Bridging information gaps between primary and secondary healthcare

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Abstract. Medication errors are harmful and costly for healthcare systems. Recent studies show that a major part of these errors are due to the problems in transferring the patient current medication-data between primary and secondary healthcare. Recent ICT development promises to improve the communication between primary and secondary healthcare. In order to find out the constraints that may hamper a communication project’s productivity, an IT configuration for building a medication-data communication network between primary and secondary healthcare in the Netherlands was followed applying qualitative methods. We analysed some important problems that project faced and conclude that problems with the data integration and saving the data integrity are important challenges for the project to maintain its objectives.

Keywords: Medication Error, Computer Communication Network, ICT, the Netherlands

1. Introduction

Many of medical errors are “Medication Errors” [1]. In the US, it has been estimated that 1-2% of patients admitted to hospitals are harmed as a result of medication errors and 7000 patients die a year because of them [2, 3]. The Royal Dutch pharmacists society (KNMP) has suggested that as many as 131,000 hospital admissions, 8.2 per cent, per year occur in the Netherlands due to adverse drug reactions. These admission would cost the Dutch society approximately 186-430 million Euro per year [4].

Amongst the sources for medication errors, limited or impaired access to “patient current medication history”, specially when patient is moving from one level of healthcare to another, is of great importance [5]. A recent systematic review by Canadian researchers of 22 studies including 3755 patients showed that errors in current medication histories at hospital admission were “disturbingly common and potentially harmful to patients”. Such errors occurred in up to 67% in the studies, which were published between 1966 and April 2005 [6].

One of the promises that recent ICT development has raised is improving the communication of patient data especially across the healthcare boundaries. Despite all IT potentials, however, fulfilling such a promise has not usually been straightforward. IT projects are complicated at different levels, thereby their productivity is challenged [7]. For an IT communication project it is of paramount importance to safeguard the integrity of the interchanged data as well as the ability to integrate different pieces of

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data together. The productivity of such a communication project, then, can be challenged by complications at these levels.

This study focuses on several important issues that complicated data integrity and data integration in an IT project aiming at medication-data communication, and thereby challenge its productivity. Our ambition in this study is to raise points that can benefit similar projects. Evaluating the medication-data transaction process, this paper indicates information gaps between the Dutch primary and secondary healthcare that may induce medication errors. The early development of an ongoing IT project, which aims at crossing these information gaps and improve medication errors, is sketched out. Through qualitative methods, then, some important challenges that may curb this kind of ICT configuration in improving medication errors are explored.

2. Methods

We approach the process of medication-data exchange between primary and secondary care providers as building a loop-process, within which patient medication-data is being circulated, updated, but may also suffer from attrition or distorted. IT accordingly is expected to accelerate circulating and updating of the data whilst prevent its attrition and distortion. We interviewed care providers from this loop and observed their work. Our interviews were semi-structured, in depth, one-by-one and face-to-face. We held 10 interviews, with each one lasting 1.5 to 2 hours. Community and hospital pharmacists' works were observed for about 4 hours as well. Moreover, we analysed the relevant documents including project initiation documents and updated about the changes in the project through emails, phone calls and direct talks to project managers.

3. The study environment

The study environment is Almere, a city near Amsterdam in the northwest of the Netherlands, where a project, TUMA, has been launched in order to exchange medication-data between primary care providers, GPs and community pharmacists, and secondary care providers, hospital pharmacists and medical specialists. In this region, from 115 GPs nearly all of them use the same GP Information System (GPIS). All of the 17 community pharmacies use the same pharmacist information system from the same vendor. Since the GPISs and pharmacist information systems share the same server, they build an “application specific network” through which primary care providers can easily share some part of patient data including patient medication-data. Though GPs and community pharmacists already communicate to some extent in the Netherlands, Almere is quite unique in the sense that in one region there exists this level communication between all GPs and community pharmacists. “We in primary care always check each other’s work [on patient medication]. This is normally done both by our information system and also through direct observation of the prescriptions. If we see there is something wrong, we just pick up the phone and call to the GP for more clarification. Every time a prescription is filled, the information system generates an automatic message that informs and updates the GP.” [CP1-04]

With the word “loop” we would like to emphasize the end-to-end closeness of the process.

TUMA means Trans-Mural Exchange of Medication data in Almere.

