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SOCIO-TECHNICAL APPROACHES 2010
Studies in Health Technology and Informatics

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Information Technology in Health Care: Socio-Technical Approaches 2010
From Safe Systems to Patient Safety

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Preface

This volume presents the papers from the fourth International Conference on Information Technology in Health Care: Socio-technical Approaches held in Aalborg, Denmark in June 2010.

In 2001 the first conference was held in Rotterdam, The Netherlands with the theme: Sociotechnical’ approaches that consider ‘social’ and ‘technical’ aspects as inextricably intertwined, and as equally important in information systems design, implementation and evaluation.

The second conference was held in 2004 in Portland, Oregon, USA. The theme here was: To err is system.

Sydney in Australia was the venue for the third conference with the theme: The ability to design, implement and evaluate safe, useable and effective systems within complex health care organizations.

The theme for this conference was “Designing and Implementing Health IT: from safe systems to patient safety”. The contributions have reflected on a number of important issues. How are the mutual adaptations of technology and work practice during implementation reflected in design and redesign? How are the successful implementations carried out as a process of organizational change? How does a socio-technical understanding improve the design and implementation of safe systems and thus contribute to the agenda of patient safety?

The contributions demonstrate how the health informatics community has contributed to the performance of significant research and to translating research findings to develop health care delivery and improve patient safety.

The editors want to thank Marianne Sørensen, Aalborg University for keeping track of all the contributions and ensuring they found their way to the final proceedings. We also want to thank all the reviewers for their excellent work in providing constructive feedback to the authors. This valuable input has significantly improved the quality of many papers. We also want to acknowledge the sponsorship of the conference by Det Obelske Familiefond, the Mayor of Aalborg and of Aalborg University.

Christian Nøhr
Jos Aarts
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<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aanestad, Margunn</td>
<td>University of Oslo, Norway</td>
</tr>
<tr>
<td>Aarts, Jos</td>
<td>Erasmus University Rotterdam, The Netherlands</td>
</tr>
<tr>
<td>Ammenwerth, Elske</td>
<td>University of Medical Informatics Tirol, Austria</td>
</tr>
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<td>Erasmus University Rotterdam, The Netherlands</td>
</tr>
<tr>
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<td>Linköping University, Sweden</td>
</tr>
<tr>
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<td>Aalborg University, Denmark</td>
</tr>
<tr>
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<td>Université Lille, France</td>
</tr>
<tr>
<td>Bossen, Claus</td>
<td>Århus University, Denmark</td>
</tr>
<tr>
<td>Chiasson, Mike</td>
<td>Lancaster University, United Kingdom</td>
</tr>
<tr>
<td>Coiera, Enrico</td>
<td>University of New South Wales, Australia</td>
</tr>
<tr>
<td>Cornford, Tony</td>
<td>London School of Economics, United Kingdom</td>
</tr>
<tr>
<td>Cummings, Liz</td>
<td>University of Tasmania, Australia</td>
</tr>
<tr>
<td>Elkin, Peter</td>
<td>Mount Sinai School of Medicine, USA</td>
</tr>
<tr>
<td>Ellingsen, Gunnar</td>
<td>University of Tromsø, Norway</td>
</tr>
<tr>
<td>Georgiou, Andrew</td>
<td>University of Sydney, Australia</td>
</tr>
<tr>
<td>Jensen, Tina Blegind</td>
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</tr>
<tr>
<td>Kanstrup, Anne Marie</td>
<td>Aalborg University, Denmark</td>
</tr>
<tr>
<td>Kaplan, Bonnie</td>
<td>Yale University, USA</td>
</tr>
<tr>
<td>Klecun, Ela</td>
<td>London School of Economics, United Kingdom</td>
</tr>
<tr>
<td>Kushniruk, Andre</td>
<td>University of Victoria, British Columbia, Canada</td>
</tr>
<tr>
<td>Kuziemsky, Craig</td>
<td>University of Ottawa, Ontario, Canada</td>
</tr>
<tr>
<td>Moen, Anne</td>
<td>University of Oslo, Norway</td>
</tr>
<tr>
<td>Nohr, Christian</td>
<td>Aalborg University, Denmark</td>
</tr>
<tr>
<td>Novak, Laurie</td>
<td>Vanderbilt University, USA</td>
</tr>
<tr>
<td>Reddy, Madhu</td>
<td>Pennsylvania State University, USA</td>
</tr>
<tr>
<td>Roberts, Jean</td>
<td>Central Lancashire University, United Kingdom</td>
</tr>
<tr>
<td>Sigurdardottir, Hrönn Kold</td>
<td>IT-University, Denmark</td>
</tr>
<tr>
<td>Simonsen, Jesper</td>
<td>Roskilde University Centre, Denmark</td>
</tr>
<tr>
<td>Sittig, Dean</td>
<td>University of Texas, USA</td>
</tr>
<tr>
<td>Vimarlund, Vivian</td>
<td>Linköping University, Sweden</td>
</tr>
<tr>
<td>Wentzer, Helle</td>
<td>Aalborg University, Denmark</td>
</tr>
<tr>
<td>Westbrook, Johanna</td>
<td>University of Sydney, Australia</td>
</tr>
</tbody>
</table>
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Contents

Preface

Christian Nøhr and Jos Aarts

From Safe Systems to Patient Safety
Jos Aarts and Christian Nøhr

Part A. Keynote Presentations

Healthcare IT Usability and Suitability for Clinical Needs: Challenges of Design, Workflow, and Contractual Relations
Ross Koppel and David A. Kreda

Aggregated Review of Route Cause Analyses Related to Medication
Annemarie Hellebek and Peter Skjoet

Sustained Participatory Design and Implementation of ITHC
Jesper Simonsen

Part B. General Considerations

Sociotechnical Changing in Healthcare
Dimitra Petrakaki, Tony Cornford and Ela Klecun

The Sociotechnical Configuration of the Problem of Patient Safety
Peter Danholt

How to Dwell in an EHR. The Question Concerning Architecture and EHR
Lars Botin

Part C. Design

Pilot Users in Agile Development Processes: Motivational Factors
Liv Karen Johannessen and Deede Gammon

Designing Shared Electronic Records for Chronic Care
Jørgen P. Bansler, Erling C. Havn and Troels Monsted

Participatory (Re)Design of a Sociotechnical Healthcare Delivery System: The Group Health Patient-Centered Medical Home
James T. Tufano, James D. Ralston, Peter Tarczy-Hornoch and Robert J. Reid

Patients and Professionals in Collaborative Testing of a Web-Based Tool for Integrated Care: An Evaluation Study
Jorunn Bjerkvand and Albert Alonso
Communication Challenges in System Development: Involvement of System Developers in Small-Scale IT Projects
Lone Stub Petersen, Charlotte D. Bjoernes and Pernille Bertelsen

Sociotechnical Integration of Decision Support in the Dementia Domain
Helena Lindgren and Sture Eriksson

Standardization – The Iron Cage of Nurses’ Work?
Torbjørn Meum, Gro Wangensteen, Harald Igesund, Gunnar Ellingsen and Eric Monteiro

Standardized Nursing Work: Works in Practice but Not in Theory?
Rune Pedersen, Gunnar Ellingsen and Eric Monteiro

Part D. Implementation

Café Seminars in a Bottom-Up Organizational Development Project at a Danish Radiology Department
Karsten Ulrik Niss

Collaboration Across Organizational Boarders, the Referral Case
Vigdis Heimly

Organizational Considerations for the Implementation of a Computerized Physician Order Entry
Sylvia Pelayo and Marie-Catherine Beuscart-Zephir

Issue Orders and Discontinued EPR
Anne Forsell, Helena Karsten and Rikki Vuokko

Sustainable Mobile Information Infrastructures in Low Resource Settings
Kristin Braa and Saptarshi Purkayastha

Where Superman Is Not on Staff – On Implementation and Lacking Feedback
Roar Stokken and Felicia Gabrielsson-Järhult

Part E. Patient

Compliance or Patient Empowerment in Online Communities: Reformation of Health Care Services?
Helle Wentzer and Ann Bygholm

Does Telehomeconsultation Lead to Substitution of Home Visits? Analysis and Implications of a Telehomecare Program
Marjolein A.G. van Offenbeek and Albert Boonstra

IT for Learning Diabetes
Marie Glasemann and Anne Marie Kanstrup

Use of “Serious Health Games” in Health Care: A Review
Samantha A. Adams
Part F. Safety

From Clinical Practice Guidelines, to Clinical Guidance in Practice – Implications for Design of Computerized Guidance
Karen Marie Lyng

Improving Health IT Through Understanding the Cultural Production of Safety in Clinical Settings
Laurie Lovett Novak

Integrating Technology-Centric and User-Centric System Testing Methods: Ensuring Healthcare System Usability and Safety
Andre Kushniruk, Elizabeth Borycki, Mu-Hsing Kuo and Shigeki Kuwata

Towards Safer Medication Use – In Practice
Gro A. Hamre, Kirsti E. Berntsen and Eric Monteiro

Patient Safety and Sociotechnical Considerations for Electronic Handover Tools in an Australian eHealth Landscape
Chris Showell, Matthew Thomas, Ming Chao Wong, Kwang Chien Yee, Steve Miller, Christy Pirone and Paul Turner

Patient Safety, Resilience and ICT. A Reason for Concern?
Espen Skorve

Socio-Technical Challenges in Implementing Safe Patient Handovers
Ellen Balka, Marianne Tolar, Shannon Coates and Sandra Whitehouse

Subject Index
Author Index
From Safe Systems to Patient Safety

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Abstract. In this introduction we summarize the contributions to the Fourth International Conference Information Technology in Health Care: Socio-technical Approaches. We argue that putting to use information systems in health care is a difficult and winding road. Systems may even compromise instead of improving patient safety. Designing and implementing systems requires a thorough understanding of the context in which technology is being used. But this understanding should also lead to better design and implementation methods. Therefore this conference wishes to address the challenges of safe systems and patient safety, ten years after the publication of the landmark reports on human error and quality of health care by the Institute of Medicine.

Keywords. Health informatics, socio-technical approach, patient safety

1. Introduction

Patient safety has been prominent on the health care agenda since the publication ten years ago of two landmark reports on human error in medicine and the quality chasm [1, 2] by the Institute of Medicine. A special role has been attributed to information systems, assuming that the completeness and correctness of patient information in support of decision-making would reduce medical errors and improve patient safety. Many countries have initiated policies and programs to stimulate the implementation and use of electronic health care record systems. Unfortunately, in practice the road towards implementing such systems is bumpy. A study of the implementation of electronic prescribing systems in seven western countries showed that the uptake does not exceed 20% of the hospitals [3]. Studies also showed that information systems may even induce errors, instead of reducing them [4].

2. Fourth International Conference ITHC: Socio-technical approaches

It is therefore appropriate that, ten years after the publication of the Institute of Medicine reports, the fourth international conference Information Technology in Health Care: Socio-technical Approaches re-visits this theme and examines how safe systems can be designed and implemented to improve patient safety. As has been written elsewhere, the sociotechnical approach emphasizes the interrelatedness of technology and people [5]. Safe systems are a prerequisite for safe care. People must be confident

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that systems they use are safe. Unfortunately this is often not the case. Ash, Berg and Coiera reported a number of unintended consequences of using IT. They argue that information systems are complicated technologies and that the interaction space can also be immensely complex, because individuals carry out their tasks by communicating across rich social networks [6]. They identified two main categories of potential errors. One category consists of errors that occur in the process of entering and retrieving information, the other concerns errors in the process of communication and coordination. In a study of the unintended consequences of computerized provider order entry systems, Campbell and her co-authors identified nine major categories which included: more and/or new work for clinicians, endless demands for system changes, the durability of paper, changes in communication patterns and practices that are difficult to cope with, negative emotions, the occurrence of new kinds of errors, changes in organizational power structures and an overdependence on technology [7]. Koppel and his co-authors identified fifteen workarounds to mitigate the shortcomings of barcode medication administration systems [8]. Workarounds are defined as deviations in which actions do not follow explicit or implicit rules, assumptions, workflow regulations, or the intentions of system designers. Workarounds may result in medication errors, such as administering the wrong medication or incorrect dose, and thus compromising patient safety. These and many other studies show that the unintended consequences of IT occur mainly as a result of the interaction between people and technology.

The challenge of socio-technical analysis of information technology in health care does not only lie in understanding how and why technology is being used in a complex environment, but should also point to ways in which systems can be designed and implemented that better support work practices in health care. In this perspective the socio-technical contains elements of engineering science [9]. Designers should make explicit the purpose and the intended users for whom they have designed and developed health IT. Health IT makes visible what hitherto has been invisible or not widely shared. Professionals must examine the balance between transparency and accountability, and the discrentional space they require in patient care when using electronic patient record and decision support systems. Ultimately health IT should support safe patient care and thus the safety and wellbeing of patients.

3. Presentations

The theme of the conference is Designing and Implementing Health IT: from safe systems to patient safety. Scholars have been invited to submit papers covering the theme, but other submissions were also welcomed. The conference call has resulted in the acceptance of 28 papers, of which seven deal directly with patient safety. Eight papers address various topics of system design. Implementation is the subject of six papers. The role of the patient is addressed in four papers. The involvement of the patient in IT research is a strongly growing field, especially because of the transfer of care to the home and the emphasis on empowering patients in the choice of care. It would not be surprising if a future conference on socio-technical approaches in health IT sees many more papers about patient involvement. Three papers cover the theme of the conference in a broader perspective.

The keynote presentations follow the theme of the conference closely. Ross Koppel summarizes his findings on how IT can induce errors because of
misconceptions of the human-computer interface and faults in design concepts. He also argues that the improvement of IT is hampered by legal regulations in vendor contracts and lack of oversight. Anne Marie Hellebek describes how root-cause analyses can help uncover errors in medication [10]. Judith Gregory describes how design and implementation processes of health IT are utopian by nature, yet incomplete, and how they lead to reinventing patient care. Finally Jesper Simonsen argues that sustained and ongoing implementation can overcome the limitations of technology-driven implementation. His approach very much ties into the Scandinavian tradition of involving users in the design and implementation of complex technology in the workplace. Therefore, it comes as no surprise that a majority of the papers at the conference are of Scandinavian origin.

4. Conclusion

The papers in this collection re-confirm that the research field is maturing. Increasingly, authors are not only describing in fine detail how health IT is being implemented and used in different contexts, but are offering insights as to how design and implementation can be improved to ensure that information systems can be used safely and in a way that ultimately improve patient safety.

References

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Healthcare IT Usability and Suitability for Clinical Needs: Challenges of Design, Workflow, and Contractual Relations

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Abstract. While healthcare information technology (HIT) offers extraordinary promise of clinical improvement and greater efficiencies, the realization of the promise must confront and overcome a number of challenges caused by incomplete and inappropriate software design. In this paper, we review several types of HIT design and workflow decisions that limit the value and utility of HIT in electronic health (medical) record (EHR/EMR), computerized physician order entry (CPOE), and electronic medication administration record (eMAR) systems. While remedies for problems of design or workflow may be either easy or difficult, the industry creates additional barriers in the contractual relationships it creates between itself (HIT vendors) and the clinical facilities (hospitals, clinics, and physician offices) that purchase its systems. We suggest that the structure of those relationships may retard the progress and responsiveness of HIT.

Keywords: Design, usability, workflow, contractual relations

Introduction

We start with a seemingly simple example (figure 1): the default arrangements for all doses of a specific medication. In the first exhibit, 5 mg was on top, followed by 4 mg, and by 1 mg, etc. Why were the dosages displayed in this way? Should users assume 5 mg was the usual dose, followed by 4 mg, etc.? And could young doctors who are working in a new rotation and not familiar with the usual dosages assume some logical clinical guideline implicit in the order? The answer is very unexpected. In English, the word “five” is earlier in the alphabet than the word “four” which, in turn, is earlier than the word “one,” and so on. The vendor was asked to change the ordering to reflect clinically guided doses, but the vendor explained that it could not be done until the next version of the software. After repeated complaints, the vendor allowed it could be changed but it would be for each medication and required the users to promise not to change dosages. Because pharmaceutical manufacturers issue new dosages frequently - preventing the clinicians from agreeing to the promise - the misleading doses remained. This example reflects a difficulty in the design of HIT but also an aspect of the relationship between HIT vendors and healthcare providers: vendors make decisions that do not necessarily reflect what is best for healthcare.

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Another example (figure 2): What is behind the red-colored tile in the lab report screen? Following somewhat standard nomenclature, a red tile means the results are abnormal, and thus of especially keen interest to physicians. The physician clicks on the red tile and, as expected, finds the results are abnormal (figure 3). But what of the other tiles? They are not red and thus we assume them to be normal results. But is that assumption warranted? We click on a white tile and find, to our surprise, that the report is abnormal and consequential (figure 4). Why was it not in red or some other color?

The answer is that the results were not in some assigned numeric value (e.g., above or below some numerical range). Thus the computer was not programmed to color the tile. This does not mean the clinician has no action to take. In fact, the lack of indicators means that physicians must click on each of the tiles to see what is behind it – a white tile does not mean “nothing.”

Doctors had asked for this misleading (or non-responsive) display to be corrected. They would accept any color except white for abnormal results. The vendor said it was too difficult to program, and refused.

What changed the vendor’s decision to remedy the problem? A large potential purchaser that controlled several hospitals was made aware of the problem and told the vendor they would only buy the software if this problem was “fixed.” Within a short time, it was.
1. Design of Electronic Health Records

The design of EHRs (also called EMRs) comes from accounting software, with its reliance on spreadsheets and transactional record keeping. Often, however, this underlying design conflicts with the needs of clinicians, who must see a wide range of information in formats that allow quick review.

Consider a typical screen from a well-known HIT company (figure 5). Nearly 40% on the left portion of the display is occupied by navigation bars, which could disappear until needed. The top portion, meanwhile, finds considerable space that communicates very little information. The business part of the screen – the spreadsheet reports of lab findings – achieves the oxymoronic feat of being both sparse and cramped in displaying actual patient data. The spreadsheet design can mean that, in many practical instances, a clinical user may be obliged to scroll through several screens of empty cells to find actual patient data. Moreover, information in cells may only be partially visible and will require either more scrolling, manual re-sizing, or drilling-down, the latter often through many intermediate pop-up windows that themselves do not reveal the full information.

This next slide is remarkably honest about a problem (figure 6). The question remains: Why not flag results that are “positive” to denote a finding of a disease or other indication of danger.

2. Designed for Deception: Allergy Information and Misinformation

The next example is from a well known EHR system, and is about how it handles allergy information (figure 7). On the system’s general EHR screen there is small section that allows clinicians to enter and see allergy information (e.g., patient is allergic to penicillin). The default image on that box is the statement “No Allergies.” However, one can click on it and enter information. For example, one might type in “Penicillin allergy,” with anaphylaxis as the outcome. Another clinician might add another allergy, such as “Latex allergy,” with a slight rash as the outcome. However, the next time the screen is seen, that “allergy” box would show “no allergies.” Of course, physicians and others in the know would click on it to see the allergy or allergies. If one clicked on it, one might see first: “‘Latex allergy’ with a slight rash as the outcome.” If one clicked on it again, one would see: “‘Penicillin allergy’ with anaphylaxis as the outcome.”
Clearly, the system is doing something wrong. First, the default statement on the box if allergy information has been entered should not read “no allergy.” Second, one should not have to search to find all of the allergies. In this example, if the user did not know to continue clicking past the latex allergy notice, she would miss the information about the deadly penicillin reaction.

Another allergy example (figure 8) shows how a key piece of medical information can be poorly captured when physicians select allergies from a standard pull-down menu. The first option may read: “no allergies.” But then the second option may read “no known allergies.” Alas, if the doctor checked “no allergies,” and then saw the more epistemologically nuanced “No known allergies,” he might well check that option, too. Unfortunately, the system displays those two choices as “multiple allergies;” and of course everyone quickly learns that “multiple allergies” is the same as “no allergies.” Needless to say, there are many patients with multiple allergies. These patients would stand a good chance of not having their allergies read or acted upon, because “multiple allergies” usually means “no allergies.”

3. Unlabeled Transformation of Weight Data

In this example (figure 9), the first physician enters the child’s weight in kilograms, which is the standard metric in the hospital. In the other screen (figure 10), seen by another physician, the weight has been transformed to pounds (undoubtedly for some legitimate reason, for example to discuss with parents in the USA). Unfortunately, the metric (pounds) is not indicated on the second screen, and the physician, assuming the usual metric for the hospital, calculates a dosage in kilograms, thus more than double dosing the child.
4. Obscured information in the EHR

Sometimes partial information is as deceptive as no information. In the next example, essential information is obscured from the physicians. It is only the doctor’s persistence and a memory of something not on the screen that saves the patient from a serious anticoagulation error.

In the first screen (figure 11) of the set of three, we see only the most recent clotting time (INR). Clotting times should be presented as trends, not isolated numbers. The effect of anticoagulation medicines takes a few days to be correctly observed, and trend data are needed to correctly adjust anticoagulation medications. Nevertheless, the trend information is not presented. Equally problematic, the medication dosage is not presented in parallel with the trend data.

In the second screen (figure 12), the only visible dosage for the anticoagulation medication Warfarin shows 2 mgs. However, the physician is quite sure he ordered 7 mgs for the patient. He looks carefully at each cell but fails to find the dose he is quite sure he ordered.

In the third screen (figure 13), the only visible dosage for the anticoagulation medication Warfarin shows 2 mgs. However, the physician is quite sure he ordered 7 mgs for the patient. He looks carefully at each cell but fails to find the dose he is quite sure he ordered.
Finally (figure 13), as he is moving the mouse around the screen, a small box suddenly emerges indicating that indeed he had ordered 2 mgs and 5 mgs. It does not quite say 7 mgs but it is good enough. Lucky he caught it out of the corner of his eye\(^2\). Of course the physician, the patient, and all of us, must wonder what would have happened if the mouse had not hovered above that spot on the screen. Why would essential information depend on what the doctor calls “mouse magic?”

5. Responsibility for HIT Errors

HIT errors are not exclusively a result of vendor design or software mistakes. Errors are introduced when implementing the software, when users fail to master basic rules of use, etc.

There are at least six causes for errors of which four to five are not the vendor’s fault (figure 14).

1. The user who forgets, does not know, does not understand, or is otherwise ignorant.
2. The implementation by the clinical or IT staff of the hospital, clinic or physicians’ offices. Similarly, unwise customizations can create problems and generate errors.
3. Certain system linkages between systems (e.g. CPOE “X” and EMR “Y”).
4. Emergent/future changes, such as new regulations or laws, or changing patient populations (e.g., patients are increasingly morbidly obese and the software was not programmed to calculate dosages for people over 250kg).
5. Routines built by the vendor that create patient safety dangers even though they may have been designed to enhance patient safety, e.g., requiring the physician to enter the patients weight before allowing her to order medications. This sometimes results in physicians estimating patients weights when weight is not relevant. Unfortunately, when the next physician sees the patient weight,

\[^2\text{Outside a narrow therapeutic range, Warfarin either prevents a heart attack or induces hemorrhaging.}\]
he will not realize the weight is estimated and will sometimes may critical
weight-based dose decisions based on very inaccurate information.

6. The software itself (i.e., a problem clearly introduced by the vendor).

Although there are six sources of errors, the earlier examples were of poor design
that can cause clinical users to inadvertently make errors in action or understanding.
Such errors are not uncommon.

6. Barriers to Remediating Software Errors

When vendors receive reports of errors, they make decisions that reflect their interests,
namely: ease of repair, cost of repair, number of customers affected, probability that
fixes will interact with other systems in unintended ways, clinical need, and future
marketing attractiveness (e.g., does repair generate a feature that can be used for
possible clients). Clearly this list embodies priorities that may not be those of clinicians
treating patients.

Last year, Koppel and Kreda argued that vendors insert three clauses into their
contracts that reduce their motivation to address errors and to provide responsive
service to clinicians [1]. This is unfortunate because HIT errors that originate in the
software are best addressed by changes to the software and are clearly candidates for
vendor action. It makes little sense to have hundreds of users each attempting
corrections/repairs for the same problem caused by the vendor. Vendor responsibility is
a matter of contractual law and vendor-customer negotiation. Certain remedial
procedures and guarantees of transparency found in other industries are not available to
clinicians. In particular, specific clauses in HIT contracts mix with malpractice
precedents to lessen the legal/contractual pressures vendors face to “fix” their products.

These clauses are:

• **Hold Harmless.** HIT vendors have no responsibility for errors even if their
  systems caused the error. And even if they were repeatedly informed of the
  problem.

• **Learned Intermediary.** That’s a doc, a nurse, a pharmacist who makes
  medical judgments about the patient. For an example we used earlier, if the
  EMR displays weight in kilograms but indicates pounds, the Learned
  Intermediary should have caught the mistake. The vendor is not responsible.

• **Non-disclosure.** What users can say about product and what they cannot say
  plays a role in whether clinicians can disclose and share problems. Users can
  inform vendors and colleagues within the same organization but remain at
  legal peril for talking beyond their organization or for sending images of
  application screens to other practitioners.

![Figure 15](image-url)
Of these, the stated reason for non-disclosure is the protection of vendor intellectual property. This is a customary if not uniformly a part of many contracts. Yet its effect, in conjunction with the learned intermediary clause, is fundamentally perverse: it is a barrier to the exchange of information that clinicians are supposed to rely upon to make “learned” decisions (figure 15).

![Figure 16](image)

The outcome of these contractual arrangements means that errors in HIT are not rapidly addressed. Needed clinical improvements to HIT are also retarded. And, most significantly, common problems faced by clinical users of HIT in different healthcare organizations are neither transparent nor acted upon (figure 16). The task of changing this is the responsibility of healthcare organizations, regulators, lawmakers, and professional societies. A more pro-active role in changing the customary and usual terms of HIT contracts will be required.

References

Aggregated review of route cause analyses related to medication

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Abstract. Since 2001 when the systematic analysis of serious patient safety incidents was implemented, a number of root cause analyses have been completed. Common to these is that the medication of the patient has been problematic and has had serious consequences for the patient. In the analyses the events causing the patient safety incidents are described in detail, the causes are identified and a plan of actions is created.

Keywords. Patient safety, Medication error, route cause analysis.

Introduction

We describe an aggregated review based on 52 of these root cause analyses and five aggregated root cause analyses. The aim is to facilitate relevant learning through an overview of the root cause analyses of medication errors in The Capital Region of Denmark.

The report is furthermore part of the European project PSIP – Patient Safety through Intelligent Procedures in Medication to identify areas of action for the establishment of IT supported decision support of prescribing and administering medicine.

Besides a descriptive analysis of the root cause analyses, the report contains an overview of all plans of actions, which the individual analysis teams have suggested in order to prevent similar incidents.

Analysis proves that more than one third of the incidents have resulted in the death of the patient and a fifth of the incidents have caused transfer of the patient to a higher level of intensive treatment. The rest of the consequences are spread almost evenly on cases of cardiac arrest, poorer treatment results, increased observation in the same department and delayed treatment or operation.

The incidents included fifteen different groups of medicine. Most of them concerned treatment with insulin and antipsykotics/anxiolytics with seven incidents each. Pain relief was part of six of the incidents whereas treatment with glucose, electrolytes and nutrition, digoxin was involved in each five incidents. Four were associated to antibiotics; the same number was related to anaesthesia and anticoagulants. The remaining medicines /groups of medicines concerned were potassium, dilitazem, cytostatics, NSAID, fenemal, fosfentoin and N-acetylcystein. This pattern corresponds with findings in other studies, Danish as well as international.

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In 50% of the events the incident happens in connection with medication, whereas every fifth (20%) case occurs in connection with error in the prescription process. In 11% of the cases it happens in connection with the dispensing of medicine. In 7% of the events more than one of the above mentioned processes were involved. The rest of the incidents are related to lack of prescription, the production of medicine, self-medication and data administration of EPM.

The present analysis attempts to provide an explanation on why the incidents happen by identifying which active errors that caused the incident and which latent circumstances were involved.

Active errors are related to the human actions involved in the processes and it here turns out that in about a third (35%) of the incidents this active error was connected to a slip, such as a person misreading the drug labels. In three out of ten (30%) the mistake – e.g. wrong interpretation of a guideline – was the active error, whereas every fifth (20%) incident is caused by a lapse such as somebody forgetting for whom the medicine was poured.

