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Inter-organisational communication networks in healthcare: centralised versus decentralised approaches

Habibollah Pirnejad, *MD, MHIM, Institute of Health Policy and Management, Erasmus University Medical Centre, The Netherlands*

Roland Bal, *MSc, PhD, Institute of Health Policy and Management, Erasmus University Medical Centre, The Netherlands*

Arjen P. Stoop, *MSc, PhD, University Hospital of Copenhagen/Information Technology University Copenhagen, Denmark*

Marc Berg, *MSc, MD, PhD, Institute of Health Policy and Management, Erasmus University Medical Centre, The Netherlands*

Correspondence to: Habibollah Pirnejad, iBMG, P.O. BOX: 1738, 3000 DR, Rotterdam, The Netherlands, Phone: +31 10 4088811, Fax: +31 10 4089094, E-mail: h.pirnejad@erasmusmc.nl

Abstract

Background: To afford efficient and high quality care, healthcare providers increasingly need to exchange patient data. The existence of a communication network amongst care providers will help them to exchange patient data more efficiently. Information and communication technology (ICT) has much potential to facilitate the development of such a communication network. Moreover, in order to offer integrated care interoperability of healthcare organizations based upon the exchanged data is of crucial importance. However, complications around such a development are beyond technical impediments.

Objectives: To determine the challenges and complexities involved in building an Inter-organisational Communication network (IOCN) in healthcare and the appropriations in the strategies.

Case study: Interviews, literature review, and document analysis were conducted to analyse the developments that have taken place toward building a countrywide electronic patient record and its challenges in The Netherlands. Due to the interrelated nature of technical and non-technical problems, a socio-technical approach was used to analyse the data and define the challenges.

Results: Organisational and cultural changes are necessary before technical solutions can be applied. There are organisational, financial, political, and ethicolegal challenges that have to be addressed appropriately. Two different approaches, one "centralised" and the other "decentralised" have been used by Dutch healthcare providers to adopt the necessary changes and cope with these challenges.

Conclusion: The best solutions in building an IOCN have to be drawn from both the centralised and the decentralised approaches. Local communication initiatives have to be supervised and supported centrally and incentives at the organisations' interest level have to be created to encourage the stakeholder organisations to adopt the necessary changes.

Keywords

healthcare communication network, ICT, integrated care, IT integration, interoperability

Introduction

Present healthcare systems are identified as fragmented organisations that have many shortcomings in the ability to respond to the growing demands of the community [1]. New advances in medical knowledge promise a longer and healthier life for chronic and handicapped patients. At the same time, however,

they introduce more specialty and subspecialty domains to medical practice leading to more fragmentation in healthcare systems. The trend for current healthcare delivery systems will inevitably be a migration from acute towards chronic healthcare and from centralised towards decentralised medical practice. Such a healthcare system will need more and better collaboration amongst different care providers. Future healthcare systems will therefore increasingly rely on effective communication to achieve efficient, multidisciplinary, and integrated healthcare.

Good communication is the cornerstone of integrated care practices [1–3] and may have a direct impact on patient outcomes [4–6]. The lack of good communication can produce medical errors and increase morbidity and mortality in healthcare [1,6–9]. Information and communication technologies (ICT) can supply healthcare providers with a secure, safe, and reliable way to access different parts of patient data stored in different databases of different organisations. The creation of an Inter-Organisational Communication Network (IOCN) by information technology is seen as a promising way to afford integrated care and improve the quality in healthcare services. Fulfilling such promises, however, is dependent on the level to which information systems within an IOCN can be integrated and are able to support interoperability amongst the communicators.

Every approach to an IOCN has to address many interrelated technical and non-technical complexities at the same time. Developing such a communication network amongst different healthcare providers requires integrating different and, in most cases, incompatible technical infrastructures. This technical issue becomes more complicated if we consider that every provider has a special reason for building such a communication network. Nonetheless, the importance of IOCN becomes increasingly evident, and healthcare authorities in many countries, such as the Netherlands, Sweden, Canada, and the UK are investing heavily to integrate their disparate healthcare units by building communication networks through information technology [10,11].

Up until now, only a few studies have focused on the mechanisms and challenges of integrating diverse information systems at a large scale [12,13], and most of the studies have focused on single tools, artefacts, and protocols [14]. These studies have identified similar challenges that are encountered in the development of IOCNs, despite differences in the healthcare systems in which these are embedded [10,11]. There is then much to learn from each other since we are now faced with the development of national and regional health information strategies in many countries.