We quote our interviewees with abbreviations plus the code number of their interview: PL= Project Leader, PM= Project Manager, CP= Community Pharmacist, HP= Hospital Pharmacist,
Another remarkable feature of Almere is existence of only one general hospital in this region; patients who need specialist attention are referred to this hospital. TUMA, then, is building a communication network on such an ideal condition.

4. Medication-data communication between primary to secondary healthcare

In the Netherlands every patient has a GP as a family doctor who acts as a gatekeeper between primary and secondary care. Every patient also has his own community pharmacist who fills his prescriptions. At the primary care level pharmacists have the responsibility for taking care of their patients’ medication safety. Registration of the patient data in the Dutch GPISs is based on the episodes, i.e. based on every time a patient consults his/her GP for a new medical problem. Except for diagnosis, coding with ICPC\(^5\), and medication-data, coding with ATC\(^6\)-classification, most data entries are made in free text format [8]. To write a referral letter, a GP may have to draw related information from several episodes in his information system. Due to the time and effort this takes for GPs the letters usually do not contain enough information for medical specialists [9].

At the hospital level, secondary care providers need a patient medication profile from primary care in order to avoid medication errors and offer high quality clinical care. Nevertheless, they do not have direct access to this data. At this point the medication-data flow comes to a halt. It does not cross the secondary care border; the first information gap between primary and secondary patient care is thus created. To fill this information gap, patients most frequently are the source for their medication related information at the Dutch hospitals. However, it is always possible that patients – or their relatives – do not remember all the currently using drugs or confuse between look-alike drug names. In addition, it is possible that hospital care providers fail to take an accurate history of patient medication or some part of information is missed while history taking or when it is handed over amongst care providers. A hospital pharmacy told us a story in this regard. “A nurse failed to register a drug name (Methoteroxate) while she was taking the drug history from a patient, only because the drug had been used in intervals. The patient got cystitis during his hospitalisation and a physician ordered him Cotrimoxazole. As soon as the Cotrimoxazole started for the patient, his condition suddenly got worse and turned to dangerous one with leucopoenia and other signs of Methoteroxate toxicity. Such a dangerous condition happened to the patient, only because the nurse failed to take an appropriate drug history from the patient. Our information system, on the other hand, failed to react to this drug interaction because Methoteroxate had not been entered to it.” [HP2-02]

When a patient is discharged from a Dutch hospital, he receives prescriptions that should be filled by a community pharmacist. Beside this early contact, additional information, including the diagnosis, procedures, and changes on patient medication are sent to the primary care providers through a discharge letter. Previous studies, however, show that this process usually takes a long time and in most cases when patients contact their GPs after discharge, the GPs usually are unaware of the last changes in the patients’ medication [10]. This delay, which is also the case for the Almere region, creates the second information gap between primary and the secondary Dutch healthcare. This information gap, in its turn, may hamper the quality of patient care and induce medication errors. Moreover, without access to the information from secondary care, both primary care providers and patients will have been left in limbo.

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\(^{5}\) International Classification for Primary Care.

\(^{6}\) Anatomical Therapeutic Chemical Classification System.
5. The role of TUMA

TUMA is building a communication network between primary and secondary healthcare. The communication network is a “Virtual Private Network” (VPN) that connects the server of the primary information systems to the server of the hospital pharmacist information system. At the centre of this communication network named “eHealthNet”, there is a “Central-Patient-Index” system to secure one-by-one match of patients’ files between the primary and the secondary healthcare. Through this communication network, patients’ medication profiles, including patient’s current medications list and a summary of his medical record, will be exchanged by OZIS, an EDIFACT-based communication protocol. TUMA has set a mechanism that every time a patient is admitted to the hospital an enquiry message is sent to primary care by the hospital pharmacist information system. The reply message, the patient medication profile, will be integrated to the hospital pharmacist information system. In near future, the information from primary healthcare care will also be available to care providers at two wards of the hospital. A link is designed in the Electronic Patient Record (EPR) interface for this purpose. Whenever a care provider clicks on this link, a message will go to the pharmacy information system, then an XML message containing patient medication-date will come back automatically to the EMR. The project finally aims at bridging over the second information gap. Discharge medications and a summary of the patient medical file will be sent through the hospital pharmacist information system –in a similar way – to the local health network as a patient is discharged from the hospital.