In terms of those of the remaining incidents where it was possible to identify the active error, more than one of the above mentioned types of errors were involved.

The latent circumstances i.e. matters related to management and design policy decisions are categorized into four groups.

In almost half of the incidents (43%) inappropriate system design (organisation of work and communication systems) was a latent matter, which made wrong medication of the patient possible. In close to every fourth event (28%) it was caused by inappropriate equipment design (design facilities), which lead to the error. Training gap (knowledge, know-how and experience of the staff) explains every fourth incident (23%), and a heavy workload (staff shortage) explained 6% of the incidents.

Plans of Action

The plans of actions in the root cause analyses are grouped into nine themes.

Most of them require further development of the electronic medications record (EMR) that improves the use of the system in relation to the control of medicine and patient identification.

The central challenges here are still the reduction of the problems with software, hardware and network, need/requirement to make variable prescriptions, decisions support concerning dispensing and administration of drugs, further development of operative standard plans and instructions and warnings concerning particularly dangerous drugs.

In order to support the EMR there is a number of problems which presumably require national solutions e.g. the ATC codes do not differ between different drugs or that many drugs might have one or more than one ATC codes.

Another important problem is drug mistakes where visual similarities between two drugs and the location of the drugs in the medicine rooms have resulted in initiatives to promote changes in design of labels and medicine rooms.

Other plans of actions concern the improvement of processes in changing data in drug information databases, reduction of the disturbances during administration and dispensing of drugs, change of not-operative guidelines, control of appropriate care and treatment and patients with poisonings, implementation of initiatives reducing the risk
of wrong loading of drug, improvement of introduction programs and staff education with too little training and the need of reduction in the number of types of pumps and better technical control of these.

Within each theme there are suggestions to how The Capital Region of Denmark may continue to improve the safety in the medication process, and to how the Unit for Patient Safety, The Regional Medications Committee, Steering Committee of EMR, The Regional Council of Anesthesia, The Pharmacy in The Capital Region of Denmark, Department of Clinical Pharmacology and Therapeutics and the risk managers of the hospitals may participate in this work.

Even if some of the types of errors identified in the root cause analyses have been corrected by implementing changes to the purchase policies, documentation systems and design and limited by changes in the guidelines, we find that mistakes apparently continue to happen again and again in The Capital Region of Denmark. We therefore conclude that The Capital Region of Denmark must improve the system to learn from medication errors.
Sustained Participatory Design and Implementation of ITHC

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Abstract. Participatory design includes engaging in large-scale information-systems development where participatory design approaches have been applied throughout design and organizational implementation. The keynote suggest to extend the iterative prototyping approach by (1) emphasizing participatory design experiments and pilot implementations as transcending traditional prototyping by evaluating fully integrated systems exposed to real work practices; (2) incorporating improvisational change management including anticipated, emergent, and opportunity-based change; and (3) extending initial design and development into a sustained and ongoing implementation that constitutes an overall technology-driven organizational change. This sustained participatory design and implementation approach is exemplified through a large-scale project in the Danish healthcare sector.

Keywords. Participatory design, iterative prototyping, improvisational change management, anticipated-, emergent-, and opportunity-based change, pilot implementation.

Introduction

Participatory design is a diverse collection of principles and practices aimed at making technologies, tools, environments, businesses, and social institutions more responsive to human needs. A central tenet of participatory design is the direct involvement of (representatives of) future users in the design process [1]. This involves collective ‘reflection-in-action’ [2] through the establishment of a process of mutual learning between designers and users from the work domains in question.

Many approaches to information technology in health care (ITHC) include iterative prototyping as part of the early design phases. The iterative prototyping approach is well-known within information systems in general [3, 4]. Prototyping is the process of creating, in advance of the completion of the final product, a working model (the prototype) that exhibits essential features of the final product and using this prototype to test aspects of the design, illustrate ideas or features, and gather early feedback and experiences from usage. The prototyping approach is most often described as an iterative process reflecting a hermeneutic circle as in the task-artefact cycle [5] where the new system (artefact) – and the task it is developed to support – interact and mutually define each other: “A task implicitly sets the requirements for the development of artefacts to support it; an artefact suggests possibilities and introduces...
constraints that often radically redefine the task for which the artefact was originally
developed” [5, p. 97].

Studies of information systems that allow for quick iterations of design, use, and
redesign have stressed the importance of using the system for real work in order to
learn about the possibilities and constraints imposed by the artefact. Orlikowski and
Hofman [6] characterized this as ‘improvisational change management’ and made a
distinction between anticipated and unanticipated change. Anticipated change denotes
the desired change that is planned ahead and occurs as intended by the originators of
the change. It is impossible to plan and predict all changes that occur when introducing
new artefacts such as IT to a clinical work context. The nature of clinical work itself is
characterized by being ‘situated’ [7] where the course of the work process depends of
the material and social circumstances at hand. Thus “[u]nanticipated use of computer
artefacts reflects the fact that work itself is undetermined until realized in situ” [8, p.
189]. Unanticipated change can be divided into ‘emergent’ or ‘opportunity-based’
change [6]. Emergent change is defined as local and spontaneous change, not originally
anticipated nor intended. Such change does not involve deliberate actions but grows out
of practice. Opportunity-based change is purposefully introduced to take advantage of
unexpected opportunities, events, or breakdowns that have occurred after the
introduction of a new information system: “Over time, however, use of the new
technology will typically involve a series of opportunity-based, emergent, and further
anticipated changes, the order of which cannot be determined in advance because the
changes interact with each other in response to outcomes, events, and conditions
arising through experimentation and use” [6, p. 13].

Traditionally, iterative prototyping has been conducted in the initial phase of the
development process and led (in commercial settings) to a contractual bid [1, 9]. And
typically, the development process succeeding the contractual bid is based on a
traditional sequential waterfall-type process, where the system is eventually ‘rolled out’
in the organization [10]. Today, standard, one-size-fits-all systems are, however,
increasingly giving way to an ‘era of configurability’ [11], where information systems
are based on flexible, generic frameworks [12]. Configurable frameworks include high-
level configuration tools (often XML based) and embed standard interfaces for other
systems as well as general business logic for specific domains. One example is the
Oracle Healthcare Transaction Base (HTB)™, which constitutes a development
framework that enables agile modeling of processes and objects native to the healthcare
domain. Such generic frameworks substantially ease the creation of individual
applications because much of the work is transformed from development of
functionality from scratch to configuration of domain-specific building blocks.

The ‘era of configurability’ introduces increasingly mature technological means
for an iterative, real-life experimentation-based participatory design approach,
comprising design as well as organizational implementation of ITHC. Configurable
information systems may be implemented, used, and evaluated as part of an overall
iterative design process. This opens for an important aspect of the design process since
only real and situated use of the system enables emergent and opportunity-based
change. During the period where a system is exposed to real use, evaluation studies can
be conducted to investigate how the system affects the clinicians’ work practices. Such
evaluations might identify and analyze emergent and opportunity-based changes,
hereby informing the subsequent design and implementation of the system. This
acknowledges the uncertainties of technology-driven organizational change and at the
same time poses the challenge of treating the entire design and implementation process
as a process of genuine development. Sustained participatory design and implementation of ITHC include a stepwise implementation, defined by Markus [13] as ‘technochange management’ combining large ITHC projects with organizational change programs: “Here what is to be prototyped is not just a technical solution or just an organizational change, but both together” [13, p. 17].

**Figure 1.** A model of sustained participatory design and implementation of ITHC. The model outlines a process that enables mutual learning, including collective reflection-in-action, through trial use of information systems for real work. The potential and impact of the model is during the keynote illustrated by an ethnographic study of emergent and opportunity-based changes resulting from clinicians’ trial use of a new electronic patient record system.

The sustained participatory design process outlined in Figure 1 is adopted from Simonsen and Hertzum [14] and emphasizes the evaluation of ITHC through exposing them to real work. The starting point of an iteration are the changes that are anticipated and aimed for. The anticipated changes are further specified, in terms of what effects the clinicians expect from using the system. The system (or a part/prototype of it) is then implemented and tried out under conditions as close as possible to real use – a process which sometimes is referred to as a pilot study or pilot implementation [15-17]. Actual use of the system allows for emergent and opportunity-based changes to occur and inform subsequent design iterations. The model in Figure 1 outlines a process of long-term engagement of both the designers and the clinicians of the proposed and evaluated ITHC.

The keynote is based on a research program on ‘effects-driven IT development’ [14, 18, 19, 20]. The program’s aim is to establish sustained participatory design and implementation processes through an effects-driven, participatory, and experimental strategy for managing large, long-term ITHC projects. This includes strategic partnerships based on trust, mutual learning, and close collaboration between vendor and customer. Effects-driven IT development focuses on (a) effects of using information systems instead of products and processes; (b) measurement and evaluations instead of expectations and estimates; and (c) specifications of the anticipated effects of system use instead of specifications of system functionality. The vendor and the customer should, based on these three characteristics, design and implement information systems that demonstrate utility value and measurable effects on the work they support. Measurement of anticipated effects and identification and
evaluation of unanticipated effects are important means to manage the general design and implementation process. Thus, the process is driven by several iterations of formative evaluation through sustained participatory design and implementation of ITHC.

References

Part B

General Considerations
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Sociotechnical Changing in Healthcare

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Abstract. This paper discusses a conceptual approach to the study of the implementation of ICTs in healthcare organizations. The paper uses some fundamental concepts from sociotechnical studies to address the complex process of change – the changing – that accompanies ICT innovations. The paper argues for the importance of the perspective of changing as a way to account for the dynamics as technology and people, organizations and institutions co-constitutively work-out their future together.

Keywords. healthcare, changing, sociotechnical, information systems

1. Introduction

Information and Communication Technologies (ICTs) are increasingly important for all types of healthcare organization with the adoption of ICTs almost always expressed through a vision for positive change and specific outcomes, and presented as a means to address identified deficiencies or problems [1- 4]. Policy makers, clinicians, managers and researchers all argue that ICTs can (or even will) lead to achievement of a mix of goals relating to efficiency, cost-effectiveness, better clinical decision making, improved data privacy, team working, speed of delivery or improved quality of healthcare [5-9]. We know that such ambitions are not always directly met. But we also know that ICTs nonetheless almost always condition changes (expected and unexpected) in the context where they are deployed; changes in work practices, professional roles, knowledge and skills deployed, and modes of collaboration [10, 11]. Thus, while ICTs and the visions they embody may not determine outcomes, they do condition complex processes of change, what we identify as the phenomenon of changing.

Changing around ICTs innovations is usually complex and on-going but to study it is fundamental to understand what happens when people, organizations, institutions and technology come together. Changing should be a primary interest to those who study health information systems but it cannot be approached in terms of visions linked to technical means and with concern only for defined outcomes. Nor can we rely on ideals of wise (even socio-technical) design and good project management to demystify and guide changing. Similarly changing cannot be understood through simple proxy measures of success or failure [12]. In brief, claims of technological causality are

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seldom credible, (sociotechnical) design is an inexact science, and measures of success or failure are at their core subjective and political abstractions.

Therefore we argue for something different. For studying ICT adoption as inevitably and eternally a process or performance, suspended between what was and what might one day be. Technology, the practice of medicine, the giving of care, the structure of the organizations and the carriers of institutional and professional norms are all in movement, passing from somewhere now lost in the past to somewhere in the uncertain future — an idea expressed by Clegg et al. in the concept of ‘becoming’ [13]. The healthcare information systems we study are constituted in this dynamic, and the dynamic is what we should study. This is not, as often proposed in a lazy rhetorically kind of way, a question of technology and ‘organizational change’, but of multiple intricately woven moments of changing including inter alia combinations of the organizational, technical, social, professional, and therapeutic. In questioning the idea of organisational change, and by analogy also ‘organizational changing’ we question any priority given to this one dimension (organization). Rather we adopt the phrase ‘sociotechnical changing’ to express a focus for studies, and explore below how sociotechnical traditions address changing [14].

The aim of this paper is then to explore a conceptual approach to sociotechnical changing. Section 2 borrows some relevant fundamental concepts of sociotechnical studies. Section 3 investigates how a sociotechnical lens might capture changing. The paper ends with a discussion about the implications of ‘sociotechnical changing’ for future research in healthcare organisations.

2. Refocusing the Sociotechnical Perspective

In a recent paper, Pope and May [15] critically reflect on the ‘quality’ of qualitative research in healthcare and argue that it has got ‘out of hand’ due to a lack of depth or sophistication in analysis and insufficient synthesis. They also question the ability of the theoretical frameworks in common use to assist in inductive analysis and theory building. One way to respond is through a restatement of the sociotechnical perspective [1, 2, 16-18], but we go further and suggest more specifically its use as a means to account for changing. To this end we unpack and borrow some of the relevant concepts of sociotechnical approaches, in particular Actor Network Theory (ANT) [14, 19] and Social Construction of Technology (SCOT) [20].

Implementation or adoption of technology into healthcare settings, understood as incorporating material artifacts, ways of working and thinking, models, tools, machines, papers and files, cannot be studied separately from the context and the ongoing production of everyday practices. Technology should not be reduced to delivery, implementation and immediate use [21], but understood as both cause and consequence of longer-term processes of change. To understand the changing that technology is a part of, and which it may in part shape, research must shed light on how people and technology come together to perform actions and tasks [19]. For example, a cardiologist’s diagnosis is in part an outcome of her deployment of professional knowledge, but this is conditioned by interplay with other healthcare professionals, GPs, nurses, radiologists, and with technologies such as files, computer screens and electrocardiographs. People and technology are co-constitutive [1, 22] - their ability to perform actions (in this case a consultation) and to produce effects (a diagnosis) - their collective agency - is distributed between the various parts and performed each time
things happen [19]. Technological artefacts are of course designed for particular purposes (e.g. to reduce prescribing errors), but also embody certain interests (e.g. of doctors, of technologists, of managers, of patients). They are thus linked to systems of politics and power relations [22] and serve to shape perceptions and actions.

Technology is not a discrete and a-contextual resource deployed in planned processes of change [11, 23]. But nor can it be understood wholly as a local construction where we make of it what we want. Contexts provide multiple possibilities but also constraints for action (e.g. through resources, meanings, rules, norms, cultures, history etc.) and are continuously shaped and reshaped through them [11]. In a health care setting a norm such as an established work practice (e.g. doing three blood tests for all admissions) or an explicit care pathway (e.g. for acute stroke admissions) provides one possible (often normative and prescriptive) way of acting, but does not define practices.

Similarly, configuration of a hospital wide Electronic Patient Record (EPR) software ‘translates’ the language, practices and purposes embedded in the software so as to be in agreement with existing or future practices of the hospital and the main interests of its ‘key’ users [24]. This may include adding interface screens to instantiate clinical pathways or informational reminders to assist clinical decision making [4]. But still, individual users and small work groups, in their own changing, will appropriate some of these features and reject or ignore others. Thus practices where technology finds relevance are rendered meaningful in part because they are conditioned by and reflect the context from which they originate (e.g. in design, concepts of best practice, evidence based working, implementation team), and in part from the context of their use (convenience, local needs, patient preferences) [25].

Studying changing (e.g. changing practices) simultaneously implies studying changing contexts. The dynamic nature of contexts and the centrality of what happens there need a special language. Our approach is through the use of verbs rather than nouns [19]; for instance ‘ordering’ rather than ‘order’ (so CPOE might become a study of ‘Computerising Prescriber Ordering and Entering’ – an active ongoing account). Similarly we use ‘organising’ rather than ‘organisation’ (ontologically an organization is nothing more than a bundle of related acts of organizing), and in this paper, ‘changing’ rather than ‘change’ [13]. Changing and other verb-like accounts offers an analytical lens to help reveal a static situation as a dynamic one. If nouns indicate stability and discrete change, then verbs (present participle) can indicate phenomena that are always held ‘in the making’ [14]. An understanding of change (as a noun) invites us to make comparisons between ‘past and present’ or ‘before and after’ - assuming that change is measured by the difference of a shift from one situation to another. What this cannot do is reveal the actual process of changing (the internal and ongoing ‘how’) or the complex drivers of changing or not changing (the ‘why’). Furthermore, change is seldom a rapid or direct movement from ‘the old’ to ‘the new’, rather the new is born within the old and co-exists with it, and the old and the older still remain sedimented within the most new [14]. Changing is then a process surrounded by continuities and discontinuities of ways of acting and thinking demanding a study that requires crossing of temporal boundaries.

3. Changing through a Sociotechnical Lens

So how might we orient ourselves to study changing rather than change?
First and foremost we need to engage the actors who are experiencing changing – and who are being changed. Technology is present not as an artefact that can expect to achieve its own ends by acting directly upon these people - technological determinism [20] - but is enacted as people try to make sense of new circumstances and use (or not use) technologies [22, 23, 25]. Drawing on ANT’s ideas of symmetry we can also see a parallel position – people do not dominate technology – and technology’s perceptions, hopes and fears might equally be of interest (or the hopes and fears it carries if that is a touch too anthropomorphic). Thus we need to investigate what people understand about technology (perceptions, hopes, fears) and what they do in their daily practices with technology (uses and practice). In doing so, we understand adoption but also rejection, ‘non use’, ‘misuse’ and resistance of technology, not as failure or negative consequence but as alternative enactments upon technology [23]. For example, Chiasson and Davidson show how different perceptions of an EPR technology obstructed its implementation [4]. Physicians expected safer storage of data and better access to and presentation of information, but also some disturbance of their interactions with patients. Dieticians expected technology to assist them in calculating patients’ diet intake and in creating reports. Administrators were keen to use a system that would look similar to the one that they were using. These perceptions conditioned conflicts of interests and resistance to the new technology and obstructed initial implementation.

Second, we need to capture not only what people say they do versus what they are doing but to reconcile states of being (being a doctor, being a computer, being a patient) and practices of doing (making a diagnosis). This implies understanding how people interact continuously with technologies at hand, shape and are shaped by them infinitely and recursively. Such a concept of enactment is seen in studies that report unpredictable or novel uses of technology, for example different treatment from that specified in a clinical pathway, pathways modified to suit patients’ needs, or doctors avoiding standard questions that may cause anxiety to a patient [1, 2, 4].

Third, we need to manifest changing as a process that crosses temporalities by capturing people’s perceptions of technology [23] as instances of both projection (what is new and becomes possible) and remembrance (what is old and hard to forget). Cho et al. [17] explain how the adoption of a health information system in a hospital conditioned redistribution of professional responsibility and (re-)division of labour as people attempted to inscribe their interests into the technology. The adoption of a radiology system meant different things and conditioned different consequences for different people. Physicians were reluctant to commit to the system because they projected extra administrative and computer work which they had previously informally displaced to nurses. Physicians displayed their reluctance by failing to participate in meetings and requesting printed images. Physicians thus were resistant to the changing technology brought continuing to enact their paper-dependent practices. Nurses, in contrast, projected an opportunity for gaining responsibilities for healthcare rather than administrative-related tasks, while technology-enabled electronic monitoring of patients provided to them more control over their work. More subtly, the system made nurses responsible for reminding physicians of their tasks, reproducing responsibilities that were never formally in their remit (manifestation of remembrance). What we see is complex changing with both reproduction of practices (albeit in different form) and changes in work roles and responsibilities through instances of projection.
4. Conclusions and Implications for Research

This paper makes a familiar argument but with a twist; we should study the processes of ‘sociotechnical changing’ and move away from static pre and post implementation ‘impacts’ or notions of discrete change that dominate studies in healthcare [26, 27]. In this processes, organisational, technical, social, professional and therapeutic aspects and their relationships need to be sought out and revealed. We propose an approach to changing drawing on sociotechnical themes that advocates nominalism (rather than essentialism), crossing of temporalities (rather than before-after dualisms) and practice (rather than strategic or functional) orientation.

Research on ICTs adoption in health might with advantage place emphasis on the above three methodological processes for capturing changing. This implies we need to delve into micro levels, on hospital wards and departments, in patient waiting rooms and doctors’ clinics as well as software strategy meetings and ministerial offices. Changing takes us across professional boundaries of IT/Project managers, healthcare professionals, administrators, service providers, and not least to patients. Research has to consider not only what people say they do but also what they are doing, how they translate their beliefs into actions, how they consider their options and how they make use of their powers. The agenda draws on questions of how healthcare technologies and their accompanying policies are enacted ‘on the ground’, how different professionals and patients engage with technology, make it work for them (or not) and what it asks them to ‘do different’. This moves us away from the assumption that (implicitly or explicitly) underpins so many studies; ‘the technology’ is out there, ready to be adopted, configured, implemented, and evaluated. The vision we live with presents a messier view of the socio-technical confections that try to find a place in healthcare. But these visions can become realised as individuals make sense, project and recall, and thereby make something that works.

5. References


The sociotechnical configuration of the problem of Patient Safety

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Abstract. This paper discusses two approaches to “the sociotechnical”, one coming from the Tavistock tradition and the other from actor network theory. These two differ in important ways and from the latter it follows that what patient safety means must be scrutinized and unpacked. The paper thus rudimentarily discusses central contributions to the problematization of patient safety. Last, it is argued that patient safety does not exist apart from the sociotechnical practices that seek to accomplish it, but is constructed in and through them, which is why it is pertinent to reflect on how those practices constructs what comes to qualify as patient safety.

Keywords. Sociotechnical, patient safety, actor network theory, adverse events.

Introduction

Hospitals are risky places and this is not a new phenomenon before antiseptics was invented having surgery was almost certain death. The surgeon would pass from an autopsy to an obstetric surgery without washing his hands and changing his clothes. Today as well as in pre-antiseptic times the problem of medical errors can thus be considered to be due to the intermingling of materiality and sociality. Before antiseptics, microorganisms and the moving (and unknowing) surgeon together formed a deadly assemblage. In 1999 the Institute of Medicine published the report To Err is Human.[1] The central point posed in the report is that the problem of errors in healthcare is mainly due to healthcare systems, not healthcare personnel. Healthcare professionals make errors but these are caused by badly designed systems. For instance, an error can happen when two different kinds of medication are packaged in the same way and therefore they are easily mistaken. Consequently, an obvious solution to this is to have different types of medication separated or differently packaged. The point of the title To Err is Human is that humans are not rational beings that check and double check. If this were the case then how medication was packed would be of little importance, since people would always carefully scrutinize the text on the package. But because we are situated, embodied beings rather than rational beings, it matters how things are designed, ordered and infrastructured. Infrastructures and designs make some actions less likely to occur and thereby mishaps can be prevented. This way of thinking about the problem of healthcare errors can be said to be sociotechnical because it holds that human actions are interwoven with systems and infrastructures and accordingly through the design of systems human actions can be affected.
In the call for this conference research that approach the problem of patient safety in this manner are invited. In this paper, however, I wish to take a different route than one suggesting how to design sociotechnical systems for patient safety. By employing an actor network understanding of “the sociotechnical”, I will unpack or “open the black box” of patient safety by discussing a central piece of work that has laid the ground for the patient safety movement. The point is not to criticize the effort of improving patient safety by designing healthcare systems, but to argue for the importance of being attentive to how the problem of patient safety is constructed and represented in order to become sensitive of how the problem of risk and safety is construed in particular instances of healthcare practice.

1. Two definitions of sociotechnical

There are at least two definitions of what “sociotechnical” might mean. One is associated with the work and research done at the Tavistock institute since the 1940’s and onwards and revitalized in the Scandinavian design tradition, nowadays internationally renown as Participatory Design [2], [3], [4]. In the Tavistock tradition sociotechnical means the mutual configuration of social and technical entities into an optimally functional assemblage. What characterizes this understanding of the sociotechnical is that “the social” and “the technical” constitutes relatively well defined realms. One can also say that it refers to a quite common sense understanding of “the social” and “the technical”, where the former is a realm populated by human beings and the latter is populated by machines, tools, artifacts, computers etc. Given this definition of sociotechnical we are faced with the continuous task of fitting these two realms to one another. A sociotechnical approach can thus be characterized as non-reductionist and non-determinist. It is non-reductionist, since it considers the problem of designing and building systems as being a matter that cannot be reduced to being strictly either a technical or a social matter, but a complicated process of shaping and designing systems and work practices to one another. Similarly, it is non-determinist since it does not attribute to either “the social” or “the technical” the power to determine the success (or failure) of organizational change related to the introduction of systems.

Thinking in terms of, and arguing for a sociotechnical approach, thus seems to constitute a modest approach to systemsdesign, because it implies that the task is a complicated matter. One could argue that it is also because of this somewhat modest way of articulating the problem that the approach has become quite dominant and the sine qua non of systems design. The sociotechnical approach, I will argue, constitutes today’s rational approach to systemsdesign. Accordingly the sociotechnical approach has thus also become more or less synonymous with user centered design approaches such as PD, CSCW [5], [6], [7].

But when we consider systemsdesign as being inherently sociotechnical, we are also articulating a complicated relation in a somewhat imprecise and general manner. Ironically, with the plea for a sociotechnical approach, which as argued above is non-reductionist and non-determinist, it seems that one easily risks to import a quite reductionist understanding of “the social” and “the technical”. In order to take these two realms into account, identifying and locating them seems by implication to become a trivial task.
Another way of conceptualizing the sociotechnical is found in actor network theory (ANT) [8], [9], [10], [11].

“Actor network theory is a ruthless application of semiotics. It tells that entities take their form and acquire their attributes as a result of their relations with other entities. In this scheme of things entities have no inherent qualities: essentialist divisions are thrown on the bonfire of the dualism. Truth and falsehood. Large and small. Agency and structure. Human and non-human. Before and after. Knowledge and Power. Context and content. Materiality and sociality. Activity and passivity. In one way or another all of these divides have been rubbed in work undertaken in the name of actor-network theory.” [11, p.3]

In ANT “the social” and “the technical” are not settled well-defined realms that are readily identified and located. They are emergent outcomes of processes. What is “technical” and “social” are outcomes of processes of associating heterogeneous actors [8]. In contrast, to the Tavistock definition where “the social” and “the technical” are given realms to be fitted together, in ANT “the social” and “the technical” are immanent to one another. “The social” is always also technical and “the technical” social. According to Latour when we speak of “the social” and “the technical” we are referring to purified, idealized types that enables us to grasp the world in a particular modernist way, however we should not, believe that the world actually plays out in this manner and respects such neat divisions [12]. On the contrary, the world is, according to Latour, unfolding and emerging in an inherently dynamic, cascading and heterogeneous manner where novel relations are continuously made with resulting novel hybrid beings and entities as a result [12], [13], [14].

Consequently, the actor network definition of the sociotechnical is one that actually destabilize what “the social” and “the technical” consists in and encourage us to empirically study practices without assuming “the social” and “the technical” to be identifiable realms. The purified notion of “the social” and “the technical” thus serves the purpose of an antidote; they remind us that they are purified representations of practices and thus that we should develop our understandings and descriptions of reality without subscribing to dichotomous epistemologies.

In sum, with the Tavistock definition of sociotechnical our problem becomes one of weaving together “the social” and “the technical” to improve patient safety. Whereas if we apply the actor network definition, our concern becomes: “what constitutes patient safety in the first place.” In the former definition patient safety is by implication more or less well defined. The primary concern is to configure the sociotechnical systems, so as to produce patient safety and what patient safety is or might mean is of less importance. With the actor network definition, since what “social” and “technical” might mean in specific situations, what qualifies as patient safety is also inherently uncertain and destabilized. By implication with the actor network definition patient safety is something to be studied empirically and not something to be taken for granted.

The French philosopher Henri Bergson argues that we should acknowledge that problems can be “badly posed”. He argues, that if we allow ourselves to pose problems adequately instead of rushing towards the solution of any given problem then we may not need a solution at all, since an adequately posed problem can resolve itself [15]. Bergson thus argues that certain problems may not actually need concrete solutions, instead the solution might be immanent to the well-posed problem. This understanding dissolves the often reiterated dichotomy posed in design research between interventionist, action oriented research approaches and descriptive or representational approaches, since the so called representational approaches may with Bergson
contribute to a different conception of a problem that calls for different solutions or might even dissolve the problem entirely.

In the remainder of this paper, I will analyze and discuss how the attitude that follows from the actor network definition of sociotechnical has ramifications for the problem of patient safety. What I will do, rudimentarily, is to unpack - or in the terms of actor network theory “open the black box” - of patient safety, in order to consider how the problem of patient safety is constructed.