In this paper we analyse the development of a national medication record[1] in The Netherlands [15] as a case study to illustrate the kinds of problems that are encountered and the experiences so far in trying to solve these issues. Our study contributes to understanding the challenges and complexities in building an IOCN in healthcare and the appropriations in the strategies. More specifically, we focus on the parties—general practitioners (GPs), medical specialists, and pharmacists—that are responsible for patient medication safety and therefore need to exchange patient medication records. Two different approaches (centralised versus decentralised) that have been framed amongst these parties are distinguished. The building of a national IT infrastructure for medication records communication is then sketched out. We applied qualitative methods for our study and a socio-technical approach [16] is used to analyse the data to show how the technical requirements are tied up with non-technical issues and to identify the main challenges for building an IOCN. Finally, we discuss a way to address those challenges.

Study context

In The Netherlands, GPs act as the gatekeepers between primary and secondary healthcare [2]. GPs have been using computers for many years in their offices, and most of the Dutch patients' medical data is stored in GP information systems. While in the past, the prototypical general medical practice was a solo practice, we now increasingly see larger and multidisciplinary primary care centres arising. Moreover, new GPs increasingly tend to work part-time and the majority of GPs are currently organised in Central GP Stations,[2] enabling the use of substitutes during off times [17,18]. Yet, the substitute GPs in many cases do not have access to patient data stored in regular GP information systems and this may increase the risk of medical error in their practice [17,19]. These changes in GP practices increase the need for communication and data sharing amongst them.

GPs, moreover, need to be in mutual communication with care providers at the secondary care level, especially medical specialists. As family doctors, GPs need to know what happens to their patients when they go to the hospital, especially when they must continue a

[1] This includes patient medication data and a summary of patient medical records.

[2] The Central GP Station is the organisation of GPs at the municipal or provincial levels, which can provide GPs with a substitute GP during their holidays and off times.

therapeutic plan after hospital discharge. In addition, secondary care providers need access to the hospitalised patients' medical records, such as medication data, from primary care in order to provide quality care.

Pharmacists also need to be kept in the communication loop. According to an agreement between the Ministry of Health and the Royal Dutch Society for Pharmacies (KNMP) in October 1999, pharmacist care was incorporated into the Dutch Medical Treatment Contracts Act (WGBO) [20]. As a result, pharmacists claim responsibility for patient medication safety and want to re-check the safety of the prescribed drugs. Hence, they need access to patient medication data and diagnosis [21]. Patients have their own pharmacists that fill their prescriptions and have an overview on their medication record. Practically all pharmacies use a pharmacist information system, which contains patient-orientated medication files both for administrative purposes and to prevent unsafe combinations of drugs. However, during nights, weekends, and holidays patients have to go to shift pharmacies, where pharmacists do not normally have access to their medication records [22].

Because medication data are not shared amongst these professionals, money is wasted and many lives are potentially put in danger. A recent study from WINAP (the scientific institute of pharmacists in the Netherlands) estimated that 90,000 hospitalisations occur each year as a result of ''avoidable medication errors''. This represents an annual cost of 300 million Euros [23]. The term ''avoidable medication errors'' refers to the fact that at least some of these errors could be avoided if the patients' medication record had been available to healthcare providers at the right time and the right place.

For many reasons, other stakeholders may also need to be in the medication data communication loop, or may have an indirect impact on building medication records communication networks (e.g. government organisations, and insurers). In this study, however, we decided to focus on the main parties from a patient safety perspective: GPs, pharmacists, and specialist physicians. We considered other parties wherever their roles converged with these parties' roles.

Case study

In this case study we focus on The Netherlands as a country facing the complex development of a national communication network. The developments have been followed since 2004. In order to collect baseline information about network development amongst the parties, the problems they encountered, and the actions they have taken so far, we reviewed the literature related to communication in the Dutch healthcare system, including publications in international or national scientific and professional journals until November 2006. Reports and documents published by the stakeholder organisations such as NICTIZ (National IT Institute for the Care Sector of the Netherlands) were also analysed. In order to deepen our insight into the mechanisms and dynamics of network development processes, we also conducted 10 interviews with senior managers of regional communication projects, IT experts, experts in the Dutch healthcare system, GPs, pharmacists and specialist physicians involved in medication data communication projects. The in-depth interviews were semi-structured, one-by-one, and face-to-face, with each one lasting approximately 1.5 hours. Interviews were integrally transcribed and analysed for emerging trends. The gathered data were used to analyse the ways in which medication data communication is framed in the Dutch healthcare system.