6. Implications

We touched upon the idea that the medication-data should ideally be circulated within a closed-loop. Medication-data is changed, updated, and handed over in this closed-loop. In this multi-stage process, it is important for care providers to receive patient medication-data in a timely fashion and accurately, with safeguarded integrity. In the Dutch healthcare system, this loop is far from closed especially when the medication-data is supposed to cross the borders between the primary and secondary healthcare. Currently, patients are considered as a link between the primary and secondary care parts of the “medication-data loop”, filling the information gaps in these points, while we know that patients get it wrong 28-38 % of the time [12].

Moreover, in the discussion of data communication among healthcare providers, the relevance of interoperability of care providers’ information systems comes into the front stage. In TUMA, this can be translated into integration of the medication-data from the community pharmacist information system into the hospital pharmacist information system and vice versa in a way that the data can be processed by the both sides information systems. Despite the high aspiration of an integrated solution,
however, a fully integrated information system is hard to find [13]. One reason is that many software products have been built and acquired from heterogeneous sources during a long period of time, and the systems have differences in implementation and architectures [14]. This has been the case for a couple of ICT projects that have recently been launched on the base of OZIS protocols in the Netherlands. TUMA, as explained, is quite unique among them. Tracing the progress of TUMA, nonetheless, we observed that the project faced problems in integrating different parts of the exchanged data. “One main reason that the project fell behind its timetable is the problems we had in integrating the medication-data to the hospital pharmacist information system, a software functionality problem. To solve the problem, we consulted other projects’ people that have already worked with the same way of data transaction. To our surprise, we found out that they only use the system for inquiring the data from primary care and then transfer the data manually to their hospital information system.” [PL-03]

There are at least two reasons why TUMA has faced problems regarding integration of different parts of patients’ medication-data. Firstly, there are drugs that are in use solely in one level of healthcare. For example, ‘Nexium’, a drug that is prescribed for a peptic ulcer disease in the hospital, is not being used in the primary care. Therefore, if a patient on this drug is discharged from the hospital, his medication has to be changed into another proton pump inhibitor, such as Omeprazole, at the primary care. Secondly, the hospital pharmacist information system works with more comprehensive “Medication Dispensing and Administration Coding system” than community pharmacist information system. A drug that is ordered once a day orally in primary care might be changed into intravenous form and in a distributed dosing schedule according to a hospital wards’ routine. Automatic integration of the medication-data in such conditions can be problematic and information systems thus produce errors. As a result, there have to be manual steps in the process of integrating different parts of patient data. Yet, there is no exact idea what portion of the medication-data has to be integrated manually. However, existing integration problem, even if it is limited to a small part of medication-data, will not let the medication-data process loop be closed and error production in some cases may facilitate [15].

In the discussion of circulating medication-data in a closed-loop, the integrity of medication-data not only depends to the integration of different parts of patient data produced in different healthcare levels, but also to safeguarding its integrity while it circulates within each healthcare level solely. This means that the medication-data should be protected from being damaged or lost while it is registered or communicated among care providers inside primary or secondary healthcare levels. In Almere region, we have seen that within primary healthcare, there is a good integrity for medication-data. However, such integrity does not exist for the medication-data at the hospital. We have presented a story of a nurse negligence that shows how the integrity of the medication-data can be hampered within the hospital. Despite being common, these kinds of errors do not usually gain attention and are often ignored if they do not lead to immediate or serious disadvantages [16]. Therefore, TUMA’s success in preventing medication errors will to some extent bound to extent to which the medication-data integrity is protected at the hospital.

For TUMA stakeholders, the weakest link in the medication loop is the patient, which has to be substitute by ICT. Yet, the patient should play a core role in verifying the accuracy of his current medication-data. There are at least three reasons for this claim. First, some patients have to fill their prescriptions in a pharmacy other than their designated community pharmacy. Second, Over-The-Counter Drugs (OTC) are not registered in any information system. Last but not least, some patients make changes in their medication administration plan by themselves. This information and changes on
patient medication are important and only can be obtained through asking the patient. In a study by Van der Kam et al [12] on medication-data exchange between GPs and pharmacists, for the drugs reported by the patient-only there was no difference between electronic communication and paper-based communication. Ignoring the patient’s role in completion and updating the current medication-data, therefore, will lead to missing some part of patient medication-data and thereby damage the data integrity. TUMA has not planned to prevent this data attrition and in that sense it will not succeed to close the medication loop.

Taken together, reducing medication error is depended not only on being timely, but also on saving the integrity and integrating different pieces of data to gather. TUMA doubtlessly improves the timeliness of medication-data transaction among care providers. However, its success in reducing medication errors is challenged by the problems with integrating different pieces of the data and safeguarding its integrity.

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