2. Unpacking patient safety

This analysis is premised by the understanding that patient safety does not arise and establish itself. Patient safety has a history; it depends on the association of a range of heterogeneous actors and interests. First, to even articulate patient safety is to be able to relate individual patient cases so that they become a population. Epidemiological research thus depends on technologies and practices that record and store patient data in a relatively standardized manner. Information technological infrastructures and tools have been crucial in this respect. Epidemiological research is highly dependable on statistical tools in order to calculate and in a systematic manner pool together the many specific, individual cases and extrapolate general characteristics that can then be referred back to e.g. the clinical practice to influence the specific individual case. This process of going back and forth from the particular to the general relies on an understanding that such a journey is meaningful to undertake.

When turning specifically to the case of patient safety an obvious point of departure is the influential report *To Err is Human* published by the Institute of Medicine [1]. In this report the problem of patient safety is discussed and specific recommendations is outlined to make treatment safer. A central premise for this report is the research done by Brennan et al. published in *New England Journal of Medicine* [16]. The study made by Brennan et al. concludes that: “There is a substantial amount of injury to patients from medical management, and many injuries are the result of substandard care.” ([16], p. 145). In order to differentiate between injury to patients caused by treatment and not the disease, Brennan et al. define *adverse events* and *negligence*. An adverse event is defined as: “an injury that was caused by medical management (rather than the underlying disease) and that prolonged the hospitalization, produced a disability at the time of discharge, or both.” ([16], p. 145) and negligence is defined as: “care that fell below the standard expected of physicians in their community.” ([16], p. 145) Brennan et al. reviewed: “30 121 randomly selected records from hospitals in New York State in 1984.” Their work showed that “adverse events occurred in 3.7% of the hospitalizations and 27.6% of the adverse events were due to negligence. 2.6% [of those] caused permanently disabling injuries and 13.6% led to death.” By using weighted totals Brennan et al. estimated that among “the 2 671 863 patients discharged from New York hospitals in 1984 there were 98 609 adverse events and 27 179 adverse events involving negligence.” ([16], p. 145).

The main conclusion, namely that potentially nearly 100.000 patients admitted to hospitals in New York in 1984 were subject to adverse events and more than every fourth of those was due to negligence by health care personnel, is a quite dramatic conclusion and has laid the ground for initiatives to improve patient safety. Now, to ‘unpack’ these conclusions takes us to the description of the method of the study.
When scrutinizing the methodology of the study, one sees the immense effort that has gone into constructing these results given the fact that the study is pioneering. Central to the study is a set of screening and reviewing processes, where selected persons, experts in their field, review patient records to decide whether adverse events has occurred during treatment and furthermore whether negligence has caused the adverse events. The reviewers were asked to rate their confidence in the occurrence of an adverse event on a scale from 0 to 6 where 6 is maximum confidence. 1 % of the selected records that showed signs of adverse events where then further scrutinized by another expert for the purpose of validation. This methodological approach thus relies to a large degree on the subjective judgment of healthcare professionals, rather than objective criteria, which is quite understandable and also, I would argue, the most obvious and reasonable way of approaching this. However, it is also an example of an ANT sociotechnical configuring process: in order to produce a specific problematization based on epidemiological research, which subscribes to a objectivist and positivist research approach, people, statistical tools, review processes - a set of heterogeneous actors – must be joined into a functioning assemblage. Thereby a figure that designates the number of patients suffering from adverse events in New York in 1984 is produced. The problem of patient safety is obviously not a simple matter but must be carefully and comprehensively constructed. It depends upon record keeping, statistical tools, but crucially also on specific persons, their situated knowledge, training and experience. This is not to criticize the work of Brennan et al. for not being objectivist and “hard” enough, it is to point to the fact that scientific results is comprised of various elements, “soft” and “hard” and more importantly that in order for results to become “hard” they rely on “soft” elements. (see also [17]).

Furthermore, Brennan et al. also describes that, in order for the reviewers to decide what counts as adverse events, the reviewers received training from the authors. The appendix provides four examples of adverse events and negligence that constituted the basis for this training. Besides supporting the argument made above, the examples provided are convincing and gives the reader the impression that to decide what an adverse event is, is somewhat trivial. However, it seems to me, that to decide whether something is an adverse event or a ‘normal’ event must be quite difficult. One would think that there must be a lot of grey areas between adverse events and ordinary events. Interestingly enough, the study seems also to be designed with a respect for this complexity, since the reviewers are provided the scale from 0 to 6 to rate the degree of whether an adverse events has occurred and then the authors place the line of demarcation at 4 (presumably in order not to overestimate the occurrence of adverse events). This also illustrates the construction of the problem of adverse event. It relies first on a continuum, a scale that allows for adverse events and ‘normal’ events to be neighboring or overlapping, and then afterwards this continuum is transformed into a dichotomous relation. One might wonder, what the study would have shown, if the reviewers did not have continuum, but should distinct sharply between adverse event and ‘normal’ event. However, a sharp demarcation line is needed in order for the problem of adverse events and thus the project of improving patient safety to be established. This is not to say that it is exaggerated, superficial or false. On the contrary, it simply affirms Bruno Latour’s understanding of the relation between “real” and “constructed”. Contrary to a common understanding that juxtaposes “real” and “constructed”, Latour relates the two by saying that the more work and effort that goes

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1 See the commentary ([16], p. 151)
into a project - in short, the more constructed it is - the more real it becomes [8]. By unpacking patient safety I am not to arguing that it is a hoax, the purpose is simply to rid us from the understanding that posing the problem of patient safety is a trivial matter.

Last, the project on patient safety relies on the belief in the ability to identify and separate out adverse events from ‘normal’ or accepted events in a meaningful way. Similarly, in the report To Err is Human, what causes errors in healthcare is described as inherently sociotechnical and complex, but still the argument in the report is that errors can be unraveled and systems designed so as to make them rarer ([1], p. 57).

We thus find a non-reductionist diagnosis of the problem, one that admits to the complexity of the occurrence of errors; a diagnosis that holds that what causes errors to happen is systemic, contextual and has multiple causes. But still the complex, systemic problem can nevertheless be broken down and taken apart so that better systems can be constructed. The belief in progress is kept intact. This argument, I think, one finds in much managerial literature on innovation and in governmental reports on diverse issues: the problem is described as complex, yet it is also always solvable. However one may wonder if the two ends actually do meet? Or one might wonder: how it affects our ability to recognize, describe and appreciate a problem when we also expect ourselves to deliver solutions for it?

3. In conclusion

In this paper two definitions of sociotechnical has been juxtaposed and discussed, the Tavistock definition and the actor network definition. Moreover, the problem of patient safety has been rudimentarily unpacked. The crucial difference established between the two versions of sociotechnical consists in a kind of inversion, I would argue. With the Tavistock definition, the challenge and the goal is to accomplish patient safety by designing whole healthcare practices. With the ANT version, patient safety is itself constructed in the process of accomplishing it. Patient safety, in this version, does not exist outside of and apart from the sociotechnical processes of realizing it. So what comes to qualify as patient safety is produced and mediated by the very practices that seek to achieve it. I have not argued that the attempts to design safer practice by drawing on the Tavistock definition of the sociotechnical, is fruitless. I definitely do not think so. But I am arguing that patient safety is constructed in and through those very practices. It is hard work to define and construct safe systems, which is not to say that it cannot or should not be done, but for this reason it is important to scrutinize how exactly it is constructed. It thus seems to me highly pertinent to reflect on how patient safety is made in the processes of designing safe systems. What comes to qualify as safe practices? What becomes construed as risk? How, why and for whom? These reflections are important, exactly because what comes to qualify as patient safety is not a trivial matter, but a highly consequential one.

References


How to dwell in an EHR
The question concerning architecture and EHR

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Abstract. The article deals with architecture and EHRs on a conceptual and philosophical level. Architecture is seen as the essential human expression of being, exemplified through the thoughts and writings of the German architect Gottfried Semper, the American architect Philip Johnson and the German philosopher Martin Heidegger. It is the assumption of the article that the current versions of EHR architectures are the result of a technical and systemic perspective on architecture, as opposed to the thoughts of Semper, Johnson and Heidegger. The article has a value-based and phronetic approach to the topic field, and claims that construction of EHRs should be a matter of concern, and not, as it is for now, a matter of fact.

Keywords: Architecture, EHRs, Standards, Dwelling and Caring.

Introduction

Architecture and building are according to the German architect Gotfried Semper (1803-79) how we live in the world. It is the essential expression of being and living. “Social institutions create conditions by which appropriate and poetic expression is given to architectural form”. (1)

What we are looking for in this specific context is the notion of poetry as a brick in the construction of architecture, because architecture is always there and our notion of space and time is expressed in architecture, and has been ever since man became as a social individual. And we have to ask ourselves what is poetry in order to ‘translate’ language into architecture, or more correct in order for us to understand the essence of language in relation to architecture.

The German philosopher Martin Heidegger (1889-1976) writes that building is at the basis of dwelling and thinking. We cannot think if we do not dwell, hence build. “For building is not merely a means and a way toward dwelling – to build is in itself already to dwell. Who tells us this? Who gives us a standard at all by which we can take the measure of the essence of dwelling and building?” (2)

Heidegger answers this rhetorical question in a highly complicated way, but the essence is that language is the bearer of essence. It is through language that we are shaped as human beings, and language shape architecture as the essential expression of man. This means that as we think architecture we implicitly think language, because we are language. We are caused to believe that we are in control of language, but it is actually language that controls us. This is a highly relevant aspect when we consider the construction of digital architecture, because it tells us that the fundamental language, i.e. digits, is determent for the architecture itself. It also means that the
standard for measure is already there to be found and liking it or not is there to be dealt with as an inevitable principle. It constitutes the ontology of digital architecture.

The question remains if we are able to build upon and add to this ontology, or if we should at all enterprise in such an effort?

The American modernist and creator of iconic buildings in the 20th century Philip Johnson (1906-2005) stated that: "All architecture is a shelter, all great architecture is the design of space that contains, cuddles, exalts, or stimulates the persons in that space.” (3)

The quotation tells us that great architecture, and why should digital architecture not strive toward greatness, transcends the bonds of ontology. It becomes more than a shelter (or in the case of digital architecture a container of facts represented through digits) and seeks to cuddle, stimulate and exalt. Digital architecture could be transcendental in reflecting on the ontological outset, and especially digital architecture within healthcare could consider the concepts of care, stimulation and cuddling when architects begin to manipulate the bricks and components of tools at hand.

EHRs and Architecture

Electronic Health Records are digital buildings and architectures that for decades have been thought of as mere constructions without qualities for dwelling and thinking, because envisioned as a matter of fact and as a container of facts. This mean that what goes on within the buildings of EHRs cannot make time and space for the individual to dwell or think, and least to be and to live. And still the question remains whether this situation should be altered, because in many ways appropriate within the framework of the institution, i.e. the hospital.

The EHR could also be seen as a parallel structure to the analogous architecture of the hospital, and if we look into that type of structure we find the container-hospital of modernism as the most equivalent to the current EHRs. (4) It is a broadly accepted fact that the container-hospital has been overcome by architectures that to a higher degree places the users and the patients in the centre. Today we witness plans for construction of new hospitals, of a more holistic character, where the dimensions of the singular departments are proportioned to the users of the place. This caring approach to patients and users has not been transferred to the construction of EHR and the main reason for this should probably be found in the cultural and social context of the EHR.

This article discuss the buildings of EHRs in the perspective of letting them become matters of concern and care as opposed to the current outline of fact and cure. In order to become that we have to think of the construction of the EHR. They have to become architecture for living, dwelling and thinking in order for the individual/user to be able to act and think appropriately.

Standards are considered the major component in the construction of EHRs and certainly there are obvious advantages of standards in building an appropriate architecture. Standards are vital part of architecture and have been ever since Egyptians constructed pyramids and Greeks temples, so there is no antinomy between standard and architecture for the living. In a more modern context we find that the Bauhaus school in Weimar and Dessau in the 1920’s had a focus on how to design and construct, through modules and standards, houses and artefacts that were meant for everyday people in a modern and democratic state. The Swedish company IKEA is as well focused on standardization on a global level trying to create artifacts and furniture.
that are “Democratic for the People”. The question of equality and democracy is to a large extent present when we talk about standardization in broader terms, and it is these broader sociological aspects of standardization that has to be infused in the discussion concerning standards in relation to architecture of EHR. For the time being we witness an overall technical perspective of standards, where we mainly think of the term as a way of gaining control over the data and as a way of making systems connect and interact. This is a very important aspect of standardization and of the architecture, because a quality that is vital in order for the whole system to perform and to work, and as such inevitable the moment we think of architecture on a huge scale level. But at the same time the technical and systemic perspective on standards has overshadowed the sociological and everyday life aspects of standards in relation to architecture. Which means that EHR architecture has become, due to the ontological outset of digits and technical control, a matter of fact and to a very little extent a matter of concern.

Just a few years ago predictions concerning the new generation of EHR’s were made, where the key-words were ‘patient focused and shared care’ which should become through “secure communication of structured, standardized datasets and a flexible technological system platform”. (5) And further down the line it is pinpointed that: “However, neither new technology nor new modeling techniques results in the desired semantic interoperability by itself. This is only achieved by continuous standardization work with participation from health care professionals and industry – and supported by validation and evaluation” (5)

The citation is important in the way that it pinpoints the significance of semantic interoperability and the role of standardization when we construct the architectures of EHR. I have stressed the importance of language (semantics) and of standards in relation to architecture, which is in its essence a question of dwelling and of being.

Heidegger is surprisingly clear about the meaning of dwelling in relation to being. Through an etymological analysis of dwelling he arrives at the verb: to free. “To free actually means to spare. The sparing itself consists not only in the fact that we do not harm the one whom we spare. Real sparing is something positive and takes place when we leave something beforehand in its own essence, when we return it specifically to its essential being, when we “free” it in the proper sense of the word into a preserve of peace. To dwell, to be set at peace, means to remain at peace within the free, the preserve, the free sphere that safeguards each thing in its essence. The fundamental character of dwelling is this sparing. (2) So to construct architecture and minding language in the phase of standardization is accordingly to search for a place and space where we feel free, at peace and in a condition to spare. The sparing is connected to the situational context and revolved toward what can be spared, i.e. the patient in this specific context. The sparing in the current situation when we consider the discourse concerning EHRs is revolved toward economical optimization of the system, which is a diametrical reading of the term sparing and this reflects in the construction of the architecture. It is actually the case that digital architecture holds for both approaches, but as the critical American philosopher of technology Andrew Feenberg noticed in Transforming Technology (2002): “Computerization of record keeping is a case in point, intensifying surveillance and control” (6). It need not be so at least according to Harley Shaiken, whom Feenberg quotes: “It is ironic that computers and microelectronics should be used to create a more authoritarian workplace. (and the point made by Feenberg and Shaiken is that this is what actually happen in almost all cases) They could as easily be deployed to make jobs more creative and increase shop floor decision-making. Rather than pace workers, systems could be designed to provide
them with more information about the production operation in general and their own jobs in particular. The technology could be used to bring work under the more complete control of the people who do it rather than the other way around" (6).

The sparing part of contemporary EHRs is ‘the other way around’ where the technical and systemic power of control, monitoring and surveillance of the patient, and of the work of the users has occupied the centre of the architectural construction. This could seem as the will of some obscure power, there in order to menace and to harm patients and users, but if we return to a sample from the analogous architecture we find that this is not the case. Container-hospitals and standardized housing were built with the best of intentions; nevertheless there are some alarming aspects in for instance the ontology of standardized housing that should alert us when we translate into digital architecture.

Standardized housing became increasingly popular and widespread as people managed to get out of the container allotments of grim suburbs, and architects designed the houses with a specific view on the function of the various components of the house. Zones for relax, eating, sleeping and so forth were created, and there was a concordance in the field that for instance the television-set would be most appropriate in the relaxing zone, hence space and infrastructure was set up in this particular room. Research made in UK in the 1970’s showed this to be wrong, because people would actually tend to have the television-set in the dining-room eating their meal whilst watching the television. “Since architects have a highly developed sense of space in its formal sense, this does perhaps lead them to make what other people might regard as odd predictions”(7).

This way of thinking architecture in a compartmentalized way making ‘odd predictions’ for the use and implementation of the space actually manifested in a set of rules for construction of public sector housing in the UK: “Mandatory Minimum Standards” (7). Architects may make ‘odd’ predictions’ because of their lack of experience with everyday life, because even the most successful architects do not build a sufficient amount of buildings in order to have practical experience. In medicine it is quite the opposite, because the rate of interventions and the constant accumulation of experience, hence: “it is much easier to see what works well and what does not” (7). This experience among professionals in the organization should of course be activated as we furniture the architecture, but most probably it should also be part of the process on a structural level and giving way to intervention and interaction as we think how things are built and not just inhabited.

It also means that trained architects of digital structures have to be assisted by the actual users (professionals) and inhabitants (patients) of the construction in order to prevent ‘odd predictions’.

Should we think EHRs in terms of architecture of the real world, might that be hospitals, allotments or private housing? The institutional setting of the EHR is obviously the hospital. And the hospital is not a place for dwelling in a Heideggerian perspective. It is a place for work and for some of us occasional settling during periods of illness or misfortunes. Nevertheless we tend to make attempts to inhabit and appropriate such occasional settlings. We give them our personal imprint and find places and spaces where we feel at ease, it is the sparing aspect of dwelling. If we were at home we would certainly prefer other structures and forms, but we adapt and appropriate because we know that this is temporary. The EHR is not an architecture that we live, as patients at least, in our everyday life. Professionals within the hospital system work on a daily basis with the EHR, as they do in the physical setting of the
hospital. The truck-driver inhabits the truck and today he finds his way on the road by the aid of GPS, actually he is totally relying on the information from the GPS, because a result of technical measurement and furthermore by accumulated experience that is constantly communicated through the device. The GPS has been absorbed into the Lifeworld and the sparing of the truck-driver. Danger is at hand if the truck-driver mistakes the map for the territory and the digital network of roads and streets replaces the actual and real world. The same thing counts for the EHR in any way we may think the construction. The technical and systemic versions that we are dealing with right now, represents the patient as a container of data and facts. We are represented in schedules, numbers and standardized terms where technical and precise generalization is the goal. On the other hand we should not create fairies (avatars) of ourselves in the digital realm, because as distant from the real as the schematic representation; and perhaps even more tempting to interact with than the difficult and irregular person lying in bed in need of caring and sparing.

Reflections

Conclusively I go along with the French philosopher Bruno Latour who, in revisiting his own work of the 80’s and 90’s on Actor Network Theories (ANT), urges us to focus on matters of concern, as something more than (and better than) matters of fact and matters of fairy. (8) The final words in the brilliant article reads: “This require that all entities, including computers, cease to be objects defined simply by their inputs and outputs and become again things, mediating, assembling, gathering many more folds than the “united four” (Latour is referring to the problematic fourfoldedness of Martin Heidegger in which a thing constitutes: mortals, immortals, heaven and earth). (8) What is meant is that an object or a thing is much more than what it is made of and what it contains, because the thing is a gathering that generates meaning that transcends the components and elements of the factual thing.

Architecture, and digital architecture, is at the root, as Semper, Heidegger and Johnson quite rightly claimed the fundamental expression of being, and it is these fundamentals that have to be infused in any discussion concerning architecture of EHR, because either way we face EHR it is a representation of something, a gathering transcending inputs and outputs, and that something is a human being.

References


Part C
Design
Pilot Users in Agile Development Processes: Motivational factors

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Abstract. Despite a wealth of research on user participation, few studies offer insights into how to involve multi-organizational users in agile development methods. This paper is a case study of user involvement in developing a system for electronic laboratory requisitions using agile methodologies in a multi-organizational context. Building on an interpretive approach, we illuminate questions such as: How does collaboration between users and developers evolve and how might it be improved? What key motivational aspects are at play when users volunteer and continue contributing in the face of considerable added burdens? The study highlights how agile methods in themselves appear to facilitate mutually motivating collaboration between user groups and developers. Lessons learned for leveraging the advantages of agile development processes include acknowledging the substantial and ongoing contributions of users and their roles as co-designers of the system.

Keywords. pilot implementation, agile development, user participation, motivation

Introduction

User involvement in information system development and implementation processes is acknowledged as being vital for ensuring the quality of such systems. A wide range of approaches and techniques have been developed to engage users [1,2]. Agile methodologies have emerged as means of counteracting some of the disadvantages associated with traditional waterfall methods [3]. While the later are characterized by pre-planned processes of requirements capturing, analyzing, designing, coding and testing, agile methodologies deliberately blur distinctions between these processes. Based on experiences that users are difficult to motivate [4] and not able to fully pre-specify their requirements, agile methods start with a simple working solution followed by short iterations whereby user requirements and the system itself evolve a little at a time [3]. Agile methods are characterized by close and continuous collaboration between developers and users or customers throughout.

The study explores the pilot implementation of a system for electronic laboratory requisitions that was developed using agile methodologies in a multi-organizational healthcare context. The system was built through close collaboration between users and developers. Several authors have offered explanations about what motivates users to participate in such projects [5], and ownership has been mentioned as one important aspect [6,7]. Benkler and Nissenbaum [8] offer another approach that could be
appropriate. They explain the drive of the contributors to peer-based systems as a moral action and define both self-regarding and other-regarding virtues, and that these virtues are a motivation in themselves. This study seeks insights into questions such as: How does collaboration between users and developers evolve in pilot implementations and how might it be improved? In particular, what key motivational aspects are at play when users volunteer and continue contributing in the face of considerable added burdens? Despite the relevance of prior literature on user involvement, few studies address the roles of users in pilot implementations [9], and human issues like for instance motivation for systems that evolve through agile methodologies [10, 11].

This case study adheres to an interpretive research approach. The research was mainly carried out in the company DIPS, the University Hospital of North Norway (UNN) and GP offices in Tromsø, Norway. Data was collected from December 2007 to August 2009. Eight in-depth semi- and unstructured interviews were conducted with members of the development team, as well as pilot users in the involved laboratories at UNN and in general practice. The first author had an office at DIPS allowing her to participate in all internal and external meetings as well as informal discussions that facilitated awareness of emerging situations and issues.

Case

Research context

Based on internal analyses showing that paper-based requisitions from primary care to UNN often contained errors or lacked clinical information, UNN acknowledged a potential for receiving electronic requisitions from GPs in primary care. UNN is the regional hospital in Northern Norway and has 7 laboratories that analyze samples from GPs and internal requisitioners. DIPS is a Norwegian vendor of hospital electronic patient record (EPR) systems and systems for communication within health care. UNN and DIPS established a project aimed at designing a system for electronic requisitions. The project started in 2006 and lasted for approximately two years. Following the project phase, the system has been sold to ten hospitals that use the system in collaboration with their respective GP offices.

The system is fully integrated with the GPs' EPR and GPs can choose and order laboratory services directly from their computer. The system creates labels with bar codes that are scanned when the sample tubes arrive at the hospital. Information from the requisition is transferred directly into the appropriate laboratory information system. An editing tool enabling the laboratories to create and edit the presentation of offered analyses and information is included.

Development and pilot implementation activities

When DIPS started to build the system for electronic requisitions from scratch they recognized the close relation between developers and customers pervading agile methodology as a way to make up for their own lack of knowledge of the users' work practice. In addition to traditional technical testing of the system there was a need to learn how the system fitted with the work practice that it was supposed to support. The pilot users expressed the necessity of pilot implementation in this way: “...you reveal a great deal, not just the little things, but also important things while piloting. When
piloting you use the system in the regular work processes. You can never test it well enough in a test environment.” (Biomedical scientist). Four months into the project, and in line with agile philosophy, the vendor presented a simple, but working solution to the customer. It was implemented for pilot use immediately and the users could see how this suited their daily work, along with providing corrections and feedback to the developers. The developers worked in three week iterations. Based on the feedback from the pilot users new versions were developed and deployed continuously. The laboratories at UNN use different information systems. The vendor wanted to start integration with one system, and biochemistry and two smaller laboratories were selected. Four GP offices in Tromso were included in the first pilot implementation and approximately 1000 electronic requisitions were sent per month. After pilot usage for approximately a year, more GP offices started to use the system and it gradually evolved into regular use. The second development phase expanded the system to include microbiology and a new pilot implementation phase started. This time the microbiology laboratory at UNN and only one of the GP offices were pilot users.

The pilot user group included physicians, biomedical laboratory scientists and computer support personnel in the laboratories and GPs and secretaries in the GP offices. To ensure real life pilot testing, the laboratories and the GPs had to set up completely new work processes parallel to the existing ones. In the laboratory most requisitions were still paper based, and in the process of receiving, unpacking, sorting and forwarding sample tubes and requisitions two parallel routines had to be organized. The GPs could only order analyses electronically from the participating laboratories, while for instance pathology had to be ordered using paper forms. All personnel both in the GP offices and the laboratories were trained and they used the new system in their daily work. Because of frequent releases of changes and new functionalities, substitute personnel and part times staff had to be followed up more closely than normal. The actual co-working sessions of users and designers consisted of the developers sitting together with the users performing their job in order to better understand user problems and needs and discuss how the system could support the work processes. There were also meetings where all user groups and developers discussed the system collectively.

Super user groups were established to organize the testing, to do trouble shooting and to be contact points for the developers. They set up special procedures to check that the system performed as anticipated. For instance, the GP offices made paper copies of the electronic requisitions and sent these together with the sample tubes. They also established internal manual routines in order to check the matching of sent orders and received analysis reports. To inform colleagues of system errors or strange events, the GP offices established informal routines based on paper notes. These findings would be further tested by the super users before they were reported by e-mail or telephone to the developers. The pilot users reported that the little by little approach to development made testing easier, even if it made them test more often: “When it comes a little at a time it is easier to focus on the one thing that needs to be checked. For instance, when we got the microbiology requisitions we already had the rest and we could focus on that” (Secretary). The pilot users reported considerable costs associated with their roles. They spent great amounts of time on organizing, meetings, support and testing. For instance the cross checking in the GP office was carried out for about a year until they felt that they could trust the system, and the secretaries estimated that they used several hours a week on this control. They also had to troubleshoot before relaying feedback to the vendor. Some users experienced extra strain and frustrations due to quick changes that were hard to keep up with. For instance they did not
understand why something worked in one particular way one day and differently the following day. The super user group had to face these users when there were problems and felt that they had to give extra support to avoid distress.

The pilot users were from different organizations and had no prior acquaintance with each other or the developers. In the beginning all project communication between the pilot user groups went through the developers. Pilot users reported that this was unsatisfactory because they felt that the developers lacked an understanding of the real problems. This changed following workshops and meetings organized by the developers in which they became personally acquainted. They established direct access to each other by telephone or e-mail to discuss immediate issues. For example the laboratory's first attempt to make a presentation of the microbiology analyses was not a success from the GPs' perspective, and one of the secretaries in a GP office had to take action: “During the testing of microbiology we had to call for a meeting because we were so displeased with the menus they had made. After all we were piloting, and this did not function well, so we had to do something. And then everybody came, from the microbiology laboratory and all our physicians. Everyone got to state their opinions and we kind of cleared the air” (Secretary). The relationship that was established between the pilot user groups were seen as a positive side effect as this had been previously lacking.

Motivational aspects

UNN was a partner in the initial project as well as the first customer of the system. It therefore became natural for them to do the pilot implementation. The users both in the laboratories and in general practice had wished for electronic requisitions for years. The super users at the biochemistry laboratory participated in the initial discussions and therefore volunteered to participate, while in the microbiology laboratory the decision was made by the management and super users were appointed for the job. In contrast, the pilot users in general practice were end users, but not customers. Their participation in the development and pilot implementation of the system was totally voluntary. The informants expressed that their reasons for piloting was an expectation of significant benefits from the system. In fact, they were so eager for the new system that they did not want to wait for anyone else to pilot it. In addition, they saw piloting as a way to influence the design of the system. As one informant reported: “I feel that we have influenced it, that we expressed our wishes and that our voices were heard” (Biomedical laboratory scientist). Another expressed similar thoughts: “We feel that we have been advisors or supervisors for those doing the technical part of the development” (Secretary). Despite the extra time and frustrations due to the piloting, the pilot users reported that the benefits outweighed the costs in that the resulting system complied with their own wishes.