In this study, we applied a socio-technical approach to analyse emergent complexities in building IOCNs, and to define the challenges for such a development. Socio-technical approaches have frequently been used to explain the interrelationships between social and technical issues in the development of information systems, focussing on the 'fit' between the organisation of working practices and information technologies [24–27]. Studies in the socio-technical tradition have particularly been powerful in understanding the reasons behind the poor acceptability, uptake, and performance of many ICT interventions [16], but have also focused on how information technologies are appropriated in healthcare practices [28]. Adoption of this perspective allows us to think about a broad class of phenomena that are crucial to uncovering the mechanisms that lead to the development of an information system, its appropriations once it is used in healthcare practice and its integration mechanisms with other information systems [24].

Medication records communication amongst the Dutch healthcare providers

Healthcare inter-organisational communication has proved to be problematic in the Netherlands. At the primary care level, studies show that though 80% of GPs use an electronic prescription system, only 10–35% of prescriptions are transmitted to community pharmacists electronically and less than 5% of GPs get an up-to-date summary of all medication/aids

Table 1. Summary of differences between the centralised and decentralised approaches

	Centralised approach	Decentralised approach
Consisted of	One large project	Small scattered projects
Involvement of parties	By central assignment	By negotiation
Start	From a macro level	From a micro level
Strategy	One comprehensive solution for all problems of the end-users	Pragmatic approach to solve immediate needs of the end-users
Governing	Power is localised in a central party	Power-sharing amongst parties through negotiation
Implementation	Top-down	Bottom-up
Change management	Macro level > Micro level	Micro level > Macro level
Timing	Big bang	Small incremental advances

supplied from the local pharmacy [19]. In the communication between primary and secondary care, the referral letters from GPs do not usually contain the necessary information for specialist physicians and hospital pharmacists and less than 1% of the specialists have electronic insight into medication supplied by community pharmacies [19,29]. A hospital pharmacist describes the situation as follows:

> Patients are normally asked about their medication history at the hospital. The information is then registered using paper-based forms and is sent to us [at the pharmacy department] to be entered into our information system. Our observational role and our information system's work are based on this information that sometimes is not reliable at all. [HP & PM][3]

The quality of communication to the GP is sub-optimal; the discharge letters take a long time to be received by primary care providers [30]. In general, less than 5% of the prescriptions generated by specialists are received electronically by community pharmacies [19]. After a patient is discharged from the hospital, his GP and community pharmacist often have no idea about the changes in their patients' medication. Despite obvious needs for communication there is no reliable way for primary and secondary care providers to communicate patient data. A community pharmacist explains the situation as follows:

> When a patient comes with a discharge prescription in his hand, we have no idea why the patient has to receive those drugs after discharge from the hospital. We do not know why his medications were changed and whether the specialist physician had considered the patient's medical records from primary care. Therefore, we cannot properly check the prescription's safety and offer the necessary advice for patients[4].

[3] A Hospital Pharmacist who is also the Project Manager for one of the local communication projects.

[4] A Community Pharmacist who is also the Project Manager for one of the local communication projects.

Inter-organisational communication and its approaches

Two approaches can be distinguished in developing a communication network amongst Dutch GPs, specialist physicians, and pharmacists for medication records exchange. The first ''decentralised approach'' is a bottom-up development, starting from *micro level changes* amongst the parties that want to build communication networks (Table 1). This approach consists of scattered projects based on local IT procurement and the minimal infrastructures to support local communication initiatives. The development process is not steered by a centrally designed plan or a detailed strategy. Rather it follows a pragmatic approach with the aim of trying to address the parities' *immediate needs,* albeit in a loosely structured manner. The development proceeds by small incremental advances which are the products of a dynamic negotiation amongst the parties that have horizontal relationships with each other in the development process. In effect, the process of network building is manageable to local circumstances and its speed is congruent to the creation of shared interests [31]. One pitfall of this approach is that it involves a long-term process. Moreover, since these networks develop regionally, it is a challenge to manage any *macro-level changes* (e.g. policy making, legislation) which are necessary for a nationwide integration.

