the results. The effects will be tested at $P < 0.05$ level and the analysis will be performed in SPSS.

C. The quality of nursing services

We also developed a questionnaire addressing the quality aspect of the nursing services after the implementation. We wanted to explore how e-messaging was affecting the quality of the service the nurses provided perceived by the nurses themselves. We had a special focus on the quality of the medication lists (if they felt that medication was more updated and correct), but also asked for general satisfaction and challenges. The questionnaire was piloted on 10 nurses. After one reminder the response rate was only 20% which is inadequate for our purposes. We are now working on an alternative plan on how to assess the quality changes of e-messaging.

D. The implementation process

This part of the project evaluates whether the implementation process has been organised and managed successfully. This part of the study is based on data collected trough questionnaires and semi-structured in-depth interviews.

A convenience sample of project managers at the local health and care services in the municipalities will be approached. We will include municipalities with a varying degree of experiences in using the e-messaging system. These project managers organise, assist and encourage the implementation processes. They are also responsible for supporting and guiding the surrounding municipalities in their designated area.

We have chosen to include a questionnaire as basis for the interviews. This will help form and structure the areas to be covered in the interviews. The questionnaire will be distributed to 17 project managers during October 2012. The main themes explored are: types of collaboration; how they perceive the usefulness of the assistance from the main project; the advice and the competence given; the need for ICT support; problems encountered; and challenges for continuous use of the e-messaging system. The questionnaire also includes spaces for open ended text where the respondents can elaborate on issues they feel are important.

Based on the findings of the questionnaire, semi-structured interviews will be conducted using videoconferencing. The interviews will take place as soon as data from the questionnaires have been analysed. The purpose of the interviews is to gather an in-depth understanding of the findings. The project managers will be asked to explain and deepen their response. The structure of the interview will also open for discussing topics not addressed in the questionnaire.

1) Data analysis

The questionnaire has been developed in the survey and data collection software Questback. Data will be displayed in tables using descriptive statistics. Open ended text will be categorised and analysed according to standard methods. The interviews will be taped and transcribed.

Notes will also be made after each interview. Two evaluators will read the interviews and identify overall themes. After agreeing on the overall themes, the data will be organised according to main categories and then discussed. This will form the foundation for the data analysis.

IV.   PRELIMINARY RESULTS

Halfway into the project seventeen of 88 municipalities in the region (20 %) have implemented the technological platform and are using electronic messages for information exchange. Five of these (Alta, Tromsø Lenvik Dyrøy and Rana) have used electronic messaging for more than a year. The remaining 11 started using the system during the first half of 2012.

A total of 25000 messages have been sent to and from the nursing services in the region during the first 6 months of 2012. Most of the messages have been sent between the nursing services and the general practitioners. These messages are mainly general health related questions about patients and their medication lists in addition to patient updates from the nurses to the general practitioners and information about changes from the general practitioners to the nurses. The nursing services in four of the municipalities (Tromsø and Dyrøy, Harstad and Lenvik) also communicate electronically with the hospital (a total of 1600 messages). Most of these messages contain patient information before hospitalisation and discharge summaries from the hospital to the local nurses. The number of messages sent in the different areas range from 380 in a small local area (Dyrøy with 1270 inhabitants) to 12000 messages in the largest city (Tromsø with 70000 inhabitants), both with more than one year of experience.

As can be seen in Fig 1, the total volume of e-messaging is steadily increasing. The blue curve shows the number of messages sent to and the red curve indicates the messages sent from the community nursing services in North Norway. This figure is borrowed from FUNNKe's web portal with permission [6].
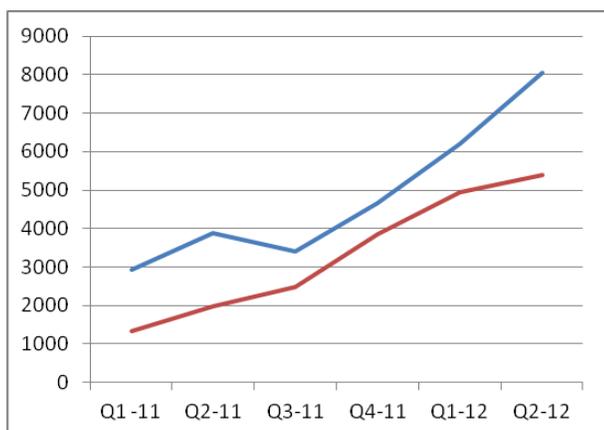

Figure 1. Number of e-messages to and from the local nursing services from the first quarter of 2011 (Q1-11) to the second quarter of 2012 (Q2-12).