Intrinsic motivational factors were highly apparent. Fun, curious, learn a lot and eager to be in front were words that the pilot users used frequently when describing their experiences as pilot users. “We like the sense of self-development. We do not want to do the same all the time. This is the reason why I got involved in this” (Secretary). They were aware that they were making significant contributions to the health care community. The recognition that they received from peers following presentations at external meetings and conferences was also important. Similarly, the developers reported that the close collaboration with the users was a positive factor for their own job satisfaction.
Also the nature of agile development in itself appeared motivating for the pilot
users. While the continuous releases of changes and fixes might easily have been
perceived as disruptive, pilot users described it as motivating: “The quick responses to
our wishes increased our motivation. It is easier to accept mistakes also when you
know that there will be rapid changes” (Biomedical laboratory scientist). On the other
hand, frustration came quickly when feedback lagged following workshops: “A long
list of wishes came up. We have not seen or heard anything about that yet, so we do not
know the status of that now” (Biomedical laboratory scientist). The development and
implementation of the system has been delayed due to unforeseen events like delays
with other vendors that the systems have to be integrated with and internal processes in
the hospital. This has caused frustration and impatience by the pilot users, and they
expressed that the system that they have been working so hard for seems very far
ahead, thus underlining their motivation.

Discussion and Conclusion

The current study sought insights into how collaboration between users and developers
evolve in agile development processes and how these processes might be improved by
focusing particularly on motivational aspects. The case illustrates how the agile
development process has been the result of developers and pilot users mutually
influencing each other throughout genuinely collaborative interactions. The case also
describes how this process may be characterized by short developmental iterations and
quick feedback. The extra burden on the pilot users has been substantial in setting up
new work processes, and by testing and providing internal support. Despite this the
pilot users have remained highly motivated throughout the process.

Our experiences support Hansson et al’s call for improving agile methods by
applying approaches from Participatory Design [12]. However, their users were
involved on a non-committed basis. Our case highlights the advantages of a selected
group of committed users who were genuinely involved in the decision-making
processes. Thus, pilot users reported experiencing their roles as designers, more than
mere users. Büscher et al [6] emphasizes the importance of membership and that both
users and developers are members of each others’ community of practice, thus erasing
the boundaries between user and developers. Our experiences coincide with the notion
that distinctions between users and developers may distract from the real contributions
of users [13].

An obvious and underlying premise for interpreting the pilot users’ experiences in
this case is that they were highly motivated to acquire the system that was being
developed. This in itself appeared to buffer pilot users from the frustrations that might
easily have undermined their involvement as collaboration progressed. Also, the agile
method in itself was mutually motivating for pilot users as well as developers by
immediate incorporation of the system into real life use. There is often an asymmetry in
benefits of collaboration between users and vendors of such systems [14]. In health
care the additional challenge is often that the system is developed to improve the work
process of one of the user groups, for instance the hospital as in this case, while the
GPs have to do the extra work. This challenge was addressed from the outset of the
project by aiming to make the ordering process more effective for the GP practices, as
well as improve the safety and effectiveness of receiving samples at the hospital. What
Benkler and Nissenbaum [8] referred to as moral virtues was demonstrated by the pilot
users in volunteering to take on the extra work that others outside their immediate organizations would benefit from and.

That said, this case illustrates a number of factors that interplay in fostering the intrinsic motivations of users to contribute to system development. It is important that vendors and project managers do not take these factors for granted, but that they are reiterated throughout the development process:

- Facilitate attitudes of mutual collaboration by acknowledging the pilot users’ role as co-designers.
- Promote arenas that enable good working relationships between the user groups—in our case GP and hospital pilot users
- Create an early win-win-situation where all user groups develop something they genuinely want and can see immediate benefits of.
- The importance of developers’ quick response to user input should not be underestimated.
- Leverage motivation by facilitating events where the users can demonstrate their acquired expertise and contributions to peers and be acknowledged for it.

References

Designing Shared Electronic Records for Chronic Care

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Abstract. This paper reports preliminary findings from an ongoing research project on the development of IT support for communication and information sharing across institutional and professional boundaries within the Danish healthcare system. The project focuses on the treatment of patients with implanted ICDs (implantable cardioverter-defibrillator). These are chronic patients who usually see several different healthcare providers on a regular basis. The main findings so far are: (1) Most of the data produced and recorded as part of the care process are context-specific and often difficult to interpret unless you are an expert on the subject. Sharing these types of data across institutional and professional boundaries is not feasible. (2) Yet, it appears that a small subset of data can make sense across the different contexts and be of use to others. These data are good candidates for sharing. (3) In addition, there appears to be a need for creating new types of data specifically designed to meet the coordination needs across different contexts and expert domains. (4) The dilemma is, however, that the production of these new types of data must not require too much extra work.

Keywords. Electronic medical records, shared care, information sharing, chronic diseases, participatory design, prototyping.

Introduction

Modern healthcare systems are incredibly complex entities. They are characterized by a high degree of scientific and professional specialization, a marked division of labor, and an interdependence among relatively autonomous healthcare providers. Provision of healthcare is, thus, distributed across an array of different, sometimes competing, entities, each with their own objectives, tasks, capabilities and sources of funding. Without adequate means of coordination, this leads to organizational fragmentation, which can result in errors, duplication of efforts and many other problems negatively affecting patient safety and the quality of care [1, 2].

Fragmentation of care is a risk, in particular, for patients with chronic diseases, because they frequently need continual treatment from multiple specialists who belong to different organizations and who do not usually collaborate [2]. Furthermore, many, especially elderly, patients suffer from several chronic diseases, which makes coordination of care even more important, but unfortunately also even more precarious [2, 3]. Not surprisingly, the rapidly rising number of patients with chronic diseases has created an increasing interest in new chronic care models such as ‘shared care’ and ‘integrated care,’ both of which promise to improve coordination, enhance quality of care, and control costs [4, 5, 6, 7, 8].
Sharing patients’ health information across organizational and professional boundaries is one of the fundamental prerequisites for improving coordination among healthcare providers. It is evident that IT potentially has an important role to play in this, but it is still an open question how best to design and implement IT solutions that facilitate cross-boundary communication and information exchange and thus tie networks of relatively autonomous healthcare providers together.

In this paper, we discuss the problem of designing a shared electronic medical record (SMR) for the treatment of ICD patients in Denmark. The study presented here is part of the research project, Co-constructing IT and Healthcare (www.cith.dk), which aims at developing IT support for communication and information sharing in heterogeneous networks of healthcare professionals and patients.

1. Clinical case: heart patients with implanted ICD devices

These patients suffer from chronic heart failure and have an ICD implanted to constantly monitor the heart and intervene when it detects a pre-specified rhythmic abnormality. An ICD (Implantable Cardioverter-Defibrillator) is a small battery-powered, programmable electric impulse generator that is designed to detect cardiac arrhythmia and correct it by pacing or by delivering an electric shock. ICD therapy is typically combined with medical therapy, often consisting of a cocktail of different drugs specially adapted for each patient. Finding the right combination of drugs and optimizing drug dosages is a difficult and ongoing task. As a consequence ICD patients need two types of regular follow-ups at a hospital or clinic, one for the medical therapy and one for the ICD therapy.

In the Capital Region in Denmark, all ICD implantations and device follow-ups have been centralized at one teaching hospital in Copenhagen. The reason for centralizing these ICD-related activities in one place is that they require highly specialized knowledge of electrophysiology and ICD management. The medical follow-ups, on the other hand, are carried out by cardiologists in a number of dedicated heart centers located in the region’s local hospitals. One implication of this is that ICD patients are treated by several care providers simultaneously, namely an ICD specialist in Copenhagen, a cardiologist at the local hospital, the patient’s own GP and, in many cases, a home care nurse as well. This situation creates an obvious need for coordinating care and exchanging information across settings and providers – a need that is not currently being met.

Interviews with health professionals and observation studies carried out as part of our research show that little or no information is currently being shared systematically among the different care providers. Patients, of course, often act as a liaison between the different physicians and communicate information about, for instance, changes in medication or dosages, but there is no direct exchange of information between the healthcare providers, except in rare cases. As a result, physicians sometimes – for instance, when a patient is unable to relay information correctly – act upon incomplete or incorrect information, which may lead to suboptimal control of the patient’s heart disease.

It is widely agreed that better and a more systematic exchange of information between the involved care providers is needed, but it is not exactly clear what type or form of information is to be exchanged or in what medium it is to take place.
2. Sharing information across boundaries

Each care provider produces a substantial amount of clinical data that are recorded in the patient’s local medical record or in dedicated databases. These data are generated by physicians, laboratory technicians, and nurses as part of their work. Most of them are intended for internal use and are recorded in a language/notation and at a level of detail that is deemed adequate for the tasks at hand. Their primary purpose is to support patient care and the coordination of work within the organizational unit, and they are tightly coupled to the unit’s specific tasks and technologies. The laboratory technicians at the ICD clinic in Copenhagen, for instance, retrieve a wealth of data from the ICDs (using a so-called ‘programmer’), which are essential to the clinic’s work with patients, but hardly understandable by non-specialists. In other words, the different care providers maintain their own specialized medical records, each of which only gives a partial picture of the patient’s situation and past care.

As already mentioned, the different healthcare providers acknowledge that there is a need for more information sharing between them. However, the cardiologists at the local heart centers do not need to have access to all of the data generated and recorded at the ICD clinic in Copenhagen, and they would not be able to interpret or make use of most of them. What they need is just a short summary of these data. Similarly, the ICD specialists do not need access to all of the data produced at the local heart centers. This would only result in information overload.

Thus, the challenge is to identify the (probably rather small amount of) relevant information and present it in a form that makes it useful — not just for the specialists who created it — but also for other people, who they don’t know and with whom they only to some extent share professional knowledge and experience. The problem is that the extraction of data from a specialized medical record belonging to one organizational unit and reformatting or ‘repackaging’ it so that it becomes useful for outsiders requires extra work and risks being quite time consuming. And if there is one thing that most clinicians do not need, it’s extra ‘paperwork.’

So, we have to acknowledge a dilemma or at least a trade-off here: increased information sharing may improve interorganizational coordination and the quality of care, but it often requires extra work on part of the clinicians. It is, therefore, important to try to design shared medical record systems so that they to the largest possible extent can re-use existing data.

3. Design approach

Needless to say, the design of shared medical records must be based on a thorough understanding of the different users’ information needs, and an active involvement of users in the design process is therefore necessary.

Inspired by participatory design methods, we have sought to combine systematic studies of the current work and documentation practices with extensive user involvement in the actual design of the SMR. This has, however, turned out to be more difficult than first anticipated, for three reasons:

1. The user group is very diverse and hard to characterize. The users are defined by their professional backgrounds, their expert knowledge, their specific work roles and tasks, and the organizations with which they are affiliated. They do
not constitute a coherent group in any meaningful sense of the word; they don’t know each other; and they have only limited knowledge of the work done by others and only a rather vague idea of how their work fits in with the rest. This makes it difficult to identify a representative group of users.

2. In today’s Danish healthcare system clinicians are pressed for time and feel so overwhelmed with competing demands that they are quite reluctant to participate in IT projects or other kinds of development initiatives.

3. The clinicians have difficulties in articulating their information needs. The ambition of the project is not just to support existing practices, but also to identify new possibilities for coordination and information sharing across professional and organizational boundaries that, in turn, may lead to new ways of working and interacting. It is, however, not easy for the clinicians to envision what a shared medical record can do for them or what it should contain, because their only frame of reference is their own existing work practice.

To overcome these challenges, the design of the SMR has been planned as a four-stage process. Currently stage 1 has been completed and the project is halfway through stage 2. Stage 3 is expected to commence early summer 2010.

Stage 1: The first stage consisted of open-ended, ethnographically inspired field studies, comprising observation studies as well as interviews with key actors from four different hospitals. These studies gave us insights into the current practices and enabled us to identify and select which problem areas we wanted to address in the later stages of the project.

Stage 2: The purpose of the second stage is to develop a running prototype in collaboration with a few selected users. We have invited two specialists from the ICD clinic and two cardiologists from a local heart center to participate in this part of the project. We have chosen these four physicians not because we assume they are in some sense ‘representative’ of the user group as a whole, but because they have a special interest in and deep knowledge of ICD patients, and they are highly motivated to participate in the design process. So, we think of them as ‘lead users’ who can provide us with valuable input [9].

Stage 3: The decision to base the prototype development on a few lead users may, of course, entail that the solution will not meet the needs of all users. To mitigate this risk, we will take steps to have a much broader group of users evaluate the prototype and, if necessary, adapt the design to accommodate their requirements.

Stage 4: Finally, it is our plan to conduct a pilot implementation of the system to see how it performs in ‘real life’ [10].

4. Preliminary findings

Our work has to date already resulted in a better understanding of the issues and challenges involved in designing shared electronic medical records for ICD patients. Our main findings are:

First, the bulk of the clinical data generated in the care of patients and recorded in the various existing local medical records and databases are highly context-specific and difficult to understand for ‘outsiders.’ Sharing these data with others is neither feasible nor perhaps desirable.
Second, we have, however, identified a relatively small subset of data that make sense to share and can be useful outside the context in which they were initially generated. This includes medication data, subracts of technical information about the ICD unit, overview of the therapies given, and information concerning changes in the patients general condition.

Third, we have also identified the need for new types of data specifically targeted at supporting coordination and information sharing among the different groups of clinicians. A good example is a new ‘patient summary’ that is going to be a common responsibility rather than just the responsibility of a specific healthcare provider (this functionality will be presented later).

Fourth, the clinicians are concerned about the burden of ‘paperwork’ and stress that the introduction of a shared electronic medical record must not require too much extra work on their part. So, they are facing a difficult trade-off between wanting more useful and customized information on the one hand, and wanting to avoid the ‘paperwork’ that its creation may entail on the other hand.

Based on these insights we have designed the software prototype ‘Shared Medical Record’ (SMR) that have been used as a test bed to explore new ways of mediating collaborative and communicative activities across organizational boundaries in healthcare. The design of the prototype is based on the general assumption that a shared information system must support a high degree of tailorability to fulfill information needs in each local, situated practice, and to enable adaptation to the existing practices rather than enforcing major changes. To meet this criterion, the SMR is designed as a web-based platform that provides customizable workspaces that users can modify according to their preferences. A workspace is a user-defined window containing various ‘widgets’, i.e. small programs that let users do a variety of tasks such as accessing a patient’s medication data or posting a message. Users can customize the number, names and content of the workspaces by adding or removing widgets selected from a pre-defined list, and thus adapt the system to meet the requirements of a number of different use situations, for instance, patient consultations or emergency admissions.

There are two main types of widgets: The first type are widgets that make local data accessible across organizational boundaries, by presenting data extracted from existing databases, either in full form or as subracts, e.g. medication lists, clinicians’ notes, or information about the ICD device. The second type of widgets support communication and information sharing by allowing clinicians to exchange messages or to collaboratively create and share common information.

An example of the latter type of widget, is the ‘patient summary’. It is intended to support accumulation of summarized information about the patients’ medical condition over time. The responsibility for creating and maintaining the patient summary is shared among all healthcare providers involved in the treatment of the patient. The patient summary is designed to be very time efficient in use. Clinicians create or update the patient summary by filling out a simple input form. The input form contains a combination of free text fields and multi-select-options through which the user inputs data about the patient’s diagnoses for specific complications or comorbidities (e.g. diabetes and COPD), essential medical history, treatments (e.g. ablation surgery), results from medical examinations (e.g. aorta insufficiency), etc. The system then generates a short text string that gives cardiologists a brief overview of the patient’s medical status. The patient summary should, of course, be updated whenever changes occur.
By distributing the task of creating and maintaining the patient summary among all involved cardiologists and by primarily basing data input on multi-select-options rather than free text, it represents a relatively small addition to the current workload. In return the patient summary is expected to help the clinicians quickly gain an overview of the patients’ condition in situations where they are normally pressed for time.

By offering easy access to medical data across organizational boundaries, and by organizing the production of common information as a responsibility that is shared among the involved healthcare providers, SMR represents a new approach to the design of information infrastructures in healthcare. Our hope is that these concepts can contribute to the development of new, inter-organizational practices, and thereby counteract the organizational fragmentation that currently seems to inhabit shared care practices, such as the ICD treatment.

References

Participatory (re)design of a sociotechnical healthcare delivery system: the Group Health Patient-Centered Medical Home

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Abstract. This paper describes one organization’s interpretation of the Patient-Centered Medical Home concept and the healthcare delivery system that has emerged from their participatory redesign initiative. Group Health, a large integrated healthcare system based in Seattle, Washington, USA initiated a Patient-Centered Medical Home care delivery system transformation in January 2007. Current theories and evidence about the Patient-Centered Medical Home (PCMH), the Chronic Care Model, and effective primary care were interpreted via a facilitated group process and translated into a core set of 5 system design principles. These design principles guided all subsequent system transformation activities. The central organizing principle is supporting and sustaining the patient-primary care physician relationship. The emergent PCMH healthcare delivery system comprises both opportunistic point-of-care and outreach components, many of which leverage and enhance the organization’s health information and communication technologies.

Keywords. patient-centered medical home, practice redesign, primary care, informatics, participatory design

Introduction

The Patient-Centered Medical Home is a model of healthcare organization and delivery receiving increased attention as a means of fundamental healthcare reform (1-6). Interpretations of this concept vary (6), but all emphasize the use of healthcare information and communication technologies (HICT) to support both the coordination of patient care activities and strong longitudinal relationships between patients and their care providers.

Group Health Cooperative (Group Health), a large integrated healthcare delivery system headquartered in Seattle, Washington, USA initiated a patient-centered medical home (PCMH) healthcare delivery system transformation pilot in January 2007 at one of its clinics in which 8 primary care physicians serve approximately 11,000 patients. The lessons learned from this PCMH pilot continue to inform an organizational transformation initiative in which the pilot’s emergent PCMH care delivery system model is being scaled and replicated in all 26 Group Health clinics. An evaluation study revealed that significant improvements in care quality, utilization, patient experience, and provider experience were achieved in a cost-neutral manner after only

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1 year (7). A qualitative study also revealed provider and staff perspectives on the necessity of HICT use in achieving these results (8). The primary aim of this paper is to provide a detailed description of the PCMH pilot intervention in order to contextualize these and other reports of its effects. The research question addressed in this paper is: what are the defining traits, components, and intended effects of a PCMH care system redesign initiative that yielded significant improvements in care and in providers’ positive attitudes towards and increased use of HICT?

Background and Setting

Group Health is a member-governed, nonprofit, integrated health insurance and delivery system. The organization currently employs over 9,700 people who support or directly provide comprehensive healthcare services to approximately 540,000 enrolled members. The medical group employs 850 staff physicians who work in 26 primary care clinics, 3 specialty care clinics, and 7 hospitals located primarily in the greater Puget Sound region. The organization is a primary care-based system in which adult members choose a family physician or general internist as their personal primary care physician. Full-time adult primary care physicians are typically responsible for providing care to approximately 2,300 patients. The organization’s HICT infrastructure includes the EpicCare Ambulatory commercial EHR system that includes integrated patient web portal and secure patient-provider email messaging features (9).

The national and regional healthcare business environment of the late 1990s led Group Health to implement a series of organization-wide redesign strategies between 2000 and 2006. These strategies were based on the Patient-Centered Access care model (10) and aimed primarily to improve patient access to services while simultaneously streamlining operations, improving provider productivity, and implementing a commercial electronic health record (EHR) system. These organizational redesign strategies, collectively called the Access Initiative (11), succeeded in improving patient access to care and patient satisfaction, but also increased provider workload (12, 13) and decreased primary care provider satisfaction (13). During this same time period the utilization of some consulting specialty, emergency room, urgent care, and hospital services increased (13). A qualitative study of providers’ experiences with the Access Initiative provided additional insight into the nature and sources of their job dissatisfaction. Participants attributed their dissatisfaction to increased productivity expectations coupled with task redistribution effects, workload increases, and stress associated with the EHR implementation and use (14).

In 2006, Group Health engaged in long-term strategic planning endeavors aimed in part at addressing these workforce issues while concurrently sustaining the gains realized through the Access Initiative. It was in this context that the Group Health PCMH transformation strategy originated.

1. Study Design and Methods

This case study of the PCMH pilot transformation initiative was developed using qualitative methods (15-17). The Group Health institutional review board approved all study procedures and activities. Author JTT conducted individual semi-structured interviews with 10 key informants who participated in the initiative. Interviews were recorded, transcribed verbatim, and de-identified prior to qualitative transcript content
analyses that employed a template organizing approach (16, 17). Interview transcript analyses were complemented with a systematic review of the PCMH project document archive, which contained over 1,000 documents produced from April 2006 to August 2008. Findings were subjected to a member-checking procedure with 8 of the 10 key informants, were deemed accurate and representative, and required no revision.

2. Findings

2.1 Origins of the Group Health PCMH Transformation Strategy

In early 2006, the group practice medical director began promoting awareness of the PCMH concepts among the organization’s medical and administrative leaders as means of both improving patient care and addressing physician job dissatisfaction and burnout, and advocating for an organizational strategy based on these concepts. A multidisciplinary working group comprising the organization’s senior administrative and physician leaders was formed shortly thereafter. This group was charged with designing, implementing, and providing sponsorship and oversight of a two-year PCMH transformation strategy pilot to be achieved through comprehensive redesign of one of the organization’s primary care medical centers. Organizational leaders selected the pilot clinic based on its location, size, and the stability and experience of the clinic’s leadership and medical staff in implementing practice-level changes.

**Text Box 1: The Core PCMH Design Principles**

The relationship between the personal care physician and the patient is the core of all that we do. The entire delivery system and the organization will align to promote & sustain this relationship.

The personal care physician will be a leader of the clinical team and be responsible for coordination & integration of services, and together with patients will create collaborative care plans.

Continuous healing relationships will be proactive and encompass all aspects of health and illness. Patients will be actively informed and encouraged to participate in all aspects of their care.

Access will be centered on patients’ needs, be available by various modes 24/7 and maximize the use of technology.

Our clinical and business systems are aligned to achieve the most efficient, satisfying and effective patient experiences.

Source: Group Health PCMH project document archive, file created 4/28/06

The working group reviewed concepts, theories and empirical evidence about the PCMH (1-6), the Chronic Care Model (18-20), and effective primary care (21) to establish guiding principles for the clinic redesign. Text Box 1 presents the 5 design principles that emerged from 3 iterations of participatory development and review, which also incorporated review by several external experts. These principles provided the foundation for all subsequent PCMH design and implementation activities.
2.2 Conceptualizing the PCMH Care Delivery System and Transformation Process

Preparation activities were initiated in mid-2006 with the full participation of the pilot clinic’s administrators and medical staff. Two 3-day participatory workshops were held in the spring and summer of 2006 to design the PCMH care model. Approximately 35 people attended each of these workshops, which applied the quality improvement techniques of future-state visioning, workflow mapping, and job scope analysis. Participants included front-line physicians, nurses and other clinical staff from the pilot clinic, organizational leaders, and a patient representative. The second workshop yielded an implementation work plan document prioritizing redesign activities for physical infrastructure improvements, appointing and scheduling template changes, clarification of staff roles and responsibilities, patient flow changes, and further tasks for more detailed implementation planning and execution. Following the August 2006 design workshop, the pilot clinic’s leaders, providers, and staff assumed primary responsibility for further care model design enhancements, implementation planning activities, and preparations for a January 2007 pilot “go-live”.

2.3 Creating Organizational Capacity for Change: Required Precursors

The working group identified several baseline changes that were required before the pilot implementation could begin. Most notably, physicians, non-physician clinical staff, and other human resources were hired to increase the clinic’s labor capacity. These capacity increases were required to enable patient re-distributions to achieve panel size reductions (from 2,300 to 1,800 patients per 1.0 FTE physician) and to accommodate appointment scheduling templates that offered longer standard visit times (30 minutes) and scheduled time for providers to perform patient outreach and follow-up activities by email and telephone (“desktop medicine time”). To allow for panel size reductions, 2,790 (approximately 25%) of the clinic’s patients were re-assigned from one primary care physician to another using a systematic process that accommodated patient requests to decline reassignment.

The PCMH working group also determined that the pilot clinic would be granted “immunity” from select other organization-wide change initiatives and policies that exhibited potential to adversely affect the implementation and success of the PCMH pilot. One noteworthy example was that, for the duration of the 2-year pilot, the physicians would be solely compensated by a fixed salary rather than the organization’s variable incentive compensation model in which salaries are modified from 80% to 120% based on relative value unit production, quality-of-care performance indicators, and patient satisfaction survey results.

The PCMH transformation planning effort also included a commitment to a systematic evaluation focused on assessing effects on patient experience, the staff work environment, quality of care, enrollment, utilization, and costs (7).

2.4 The Emergent Group Health PCMH Care Delivery System

The emergent PCMH care system utilizes a physician-led multidisciplinary care team as the primary strategy to achieve the first two design principles (see Text Box 1). The roster of each physician-led team remains constant although some personnel serve on more than one team (e.g., a 1.0 FTE clinical pharmacist may serve as a member of 3 care teams). Physicians work with their own dedicated medical assistant (MA) or licensed practical nurse (LPN) in a 1:1 staffing ratio. Each of the physician-led care teams also comprises and is supported by other personnel, each at an FTE level < 1.0.
These partial-FTE care team members include a designated registered nurse (RN); clinical pharmacist who is directly involved in patient care; physician assistant (PA); and a “desktop” LPN who manages calls and emails and serves as a central communications hub. Clinic facilities were also re-configured to provide common workspaces, shared physician-nurse offices, dedicated patient exam rooms for each care team, and co-location of care team members including the clinical pharmacist and the desktop LPN.

The job roles and responsibilities were reviewed and reconfigured for each non-physician care team member with the goals of providing flexibility within teams and adhering to scope-of-care licensure requirements. Job redesign explicitly included assigning responsibilities for executing specific HICT use cases. Because team roles are often not transparent to patients (22, 23), team members are also expected to communicate with patients about how they support and interact with their personal physician. Care team members use standard “scripted” approaches to introduce themselves personally to patients and describe their respective roles and responsibilities in relation to the physician. Patients are reassured that while each team member has a unique role, his or her activities are directed, endorsed, and supervised by the physician. Physicians also personally introduce patients to care team members, and explain their primary functions, roles, and responsibilities. The intended effect is to provide transparency into the working relationships within the care team, build patient confidence and trust, and strengthen the bonds between patients and providers.

Appendix 1 illustrates specific components of the care system that continues to evolve in this PCMH transformation. It differentiates care system components by their primary intended role in opportunistic point-of-care processes, outreach care processes, or management of team-based rapid cycle process improvement endeavors.

3. Discussion

Qualitative studies revealed sharply contrasting provider perspectives on the roles and effects of HICT use in the contexts of the Access Initiative and PCMH pilot care redesign initiatives. The same HICT that were cited as contributing to provider burnout in one context were viewed as necessary components of a care delivery system that yielded improved patient care and reversal of provider burnout trends in a different context.

Text Box 2: Primary Care Physician Interview Quotes: Access Initiative vs. PCMH Pilot

“The [EHR] inbox… you've got this red flag all the time, I think that's part of the burnout for folks, which is you're constantly on alert as the stuff is coming at you… and there's this absolute exhaustion that occurs with that.”– Access Initiative study participant

“This would not be possible without the EMR… I’m using [the HICT] much more extensively and leveraging them more, taking more time to use them. Looking for opportunities for me to change something, intervene, plan ahead.”– PCMH Pilot study participant

By describing one healthcare organization’s interpretation and implementation of the PCMH and the emergent care system’s key defining traits, components, and intended effects, we provide transparency into contextual factors that might serve as determinants of these different HICT user experiences. We have not attempted to build
an argument for a normative model of the PCMH, nor provide an assessment of the “goodness of fit” of the Group Health PCMH with any such normative models or classification frameworks (24, 25).