The second approach is in many aspects the converse of the decentralised approach; hence it can be called a ''centralised approach''. It consists of a single large-scale project that is governed by a *central party*, determined by the government, and assigns other stakeholder parties to join the development process. The central party has the power to arrange the required *macro level changes* for networking, such as providing the necessary infrastructure, supporting IT policy and law and so forth. The course and the goals

are predetermined and there is a strategy that offers the best solutions for the potential development problems. The implementation is top-down with a big-bang introduction and the deadlines in this approach ensure that the development will progress at a desired pace (Table 1). However, the speed of the process challenges the ability of the development strategy to address unexpected problems and changes. Moreover, since this approach is applied in a top-down fashion, the management of any necessary micro level changes represents a formidable challenge.

In The Netherlands, the decentralised approach has been gradually developed throughout the years, starting from the regional clusters of GPs and community pharmacists that use information systems from the same vendor. By sharing the same server, these clusters usually built [application specific] networks through which they could share patients' medication records [17]. Since 1998, the domain of this networking process has expanded beyond the clusters by means of a lightweight infrastructure; a communication protocol named OZIS[5]. Gradually, OZIS has become the central notion to this approach, allowing the primary care providers, especially Dutch community pharmacists, to communicate patient medication records across their different information systems [22]. During the past few years, some of these regional projects have tried to connect their local primary care network to secondary healthcare, using OZIS based messaging mechanisms. These initiations, which are limited to communicating patients' medication records between primary and secondary care, have booked considerable results in some cases, even though they are still challenged by many issues (e.g. coding) as described below [32].

The centralised approach also has a long history in The Netherlands, but gained new impetus in January 2002, when the Dutch government established NICTIZ[6] to facilitate communication amongst the healthcare stakeholders. NICTIZ is a publicly sponsored organisation, trying to bring together different stakeholders in the Dutch healthcare system, and provide a nationwide vision for building a national Electronic Patient Record (EPR) that can fully represent all relevant patient data for every healthcare stakeholder at any time and at any place [19]. One of the main tasks of NICTIZ is to support the construction of a communication network. As a short-term goal, NICTIZ has focused on exchanging medication records, which is considered as a common interest amongst the participants. The early plan was to have patient medication records available in one region in 2004 and nation-wide in 2006. This plan seemed to be realistic at the time NICTIZ succeeded in taking good steps in defining standards and providing some necessary technical infrastructure for an inter-organisational communication. However, it later became clear that the plan was too ambitious to be realised by those deadlines. NICTIZ has since developed a national healthcare information hub, known as LSP in Dutch, which makes information exchange of different care providers feasible. No patient information will be stored in the hub, except a record of which information on which patient is kept by which healthcare practitioner as well as a log of who has accessed what information. In principle, GPs could read a professional summary of a patient's record by using their care unique identification card, while physicians and pharmacists could read the medication overview of patients. The hub became operational and could be tested only recently. In the near future, by connecting different care providers [in one region] to this hub the real implementation phase toward building an IOCN will start. In order to connect to the hub different care providers will have to upgrade their information system in order to comply with the qualifications determined by NICTIZ, Qualified Healthcare Information System [33].

The current Dutch healthcare information infrastructure

The purpose of building an IOCN is to make different care providers work cooperatively on the same set of data by integrating the fragmented and distributed pieces of patient data. For such a purpose, information systems must be able to exchange information and process the exchanged information, or in other words the information systems must be 'interoperable'. To accomplish interoperable data transaction, both the sender and the receiver systems must use a standard format, content, vocabulary as well as delivery mode, i.e. ''syntactic interoperability'' [3,34]. Moreover, the underlying Reference Information Model (RIM) of the information systems must be able to support the information transaction and its integration [35]. This means that the RIM of information systems must include the concepts, attributes, and relationships needed to describe aspects of care providers' work, i.e. ''semantic interoperability''. Therefore, interoperability is at centre stage of every 'true communication network' and to maintain such functionality, there are two main technical concerns: standards and RIM.

Building an interoperable IOCN requires an appropriate infrastructure, standard and RIM. However, solving

[5] OZIS (the 'open care information standard') are EDIFACT based protocols for data transaction in primary healthcare or between primary and secondary healthcare.