The main barriers to actual use reported so far in the project have mainly been around four aspects: lack of political will; shortage of personnel and other resources; lack of ICT skills; and technological difficulties due to old equipment.

Primary care nurses already using e-messaging is reporting that the system seems to be time saving. Previously they spent a considerable amount of time on the phone trying to get in touch with the general practitioners. They are also claiming that having access to ready and updated information is improving the quality of the care they are providing (personal communication).

Preliminary results seem to support the nurses' perceived benefits of e-messaging. We have data from six nursing services. Crude preliminary analyses, unadjusted for patient volume, show that the nursing services who have taken the service into use have 37% less phone volume compared to the control nursing services. Adjusted analyses are planned, but critical data elements are still missing. The time spent on the phone also tends to be less for the e-messaging users. We can, however, not confirm these results yet. The post intervention data collection will start in the first half of 2013. We are also consecutively working to recruit more nursing services to provide data for the quantitative analysis.

V.   DISCUSSION

Despite political will and several strategic action plans the health sector has been slow to adopt digital solutions. Over 70 % of the community health services still lack proper ICT equipment and infrastructure to communicate electronically with other health service providers [25]. Information transfer still mostly uses traditional means such as telephone, fax and written notes. The latest health care reform "The Coordination Reform" [26] is encouraging more health services to be provided in local communities where the patients live. More patients are being discharged from the hospital sooner causing a need secure and effective electronic communication between the levels of care [27]. Despite this need for a more timely information exchange the municipalities are slower to implement and use electronic messaging. After two years of active encouragement, technical and financial support and organisational advice still only one in five municipalities have started to use electronic messaging in the region. There might be several reasons for this slow uptake and low use. The main challenge so far has been the integration of the messages into day-to-day work. The administrative routines have had to change to adapt to the new mode of communication. There have been problems with identifying recipients and which addresses to use for which message. Continuous monitoring of the activity and large amount of technological support has overcome these challenges. This highlights the need for a support and troubleshooting plan early in implementation processes.

Another factor that might have contributed to the slow uptake is that most of the municipalities are relatively

small. Forty-three percent have less than 2000 inhabitants and 77% have less than 5000 inhabitants. This might imply a general shortage of both qualified personnel and financial resources. A general lack of ICT skills tends to limit adoption of the technology [28, 29]. Furthermore, the existing computer equipment is relatively old and of low quality [30] and this can be a major challenge to wider adoption [31]. The cost of upgrading the computer equipment might also be too high. The municipalities are facing a higher cost than expected as part of the latest health care reform.

There might also be a general reluctance towards changing existing routines and implement new working patterns. Organisational barriers such as the absence of clear guidelines defining roles and responsibilities can hamper adoption [29, 31, 32]. There seems to be an overall lack of willingness to innovate in the health sector [29, 31]. The community nurses might also have too busy time schedules caring for patients to innovate.

The main limitation of this evaluation is the low number of community nursing services included for the quantitative analysis. The main problem has been to get the local nurses to respond to our request for data. This might be due to a combination of shortage of time and lack of interest. To get the nurses to register the time they spend on reading, writing and systematise the information is by far the greatest challenge. We will, however, continue our data collection effort.

VI.   CONCLUSION AND FUTURE WORK

This paper has described and reported preliminary results from an ongoing large-scale implementation project in North Norway. The project aims to establish standardised electronic clinical information exchange in all sectors of the health service delivery in 88 municipalities the region. Halfway through the project 17 of the 88 municipalities (the community health service providers) have implemented the technological platform and are using e-messaging. The e-messages have mostly been sent between the nursing services and the general practitioners with a much lower volume between the nursing services and the hospitals. Electronic communication between general practitioners and hospitals are already in place. Preliminary results also indicate a potential reduction in number of phone calls to the general practitioners and reduced time spent on the phone for the nursing services using e-messages.

The next step in our study is to begin analysing the implementation process. Questionnaires are now being sent to seventeen of the e-messaging users. Data from the questionnaires will be processed and analysed. This will be followed by in-depth interviews for a deeper understanding of the implementation process.

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