References

Appendix 1

<table>
<thead>
<tr>
<th>PCMH Care System Components</th>
<th>Mode of Provider Engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Opportunistic/Point-of-Care</td>
</tr>
<tr>
<td><strong>Implementation Precursors</strong></td>
<td></td>
</tr>
<tr>
<td>Patient panel size adjustments (1800 per 1.0 FTE physician)</td>
<td>X</td>
</tr>
<tr>
<td>Fixed salary physician compensation method</td>
<td>X</td>
</tr>
<tr>
<td>30 minute standard appointment times</td>
<td>X</td>
</tr>
<tr>
<td>Scheduling slots designated for provider outreach activities</td>
<td>X</td>
</tr>
<tr>
<td><strong>Information &amp; Communication Technologies</strong></td>
<td>X</td>
</tr>
<tr>
<td>Patient as primary end user</td>
<td>X</td>
</tr>
<tr>
<td>• Online appointment scheduling</td>
<td>X</td>
</tr>
<tr>
<td>• Online medication refills</td>
<td>X</td>
</tr>
<tr>
<td>• Automated mailed patient reminders</td>
<td>X</td>
</tr>
<tr>
<td>• Online &amp; printed after-visit summaries</td>
<td>X</td>
</tr>
<tr>
<td>• Online vettted health literature</td>
<td>X</td>
</tr>
<tr>
<td>• Online test results reporting with trending functions</td>
<td>X</td>
</tr>
<tr>
<td>Patient and provider end users</td>
<td>X</td>
</tr>
<tr>
<td>• Online health risk appraisal</td>
<td>X</td>
</tr>
<tr>
<td>• Patient Website with medical record and secure email</td>
<td>X</td>
</tr>
<tr>
<td>• Direct routing of patient phone calls to care team</td>
<td>X</td>
</tr>
<tr>
<td>• 24 hour telephone nurse consulting</td>
<td>X</td>
</tr>
<tr>
<td>• Scheduled telephone encounters</td>
<td>X</td>
</tr>
<tr>
<td>Provider as primary end user</td>
<td>X</td>
</tr>
<tr>
<td>• Longitudinal electronic medical records</td>
<td>X</td>
</tr>
<tr>
<td>• Rapid online specialist consults</td>
<td>X</td>
</tr>
<tr>
<td>• Health maintenance provider reminders</td>
<td>X</td>
</tr>
<tr>
<td>• Best practice provider alerts</td>
<td>X</td>
</tr>
<tr>
<td>• Automated predictive risk modeling</td>
<td>X</td>
</tr>
<tr>
<td>• Abnormal test result flags</td>
<td>X</td>
</tr>
<tr>
<td>• Disease registry databases</td>
<td>X</td>
</tr>
<tr>
<td>• Performance report visual displays</td>
<td>X</td>
</tr>
<tr>
<td><strong>Care Processes</strong></td>
<td>X</td>
</tr>
<tr>
<td>Intramural care team interactions</td>
<td>X</td>
</tr>
<tr>
<td>• Daily MD-MA (or MD-LPN) huddles</td>
<td>X</td>
</tr>
<tr>
<td>• Pre-visit chart review and visit preparation outreach</td>
<td>X</td>
</tr>
<tr>
<td>• LPN as care team communications hub</td>
<td>X</td>
</tr>
<tr>
<td>Patient-care team interactions</td>
<td>X</td>
</tr>
<tr>
<td>• Scripted care team member introductions</td>
<td>X</td>
</tr>
<tr>
<td>• Motivational interviewing &amp; brief negotiation</td>
<td>X</td>
</tr>
<tr>
<td>• Group visits</td>
<td>X</td>
</tr>
<tr>
<td>• Medication adjustment outreach by team pharmacist</td>
<td>X</td>
</tr>
<tr>
<td>• New patient outreach</td>
<td>X</td>
</tr>
<tr>
<td>• Collaborative care planning</td>
<td>X</td>
</tr>
<tr>
<td>• Care team RN management of complex cases</td>
<td>X</td>
</tr>
<tr>
<td>• Next-day follow-up to discharges, UC and ER visits</td>
<td>X</td>
</tr>
<tr>
<td>• Outreach for preventive and chronic care service</td>
<td>X</td>
</tr>
<tr>
<td>Patient self-management support</td>
<td>X</td>
</tr>
<tr>
<td>• Health coaching for lifestyle concerns</td>
<td>X</td>
</tr>
<tr>
<td>• Peer-led self-management support workshops</td>
<td>X</td>
</tr>
<tr>
<td><strong>Management Tactics</strong></td>
<td>X</td>
</tr>
<tr>
<td>Daily care team huddles</td>
<td>X</td>
</tr>
<tr>
<td>Performance reporting via visual display systems</td>
<td>X</td>
</tr>
<tr>
<td>Rapid-cycle process improvement</td>
<td>X</td>
</tr>
</tbody>
</table>

J.T. Tufano et al. / Participatory (Re)Design of a Sociotechnical Healthcare Delivery System 65

Patients and professionals in collaborative testing of a web-based tool for integrated care: an evaluation study

Jorunn BJERKAN and Albert ALONSO

Abstract: Since 2001, patients in Norway with long-term, complex needs for care have had a legal right to an “individual care plan”, intended to increase efficiency and quality in health and social services, as well as patient involvement. Commonly, a responsible group is established to manage the planning process. A web-based application was developed and tested for three years in groups including both patients and professionals. Data were collected through questionnaires, interviews, project documentation and field notes. The findings showed that iterative testing improved usability. Participants expressed confidence in the online access and their enhanced control of planning and documentation. Testing in real-life environments added valuable and unforeseen information. It also showed that technical and organizational aspects influenced each other, and should not be considered separately. Despite the successful testing and improvement of the application, some participants and groups did not feel comfortable using it. Further research will be undertaken to address barriers to participation.

Keywords: Patient care management, collaboration, patient-centred care, individual care plan,

1. Introduction

“Individual care plans” are patient-oriented plans developed in response to a Norwegian state initiative for patients with long-term, complex conditions requiring health and social care. The plans reflect management strategies agreed with the patient, typically involving a multidisciplinary team, the “responsible group”, whose work practices need to be coordinated [1].

However, the initial tools to support such collaboration have been poor. Hospitals and municipalities developed their own templates for individual plans, but knowledge and experience in effective care planning varied between professionals and institutions [2], making it difficult for patients and professionals to implement the plans effectively.

To support improved coordination, the Central Norway Regional Health Authority (CNRHA) initiated development of a web-based application, “SamPro”. The aim was to meet the needs of different groups, as well as to support individual levels of IT

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competence and frequency of use. The application should be user friendly, easily accessible for both professionals and patients, and as universal a solution as possible.

The aim of the study was to evaluate the iterative testing and development of a web-based tool for integrated care in authentic user environments.

2. Materials and Methods

The pilot application was designed to conform to the legal framework for individual care plans. Internet use enabled additional communication functions.

Table 1 – Functionality in individual plans and functionality added by the web-based IP tool

<table>
<thead>
<tr>
<th>Legal requirements</th>
<th>Supporting functionality in the web-based solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>One universal plan per patient, no duplications</td>
<td>Duplication control, online plan overview, log of plan activity</td>
</tr>
<tr>
<td>A named coordinator</td>
<td>Online distribution of plan, participant overview</td>
</tr>
<tr>
<td>Patient consent form, signed</td>
<td>Control of access to plan: security model, access fragmentation</td>
</tr>
<tr>
<td>Plan documentation: Patient mapping, goals, actions, evaluations</td>
<td>Online communication and collaboration: calendar, internal messaging, optional SMS alert for fast information about changes</td>
</tr>
</tbody>
</table>

Notes

Control and log of printouts

The web-based functions allowed team members to arrange meetings, send messages within the system, and share documentation and follow-up activities. The documentation module was intended for overall planning and evaluation, including notes that were mainly designed for minutes of meetings.

2.1. Data collection and analysis

Initially, system training was given to groups of professionals or to each responsible group including the patient. Groups received additional technological or planning assistance during the testing as needed. Field notes and other project documentation were collected throughout the study. Local project managers with access to the tool supervised the development of the web-based plans. The participating groups reported regularly to their local project managers. System errors and suggestions for improvements were managed in the regional project team and included in field observation material, as researchers participated in the groups. Semi-structured interviews were conducted among participants in late 2005 and early 2007. The System Usability Scale (SUS) questionnaire was used to measure SamPro’s usability. The questionnaire was administered to the professionals and patients involved together with questions specific to the pilot. In the analysis of results, usability levels were presented as a Likert scale ranging from 0 (very little satisfaction) to 100 (very high satisfaction), with an expected average of 65-70 [3]. The questionnaires were also analyzed using frequency tables. The interview material was analyzed using content analysis methodology, inspired by Graneman and Lunman [4].
3. Results

3.1. Improving usability

The set of questionnaires answered early in 2006 by 30 participants confirmed the field observations of usability. The SUS questionnaire gave the answers shown in Figure 1.

![Figure 1. System Usability Scale questionnaire answered by 30 participants](image)

In our study, the average SUS value calculated for all the questions in Figure 1 was 61. The average score was 65 for the group still using the application and 55 for the group that had stopped using it. The pilot-specific questions revealed both technical and organizational reasons for discontinued use.

These findings also indicated potential usability improvements. Participants tested and responded to new versions of the template in short, iterative cycles. Once technological log-on problems had been resolved, the documentation module appeared to be the main barrier to use. It did not give participants the control or overview they had expected. Participants perceived the user interface as complicated due to a lack of coherence between parts of the documentation.

Professionals, especially coordinators who had been active users of the system, stated in interviews that despite the need for improvements, SamPro provided a better overview than had previously been possible. In contrast, professionals with little engagement in the care planning groups seldom or never accessed the SamPro tool online. They expressed discomfort using the system for various reasons, mainly technical barriers or the lack of documentation coherence.

The questionnaire showed that messaging had somewhat greater acceptance and was used more frequently than the other modules. A positive response to the messaging was confirmed in the interviews and field studies. Patients said they used the messaging in the absence of direct telephone contact with health staff:

> My social worker is so busy, I call many times but she is never there or the line is busy. Now I send her a SamPro message, then she can call me.
3.2. The experience of control

Technological and organizational aspects of control were described. Online access enabled active participation and thus greater control, which emerged as a clear benefit. The participants interviewed, both professionals and patients, felt secure and comfortable when using the system. Only a few required further technical assistance after the training period. This corresponded to the SUS findings. Risk and vulnerability analyses were performed as part of the implementation. Participants discussed security issues and expressed confidence in the web-based solution; they had no fear that sensitive information might be distributed unintentionally.

The patient consent module, allowing for the fragmentation of individual users’ access to information, was iteratively tested and improved. Patients decided the level and period of access for all participants in their groups. The patient’s named care coordinator was responsible for the technical administration of this. Both patients and coordinators found that extensive fragmentation of access increased administration time and reduced the information flow in the collaborative processes. Only the note module was sometimes protected from common access. The logging module was open, and visible as suggested by patients. To support transparent collaboration, the final SamPro version identified all visitors reading the plan since the last log-on. The professionals did not perceive this logging as uncomfortable supervision by patients.

Patients and parents expressed regret that some suggestions for improving usability could not be implemented due to Norwegian law on information security. This limited the potential for uploading documents from case management systems and for integration with other electronic patient record systems and documentation systems in social care and schools. These controls impeded the flow and control of information.

Nevertheless, the web-based tool enabled the participating groups to develop collaboration beyond that which was possible when working with paper-based plans.

This is my plan now. Well, that is to say: Before, I had no access to the planning process. I could have had access, right? But I had no access in what was going on about me. I couldn’t suggest “This is how I want it!” Now I plan things myself. “This is what I want and this is how I do not want it to be.”

A father involved in care planning on behalf of his son had another perspective:

- I access SamPro when I want to. It is not my duty, in a way. This is not going to be another Net banking system where I do the work for them and pay for it as well.

This father expected an individual plan to fulfill the needs of his son and the family’s requests. In the children’s rehabilitation groups, the application was used mainly as a practical way to monitor planning and follow-up, as initially intended for the planning tool. These groups particularly influenced the development of the collective agenda and messaging. They initiated design of a front page for the tool, including a participant overview with a brief personal summary named “my area”.

In interviews, patients described how the system had led to improvements in their mental health, with less need for hospitalization. This was confirmed by their
supporting professionals. Both patients and professionals attributed this finding to the fact that the patients had gained greater control over their life planning process.

Some patients wanted the reassurance of documented emergency plans for critical situations that might arise. This proposal was appreciated by the professionals involved, because ordinarily emergency plans would only be accessible by professionals in hospitals or primary care as part of their patient record systems.

4. Discussion and conclusion

Our main finding was that users’ active involvement evolved from simply testing a pilot for individual care plans to influencing the functionality that extended their involvement in and control of the planning processes.

Testing in real-life situations revealed unforeseen possibilities that would not have been discovered under simulated conditions [5].

Usability

We believe that training and more than a year of testing gave the participants a realistic view of the tool’s potential in the individual’s specific context of use. We do not know whether some participants had unrealistic expectations before the study. We cannot prove the value of the coherent SUS scores recorded, only that it was below the expected average. This formative evaluation study provided inspiration and direction for further usability improvement. The stepwise refinement gave test groups richer experience of the potential functionality, e.g. the communication fields and individual plan overview. Users appreciated new software versions that reflected their suggestions for improvements or for new functions.

Some groups stopped or seldom used the tool in response to usability barriers such as log-on problems that were easily overcome by users in more active testing groups. Analysis of groups with low use showed no specific common characteristics associated with the limited use. Active testing groups, in contrast, had important characteristics in common: An interested and eager client supported by a like-minded coordinator. Involvement from both client and coordinator has shown to be a key criterion for successful development and implementation of well-functioning individual plans. This has also been noted in studies on paper-based plans [6]. The extent of involvement by other professionals was consistent with their former roles and collaborative patterns. Those who worked closely with patients and clients were the ones who most often accessed the tool for planning and communication purposes [7-8].

Experience of control

The users felt confident about information security, which is essential in any such tool. From the early period of focusing on the safety and stability of patient information, the testing process evolved in the direction of extending the patient’s control of the care planning process, with active involvement by the patients in the study. Read and write access to the planning tool increased convenience for patients. It enabled effective monitoring of whether the agreements were being carried out. Improvements in users’ quality of life and reduced hospitalization were confirmed in a post-doctoral project by Vatne [9].
The care planning tool enhanced patients’ confidence about coping in their everyday life, as it ensured that they could contact their professional supporters through SamPro messaging, and offered the option of recording agreed plans for managing crises.

Conclusion

Some groups stopped using the tool after a period of testing. More research is needed to reveal whether the key obstacles were technological or organizational.

We found that the web-based application enabled more extensive organizational collaboration than had been achieved by means of earlier tools that had been administered only by professionals. This study supports the conclusion by Berg [10] that technological and organizational aspects supplement each other, and cannot be developed separately.

The findings in this evaluation study support the concept of a collaboration method, and will hopefully lead to the development of further models of integrated care, whereby patients are actively participating, and sharing process and documentation with their professional team.

References

Communication Challenges in System Development: Involvement of System Developers in small-scale IT Projects

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b Department of Urology, Aalborg Hospital, Aarhus University Hospital and Aalborg University

Abstract. A well-known challenge in system development is the aspect of user participation. In this paper we shift perspective from how to involve users in system development to how project managers with a clinical background, but without technical system knowledge, can involve system developers in IT projects. Using data from the development of an online patient book (an ICT application for clinical practice), we analyze challenges using the concept of language-games. We conclude that further research and development of participatory and communicative methods to involve system developers in IT projects, based in a clinical context, is needed.

Keywords. Communication, System Development, Profession, Language-Games

Introduction

In recent years, the health informatics field has expanded, giving rise to many different perspectives on how to develop systems within the health care sector. Building on this tradition, the involvement of users when developing IT systems has been the focus of many research projects, using methods from e.g. participatory design and CSCW.[1] A perspective that has received less attention is the involvement of system developers (developers, designers, programmers) in health informatics projects initiated and managed by clinicians. For a project manager with a clinical background, it is a challenge to “stay in control” of a system development project where you are not familiar with the technical terminology or do not have a clear view of the limits and possibilities in IT system development. Communicating with the system developers is a major challenge; finding ways and methods of participation that allow the non-technical project manager or clinician to be in charge of the project.

Communication plays a key role in the process of designing and developing an IT system. A skill often forgotten in the practice of the IT professional.[2][3] Clinical managers of IT projects need to facilitate communication and participation with the system developers. Participation and communication are important factors because they enable the project managers to understand and make decisions during the system development process. The different actors need to share ideas and meaning, practice

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and language. Communication challenges occur on many levels in relation to system development projects, both in user participation and in what we call system developer participation.

In this paper we describe and analyze the communication and cooperation between system developers and a clinical project manager (co-author, PhD-student Charlotte D. Bjoernes) in the development and implementation phases of a Health IT system; the ‘Online Patient Book©’ in 2009 (see table 1). The Online Patient Book is a web application for ‘personal’ communication between well-known clinicians and the patient and between patients. The objective of the Online Patient Book is to bridge the gap between the practice of the healthcare system of today based on Short Stay Patients and knowledge from review, which indicate that these patients have a need for more contact with healthcare professionals in order to get individual information, support and dialogue.[4] The clinical project manager was a nurse at the hospital while the system developers were from the regional IT department (within the same organization). The case is used to explore the challenges involved in participation between system developers and the clinical project manager on a system development project, however mainly from a clinical project manager’s point of view.

Firstly, the challenge of participation and communication is presented through Pelle Ehn’s interpretation of Wittgenstein’s concept of language-games[5][6]. Secondly, two examples of specific communication challenges, experienced during the above-mentioned project, are presented. Finally, we analyze the communication challenges between different professions – clinical project manager and system developers – in relation to system development. We conclude that a prior or specific focus on facilitation of communication and participation between project managers and system developers in IT projects is needed, and propose a way to do so, by thinking the concept of design as a language-game.

1. System Development Perspectives and Language-Games

Challenges of communication can be framed in different ways. As Michael Polanyi states in ‘The Tacit Dimension’: ‘We can know more than we can tell.’[7] He gives the example of knowing a person’s face, but not being able to say why we recognize it, it simply cannot be put into words. The knowledge imbedded in doing many practical things is not something known explicitly, but a kind of practice that we ‘just do’ because of practical, social and shared experience.

The challenge of communication, e.g. how to make knowledge explicit, also emerges within the field of system development. Here the modeling of practice is important for the system developer, but the question is how to model something that might not be explicit or even possible to make explicit. In the development of methods, focus has traditionally been on ways of involving the user in the system development process (e.g. the so called ‘Scandinavian tradition’ or ‘participatory design’).[8][1] A different academic perspective on this problem of communication and participation between system developers and users is through Wittgenstein’s concept of language-games[5] seeing language as woven into practice or forms of life, as something that cannot be understood separate from a given practice or ‘game’. You have to know the ‘game’ or practice to know the language. Pelle Ehn describes ways of making software for and with the end-users, viewing system development through Wittgenstein’s concept of language-games and family resemblance. Ehn’s perspective is on ‘…the role
of skill and participation in design as a creative and communicative process.'[4] The aim is to find ‘creative designary[sic] ways of thinking and doing design as cooperative work, involving the skill of both users and designers.'[5] Through Wittgenstein’s concept of language-games, emphasis is put on language as a creative and improvising activity. Language is often viewed as a way of describing and making sense of the world. But it is not just descriptive; it is also a shared and social practice. Through the concept of language-games, we can emphasize that different practices do not necessarily share the same understanding. ‘Two groups with different technological frames can appear to an observer to be working with the same technology, while at the same understanding it in radically different and perhaps incommensurate ways’[9] Practical or practiced knowledge is tacit, but furthermore different social and cultural forms of practice or different professions like that of the clinicians and the system developers can differ to the extent where the two do not understand each other – they do not share the same language-game about developing an IT system.

In the following, we illustrate communication challenges within the Online Patient Book development project.

2. Cooperation and communication between system developers and clinician on a small-scale health informatics project

The Online Patient Book was designed, developed and successfully implemented in clinical practice in cooperation between clinicians and system developers. Thus, the development process bridges the boundary between the contexts and work practices of two very different professions. The project was managed and driven by the clinical practice. The cooperation (Table 1) was primarily based on e-mails - characterized as asynchronous communication. Six face-to-face meetings were held over a period of two years, from the first meeting until the Online Patient Book was implemented. Phone calls were partial and few, often on intense workdays close to deadlines.

Table 1. The process and cooperative activities during the project.

<table>
<thead>
<tr>
<th>Phase phase</th>
<th>Time</th>
<th>Meeting activities</th>
<th>Email communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary/contract</td>
<td>Nov. 2007 – March 2009</td>
<td>2 initial meetings, 1 design meeting</td>
<td>Few initial emails</td>
</tr>
<tr>
<td>Development and implementation</td>
<td>Feb. 2009 – Sept. 2009</td>
<td>3 design meetings</td>
<td>0-20 emails pr. day, Attach files: &gt;1750 text pages, &gt;50 pamphlets, &gt;100 PNG, &gt;380 screen dumps</td>
</tr>
<tr>
<td>Intervention phase = running</td>
<td>Sept. 2009 – Sept. 2010</td>
<td>1 meeting is planned</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

Differences in work practice and knowledge between the two different professions, in addition to the asynchronous communication, made the cooperation a challenge. Email communication was used mostly because the system developers favoured this form of communication, but also because the project manager and system developers were at different locations, though in the same city. Getting from initial design to the final Online Patient Book involved more than 500 sent emails, several attached with files (Table 1) and commented screen dumps. E.g. early in the developing phase (14th April – 8th May 2009), more than 150 screen dumps were sent from the clinical project
manager to the system developer. Each screen dump visually illustrated between 3-7 problems, including design errors, small adjustments, spelling errors etc. To minimize the number of emails about changes to the system, the corrections were collected and sent in batches. The clinical project manager used colour codes and visualization to communicate the changes via text files and screen dumps trying to ‘speak’ the language of the system developer. Following are two examples of challenges in the communication from the perspective of the clinical project manager.

2.1. Difference in work practice means difference in design

In the development phase, the clinical project manager identified a problem around an eAlert. An eAlert is an alert sent to a clinician’s e-mailbox in the software program Outlook, when there is new correspondence from the patient available in the dialogue part of the Online Patient Book. This function is problematic. Firstly, in daily clinical practice the clinicians do not have access to a personal Outlook inbox, because the use of computers is based on one shared logon on all computers. Secondly, the project manager expressed that it was too complex a task to activate the eAlert in every clinicians personal Outlook on all 15-20 computers in the ward, which was needed because of the clinicians’ very “mobile work” practice. Therefore, the strategy and the function of eAlert had to be changed.

In this change process, the system developers and the clinical project manager had two different perspectives on the need for change. The system developer is used to working on only one computer using a personal logon and having access to a private mailbox. In the clinical practice, different computers are used during a workday. To lessen the time spent on logging on, a work around practice has developed, where everyone log on with the same user profile. The clinical project manager’s perspective is influenced by what user-friendly practice is to her, based on her experienced knowledge of what is possible during a nurse’s busy workday. The problem was finally solved after a persistent email-based dialogue involving many different IT professionals. They built an eAlert function directly into the Online Patient Book.

2.2. Disagreement in the development process

On an initial project meeting, one of the requirements raised was that the clinical project manager would be the Online Patient Book administrator. Both in the development phase and the implementation phase, the administrator should have the possibility to generate content. The logic from the clinical project manager’s perspective was that she, as the administrator, should be able to edit the content during as well as after its development because this would make the editing process more direct and, as it turned out, less complex and time consuming. The system was, however, implemented without this possibility. Instead, the clinical project manager has to request for content changes which are then carried out by the system developer. The system developers seemed to think that there was made an agreement on this procedure during the development process, and from their perspective the editing process did not require any additional resources. Furthermore, there were economic circumstances in implementing editing functionality. All in all, there did not seem to be a reason for the system developers to include the function or to make this an explicit topic to the clinical project manager.
When analyzing the dialogue, it is evident that the clinical project manager and the system developer did not agree on the system requirements. Furthermore, their views on ‘additional resources’ were very different. The system developer did not ‘see’ the resources involved in documenting all requests for changes via email, text files and illustrations on screen dumps. The added value of implementing the possibility of editing within the system was simply not evident to the system developer. Moreover, the possible problem of ‘scalability’ of the system – providing it for the use of other departments of the hospital was not considered. On the other hand, the clinical project manager was not made aware of these limitations in a language that she could understand before the Online Patient Book was actually implemented.

3. Building a shared Language-Game

Ehn considers the problem of communicating and agreeing across professional boundaries as a matter of not having a shared background and thereby sharing an understanding of practice: ‘[…]inter-subjective consensus is more a question of shared background and language than of stated opinions. Language as a means of communication requires agreement not only in definitions, but also in judgements.’ [4] The clinicians and the system developers do not only need to speak the same language or use the same terminology, they also need to share a common background that allows them to attach the same meaning to words. They need to share a common background in order to be able to make the same judgements. That is to use words in a way that is understandable within a shared practice: ‘To be able to participate in the practice of a specific language-game one has to share the form of life within which that practice is possible.’ [4]

The system developers and the clinical project manager need to share ‘a form of life’ or at least make an effort in order to understand the shared practice of designing an IT system for clinical practice. But can we make a foundation on which we can talk across the boundaries of profession languages? Ehn again refers to Wittgenstein and the concept of family resemblance: ‘There is a kind of family resemblance between games. They are possible to learn and understand because of their family resemblance with other language-games which we know how to play.’ [4] He suggests that we can make a shared language-game of design-in-use, using experimental methods within system development that can support the construction of a shared understanding: ‘Integrated with scenarios of future use, the experimental use of prototypes in design may be an improvement technique in playing the language-game of design, games of involvement and doing that defeats some of the limits of formalization.’ [4] In Ehn’s approach, the system developers and the users (the clinicians and the patients) need to create a shared language-game in order to create shared understanding, a language-game of design. But is this the same language-game we need in order to communicate about system development between a clinical project manager and system developers?

This shows us the importance of being aware that the clinicians and the system developers are formed by different practices, but also that cooperation and communication are practised in very different ways. The way we communicate (email, f2f, by phone etc.) is formed by the culture within the specific practice. In the communication between project manager and system developer there is also the additional problem of power. The project manager needs to control the development
process, but the system developer is the one most familiar with the language-game of system design – the language-game they need to play.

The challenges extracted from the development of the Online Patient Book are different examples of ‘breakdown’ in communication caused by not sharing or working within or on a shared language-game. The challenges can be related to the clash between different kinds of language, knowledge or practice. A way to overcome this could be by perceiving the communication about system design between the project manager and the system developer as an attempt to create a new, shared language-game. A game not focused on user participation, but on managing a project and building a shared understanding of what this project is, including a clinical perspective in interplay with the terminology of the system developer; a game that requires engagement and willingness to bridge the gap of understanding on both sides - a game for developer-participation.

Agreeing on and sharing terminology, and being aware of enabling the project manager in the system-related decision-making from the beginning of the project, could have helped bridge the communication gap between professions.

4. Developer-participation in small-scale IT projects

This article has pointed out an important challenge in system development and health informatics traditions that needs more attention – maybe what could be a Copernican turn, where focus is on the project manager without an IT background cooperating with system developers. Cooperation between different professions can be difficult, but if handled correctly it is also creative and inspiring – a game. To support this design-game, there is a need to develop a way of doing system development that makes the clinical practice and the system development practice meet in a shared language-game. A game that also enables the project manager to handle the project. There is a need to develop methods that can counter the communication challenges, support the understanding of the technical terminology of the system developers and empower decision-making.

In the system development literature and within health informatics, focus is largely on the involvement and participation of users. The challenge presented here is system developer-participation and the need to bridge the communication gap between ‘cultures’ or professions in relation to IT development projects. We see a potential and a need for developing a framework and methods for empowering project managers/clinicians in the system development process. Methods specialized to enable the shared language-games and thereby also empower the clinical project managers in the system development process. It is, however, not within the scope of this article to suggest such methods.

References


Sociotechnical Integration of Decision Support in the Dementia Domain

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Abstract. The need for improving dementia care has driven the development of the clinical decision support system DMSS (Dementia Management and Support System). A sociotechnical approach to design and development has been applied, with an activity-centered methodology and user participation throughout the process. Prototypes have been developed based on the characteristics of clinical practice and domain knowledge, while clinical practice has been subjected to different efforts for development such as education and organizational change. This paper addresses the lessons learned and role and impact DMSS has had, and is expected to have on the clinical assessment of dementia in different clinics in Sweden, South Korea and Japan. Furthermore, it will be described in what way the development of DMSS and the development of dementia care in those three areas are interlinked. Results indicate that the most important contribution of DMSS at the point of care, is the educational support that DMSS provides, part from the tailored explanatory support related to a patient case. This effect was partly manifested in a change of routines in the encounter with patients.