[6] Nationaal ICT Instituut in de Zorg'.

the problems with old infrastructure or adopting a new information infrastructure is not merely a technical but rather a socio-technical issue. The work practices and infrastructure technologies have co-developed over time within the healthcare stakeholder organisations. They are mutually adapted to each other to form a socio-technical network, making it difficult to change one of them without changing the other [36]. Four main categories of challenges for changing infrastructures are presented below using a socio-technical perspective. Wherever possible, we analysed how the two different Dutch approaches managed to meet these challenges.

Political commitment

Many changes, both at the micro and macro levels, are needed to set up an IOCN. At the macro level, managers are required to take appropriate strategies and policies needed to cope with significant changes in infrastructure technologies. At the micro level, on the other hand, end-users are required to adopt the necessary changes, for example in their routines and working behaviours. As argued, the decentralised approach basically grows upon the micro level changes and the horizontal relationships between the participant organisations in order to build *political commitment* amongst each and every participant organisation to cope with changes. On the down side, this approach has difficulty dealing with macro level changes due to power limitations. In contrast, the centralised approach can more easily deal with macro level changes; the challenge in that approach is to create commitment amongst all stakeholders.

In general, the RIMs of the current Dutch healthcare information systems lack the ability to support inter-organisational communication. Changing the RIM and adopting a new technology despite its feasibility is far from being merely a technical fix. History shows that many social issues have so far been involved. For instance, the Reference Information Model (RIM) of the present Dutch GPISs (WCIA[7]-RIM introduced in 1996 and upgraded in 2000 and 2001) has been considered a major impediment for communicating patient data, as this RIM lacks a data model that supports information exchange. Despite the technical feasibility of upgrading the systems, the problem with communication through GPISs has not been improved so far [17]. One reason for this was concern by vendors about privacy and data safety. Another reason was that data exchange beyond their own systems was seen as a risk to their competitive position on the ICT market.

The history of the decentralised approach, on the other hand, shows that its success in solving communication problems has mainly been due to its success in gaining the participants' commitment to cope with the required changes. The mid 1990s was the period when Dutch pharmacists started to see the lack of communicating patient data amongst themselves as a major constraint to fulfil one of their important claims, namely playing an active role in patient safety [22]. In 1995 the Royal Dutch Society for Pharmacies (KNMP) negotiated with the information system vendors to solve the communication problem amongst local pharmacists. While this led to the development of OZIS, vendors remained reluctant to change their information systems to support this communication standard, since their strategy was to create local networks of same-vendor systems. The pharmacists' decision and commitment to change the situation, however, made it possible for the Dutch government to invest money in improving the pharmaceutical situation in the Netherlands in 1999. The KNMP then used this financial aid to persuade the vendors to rebuild the RIM of the early Pharmacist Information System based on OZIS, in 2000, thus enabling data exchange between systems of different vendors [22].

In changing the standards, similar political dynamics are also in effect. Though selecting and using appropriate standards is mainly a centralised and a top-down process, its successful implementation has very much to do with users' behaviours and coding routines at the micro level. In the Dutch healthcare system, standardisation has never been a solid process. GPs use the International Classification for Primary Care (ICPC) and ATC[8]-classification to register patient data in their information systems. This registration, however, mainly includes the diagnosis and medications, yet the majority of patient data is stored in the form of free text. Recent research revealed that Dutch GPs fail to register contraindication, intolerance and the discontinuation of treatment in their information systems in 22%, 15%, and 45% of the cases, respectively [37]. Besides, the routine used in applying diagnostic codes varies amongst GPs and studies have shown that one code may not mean the same for different general practitioners [38]. The same problem exists with the secondary care providers. At the secondary healthcare level, the International Classification of Diseases (ICD-9-CM or ICD-10) is applied mainly for discharge purposes. It has been argued that the quality of this coding is not sufficient and studies have shown that healthcare providers at hospitals frequently code patient diagnosis inaccurately or do not code at

[7] WCIA stands for Workgroup of Coordination Information Automation.

[8] Anatomical Therapeutic Chemical Classification System.

all [39]. These studies denote the necessary micro level changes that have to be fulfilled in order to improve coding patient data. Without these changes, serious damage to communication and interoperability has to be expected.