Keywords. Clinical decision-support systems, continuing medical education, sociotechnical, interaction design, evaluation, clinical practice, dementia

Introduction

There is a common understanding that medical and health practices are fundamentally sociotechnical, in that daily work involves a range of professionals and technical devices where all contribute to and put constraints on the outcome of care [1]. Clinical practice is also highly situated, where decisions often must be made based on the available limited knowledge and resources [2]. This poses demands on the different phases of information technology development for such use environment. It is argued that the sociotechnical perspective needs to be integrated from the early phases and that evaluations should put focus on the change of work routines and culture that may affect the use of systems, just as the use of systems may direct changes in and development of work. It is also argued that development of health care systems should emerge within the organization and daily practice instead of something that is implemented by a third party into the daily work, for the system to become successful [3].

The clinical decision-support system (CDSS) DMSS (Dementia Management Support System), is being developed for assisting medical personnel in the investigation of suspected cases of dementia [4-6]. The main purpose of the system is
to function as an extension of the individual professional’s cognitive ability and as a common ground for collaborative and distributed teamwork. This paper presents the iterative development process and results from clinical practice environments in Sweden, South Korea and Japan where versions of DMSS have been or are integrated in controlled evaluation settings [5, 6]. These use environments are characterized by an ongoing development for improving dementia care and the development of DMSS is integrated in this process. The sociotechnical and situated nature of work has been in focus from the initial stage and throughout the development process of DMSS. This paper describes in what way the sociotechnical perspective have been instrumental in this process.

In the following section the results from the qualitative studies conducted of the use environments at different points are summarized, providing an overview of major differences in culture, organization, attitudes, etc. The subsequent section describes the development of dementia care and DMSS. The paper provides a summary of three evaluation studies as further exemplification and finally a conclusion.

1. Sociotechnical and Situated Nature of the Dementia Workup

Dementia care is a medical domain characterized by complex disease manifestations in patients that affect and are affected by the patient’s environment, and incomplete and evolving domain knowledge. This complexity enforces a need for assessing the patient’s difficulties from different viewpoints and professional competences. The individual user of a CDSS integrated in this context has different professional backgrounds, different preferences on, for example, which clinical practice guidelines to use and different need for an individually tailored support.

A clinical reality that adds complexity to the development of a CDSS for the domain is the diversity in routines regarding how and by which professional categories patients with suspected dementia is managed. This diversity is seen within local care organizations in Sweden as well as in countries such as Japan and South Korea. Depending on local organizations and individual preferences, the professionals who diagnose dementia in daily practice can be geriatricians, neurologists, primary care physicians, psychiatrists, physicians specialized in neurosurgery or internal medicine, etc. Consequently, their knowledge of dementia is often colored by their main professional domain, with the risk of overlooking important aspects relating to other domains. On the other hand, dementia diseases affect many domains, which probably contributes to creating the special interest of individual physicians that is needed to develop required skills in the dementia domain. To what extent the dementia workup includes additional professionals such as psychologists, nurses or occupational therapists also depends on the local organization, priorities and individual preferences.

In clinical practice when investigating a suspected case of dementia disease, a range of additional medical conditions needs to be considered in a differentiation process. In addition, the assessment of the existence and severity of symptoms is crucial, especially since dementia diseases including their symptoms are progressive, and need to be continuously monitored. In the daily life of the patient, care personnel or next-of-kin are the first to detect and describe crucial progressive symptoms. Thus, the information used in the physician’s clinical diagnostic reasoning process is generated from different sources such as other professionals, the patient and the patient’s family members. These sociotechnical and situated characteristics of the decision-environment
were taken into consideration as they unfolded, by applying formative methods for translating these into requirements and interaction design (e.g. [4-6]). The aim has been to enrich the use environment with a tool that meets the immediate needs of a team of professionals while contributing to shaping their organization of work.

2. Development of Dementia Care and the Integration of DMSS

The development of DMSS can be roughly described consisting of a system requirement phase and an implementation phase, which correspond to the increasing interest and development of dementia care in society. During the initial period, development and iterative evaluation of prototypes in clinical practice focused organizational issues at local clinical practices as well as at a national and international level. Work was done to increase the awareness of the status of dementia care and the importance to improve the situation in Sweden and simultaneously also in South Korea and Japan. The members of the development team were during this period active in this work, due to their expertise in the domain. Early prototypes of DMSS were demonstrated at the different levels and evaluated using qualitative methods in order to gain responses and for discussing potentials of a decision support system in dementia care from different perspectives, as well as obstacles that may prevent a successful implementation. Factors were identified, at personal use level as well as organizational and political levels. A major factor found in both Sweden and Japan during this period was the unwillingness to change the routines for referrals of patients to specialist care, mainly due to the financial organization. The local health care centers envisioned an increase in workload, without economic compensation. However, this unwillingness of local organizations was challenged by efforts initiated by national political forces in the three countries. At a personal level, different levels of support were needed depending on experience, skills, work organization and work division. In parallel, DMSS was improved, with increasingly flexible and interactive support for managing both typical and atypical patient cases and support for teamwork settings and distant consultations with experts. The different preferences expressed by the local organizations on which guidelines and assessment instruments to be used also generated adjustments.

The next and current phase is characterized by an ongoing development of dementia care with a broad range of different efforts, such as educational support, extended support for consultation with experts in difficult cases, increased team work and engagement of specialized nurses and care personnel, increased efforts to distribute results from evidence-based medical research to clinical practice, support to patient’s families and informal care providers, development of local and national practice guidelines and an increased willingness and incitements to change routines. Members of the development team have been involved also in these interventions as part of their daily work in clinical and research practice. In this phase, DMSS-R (a revised version) is introduced and used in controlled evaluation settings, initially as a tool for collaboration and continuing medical education at the point of care.

DMSS has been developed in collaboration with specialists from the main geriatric clinic in Northern Sweden, and prototypes have been used by a range of professionals in evaluation settings. Currently, DMSS-R is available at two of the remote health care centers in Northern Sweden in daily practice and is used in distant consultations with geriatric specialists. With long distances to care, routines are currently being changed from referring patients to the specialist clinic to consulting the specialists using tele-
medical equipment. This is a development that one of the expert physicians who participates in the development of DMSS has been leading. Education has been provided to personnel although this has been difficult due to the high turnover of primary care physicians. The continuation of care typically relies heavily on nurses and occupational therapists in these locations. DMSS-R was introduced at the centers at the same time as one of the educational seminars was held. Current patient cases were discussed while introducing the system. Aspects regarding the local organization of the dementia workup were discussed and put into relation to current design of the system as well as possible future redesigns. The local organization differs significantly between the two centers, and the introduction generated important aspects to be taken into consideration in the redesign of the system, such as improving the support for teamwork. The redesign was later presented at the clinics during another of the educational seminars, giving the professionals an opportunity to reflect on the design before a new version was installed. A similar approach has been adopted in the implementation of the system into clinical practice in Japan, South Korea and China. Medical professionals who have the authority to and been assigned the task to develop dementia care, are integrating DMSS as one of their means to accomplish change, with a purpose of evaluating its potentials in the local environment. In practice, the involved domain expert physicians at the different locations are shaping their own and their collaborators’ work organization, culture and processes while contributing to shaping the design of technology, in this case DMSS.

The main aim of the development team is to assess the development of attitudes and skills in direct and indirect novice users in the process of integrating the system into daily practice, as well as changes in work routines and organization. This is done using formative and qualitative methods such as observation, interviews, focus groups and the use of the system in assessing and reasoning about familiar patient cases [7].

3. Results from Three Use Environments at Different Stages

An early prototype was in the system requirements phase introduced hands-on to a network of physicians of different specialties for evaluation purposes. The prototype was also used by two experienced physicians during an evaluation period at a hospital, which managed referred patients with suspected dementia within this network [5]. At this point, the organizational structure of dementia management posed limitations on the possible use scenarios in this use environment. The primary care physicians that were satisfied with the current organization were not interested in improving their skills in diagnostics, but needed support in assessing care needs in later stages of the disease, while the clinics that received the referred patients for diagnosis were also not interested in changing these routines. However, the experienced physicians at the clinic viewed the system beneficial for verifying their assessments. The early prototype provided support for diagnosing the common types of dementia but provided no elaborated explanations in the atypical, ambiguous cases. As a result of this evaluation, the interactive support was improved, partly to meet the needs that generated the “workarounds” that the two physicians developed who used the system in clinical practice during this period. Furthermore, when analyzing the responses obtained from the early prototype that was limited to the most common dementia diagnoses, it was found that the system behaved unsatisfactory in some of the few cases of rare dementia types. The initial purpose of the system was to provide support only in the typical and
“easy” cases, in order to prevent referrals of these to specialist care. However, the distinction between what cases were typical and not, proved to be subjected to biases. The perception by participants in evaluations on what cases were “difficult”, atypical cases did not necessarily correlate to the developers’ view that was based on experience, or the system’s distinction that was based on formal representation of multiple ambiguous guidelines. The described distribution of types of disease manifestations in patients depended on the type of clinic and the physician’s specialization. As a consequence, support was integrated also for the rare cases in the revised version DMSS-R.

Another evaluation period in a different network of collaborating professionals distributed over different types of clinics has been recently initiated after an introduction made to a local doctors’ society, in which physicians were testing the system with current and well-known patient cases. The system responded in an accurate and satisfactory way to the patient cases and the professionals’ responses were very positive. As a result of the introduction, the explanations of symptoms by the system was further developed by the collaborating domain expert in this use environment, for the purpose to better suite the particular needs of his colleagues. Currently, ten primary care physicians and specialists have access to the system in daily practice for evaluation purposes as part of a general effort to find ways to improve dementia care in this region. The purpose is to increase the skills in dementia workup through the use of the system as a tool, and decrease the number of typical, “easy” patient cases that are referred for diagnosis to specialists in hospitals.

Our final example is an evaluation study that was made where 41 patient cases with suspected dementia was examined by one of two physicians (one neurosurgeon or one with a specialist degree in internal medicine) with the system integrated as a tool in the patient encounters without prior introduction. A group of nurses together with care personnel and relatives were also involved. To summarize the results, the most important contribution of DMSS-R at the point of care, part from the tailored explanatory support related to an individual patient case, was the educational support that DMSS-R provided. This was partly manifested in a change of routines in the encounter with patients. The results include an increased use of validated assessment instruments in order to obtain objective data, and an increased involvement of patient, relatives and care personnel in the assessments. This effect is partly explained by the enforcements by the system on the assessments in how to conduct the dementia workup, and partly by an increase in the knowledge about phenomenon related to the dementia workup. The general view of the effects of integrating DMSS-R in the work was very positive, as expressed by the nurses. They observed an increase in the questions directed to the patient, and they also became more involved in the assessments. They also viewed DMSS-R as a tool for learning more about the different symptoms commonly seen in dementia. The general view expressed by the physicians was that the system contributes to making the assessments more objective when the assessment instruments that are integrated in the system were used and when the levels of severities were assessed. They also mentioned the importance to schedule appointments with patients in which a person participates who knows the patient well, in order to obtain reliable information requested by the system. The physicians and nurses organized during the evaluation study a series of meetings to take place after the evaluation study in which they were going to discuss and develop their understandings of the phenomenon and concepts defined and explained in the system.
4. Conclusions

Results indicate that DMSS can be used as a common base for assessing patient cases in a multi-disciplinary teamwork setting and in distant consultations with geriatricians. Results also show that changes occur in an initial phase, due to the introduction of DMSS, in work routines, collaboration patterns between professionals and in individuals’ knowledge. An increase was observed of the influence of additional professionals and the use of standardized and validated assessment instruments together with clinical practice guidelines. The results were obtained using a sociotechnical approach on system development and qualitative and formative evaluation methods. We have found the approach to integrate system development into the development of practice highly valuable, by giving health professionals influence and control over the emerging content and design of the system, while they also work to develop their clinical practices. Using multi-professional evaluators who besides interaction design also know the disease domain, enrich the situated evaluation session with alternative ways of interpreting data in patient encounters. These can be used in interviews with the professional for the purpose of obtaining reasons for deviations from suggestions provided by the system, and most important, detecting ignorance and other reasons for errors. This also provides the patient who agrees on participating in evaluation a qualified second opinion, which increases the reliability in assessments.

The main lesson learned during the development of DMSS is that incitements for use are crucial, since the implementation of the system is expected to change work practices and individuals’ knowledge and skills. Adopting a sociotechnical approach in the DMSS project provided means to identify incitements and adjust the system and the development process accordingly. Incitements such as the following have been created in collaboration with the local use environments: the system needs to be approved and enforced or encouraged to be used by both management of the local organization and the doctors’ collegiums, with clearly stated expectations on how the system is affecting the quality, organization and cost for care; and the individual user needs to envision immediate benefits of using the system in patient encounters, as a checklist or time saver, for verification of own assessments or for simply evoking the curiosity needed for developing his or her knowledge.

References

Standardization – the iron cage of nurses’ work?

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Abstract. This paper explores how nursing classification has been adopted and used in a local clinical practice. The study is inspired by the socio-technical approach to information system and illustrates some of the enabling and constraining properties of standardization. Findings from the study show how international standards have been embedded into local practice. At the same time, the use of locally developed standards has increased and many of these are similar to the international classification. This indicates that we need to move beyond the dichotomous perspective on nurses’ use of classification and strive for more flexible solutions.

Keywords. Nursing classification, Standardization, Electronic Patient Record.

Introduction

The use of international standard classification in nursing practices has generated heated debates in the nursing community. On the one hand, standards are expected to promote quality assessment, to meet the demand for evidence-practice and to enable reuse of data comparisons across heterogeneous representations [1, 2]. On the other hand, many nursing professionals are deeply sceptical about what they see as attempts to break down holistically oriented care into different fragments [3]. In addition, international standards have been criticized as useless in local contexts, both in the nursing documentation literature [4] and more broadly in science and technology studies [5].

The results from our longitudinal case study illustrate how we need to move beyond the dichotomous perspective on nurses’ use of classifications indicated above. After one year of routine use of standard classification, nurses were offered the opportunity to use locally developed terms instead. Surprisingly, after one year of being allowed to use local terms, as many as 95.5 % of the local terms corresponded to the international terms used previously.

We set out to explain this phenomenon by arguing for a perspective on standardization as a process of co-construction: adjustments, modifications and extensions represent necessary input generated from the bottom up that makes standards closer to folksonomy than to iron cages.
Empirically, we draw on a longitudinal case study of the work practices in the psychogeriatric ward at the University Hospital in Northern Norway (UNN). Patients in this ward are aged 65 or older, and have cognitive impairment, dementia and/or agitation. The ward has 15 rooms, and treats 95 patients a year with an average stay of 6–8 weeks. Some 36 people work permanently here, many of them nurses.

1. Introducing nursing classification standards

In 2003 the University Hospital of Northern Norway implemented a new electronic patient record (EPR), including a nursing module. In this connection, the psychogeriatric ward implemented the nursing module, where the goal was to replace the existing paper-based nursing documentation as well as to improve the quality of nursing documentation. A typical nursing plan for this ward is illustrated in the figure below:

![Screenshot of the nursing plan.](image)

Figure 1. Screenshot of the nursing plan.

At the core of the nursing plan is its shared terminology. Nurses apply this terminology to describe patients’ problems (i.e., nurse diagnoses): they link each problem with one or several interventions, detailing what to do in particular situations. The new nursing module consists of the international classification system provided by the North American Nursing Diagnosis Association (NANDA) [6] and the Nursing Intervention Classification (NIC) [7]. The North American Nursing Diagnosis Association developed NANDA in the early 1970s. Today, further development of NANDA is based on consensus decision making. Every second year, diagnoses are presented and validated at NANDA conferences. The most recent edition of NANDA, from 2007–2008, contains 188 diagnoses classified into nine domains. Each diagnosis has the following attributes: a label, a definition, defining characteristics, and related factors.

In this project two nurses and one secretary were recruited internally to run the project in close cooperation with the management. In terms of the plan, it was mandatory for all of the nurses and assistants to include NANDA and NIC terminology. This was further ensured by the close involvement of the project nurses.
2. Breaking out of the iron cage?

After one year of use, it was evident that users still had some difficulty in finding appropriate classifications to describe nursing diagnoses and interventions. Based on these observations, the management decided to give the users the opportunity to choose their own local terms to describe nursing diagnoses and interventions. After the change from mandatory to voluntary use of classifications, the use of NANDA and NIC decreased. However, at the same time, the local terms seemed to correspond with the NANDA and NIC terms.

To investigate the extent of this, we conducted an analysis based on reports from the EPR during the spring of 2008. We investigated: a) the incidence of NANDA diagnoses and locally developed diagnoses, and (b) whether the local diagnosis could be mapped to a NANDA diagnosis. The study addresses the incidence of NANDA in the first period (April 2005/March 2006) and the second period (2007). The figures in the table indicate a clear decline in the use of NANDA diagnoses.

Table 1. Distribution of NANDA and locally developed diagnoses

<table>
<thead>
<tr>
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<th>2005/2006</th>
<th>2007</th>
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</thead>
<tbody>
<tr>
<td>Total number diagnoses</td>
<td>805</td>
<td>909</td>
</tr>
<tr>
<td>NANDA diagnoses</td>
<td>756 (93.9%)</td>
<td>526 (57.9%)</td>
</tr>
<tr>
<td>Locally-developed diagnoses</td>
<td>49 (6.1%)</td>
<td>383 (42.1%)</td>
</tr>
</tbody>
</table>

The next step was to determine to what extent the local diagnosis could be mapped to a NANDA diagnosis. Terms from the local diagnosis were compared with terms in NANDA and characterized as “Same”, “Similar”, “Broader”, “Narrower” and “No Match” [8, 9]. Validation of consistency and accuracy was done by two of the authors, both nurses, performing the same mapping separately. After completing the mapping, we compared our assessments and found that a minor degree of inconsistency occurred when a local diagnosis could be mapped to several NANDA diagnoses. After a discussion of the cause of this, we reached almost 100% consensus [8]. We found that around 70% of all local diagnoses could be mapped to a NANDA diagnosis.

Table 2. Characterization of local diagnoses in 2007

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<table>
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<tbody>
<tr>
<td>Total local diagnoses</td>
<td>383</td>
</tr>
<tr>
<td>Same</td>
<td>41 (10.7%)</td>
</tr>
<tr>
<td>Similar</td>
<td>80 (20.9%)</td>
</tr>
<tr>
<td>Broader</td>
<td>24 (6.3%)</td>
</tr>
<tr>
<td>Narrower</td>
<td>124 (32.4%)</td>
</tr>
<tr>
<td>No match</td>
<td>114 (29.8%)</td>
</tr>
</tbody>
</table>

In the “No Match” category (29.8%), 9.9% could not be mapped to NANDA due to limitations in NANDA. Examples are nursing diagnoses related to emotion, aggression and euphoria, adverse effects of medication, and problems related to allergy. Furthermore, we found a group of local codes (8.4%) that could not be interpreted as a nursing diagnosis. This category, together with procedure, intervention, observation and medical diagnoses, is regarded as reflecting errors, and not nursing diagnoses.
Table 3. Distribution of NANDA and locally developed diagnoses mapped to NANDA

<table>
<thead>
<tr>
<th></th>
<th>2005/2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of diagnoses</td>
<td>805</td>
<td>909</td>
</tr>
<tr>
<td>NANDA diagnoses + local diagnoses mapped to NANDA</td>
<td>791 (98.3%)</td>
<td>795 (87.5%)</td>
</tr>
<tr>
<td>Locally developed diagnoses</td>
<td>14 (1.7%)</td>
<td>114 (12.5%)</td>
</tr>
</tbody>
</table>

If we combine the number of NANDA diagnoses with the number of local diagnoses that could be mapped to NANDA in 2007, we get 87.5%. If we subtract diagnoses that were considered errors, 8.4% (76 diagnoses), we get 95.5%. This implies that NANDA diagnoses and local diagnoses mapped to NANDA constituted 95.5% of all nursing diagnoses documented in 2007, a strikingly high coverage.

3. Standardization revisited

So, how do we explain the high degree of local terms that were similar to NANDA, particularly as many nursing professionals complain about the American bias and how remote the system is from local practice [4, 5].

We found that NANDA and similar local terms were tightly embedded in local practice and was used as a support in the daily documentation, professional meetings and discussions. Since the implementation of the nursing module at the psychogeriatric ward, there has been a continuous focus on the electronic care plan and the nurse in charge of professional development regularly offers guidance and support to the individual user to ensure the quality of nursing documentation. Some users need support to use the care plan and others need professional assistance to find words to describe problems and interventions in the care plan. The care plan is always the starting point for this guidance:

“It is great to use the care plan as a basis for discussing the individual patient.” (Nurse)

They also discuss terms and learn from each other. When they sit together in the nursing office, they often discuss issues in the care plan, for instance what the actual content of a NANDA term means. Often, the two nurses responsible for a patient work together with the care plan.

“For sure we have been more confident in using classifications, but still we discuss the meaning of diagnoses and give feedback to each other.” (Nurse)

If they cannot find the right concept in NANDA, they discuss how to formulate the problem and often come up with an alternative (but still related) concept. An example is “agitated behaviour”, which is not included in NANDA. The closest term is “risk for violence”, but the nurses feel that this may send a misleading signal, implying that the patient is intentionally violent. Instead they use the term “risk for aggressive behaviour”. This term is similar to NANDA, but seems more appropriate in practical use. Nurses also learn from each other by reading existing care plans.

“I often look in the care plan of other patients who have the same problem, to decide what terms to use.” (Nurse)

During handover meetings, the care plan is always displayed on the wall using a video projector. In addition, care plans and classifications have been the subject of clinical reflection and discussions.
After several years of training, nurses have become accustomed to using terms from NANDA. They use some terms frequently, and these have become a part of the vocabulary at the ward. NANDA terms such as “Bathing/Hygiene Self Care Deficit” are often used and correspond with the professional terminology used locally. However, users often experience that the patient has lack of self-care in relation to several function areas, or on a general basis, which is not limited to bathing/hygiene or eating as defined in NANDA. As a result, they often choose a free-text diagnosis and write, “Self Care Deficit” or “Self Care Deficit All Function Areas”.

“I think it is okay to work with classification because it is easier to change something that already exists than to reinvent the wheel. If I find a classification that does not completely fit the situation of the patient, it is still easy to take the classification as a starting point. Instead of ‘Self Care Deficit, Eating’, I can write ‘Self Care Deficit, All Function Areas’.” (Nurse)

Another example of frequently used NANDA terminology is “Risk for falls” and “Impaired Physical Mobility”. If used separately, these terms represent two different NANDA diagnoses. However, some nurses prefer to link several terms into one nursing diagnosis such as “Impaired Physical Mobility with Risk for falls”. In this case, they have become familiar with two different NANDA terms and combine them to form a local diagnosis. One problem with NANDA is that the terms are fragmentary. First, patients often have many different problems that are related to each other. In many cases it is therefore appropriate to relate to symptoms and causes. Second, many patients do have several problems, and the care plan may thus be very long and complex if the information is fragmented. Therefore, through experience and discussions, it has become common to link different problems with one nursing diagnosis.

It is also recommended to add an explanatory comment to a NANDA diagnosis. For instance, “Anxiety” is a commonly used NANDA diagnosis, but needs a more specific explanation such as “Anxiety related to depression”. To document this in the electronic care plan, the users first has to search for the NANDA diagnosis “Anxiety” and then add “related to depression” in the comment field. Entering this information in the care plan requires intensive mouse clicking through various windows, dialogue boxes and menus in the application. It requires 10 mouse clicks to add a NANDA diagnosis and 5 mouse clicks to add a local diagnosis. After becoming more familiar with the terms of NANDA, some find it easier to just add the whole entry as a local diagnosis. In this way, development of new concepts and expression occurs. Gradually, several local terms have evolved, which are frequently used in the ward.

“One day I said to my colleague – we should write down all these local terms that are ‘buzzing around’. So we sat down and created a local list of terms that we often use instead of NANDA.” (Nurse)

To make these concepts available in the documentation process, they were collected in a paper-based list. Later, some users had the idea of adding the list of concepts as a document in the nursing plan. The nursing module offers a function for adding a “standard care plan” as a guideline. This functionality is used in the local practice to maintain the list of locally developed diagnoses. From the user interface in the care plan, it is possible to present the “Standard Care Plan” (i.e. the list of local diagnoses) on the screen. Then it is easy to pick the terms suitable for explaining the patient’s condition. Many nurses find the local list a valuable support when they want to create a care plan or when they are looking for words or expressions to describe patient’s problems.
4. Discussion and conclusion

Terminological standards have had an important role in modern medicine for a long time, e.g. through the global ICD (International Classification of Diseases) published by the World Health Organization, NANDA, and SNOMED (the Systematized Nomenclature of Medicine). Standardized terminologies have been developed and used to ensure consistency of meaning across time and place, enabling large-scale planning opportunities for local users as well as for national health authorities and international health organizations.

Traditionally, nurses have struggled to achieve a status for their profession as independent from rather than subordinate to physicians, and hitherto nurses’ documentation has been relatively “invisible” [5, 3]. An effective nursing classification system is thus a precondition for an increased professionalization of nursing.

As our case illustrates, Timmermans and Berg (1997) argue that while standards attempt to change and replace current practices, they also need to incorporate and extend those routines. Such tinkering with the protocol is not a failing, but a prerequisite for the protocol to function: it allows leeway to adjust the protocol to unforeseen events [10, p.293]. This perspective on standardization is more akin to folksonomies – without user input the terminology standards cease to exist – than an iron cage.

The main findings from our study show extensive use of NANDA in the psychogeriatric ward. Through training and support, use of care plans and classification has become a foundation for the clinical reasoning and professional development at the ward. However, despite the use of NANDA, the use of locally developed standards has increased. User experience has revealed a need for more flexibility, and that it is time-consuming to search in the application. As a solution, users find it helpful to use the local list that has been integrated into the nursing module.

References

Standardized Nursing Work: Works in Practice but not in Theory?

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Abstract. Socio-technical approaches have established that ICT-supported standardization of healthcare work is difficult, if not impossible. We argue that standardization is neither straightforward nor uncontroversial, but discuss an interpretative case study where standardization of nursing work – to an interesting degree – has been achieved. Our case suggests that co-constructing of the standards is essential to standardization in practice. This is partly imposed from the top, and partly accomplished through the active involvement and ingenuity of users.

Keywords. Standardization, nursing work, quality, and efficiency

Introduction

Standardizing the work of nurses, physicians and other health workers has proven remarkably difficult to achieve [1],[2],[3].

Despite the obvious potential for improvements in efficiency, safety, and quality, standardization efforts seldom meet their objectives [4]. One reason for this is that health care in general and hospitals in particular are characterized by highly specialized – and thus unique – routines and procedures that differ across wards, areas, and geography [5]. Standardization of work practices is motivated by a concern for either efficiency or improved quality. In our case, we cover both of these.

Against this backdrop, where standardized work in hospitals does not seem to work in theory (i.e. the academic literature), we discuss a case where nursing work has been standardized to an interesting degree. Certainly, the boldest ambitions regarding standardization have not been achieved. Yet nursing work is significantly more standardized than the literature suggests. We describe and critically discuss four selected areas of nursing work subject to standardization. Standardization is hinged in diverse processes as described through four cases that are deeply interconnected.

Empirically, our study draws on a five-week case study that included 10 semi-structured interviews at the Cardiology ward and six interviews from the Department of Pulmonary Medicine at the new US$ 1.5-billion Akershus University Hospital (AHUS) in Norway. The wards are standardized to increase efficiency with small, intimate
spaces and a transparent work environment, modelled after Johns Hopkins Hospital in the United States.

1. Standardized beds and nurses

An explicit objective for the 500-bed AHUS Hospital is that it should rank among Europe’s most effectively run institutions. A crucial aspect in this respect has been to avoid bottlenecks caused by overly specialized services. More specifically, AHUS wanted more standardized beds and nurses for patients, i.e. the capacity to allocate patients to beds outside ‘their’ wards and have nurses work in wards other than their ‘own’.

To allocate patient beds, a new unit for patient logistics was established, which would book the beds for patients. As a rule this unit would try to allocate patients where they normally belonged. In cases of over-bookings, “the patient logistics unit prioritizes the serious incidents” and moves less serious cases out of the ‘home’ wards and into any of two generic bed wards. Here, nurses have special training in caring for patients with a wide variety of conditions, but who are not seriously ill. As one nurse noted, “the biggest change was for the physicians, as they now also have to visit the generic bed wards”.

Circulating nurses outside their own ward has been challenging. Nurses are trained and specialized to function within their own ward. Many “have a gloomy attitude” to the prospect of circulating to other wards, precisely because of the highly specialized nature of hospital work – every ward is apparently different – ‘outside’ nurses “threaten to undermine the continuity of care within our ward”. What, then, could possibly motivate nurses to volunteer to circulate to other wards, and will this work in practice? Key mechanisms are incentives: salary and flexibility. Salaries are increased by an extra 5% for those who have chosen to circulate. Equally important, especially for family oriented nurses, is that signing up for circulation gives nurses greater control over when they are to work, as “I can decide for myself which shift to work” rather than follow the ordinary work schedule of wards. Furthermore, circulating out of the ward is strongly regulated. Nurses are never transformed into generic nurses who are expected to serve any ward. When volunteering to circulate, you identify a handful of potential wards that you would be comfortable with.

2. Standardized care plans

The Cardiology ward has used the electronic care plan for four years and the standardized one for two years. The standardized care plan is used extensively at this department. Patients staying for over 24 hours typically have a plan, often a standardized one. Figure 1 illustrates the ordinary and the standardized plan respectively. Basically, the nursing plan is an overview of nurse-related diagnoses for a particular patient group combined with relevant interventions (NIC Interventions, following the NANDA diagnosis). The diagnoses are represented by the international classification system of the North American Nursing Diagnosis Association (NANDA), consisting of 206 nursing diagnoses [6]. The interventions are represented by the classification system Nursing Intervention Classification (NIC), consisting of 486 interventions [7].
To ease the production of new plans, the nurses use a standardized plan (figure 1). The standardized plan represents a carefully selected combination of NANDA diagnoses and NIC interventions for a given medical diagnosis or a clinical specialty. A number of plans are made by and for each specialty, with 17 for cardiology, and 406 plans in total. Some plans are also generic, covering diagnosis and interventions for patients with composite diagnoses.

The initiative to make standardized care plans came from a board of experts appointed by the management. Nursing specialists from different clinical specialties were engaged to create the content, especially NIC interventions related to each NANDA diagnosis. The standardized plans have been added to a shared list (figure 1 on the right) maintained by the board.

Care plans are almost always written by experienced nurses during the first day after hospitalization, usually in the morning. Any updates on other patients are done simultaneously. In comparison, inexperienced nurses typically write their reports in the free-text area as “I write my report mostly using free text in the report section. .... I haven’t learned how to make standardized plans so I try to do updates on the plans written by the more experienced nurses.”

Inexperienced nurses’ training in writing care plans has not been prioritized by the local management, but they have a plan for implementing this in the future.

The standardized care plans for cardiology and some of the more general constructed ones are frequently used by the skilled nurses. In comparison, standardized plans for other specialties are less frequently used, as “I...always end up with free-text interventions. There is no logical explanation on how to find the diagnosis you are searching for, therefore I always end up with writing free text.”

As a result, the plan is produced in plain free text instead. This may not be a big issue whenever “other specialties” are of less relevance for the ward. However, most wards deal with heterogeneous diagnoses where more general standardized plans are
developed and which definitely should be used. As an example, one of the nurses tried to find a standardized plan for “nausea”, which is one of the general developed plans. She searched using different terms such as “Med-nausea”, “surgical-nausea”, “gastric”, and “nausea” without finding the right diagnosis and gave up, went back to the care plan and made “nausea” a free-text diagnosis.

3. PPS, Practical procedures in nursing

In 2006, AHUS started the Practical Procedures for Nursing (PPS) project as a decision support system in nursing, and for gaining ISO certification. In addition, the PPS is linked to Electronic Quality Systems (EQS).

The PPS database contains 267 detailed procedures for nursing practice developed by carefully selected professionals around the country.

The board of directors, experts appointed by the management established eight work groups to evaluate existing procedures and compare them to the PPS procedures with a view to potential replacement with PPS-based procedures. Of the 267 PPS procedures, 191 have replaced existing local ones, 47 have been adjusted to local practices, and 26 were not recommended for use at AHUS. They found it necessary to develop 31 recommendations for additional procedures. The procedures are upgraded once a year. From 2007, PPS was integrated with the standardized care plan, providing a link between NIC and relevant PPS procedures. The direct integration with the standardized care plan confirms the hospital’s general attitude to increasing the quality of nursing work. The PPS can be accessed on four different levels: from the AHUS intranet, from the main page of the EPR, from the care plan, and from the standardized plans.

For entry of a NANDA diagnosis, the standard gives the opportunity to choose from a number of predefined interventions appropriate to the patient’s condition. Linked to some of the interventions there are short cuts to PPS procedures: see Figure 1. When one specific intervention is selected and the OK button is pressed, the procedure will appear as shown in (Figure 1, middle)

In addition to PPS, the ward uses the procedures in EQS that include more general guidelines, schemes, routines, descriptions, etc. Further, the departments use small handwritten manuals containing summaries of the most frequently used PPS and EQS procedures specially developed for new personnel as a substitute for PPS. All PPS procedures are also integrated in EQS and can be accessed from there.

One advantage of PPS is that the newly educated nurses (novices) are very skilled in using it. PPS training has been a significant part of their training as a nurse. Unfortunately, the nurses and assistants at this department do not use PPS very often. One reason for this is that it is difficult to find the correct procedure, as one nurse explains, “It is not intuitive where to find the right procedures in PPS. It becomes too time consuming. It is often better to use the handwritten manual or ask the more skilled nurses”.

Another challenge is the way the PPS is tightly connected to the standardized plans. As the novices do not use the standardized plans, they do not get direct access to the associated PPS procedures. This type of direct access might have reduced their difficulties in finding the applicable procedures in the database. The problem is that novices use the care plan mostly as an extension to what the experienced nurses have produced. They have limited knowledge about how to create care plans, and that
standardized plans with PPS procedures exist, and the purpose of creating care plans. As one nurse states, “I don’t use PPS much in my daily routines, and I don’t have the knowledge required to make standardized care plans. I see the opportunities that lie in standardized plans and the direct access to PPS procedures as extremely valuable for us novices. The instructions are very easily accessible”.

It is possible to search for PPS procedures in different locations inside the EPR, but this requires a PPS code or some basic skills in how to find the right procedure. Direct access to PPS procedures without using the search engine is only possible through the standardized plans.

For the experienced nurses the situation is different; they use the standard plans frequently, but they seldom use the associated PPS procedures, for two reasons. First, the procedures are connected to NIC interventions that are frequently used, meaning that the nurses are comfortable with the content of the procedures. Second, when they do not find the correct NANDA diagnosis they do not find the PPS procedures attached to the predefined interventions.

4. Decentralized blood specimen collection

From 2007 the responsibility for collecting blood specimens from patients was, on the whole, decentralized to a departmental level and to the hospital’s nurses.

The potential effects of this were related to efficiency. Previously, technologists from the Medical Biochemistry laboratory collected blood specimens on fixed rounds three times a day, which resulted in delays and rigidity in the routines. In particular, blood specimens collected on an ad hoc basis or in emergencies had to be handled manually. The information was handwritten on the sample tube label. The colour of the sample tube and the number of sample tubes had to be checked against a handwritten manual kept in each department. The labelled samples were then brought to the laboratory, often by the nurses themselves. Redistributing this work to the departmental nurses offered the potential for considerable benefits. However, this presupposed implementation of standardized blood specimen routines for the nurses.

Initially, local collection of blood specimens was implemented together with an automatic multi-dose system for handling medications and an automatic postal service for easy transmission of blood sample tubes. The multi-dose system was meant to free up time for the nurses, as they would not need to take care of all the details related to managing the patients’ medication (such as ensuring that a patient received the right dosage of tablets). This made it reasonable to assign some new responsibility to them. The in-house training for nurses consisted of two hours of theory, three hours of individual training in the Medical Biochemistry laboratory, a 20-minute exam, and a folder with a short version of all applicable procedures. In May 2009, 1200 nurses were trained, and the programme is still ongoing. Most nurses were satisfied with the training programme. However, collecting blood specimens is a resource-demanding procedure that, one nurse complains, “has resulted in much more work for us, and is not time-saving”. Combined with the fact that the multi-dose system never worked due to technical complications, it has imposed more responsibility on the nurses than planned. The typical routine on a normal day involves getting an overview of laboratory requisitions in the EPR, printing out the labels, collecting the blood specimens, labelling, packing, and sending them. The nurses have to monitor the EPR regularly, thus checking whether any requisitions have been made. If so, specimen tube
labels are printed out on a local printer. This procedure is partly accomplished by staff on the night shift, depending on work pressure, and partly by the responsible nurse on the unit. The group leader is responsible for getting an overview over the specimens before delegating the work of labelling, packing, and dispatch to other nurses. The labels consist of patient information, time lines, number of tubes, details of the tubes and their colour codes, and bar codes that communicate the information to the electronic analysis system. Overall, the project is considered a success, as most departments manage to collect blood specimens themselves. The time from requesting a laboratory analysis until the result is available has decreased enormously. In addition, there are positive side effects. The nurses spend more time with the patients, and the patients do not need to relate so much to different personnel. In addition, as the nurses collect blood specimens, it increases the collaboration with the physicians in the same way as taking and documenting blood pressure and temperature.

5. Discussion/conclusion

Perspectives on standardization of work tend to be polarized: either standardization is perceived as a typically top-down effort promoting ‘best practices’ or, as often argued in socio-technical approaches to ICT in health care [1], [2] standardization is futile, as health work is inherently situated and thus unique.

The perspective emerging from our work provides a theoretically more appealing and empirically more compelling middle position.

Standardized work – we focus exclusively on nursing practices – is neither straightforward nor uncontroversial. Yet it is not impossible. Essential to standardization in practice, as suggested by our case, is the co-constructing of the standards, in part imposed from the top, in part provided by active involvement and ingenuity of users. The four case descriptions describe well the theoretical backdrop of standardization, and co-constructive standards as local involvement clearly increase the involvement and use of adopted standards as with care plans.

References

Part D

Implementation
Café seminars in a bottom-up organizational development project at a Danish Radiology Department

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Abstract. The radiology department at a Danish regional university hospital implemented integrated RIS/PACS. In the process, it became clear that some aspects of the changes had been ignored and that the impact on the organization would be substantial. With that in mind this study was planned, and an interdisciplinary working group was appointed and tasked with implementing activities to improve the organizational environment and atmosphere in the department. One activity aimed at formulating a vision/activity plan by using café seminars to involve all employees. The plan for implementation included 35 activities to support the realization of the vision. Bottom-up organizational development does work – provided that responsibility for the process is delegated.

Keywords. Radiology Information Systems, PACS (Radiology), Organizational Change, Action Research.

1. Introduction

The last few years have witnessed a focus shift in the development and implementation of information systems in the health care sector. While earlier focus tended to concentrate on technology issues, more attention is now being paid to organizational issues during development and implementation. Several contributing factors could be stated but faster and bigger computers, faster computer network and storage equipment, together with improved programming tools and languages, have enhanced the technological aspects of the process. The prevailing opinion, as it has evolved over the last five to ten years, is reflected in statements such as "IT-systems in health care are 80% organization and 20% technology". Marc Berg is a case in point: "…properly developing and implementing IT in health care practices is primarily about organizational development. Technology is crucial – but secondary." (Berg 2004)

In 2005/2006 the former North Jutland County in Denmark (now the North Denmark Region) moved to implement the integrated Radiology Information System/Picture Archiving and Communication System (RIS/PACS) in its hospitals. The goal was to create radiology departments that were (almost exclusively) digitally based. During and after the implementation of the RIS/PACS, it became clear that not all aspects of the change process had been considered and that the impact on the organization would be substantial. This prompted the management of the Radiology
Department at Aalborg Hospital to take further action. Based on a workflow analysis performed as part of the system development phase and the first experiences with the new RIS/PACS, a process was initiated in order to facilitate the adjustment of the organization to the new system – or at least be instrumental in specifying issues for change.

A research project was planned in order to identify the main problems and to implement actions in the organization that could eliminate or minimize the problems identified. This paper addresses the work related to creating a vision statement and a plan for implementation activities identified to be part of the vision. A separate part of the research project focused on intra-departmental communication issues.

2. Methods

The present work was part of a larger single case study (Yin 1994) whose research aim was two-fold; one was to document the process using a bottom-up action research approach to organizational change, the other to document, discuss, and develop the theories’ use for the organizational changes pursued by a working group. The research question was: “How can a bottom-up approach be used at a radiology department for organizational development?”

The working group members were appointed in a stratified selection process; it consisted of two middle-level managers and five employees (the present author participated as researcher). In adopting action research (Coghlan 2002; Dick 2002; Zuber-Skerritt & Perry 2002) as the overarching methodology, an iterative process consisting of four main steps was used for most activities (Robson 2002):

- Planning
- Acting
- Observing
- Reflecting

The four steps were repeated in a process in which the reflection process resulted in either an acceptance of the outcome of an activity or in an updated plan for new or revised action. This process was reiterated until an acceptable result was achieved.

Figure 1 shows the activities related to the process of vision creation and the ensuing plan.

![Figure 1. Activities in the vision/plan work](image)
2.1. Café seminar: Vision day

A “vision day” formed the first activity on the way to formulating the vision; it consisted in a half-day café seminar held in a local restaurant. The participants were seventeen top and middle-level managers in the department and six members of the working group who hosted the activity. A carefully planned café seminar format was chosen to enable participants to work in a relaxed atmosphere with a high degree of participation. Bringing people away from their daily surroundings aimed at creating a focused and creative atmosphere. Participants were grouped around four tables, all of them discussing the same theme in three separate rounds followed by interaction among the tables to exchange ideas. After the day, all written documentation was published in a café bulletin available to all department staff.

2.1.1. Round One: Successful work experiences

This round focused on positive experiences that either individual participants or groups had had. Subsequently, the group discussed their successes and achievements in looking for any common denominator among them.

The duration of this round was 20 minutes. No interaction took place among the tables. Reporting to plenum was made on “postcards” from each table, which were read aloud and handed over to the hosts for documentation.

2.1.2. Round Two: Vision for the future

The second round focused on the future. Based on the individual participants’ conception of the future, each group formulated a common vision – as a more or less realistic dream about their department in 3-5 years’ time.

The round took 45 minutes, with interaction among tables starting after the first 20 minutes. This took the form of sending a postcard of 3-5 words or sentences to two of the other tables. The final plenary reporting was done using a flip chart placed by each table.

2.1.3. Round Three: Need for changes/Recommendations for action

The third round focused on differences between the current situation and the visions developed in the second round. Each table made recommendations for action to ensure that the department would be able to implement the vision.

Also for this round, 45 minutes in all were allotted, with interaction starting after 20 minutes. At each table, two participants would stay to report the group’s discussion to visitors from each of the other three tables (duration 4 minutes). Again, “postcards” were used for reporting to plenum and documentation.

2.2. From vision day to final vision

Based on the input from the café seminar, the working group subsequently formulated and discussed a draft with the executive management group. A pre-final version was distributed to all employees, and each profession was asked to discuss the vision and
report back to the working group, which formulated the final version on the basis of the feedback. The vision was divided into four statements.

2.3. Café seminar: Theme day

The entire staff was invited to an all-department café seminar. Of the approximately 190 employees, 96 participated in the theme day, which was hosted by 8 members of working group. With the participants randomly placed at ten tables in a hospital auditorium, discussions focused on cooperation and communication in the department, externally as well as internally. Pictures from the café and all postcards were published in a café bulletin available for all employees in the department.

2.3.1. Round One: Successful work experiences

This round was organized in a similar way to Round One described above in 2.1.1, except for the reporting activity, which was omitted.

2.3.2. Round Two: Cooperation and communication with external partners

The second round focused on the department’s cooperation and communication with external partners, defined as patients, clinical departments, other hospitals, general practitioners, suppliers and others.

The round took 55 minutes with interaction after 20 minutes by sending to two other tables a short “postcard” as described. These short messages were also used for the oral reporting to plenum.

2.3.3. Round Three: Internal cooperation and communication

The third round focused on intra-departmental cooperation and communication. The round took 55 minutes with interaction after 30 minutes. This interaction last five minutes and was dedicated to three group members’ reporting of the discussion to guest from the other tables. The final reporting followed the described procedure.

2.4. Plan of action

Based on the café bulletin the working group identified 35 activities, which were listed in a joint activity plan. Each activity was related to one or more of the four statements formulated in the vision. Every three or four months over the next twelve months, executive management and the working group evaluated the activities.

3. Results

The outcome of the vision café seminar and the ensuing work was a shared vision for the department’s future, the final version of which reads:

“Collaborating across disciplines, departments, specialities and professions, the Radiology Department at Aalborg Hospital aims at:
• Ensuring patients the best quality in diagnosis, treatment and service as part of a coherent course of treatment
• Improving the level of professional work, by increased focus on learning, training and research with shared responsibility and respect
• That departmental staff work on the basis of common goals and a shared identity/culture of commitment, ambition and willingness to rethink their work
• Ensuring that its organization and the use of the latest technology improve examination and treatment.”

In addition to the theme day bulletin, the activities resulted in a 21-page document, giving an overview of project tasks. It also states which statements in the vision that the listed activity supports. The following description illustrates one of the activities:

“Number 24: Information for new employees. Try to coordinate introduction materials for all new employees. At the moment there are different leaflets for trainee secretaries and for MTA students. Leaflets should be made available for everyone on the Intranet.”

Some of the activities have no stated end-date as they are of a more continuous character; for example:

“Number 18: Improved respect and recognition among department staff. This should be addressed both from above and below. Management and the working group should encourage everyone to treat and talk to colleagues in a way that reflects the way in which they would like to be treated and addressed. Management (and other employees) in the department who experience a lack of respect are encouraged to point this out to the persons involved.

We share the responsibility for success!”

4. Discussion

From the beginning of this study it was clear that there was no common understanding of the future for the radiology department. Individual perceptions varied greatly although everybody agreed that implementation of the RIS/PACS would pose an interesting challenge. The department had no formulated policy for the future. According to Johnson et al. (Johnson, Scholes, & Whittington 2008) a vision statement should be “…concerned with what the organisation aspires to be. Its purpose is to set out a view of the future to enthuse, gain commitment and stretch performance.” (Johnson, Scholes, & Whittington 2008)

Today, the department’s written vision consists of an introduction and four statements – only the last of which can be directly connected to the RIS/PACS implementation. The first one relates to patients, the second to knowledge development and the third to the staff policy. All four statements set out a view of the future for each area, and hopefully it will enthuse, increase commitment and stretch performance – to echo the quote above.
To ensure that the vision would become part of daily work in the department, we explicitly showed interrelations between each activity in the plan and the four vision statements. Some activities could be related to only one statement, other could be related to several, and a few to all four statements. At the same time we explicitly stated the origin of the input from the seminars and rounds.

The starting point for the study was “social-technical”, but later in the process the project focused more and more on interpersonal issues. By the end of the project only very few of the 35 activities in the plan could be directly related to the new RIS/PACS, but the new system was somehow used as a reason to articulate interpersonal communication and cooperation.

To succeed with a bottom-up approach like the one used in this project management support is important. Other organisations may need a different approach and methods – and in some cultures it may be very difficult to use café seminars as a method.

4.1 Conclusion

"You have to crawl before you can walk" and “things take time” could stand as the main lessons of the work reported here. It is interesting to notice that organizational development from a bottom-up perspective seems to work if someone (in this case, the working group) takes the time and makes the effort to initiate, plan and follow up on activities involving the organization’s staff. This could be illustrated by an examples:

- After the vision day, the head of department noted that everyone had stayed all day, and that someone had even proposed to extend the day. A senior radiologist added: ”...this is because this day was planned, and it was well managed…”

Reviewing the activities listed in the plan, it is clear that progress has been achieved on nearly all activities – and several have already been completed. Many of the listed activities do not have a fixed end-date but will be ongoing activities.

5. Acknowledgement

Sincere thanks are due to the working group members, management and all employees at the Radiology Department at Aalborg Hospital for their commitment to the project.

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Collaboration across Organizational Boarders, the Referral Case

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Abstract. Referrals are requests for medical examination and evaluation by a specialist, outpatient clinic or a hospital. The referral can be sent from a GP, specialist or from one hospital to another. The referral transfers fully or partly the responsibility for further treatment of the patient. The diffusion of electronic referrals in the health sector has been slow in many countries despite the fact that EHR-systems, referral standards and technical infrastructure are available. This paper addresses shortcomings that have been seen in the Norwegian deployment process, and how collaboration can support, and be supported by, the involved actors in different organizations. Special attention is paid to how GPs that work in part time positions as practice consultants in Hospitals can act as boundary spanners in order to improve the collaborating actors understanding of each other’s needs and work processes. Practice consultant should also be used actively in design of ICT-systems that support collaboration across organizational boarders in health care.

Keywords. Collaboration, Diffusion, Practice Consultants, Boundary Spanners, Health Care, Referrals

Introduction

When electronic referrals were introduced, many were hopeful regarding potential economic savings and user benefits, examples are Hasman \cite{1} and Harno et al \cite{2}. One of the first referral projects was started at Helsinki University hospital as early as 1991\cite{3}. Another initiative was introduced by the Danish company MedCom in Vejle in Fyn County in Denmark \cite{4}. Two other Finnish projects were established early: One of them was a system for developed countries \cite{5}, the other was in the Oulo region \cite{6}. Newer projects of national interest are: The Danish referral Hotel \cite{7}, \cite{8}, the Choose and Book system in the UK \cite{9} and ZorgDomein \cite{10} in the Netherlands. An electronic booking project was established in Norway in 2002. The electronic booking project was a national project supported by the politicians. The idea was that GPs in cooperation with the patient should book appointments at any Norwegian hospital. The usage of the system has been very limited \cite{11}. Referrals are also sent as standardized XML-messages from GPs to specialists, but more than 80% of the referrals were still sent by ordinary mail in 2009. The same trend can be seen in other European countries \cite{12}. MedCom and NHS (National Health Service) now reports increasing usage, but the diffusion process still seems to be slow in most European countries.

Lack of availability to a common infrastructure, missing implementations of standards by the vendors and shortcomings in the EHR-systems are technical factors
that limit the possibilities for collaboration, but even if the technical solutions are available, it seems to be a long way to full deployment and further attention need to be paid to organizational and human factors [13].

1. Description of Research Design and Methodology

In order to get a better understanding of the challenges in the Norwegian deployment process of electronic referrals, both quantitative and qualitative methods have been used.

Hospitals in Norway are organized under 5 Regional Health Authorities (RHAs). Each RHA is responsible for a group or Health Authorities (HAs) that includes one or more hospitals. Qualitative and quantitative data from the HAs have been collected through a national survey. A questionnaire was sent to all the 28 HAs in September 2008. 23 (82%) of the forms were returned, among them the forms from all the largest hospitals. The forms were filled out by different categories of personnel, but most of the respondents were responsible for cooperation departments or projects managers for cooperation projects. The main rationale behind the survey was to find out: what the status and plans were at a hospital level, what the hospitals see as their main challenges for deployment and if and how the introduction of new software is linked to organizational development within own organization and across organizational borders.

Semi structured interviews [14], [15] have also been used to collect information from two hospitals. Interviewed persons at the hospitals were: project managers for referral projects, technical project manager with responsibility for implementation of the communication solution, people with an overall responsibility for the hospitals EHR-systems, end users and the waiting list coordinator at two different wards, workflow analyst and projects manager for the patient logistics project at one of the hospitals. The patient logistics project has as a main goal to decrease the time the patient has to spend at the hospital, and accordingly also reduce the hospitals cost per patient. The interviews have been transcribed and analyzed.

So far, input from the GPs have been through semi structured interviews at one clinical practice and contact with practice consultants and resource persons that participate in a national project where requirements for the user interface of the GPs EHR-systems are defined. Field notes from participation in national meetings and seminars related to electronic collaboration in the health sector have also been used.

2. Theory

Carlile [16], [17] has used Shannon and Weaver’s [18] three levels of communication complexity: syntactic, semantic and pragmatic to describe a framework for managing knowledge across boundaries. In comparison to Shannon and Weaver, who had a mathematical focus on the syntactic level, Carlile describes progressively complex processes (transfer, translation, transformation) at the three corresponding levels. When we see the electronic referral as a boundary object in relation to Carlile’s framework, format standards for referrals developed by CEN, ISO or other standardization organizations will be at the bottom layer. The semantic layer will consist of interpretations of the standard for daily use, where clinicians and other health workers have made agreements on which information they exchange. As an example, an XML-
format standard for referrals can be used for exchanging different types of referrals as referrals for rehabilitation, physiotherapy or clinical surgery. In each of the cases the collaborating actors have to agree on the use of subsets of the standard. At the pragmatic level, different interests among actors have to be sorted out and may lead to changes in daily work processes. It is important to stabilize the system in a way that all actors can see benefits from using the new services [8].

Levina and Vaast [19] have also studied how organizational competence emerges in practice, and how actors in a new joint field develop interests in spanning boundaries and eventually transforming knowledge. Orlikowski [20] also addresses this issue. Boundary spanners are organizational members who link their organization with the external environment. Boundary spanning primarily concerns the exchange of information [21]. A boundary spanner is further defined as one who attempts to influence external environmental elements and processes.

3. Analysis

16 of the 23 HAs that responded to the survey did not use electronic referrals today, but they were very optimistic about the future roll-out process, and assume that they will send 75-100% of the message volume electronically by the end of 2010.

To support cooperative work, 17 of the HAs had employed practice consultants. Practice consultants are GPs that work in part-time positions at the hospital. This is likely to be a 10-20% position. When the practice consultant is present at the hospital he or she will work with issues that are related to collaboration across organizational boundaries. Some examples of activities are: revisions of procedures for referral from general practice to the hospital ward, and collaboration with specialists at the hospital about the structure of, and use of, documents that are communicated, eg discharge summaries, referrals and laboratory reports.

The practice consultants will also often be used as resource persons in projects where new ICT-solutions to support shared care are introduced. The practice consultant’s practice will then often be used as a pilot site. Most of the hospitals have started to use practice consultants recently (last 2-4 years), and the hospitals who
employed them reported that they had positive experiences with their effect on improvement on collaboration issues.

The questionnaire gave the responders the possibility to provide open feedback on issues that were of special concerns for them. Many of the hospitals had addressed the question of optimization of the work flow related to their own internal handling of electronic referrals. This includes scanning of the paper referrals in order to be able to handle them digitally in the EHR-system. Some of the larger hospitals also want to replace the message-based solutions with a web-based solution where they can require more input from the GPs. The standardized electronic referral has so far been fairly open and the structure of the referral has been more based on bilateral agreements than rigid controls.

To a large extent the input from the interviews corresponds with the impression from the surveys. The interviews have specifically been used to supply the survey information that seemed to be of specials interest, or areas where information was lacking. The hospitals have a drive to provide solutions that can facilitate reception of referrals, but it is also evident that they would like to benefit from new possibilities that electronic referrals can more easily provide.

The specialists at the wards also see that there is a potential for putting more controls on the information that the GPs deliver to the hospital. Instead of “unreadable” paper referrals, they see a potential for more detailed and specialized referrals. This can also potentially provide them with more information that can be used for research purposes. The interviews indicated the even if some practice consultants were employed by the hospital, they were missing in some specialties. This was reported to be due to lack of funding.

The GPs were also concerned with the quality of the referral, but they did not necessarily see the specialist’s and the hospital’s needs. When the GPs get paid according to the number of patients treated, it is no surprise that the GPs are reluctant to use solutions that may imply an additional workload for them. It is important for them that referrals can be produced from the information that is already present in their EHR-system and sent electronically with as little manual effort as possible.

4. Discussion

Norway has a public health care system and hospitals are under pressure from the Government in order to be more cost efficient. Rising costs has lead to an increased focus on daily operation costs of the hospital. The hospital administration looks for ways to keep the patient’s stay at hospital as short as possible, and electronic referrals with more detailed and updated information about the patient’s condition can be valuable in this respect. If the specialist at the hospital can trust that the necessary lab tests and scan are available from the GP, the patient can be ready for surgery on the admittance day. Today the secretaries spend a lot of time on gathering additional information like results from lab tests, X-rays, MRIs and the patient’s function level by phone. Information about function level is also important in order to plan if the patient has to stay at the hospital after surgery or if it is likely that the patient can be sent to the patient hotel which has a lower medical service level.