Regarding data exchanging standards, EDIFACT[9] is widely adopted in The Netherlands for data exchange amongst healthcare organisations. However, the problem with EDIFACT and the standard protocols built on it, such as OZIS, lies mainly in integrating the transferred data within the receiving systems. Most often, the sender and receiver need to apply a tailor-made software programme that will be dedicated to mapping their two types of datasets. Different standards and standardisation routines amongst healthcare stakeholders, as discussed above, and the problems with the RIMs of the information systems make the data mapping and translation of message transacted by OZIS protocol in the decentralised approach a problematic process. In most cases semiautomatic steps and human intervention have to be applied to match the transacted data [32]. This requires a laborious work of reviewing already registered data by different parties. Moreover, the coding routines of care providers have to be improved upon. These are all changes that can be coped better in the decentralised approach. In fact, the community pharmacists in some projects already started to review their databases and negotiate with other parties to improve their coding routine.

In contrast, NICTIZ is following a centralised approach and adopting HL7-V3[10], hoping to solve many of the problems with the RIMs and inconsistencies in data registration standards. Although HL7-V3 can transact data regardless of the standards used to register data, its ability to accomplish a meaningful data transfer is dependent on the degree to which care providers code their data completely and correctly. Therefore, even if NICTIZ succeeds in adopting HL7-V3, its success in building an interoperable communication network will depend on gaining the commitment of the users and parties to adopt the required micro level changes known to be hard and labour-intensive. Moreover, many of the micro level changes, such as end user adaptation and adopting new routines, are likely to be problematic in the top-down centralised approach. Since stakeholders in the decentralised approach are committed to one another, gaining their commitment to adopt the changes is more feasible compared to the centralised approach.

[9] The Electronic Data Interchange For Administration, Communication and Transport.

[10] The Health Level Seven Version 3 is an international standard for storing and sharing health information.

Financial challenges and interests alignment

The cost of transition from one IT configuration to another is another important issue to consider when building an IOCN. Distribution of the costs is paramount; what is the underlying 'business model' and who will pay for what? The financial burden of building a communication network is potentially a big impediment. It becomes even more important if we consider that most Dutch healthcare organisations currently spend less than 2% of their revenues on IT. Moreover, the costs not only play a role in building IOCNs, but also in doing the works that are needed to register and code data. For example, in a study on a referral system between primary and secondary care in the Netherlands, GPs insisted on receiving financial compensation for the extra work that they were doing [40]. As mentioned above, concerns about the competitive position of vendors are also important here.

The recent Dutch IT history demonstrates that financial aids and subsidies have always been a good promoter of IT projects [22,41]. Two decades ago, in the early introduction of computers to primary care, the Dutch government paid 100% of the expenses of computerisation to GPs. The information model for this computerisation was the ''Groene Kaart'' (Green Card): a paper-based chart that most GPs were using for data registration. When this information model was changed from ''Green Card'' to ''WCIA'', an accredited system, in 1990; 60% of all costs were subsidised [41,42]. However, in the complex and interrelated process of changing information infrastructures for communication purposes, central funding will not be able to cover all local IT spending. Although some expenses will have to be incurred by individual parties, other expenses will have to be shared by all parties. These expenses do not deliver clear benefits to the individual parties and therefore are hard to distribute. Moreover, some more expenses may be incurred by organisations as a result of new regulations, such as losing their market. Many of these expenses appear gradually and lately during the course of implementation. Understandably, organisations may be reluctant to invest if some of the costs will be covered centrally. This lack of certainty in the central approach may lead to a larger IT gap between 'cash rich' and 'cash poor' organisations [43].

The history of the decentralised approach shows that many of the late expenses can be negotiated among the organisations. One of the major impediments in upgrading the pharmacist information systems was the resistance by the systems' vendors. There were

[and still are] three main vendors for pharmacist information systems in the market. They saw opening up the information systems as a threat to their interests, saving their clients [22]. The problem was solved only when KNMP guaranteed the vendors' interests with the money that had been received from the Dutch government.

Organisational challenges

Many organisational changes are required in setting up an IOCN. Changing information infrastructure then will inevitably require the work processes of the communicators at different organisations to align with each other. This means that working practices will be affected in all participant organisations. Such changes can create tension and increase resistance among the staff to the implementation if they are not approached properly [43]. Organisational changes, therefore, have to be expected and managed at both inter-organisational and intra-organisational levels. A number of vital questions need to be addressed here. For example, when does a new organisational role, such as a new responsibility, come into effect? When is an organisational role no longer effective? Where do responsibilities of healthcare providers from different organisations, such as a GP and a specialist, overlap or interfere? And when should tasks be delegated or redistributed between organisations or care providers? Good inter-organisational relationships are key for governing these changes. For example, in studying communication networks between pharmacists, we found that those regions that had a long history of cooperation on other issues were much quicker to accept this new challenge than regions where such inter-organisational networks did not already exist [22].

These changes need to be considered and addressed carefully. Every stakeholder in fact sees the process of communication from its own standpoint and this may challenge the building of an IOCN. For example, the role of pharmacists in the process of medication records communication is challenged by doctors, leading to a resistance to share information about diagnoses. Since many of these changes are found at the micro level and they come up gradually during the implementation, they are rarely considered and may even be ignored in the centralised approach. Moreover, the participant organisations in the centralised approach usually do not represent a homogenous society of end-users. For example, only one organisation represents all specialist physicians. This introduces the possibility that the interests of some end-users will be ignored. The organisational changes involved with the new IT configuration, and the fact that many stakeholder organisations lack the knowledge and strategies to cope with these changes ensures that they will move very carefully and slowly. Effectively, then, they will hinder the necessary changes. Since The Netherlands is a country where policy-making in health care is seen as a process of consensus making, and since many parties are involved in setting up the Dutch national EPR [19], there is little chance that extensive progress will be made fast.

Ethicolegal challenge

The role of patients in building IOCN goes beyond that of an ordinary stakeholder and their attitudes towards sharing their data with healthcare stakeholders are very important and must be considered carefully. According to the Dutch Medical Treatment Contracts Act (WGBO), in many situations patients must be asked permission for their information to be made available to care providers and health insurers. However, even amongst different groups of patients, attitudes toward sharing data with other healthcare providers and stakeholders differ. In this regard, it is possible to distinguish different categories of patients, such as patients suffering from chronic diseases, who benefit more from data sharing and do not consider it as any important threat to their privacy [44]. Considering that patients' records serves not only as a depository for medical data but also assists in quality assurance, follow-up patient claims, and legal judgments [45], the greater focus on patient rights the visibility and accountability of patients' records.

In the centralised approach, ethicolegal impediments can be a big challenge when building an IOCN if they are not addressed appropriately. At the micro level, patient expectations about sharing their data with healthcare stakeholders must carefully be considered [46]. This consideration should focus on finding the best way to protect patient privacy rights, while letting patients benefit from advantages of healthcare inter-organisational communication [46]. On the other hand, at the macro level, legislation has to be passed in order to protect patients' rights. The current strategy of NICTIZ is to implement a so-called 'unique care professionals identification' pass, that enables both the prior authorisation and control of healthcare professional to access and use the patient electronic records.

Besides a clear focus on the different interests of parties involved in centralised approach, there is also a need to establish optimal balances between the various demands placed on such systems. Since these demands may conflict with each other—e.g.

creating full authorisation processes for doctors looking at patient data might conflict with the time pressure in patient care work—trade-offs are inevitable. For example, in a study on the use of the 'unique care professionals identification' pass, we found that medical specialists often leave their card in the computer to avoid having to login and logout every time they need to access the system [47]. Although some of those problems might wither away when more technically sophisticated identification procedures are introduced, examples like these serve to illustrate that trade-offs are necessary. For example, it might be better to improve login and logout procedures rather than focus on authorisation.

Moreover, our research shows that data privacy has never been a major concern and challenge for the decentralised approach. Whenever it is seen as problem, it is solved very pragmatically for example by positioning a notice in the waiting rooms of community pharmacists and GP offices that declares patient data could be shared. Since local projects have fairly been closed for outsiders, patients' representation is totally missing from these developments. Therefore, contrary to the centralised approach, patients' rights and privacy are not easily recognised and considered in local communication developments.

Discussion

The development of a nationwide communication network amongst healthcare stakeholders has been recognised as an essential strategy in many healthcare system reforms. The way to approach such a configuration, adopt the changes, and cope with its challenges, however, remains as yet an underdeveloped topic in the literature. The Netherlands is amongst the pioneers in the development of a nationwide communication network in healthcare. As we have seen for the Dutch case, there are two different approaches for this purpose, each of which faces considerable challenges to the integration of heterogeneous information systems.

Development of a true communication network requires changes to the information infrastructure of participating organisations. Since there is no single factor at play in all the changes in this field, the development process should never be considered as a matter of investing in technical factor alone (e.g. changing standards). Rather, the development has to be viewed as the integration of the [medication related] activities seen on the ''work floor'' of the participant organisations. There are cultural, financial, technical, political, ethical, and organisational differences that all affect the process of change adoption by these organisations. Although some of these factors can be considered beforehand, many others are hard to recognize in advance, including the consequences at the micro level. Moreover, the magnitude of differences must be multiplied by the size of the project; a larger project will therefore have to deal with greater diversity and unpredictability than a smaller project. Required changes that are not managed properly will impede the development process.

The efforts and strategies should be implemented at multiple levels to cope with micro level and macro level changes. The best solutions have to be drawn from both centralised and decentralised approaches. Such a multi-levelled approach can show how the development process has to provide the participant organisations with a solution for their immediate needs rather than a perfect solution for future needs. Instead of a top-down implementation of large-scale changes, communication initiatives based on local IT procurements can be supervised and supported centrally in order to facilitate the necessary changes that extend beyond the ability and scope of local projects (e.g. necessary legislation). Moreover, the development process in one way or another has to address the common incentives of participant organisations. Considering the nature of the challenges, different incentives can be found for the different parties, varying from financial aids to political gains, reputation, qualitative care and confidentiality assurance. On example of a financial aid would be a start-up subsidy for stakeholders expecting to bear substantial front-end expenses, in line with the understanding that a financial relationship will have to be structurally embedded. In the centralised approach, as argued, the governing party sets the goals and the course. The speed of the process in effect does not leave enough time for the parties' interplay to find the most satisfactory path through their joint incentives, and this likely means a continuous postponement of deadlines. The decentralised approach, on the other hand, starts from the moment where the parties set out their strategies according to their joint incentives. Since at that moment the different parties have strong incentives (financial, reputation, etc) in building an IOCN, they will move to cooperate with each other and are motivated to adopt the necessary changes. The important point is to let the parties negotiate with one another to seek out a way that can address their joint interests. In a study of a local communication project between primary and secondary healthcare levels, the project leader explained how an organisational challenge in their project was met by addressing a common interest:

> The hospital pharmacist information system in our project is a shared system with another hospital in the nearby city. The server of the information system is located in that hospital. During the first six months of our project it was really hard to convince the medical informatics department of that hospital to cooperate with us. It was hard even to convince them to let us put a CD in the server of the information system. … However, as soon as they started to do a similar project and build their communication network between primary and secondary care, they realised that they could benefit from our project and now they are co-operating with us very well.

The benefits of a centralised approach are potentially much greater than those of a decentralised approach. However, the realisation of those benefits depends on the initiation and operation of the communication network. NICTIZ has considered ''exchanging patient medication records'' as a common interest amongst all parties that can facilitate the development process. However, for some parties, such as medical specialists, there is as yet no short-term gain and incentive; it would only be more registration work for them. Since they are not yet convinced that the current paper-based medication management systems are incomplete and obsolete, it has been difficult to get them on board. In stark contrast, Dutch pharmacies, as we have seen, are increasingly joining OZIS for communication purposes [22]. For them, joining OZIS is a welcome support for their professional prestige, which is being battered by ongoing media reports about excessive incomes, and a lack of relevance in the era of IT supported, integrated health care [22].

Conclusion

We have seen that important organisational and cultural changes are to be expected when setting up an IOCN in healthcare. We argue that pushing forward ''true IOCN'' in a situation where there is no sufficient political determination and a commitment to adopt the changes is bound to fail. We argue that significant changes will only emerge by means of significant changes at the level of ''system incentives''. We believe that IT is fundamental in integrating different healthcare organisations and generating high quality and low cost healthcare. However, the best solution has to be sought in combination of the centralised and the decentralised approaches. Local communication initiatives have to be supervised and supported; incentives at the organisations' interest level have to be created to encourage the stakeholder organisations to adopt the necessary changes.

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Mark J.G. Govers, Dr., Assistant Professor, University of Maastricht, The Netherlands.

Eric Monteiro, Prof., Department of Computer and Information Science, Norwegian University of Science and Technology (NTNU), Trondheim, Norway.

One **anonymous** reviewer.

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