It is also likely to assume that referrals with more and “better” information from the GP could imply that some patients could be admitted for surgery without the need
for an appointment at the outpatient clinic, given that the hospitals recommended procedures had been followed.

The hospitals mainly seem to address their own needs. According to the recommendation from the government, the RHAs have a responsibility to ensure that essential medical documentation is communicated electronically between primary and secondary care. This “responsibility” has been handled differently by the RHAs. Many of the hospitals have technically made it possible for the GPs to communicate, but this does not necessarily mean that communication is possible. Misunderstanding is interpretations of how standards and software should be used on both sides, clutter this processes. The fact that the technical solution is tested and implemented according to standards at one end does not also necessarily imply that the chain from hospital to GP will work.

The boundary spanners in the referral diffusion process are the practice consultants. They are important actors in order to make collaboration as smooth as possible and ensure that transformation at the pragmatic level in Carlile’s framework can be possible. At the pragmatic level, different interests among actors have to be sorted out. Collaborative work processes that involve many actors in a hospital setting seem to be demanding based on the input from the survey and the interviews. Electronic referrals interfere with work process both at the GPs office, at the hospital and also in the patient’s surroundings. The interviews so far have showed that the hospital wants to start to use electronic referrals, but mainly as a means to support their own internal work-processes. The hospitals are also very eager to control the information flow from the GP to the hospital, and the specialists often want to define what kind of information they want the GP to deliver. Proprietary web-based referral-solutions can also be a means to tie the GP closer to the hospital. This is in conflict with the government’s intention of free hospital choice for the patient. It will be a burden for the GP to log on to different systems in order to reach the hospital in question for different patient. Indications from meetings and seminars with GPs present are that they to send referrals directly from their EHR-system based on the medical information that is already present in the system. They do not want to spend more time than today on this work-process.

5. Conclusions

There are some indications to possible enablers for better cooperative work in shared care, although more work is needed to reach final conclusions. Some possible enablers are:

**Better understanding of each other’s work-processes is needed.** This means that GPs should have a better understanding of the specialist work processes and that the specialists should have a better understanding of the specialist’s work process. More extended use of practice consultants as boundary spanners and common meeting arenas might be beneficial tools as a support.

**Design of new collaboration systems that support transfer of electronic referrals should be designed with the potential for deployment in mind,** and not have too much focus on the potential for reducing costs and workload for one particular actor. It does not help the hospital if they design a system that will force the GPs to improve the
The practice consultants are to some degree used as resources in defining procedures for collaboration and as pilot sites for deployment of ICT-systems that support collaboration, but they should also be more involved in design of this kind of systems than they are today.

**It must be something in it for me!** Unless all the cooperating actors can see that they benefit from partaking in a cooperative ICT-supported work process, it is a risk that the deployment process will still be slow. This can be through examples like better support for work processes, more funding for registering additional information, reduced hospital stay, better research data or shorter waiting time.

6. References

Organizational Considerations for the Implementation of a Computerized Physician Order Entry

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Abstract. Several studies stressed that the introduction of CPOE applications deteriorates the doctor-nurse communication. But there are many factors that might influence communication behaviors, as for example the way these communications are organized. The present study aims at showing that the impact of a CPOE system on the cooperative activities can be controlled given that a good understanding of the cooperative workflows support the implementation. By analyzing the doctors-nurses communications during the medication use process, the study demonstrates that the technical system has no impact on the cooperative activities within a given organization. CPOE does not induce differences in the dialogs’ durations and contents.

Keywords. Organizations, Medical Order Entry System, Communication, Human Factors, Socio-technical system.

Introduction

In the healthcare domain, the medication use process has been studied under the safety point of view and successfully implementation of Computerized Physician Order Entry (CPOE) systems prove efficient to achieve a significant reduction of Adverse Drug Events (ADE) [1-2]. However, sociotechnical or human factors qualitative studies repeatedly uncover unexpected and unintended negative effects of CPOE systems [3]. In the hospital setting, the work situations are inherently collaborative. The medication use process may be characterized as a complex distributed work situation: the information is distributed across the minds of the members of the clinical team and across physical media [4]. In this context, the critical role of doctors-nurses face-to-face communications has been demonstrated [5-6]. Moreover, some studies stress that problems with these communications are common causes of medical errors [7]. Since the responsibility of doctors and nurses are complementary rather than overlapping, a complete, coherent, and updated knowledge of the patient status requires a direct two-way information flow among team partners.

The impact of the introduction of CPOE applications on doctors-nurses communications has been demonstrated: the technical system seems to deteriorate the
communication and cooperative activities [8-9]. For instance, the destructive effect of the switch from synchronous to asynchronous communications has been highlighted [10-11], leaving nurses out of the ordering loop [12] and impairing synchronization and feed-backs mechanisms [8]. The present study aims at showing that this impact of a CPOE system on cooperative activities can be controlled given that a good understanding of the cooperative workflows support the implementation. We think one of the problems is that implementations of CPOE systems are mainly technology-driven without particular attention to the doctors-nurses cooperation and communications processes. Highly cooperative work, such as the medication use process, inevitably generates differences in the structure and organization of the communicative processes. These different communications’ organizations impact the quality and reliability of the cooperative activities. Although most of the information in the clinical workplace is acquired and presented in a face-to-face manner, very little work has been done to understand the communications dynamics and requirements [13].

The aim of this paper is to show that the potentially negative impact of the technical system on the cooperative processes can be neutralized if particular attention is given to the work organizational factors during implementations. The study was undertaken in two hospitals functioning with different systems of work, a CPOE system and a paper-based one, to analyze the CPOE impact on cooperative activities. As we have participated to the implementation of the concerned CPOE, we could give recommendations to take into account the particular features of the doctors-nurses face-to-face communications. Especially, we stressed the importance to keep the nurse in the ordering loop and to preserve also the common rounds when they already exist. To do so, enough laptops were installed in the departments so that doctors and nurses can each have their own screen with the relevant information during the medical round.

From previous studies in different hospitals and wards, we could identify that the doctors-nurses face-to-face communications during the medication use process are mainly based on three work organizations [14], strengthened by other observations in Denmark. The common rounds organization has the nurses’ activities organized so that they can systematically participate with doctor to the medical rounds. In the briefing organization, dedicated time slots are scheduled before and/or after the medical rounds where doctors and nurses participate in short daily meetings. Then doctors perform medical rounds. These briefings are regularly planned at the same time so that doctors and nurses can organize their activities to participate. A third organization appears sporadically which is characterized by opportunistic exchanges. No time-slot is dedicated to doctor-nurse face-to-face exchanges and communications are mainly written and asynchronous. Within this general framework, the present study analyzes the doctors-nurses face-to-face communications during the medication prescribing-preparation-administration process, according to both the organization of their work: {Briefings-B; Common Rounds-CR; Opportunistic Exchanges-OE} and their technical environment {CPOE; Paper-based}.

1. Sites of the study

This study was part of the work of a French PhD thesis, thus explaining the analyses were undertaken in two French hospitals. The paper-based observation site is the University Hospital of Lille. The analyses were realized in three departments: Cardiology, Nephrology and Neurosurgery presenting the three different organizations
(B, CR and OE). The CPOE observation site is the Denain Public Hospital which had been running the CPOE for three years. The analyses were realized in two medical departments: cardiology/gastroenterology and infectious disease presenting two different organizations, Briefing and Common Round. At the time of the study, there was no site combining the CPOE and Opportunistic Exchanges organization.

Even if the specialities are different, the departments can be considered as belonging to a similar type: (i) the medication prescribing-preparation-administration process is similar, (ii) the number of medications per day and per patient is comparable ($F(4, 472) = 0.7, p > .05$) and (iii) the pathologies attended are comparable in terms of mean number of days’ care (Annual figures, lasting 5 to 6.4 days), the severity of patient’s state can also be considered as similar.

It must be noted that in European hospital settings, the physician is in charge of the therapeutic decision making and of ordering the meds. The nurse has no medication ordering rights except for a small number of usual drugs (i.e. standard painkillers) and only if a written protocol exists in the department. The nurse must validate the administration and eventually document any unexpected event. All the physicians attend all the patients and so do the nurses.

2. Methods

2.1. Quantitative analysis: the dialogs’ duration

For each department, eight systematic observations were undertaken starting with the arrival of the physician in the ward and ending with the preparation-administration of the meds to the patients. This observation window covers the entire medication cycle, i.e. prescription ordering – administration and its documentation. During each period, all the doctors-nurses communications about the care-providing for the inpatients were audio-taped. Semi-structured interviews of target users were carried out.

2.2. Qualitative analysis: the dialogs’ contents

The coding method of DAMSL (Dialog Act Markup in Several Layers) [15] was used to analyze the communications. The dialogs were divided to obtain “utterances” which reflect the intentions of the transmitter. A third of the data of one department was coded by two analysts to calculate a kappa to test the reliability of the coding. For illustration purpose, we present in this paper the results for the dimension “semantic content” of the utterances (kappa = 0.78). Three main contents were highlighted by our data: (i) the patient which refers to the variables characterizing the patient e.g. pathology, clinical signs, physiological data, etc.; (ii) the care-providing which refers to the variables characterizing the interventions on the patient e.g. therapeutic order, biological order, surgery, etc. and (iii) the logistics which refers to the variables characterizing the organizational, technical and human resources and constrains, e.g. the availability of meds in the ward.
3. Results

3.1. Quantitative analysis: the dialogs’ duration

The quantitative analyses amounted to approximately the same number of hours in the 5 different departments (from 36h58 to 40h05) (see Table 1), meaning that there are no significant differences in the medication use process itself across those departments, \( F(4, 35) = 1.01, p > .05 \). As expected, there is a marked difference in the duration of the physicians-nurses dialogs according to the organization of their work (CR / B / OE). But the most striking result is there is no significant difference depending on the technical environment, i.e. CPOE vs. paper-based, \( \chi^2(1, N = 40) = 1.66, p > .05 \).

<table>
<thead>
<tr>
<th>System</th>
<th>Communications’ organization</th>
<th>Mean duration in minutes (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CR</td>
<td>B</td>
</tr>
<tr>
<td>CPOE</td>
<td>16h50 / M = 126.25 (20.6)</td>
<td>2h18 / M = 17.25 (2.5)</td>
</tr>
<tr>
<td>Paper-based</td>
<td>13h10 / M = 98.75 (12.2)</td>
<td>2h15 / M = 16.9 (3.3)</td>
</tr>
</tbody>
</table>

Table 1. Total durations of the doctors-nurses dialogs depending on the system (CPOE, Paper-based) and the communications’ organization (CR, B, OE) / Mean duration in minutes (SD).

The duration of the communications in the Common Round organization is 6 to 8 times higher than in the Briefing organization and is up to 28 times higher than in the Opportunistic Exchanges organization. In the two Common Round organization (CPOE and Paper-based), all the dialogs occur during the medical rounds and most of them involve the prescribing doctor and the nurses. The partners take the time to understand the situation, they elaborate or adjust a shared understanding of the situation. Moreover, the overhearing by nurses of the doctors-doctors and doctor-patient dialogs allow them to take advantage of the medical expertise. Very few other medication-related doctor-nurse communications, if any, is observed outside the medical rounds. The face-to-face exchanges occurring during the medical round provide both the doctors and the nurses enough information to go on with their own activities, with the only support of the patient record, be it paper-based or CPOE.

In the two Briefing organizations (CPOE and Paper-based), most of the dialogs occur during briefings before the medical round. All the patients’ cases of the department are reviewed so that physicians and nurses are mutually aware of the patient’s cases and their evolution. The dialogs may influence the next decision making of the physicians during the medical round. When physicians need notifying new therapeutic changes that have not been addressed during the first briefing, a second very short briefing occur just after the medical round. A few dialogs occur outside these briefings, mainly when a change in the situation occurs (unexpected results, unexpected evolution in the patient’s status, etc.).

In the Opportunistic Exchanges organization, the dialogs occur when the physician or the nurse can no longer perform their own activities with the only support of the patient record: the information they need is not readily available, and they are constrained to ask their colleague. Many of these brief exchanges are initiated by the nurses needing additional information to interpret unusual therapeutic orders. If the physician is not available when the nurse needs additional information, she has to perform her activity with incomplete knowledge which can prove dangerous. Some of these brief dialogs are initiated by physicians. They interrupt the medical round to fetch...
complementary information about the patient, e.g. “does he sleep well?” or “How much does he piss?”. The information they need is not readily available whatever the technical system.

3.2. Qualitative analysis: the dialogs’ contents

The qualitative analysis of the content of the dialogs confirms the global results issued from the analysis of dialogs’ durations, showing no differences between the CPOE and the paper-based situation within each organization, \( \chi^2(2, N = 7942) = 8.5, p > .01 \), (cf. Figure 1). For the main organizations (Common Round and Briefing), the introduction of the CPOE system does not modify the content of the oral exchanges or the proportion of these contents in the dialogs.

**Figure 1**: Distribution of the number of utterances emitted by doctors and nurses according to the 5 conditions (CR-paper; CR-CPOE; B-paper; B-CPOE; OE-paper) and the content of the communications (Patient, Care-providing, Logistic).

Globally, during the Common Round the professionals exchange a lot about the patient while they discuss the recent relevant information to support the therapeutic decision. They take the opportunity to negotiate the care plans together. During the Briefing, the utterances are mainly dedicated to transmit information about the patient. The short exchanges in the Opportunistic Exchanges condition aim essentially at obtaining the minimal mandatory information about the patient status or the care-providing to be able to perform one’s activities.

4. Discussion

This study addresses the question of the impact of technical variables on the collective aspects of healthcare work situations. It demonstrates that the technical system has no impact on the cooperative activities within a given organization. If the organizational factors are controlled, CPOE does not induce differences in the dialogs’ durations and contents and also does not seem to deteriorate the doctors-nurses communications. Although a condition is missing in the study (OE/CPOE), previous observations in other hospitals in such a condition suggest that the results would be similar, e.g. very few dialogs occur between doctors and nurses and mainly to obtain information to act.

With these new insights, the organizational variables could be interpreted as confounding factors distorting the results reported in the literature. The impact studies showing that technical systems weaken the doctors-nurses communications did not consider the organizational factors for the interpretation of their outcomes. Effectively,
it seems the introduction of a CPOE in a work environment induces particular communications’ organizations when no attention is given to the organisational factors. Especially, the implementation of a CPOE can unexpectedly lead to a shift from an efficient existing organization to a weaker one, e.g. Common Round or Briefing to Opportunistic Exchanges (synchronous to asynchronous). This change of organization explains better than the technical system itself that doctors-nurses communications were damaged.

On a more pragmatic level, this study confirms that it is important to consider the entire work system when introducing a new technology such as an IT application. Although supporting more effective communication practices may have great impact on the collective activities, there remain enormous gaps in our broad understanding of the role of communication in health care delivery. The great variety of communications’ organizations within each hospital complicates the task. The findings of this study on the three organizations need to be generalized. The issue is to identify in the work situations what shapes the collective activities. One critical feature is the scheduled (or not) of face-to-face communications’ slots in the work organization, and also its modalities.

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Issue Orders and Discontinued EPR

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Abstract. Users gave us 104 different reasons for the failure of implementing an EPR in a surgical clinic. We classify the reasons with the issue order model, where the first issue level is for simple and technical issues, the second one for more complex and combined issues, and the third one for political or ideological issues. However, what appears as a first order issue to a manager might be seen as an insurmountable third order issue for a worker and vice versa. The issues are interrelated, and solving one issue might have a substantial influence on other issues. Also, the issues seemed to accumulate and concentrate on points. The analysis helps focus on key problems, with consideration to related issues.

Keywords. Electronic patient record, organizational implementation, social structures, issue order.

1. Introduction

During the organizational implementation of an information system [1], any number of problems may emerge. The organizational members may feel threatened when faced with, for example, the challenge of a new technology, by being forced to adjust their work practices and routines, by not having a voice in the process, or by re-emergence of old tensions (e.g., [2]). New technology may even be given the role of a scapegoat when technical issues are used as a surrogate for cultural or behavioral issues [3]. Damsgaard and Scheepers [4] argue that an information system faces a crisis at each implementation stage. When the content of the system becomes chaotic instead of organized and up to date, and when information cannot be retrieved timely and accurately, the organizational members start to mistrust the system. Mistrust transforms easily to avoiding or rejecting the system [1].

This study is about a crisis in the organizational implementation of an EPR system. The surgery clinic is a part of the second largest teaching hospital in Finland with 953 beds and 3800 employees. The surgical in-patient ward has 9 surgeons, 3 physicians, 50 nurses and a ward secretary. Even though the hospital has a long history of IT use, the electronic patient record system (EPR) was introduced in the hospital only in 2003. The crisis we discuss took place in 2005, as the EPR was rejected in a surgical out-patient clinic, and its use was discontinued in a surgical bed ward.

2. The issue level model

Inspired by Bateson’s model of learning [5], Star and Ruhleder [6] studied the implementation of a large information system, and how it affected various
organizational units and stakeholders. They identified three levels of issues during the implementation.

**First order issues** are the ones that are quite easily solved by re-allocation of resources. These problems are often easily visible and solutions to them are practical in nature. First order problems concern, for example, getting user accounts, connecting or installing the system, or arranging user training. Typical first order problems are related to everyday situations, such as how the system should be used and how it is used.

**Second order issues** can be caused by a collision or combinations of two or more first order issues. These are unexpected by nature and emerge as secondary effects after the implementation. These may be caused, for example, by technical choices made or by the differences between the various cultures of practice. The uncertainty that is present during implementation is also considered a second order problem.

**Third order issues** are political or social by nature and as such, hard to solve. In the background are the historical reasons behind the choices made in the implementation project or the distinct features in the organizational culture. Also the differences between various disciplines or viewpoints can have a nature of permanent disputes.

According to Star and Ruhleder [6], the three levels of issues are not unambiguous as various problems can be inspected on different levels depending on the stakeholder perspective. Relationships between different issues can be affected by how the members identify these problems. In this study, the issue order model provided at first a classification for various issues and then a possibility to emphasise how different stakeholders perceived the issues through different lenses. Accounting for the various interpretations helps also to understand these issues more thoroughly.

3. The crises with the electronic patient record system

A set of semi-structured interviews were conducted during spring and summer 2006. The interviewees were two surgeons, one ward secretary, four nurses in the out-patient unit and three nurses in the ward, and three EPR implementation project members. A video recording of the EPR in clinical work was also studied. The recording shows both manual and electronic recording of patient data and a situation where a surgeon and a nurse work with one of the in-bed patients. All data were analysed as a set, regardless of the outcome of the crisis. We arranged the data first into loose groups such as technical, organizational and people related issues. Then, within these themes, we arranged recurrent issues according to the issues orders (see Appendix). We noted that the same issues could be placed on different levels depending on the perspective of the informant. In this paper, as an example, we have “slowness of use” explored on all issue orders.

**First order issues** were common and easily visible. The first order issues were grouped according to the themes of redistribution of work resources and working time, user training, user-friendliness, technical problems, changes in work tasks, and expected new features with the EPR). In each group, we found issues complicating the everyday working with technology.

Information access in the EPR was considered slower than using paper records at hand and the structured character of information in the EPR increased slowness of use. There are, for example, over 50 headings for recording nursing action, as described by a nurse: “Now I have to open Miranda [EPR], to open the nursing records. Now I’ll
make the record, that takes many clicks – like surgeons name, date, and cause this and cause that. Then I’ll have to choose the right headings, and then I can go and record the day visit by the patient, I can make it, and then I’ll have to choose the next suitable heading... I have many phases here, phases that I have never done before... Before I just wrote, for example, ‘covering letter’ and ‘breast cancer’ on the paper and that was it.”

The slowness of use affects everyday arrangements and work-around practices have emerged. During doctor’s rounds, surgeon-patient interaction was disturbed because of this slowness, and this is now worked around by having two physicians. One examines and converses with a patient, and the other enters or retrieves patient information in the EPR. The medical personnel had no means to know the reasons causing slowness when they attempted to use the EPR. It could be anything from occasional capacity issues and use peaks to actual breakdown of the EPR. The medical personnel were concerned about how time was re-divided between caring of a patient and documenting care. Documenting in the EPR was experienced as extra work that can mean even triple time for handling a patient. The focus of concentration is shifting from handling a patient to handling the computer, as one of the surgeons describes: "With the paper system we would have handled ... two thirds of the patients in the same time that it takes us to get the electronic system open and running...” This can cause the staff to think twice whether to use electronic records or not, especially in situations when a patient has an acute need. For example, in the surgical clinic it was the nurses who decided not to use the EPR, whereas in the ward the doctors did not want to use the EPR. This caused a situation where some of the patient records were on paper and some in the EPR.

Second order issues were grouped into eight categories: the first order issues’ combined effects, prolongation of the implementation, vast and constant changes at work, interpretation issues, technical issues, cultural differences, training issues and reliability or trust issues. Most of these issues relate to each other.

Exploring slowness of use on the second order level relates it to the instability of the EPR. This caused trust issues as the personnel feared information breakdowns which, in turn, prompt several practical problems. When patient information is not timely and up to date in the EPR, situations such as patient transfer can be delayed or problematic: a patient is taken care of with inadequate information, and new treatments cannot begin without the acknowledged surgeon’s orders: "What we have here is the ultimate slowness. When the hourglass stays there for 15 or 30 seconds before you get the next window open ... It’s a long time to wait, ... because you’re supposed to get on with the things, you want to reserve an appointment for a patient who’s waiting there, or you should be placing laboratory orders as a patient is already on the way to the laboratory, but all you get is the hourglass.”

During the implementation, two parallel systems of patient documentation have been maintained. It felt more secure to uphold also the old documenting practices. Furthermore, at first there remained gaps in the EPR system, and there was a need to fill in those gaps with the old paper system. Still, it was conflicting to document partly with the old practices and then proceed to do some of the entries again in the EPR. In practice, this was interpreted as double documenting and as increasing work load.

Varied practices during breakdowns of the EPR add to the mistrust. During breakdowns, patient records can be written as separate text files that are afterwards added to the EPR. Problems emerge when the separate text files are attached as printouts to the paper version of the patient records and not to the EPR. This causes that
the EPR system is not up-to-date, and the staff cannot trust it. Moreover, the slowness of use is related to problems of resource allocation. One surgeon or nurse is not necessarily able to carry out multiple tasks at a time but has to prioritize. When tasks are prioritized, caring for the patients wins over documenting the care. Also, the tempo of working culture differs between the in-bed ward and the out-patient clinic. An appointment time is 15 minutes in the out-patient clinic, and this time should cover both examination and documentation.

**Third order issues** have a long-term and large-scale impact on the organizational context, such as, rationales for implementation and application development, attitudes, work tasks, technical issues and political viewpoints. Successful implementation demands the whole organization to commit to the goals and to the overall process of the system’s implementation. If the management of the organization does not support the information system it may cause issues on all three orders with the end users.

Attitudes of those workers that act as opinion leaders easily transmit to other workers in the same unit. In this case, the surgeons’ attitudes to the EPR were generally negative. As they mistrusted the EPR, they declined to use it. Most surgeons used alternative ways and tools to mediate orders concerning care, and their practices influenced nurses’ attitudes towards the EPR. Moreover, the EPR’s slowness caused the medical personnel to bring up the question of malpractice. If the patient information is not available quickly enough, the surgeon can make a decision regarding a patient’s treatment with insufficient information. This brings up both fear and ethical questions: How one can do one’s work without necessary information about the patient’s status and medication? To what extent should the nursing staff be responsible for their choices about the treatment if information is unavailable?

The surgeons felt that the slowness can cause multiple third order problems. For example, while working bedside, both the surgeon and the nurse may record information quite fluently and not consider whose user account was used to log in the system. Problems of responsibility emerge when mistakes are made in the records. The one whose username was used is held responsible. Issues which can endanger patient safety or which can even cause malpractice rise up to the third order because handling of this kind of issues is related also to political factors within the organization. In the long run, the third order issues can affect the reputation of the hospital and even the hospital’s financial standing.

Several issues are caused by the division of work tasks and the re-forming of work practices during the implementation. Division of work tasks also varies between the hospital units and stakeholder groups, and this causes the personnel to ask repeatedly: “Whose responsibility is this particular task?” The answer is dependent on the person who gives the answer. Also one of the third order issues is how the nurses interpret meanings behind the EPR. Most nurses state that EPR does not help their work and that instead the records are kept for a third party, such as, the hospital administration.

**4. Conclusions**

Exploring the EPR implementation issues show that these issues tend to cluster and accumulate as the implementation continues. Single first and second level issues cluster, and become second or third level issues. With the issue order model, we identified 104 different issues, of which 48 were on the first order, 36 on the second, and 20 on the third order. When the medical personnel declined to use the EPR, information validity
in the system became an issue. At times, the staff members did not have the knowledge where to find the latest patient information. These issues cumulated into the third order issue of responsibility, when investments, budgets, resources and project schedules needed to be modified. Orlikowski [7], among others, argues that managerial commitment is crucial for the system success. In the hospital case, managerial commitment was not experienced by the medical personnel, as they could choose to use or not to use the EPR. Especially, in the surgical clinic, it was interpreted that even the EPR project managers hesitated about committing to use. During our analysis, social and organizational issues emerged as intertwined and clustered with technical and usability issues.

McGrath [8] recommends that something of the previous routines should be preserved to give the organizational members a sense of continuity instead of heightening the sense of unfamiliarity. She proposes that a successful change can be achieved with a phase-by-phase development to increase the future users’ knowledge of and trust in the new technology. In the hospital case, the medical staff experienced the change as radical and uncontrollable. Moreover, they did not expect the new documenting practices with the EPR to improve working arrangements significantly. McGrath continues her argument with the idea that a parallel use of the old and the new system could have a positive impact on the success of the organizational implementation. However, the hospital case shows that a long lasting parallel use of two systems becomes a negative issue as the number of organizational members’ work tasks increase. In addition, the organizational members tend to stick to the old practices instead of learning the new practices and familiarizing themselves with the features and functions of the new system.

Star and Ruhleder [6] argue that the emerging gaps during the implementation cause further issues as stakeholders may have varied bases for adopting and learning the new system, depending on their educational and occupational backgrounds. These issues may cause communication gaps between the stakeholder groups. For example, the application supplier can use more technical terms to flourish her or his language, and the medical personnel may interpret the terms wrongly or not at all. Added tension is caused by the organizational relations and by varied interpretations between the stakeholder groups and even within them. The medical personnel interpreted the EPR in a number of different ways: it could mean just files of patient information, the whole care documentation, or a combination for making appointments and documentations, for example. Only the implementation project leaders seemed to have an understanding of a semi-integrated EPR as a whole.

Based on our experience with issue order model, this is where its strength lies. The issue order model can be used as a starting point to illustrate the various interpretations and enable various stakeholder groups to understand each others better. Thus, it helps also the decision makers to start solving the clustering issues typical to any organizational implementation.

The issue order model has been rarely used as analysis tool in later research although Star’s and Ruhleder’s article is much cited [9]. Even Star herself [10] has modified the model. In the later definition, the first order issues are simple such as getting the system running, the second order issued contain abstract choices that the users need to make, and the third order issues are described as political or philosophical. In this study, the original classification we applied seems to be more adaptable to our data set. In future, it would prove valuable to start the classification from the data itself, instead of using the Star and Ruhleder classification as a reified model.
From the perspective of the hospital and the EPR users, this kind of analysis provides not only the classifications, but a tool to discuss the differing perspectives on organizational implementation of an information system.

References


Appendix: Grouping of issue orders

<table>
<thead>
<tr>
<th>First order issues.</th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Issue group</strong></td>
<td><strong>Issue</strong></td>
</tr>
<tr>
<td>Redistribution of work resources</td>
<td>New and changing work tasks</td>
</tr>
<tr>
<td></td>
<td>Issues with the distribution of work tasks</td>
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<tr>
<td></td>
<td>Slowness of documenting</td>
</tr>
<tr>
<td></td>
<td>Too few computers in the ward</td>
</tr>
<tr>
<td></td>
<td>Issues with disposition of computers</td>
</tr>
<tr>
<td>Training</td>
<td>Slow tempo of training, mixed experiences</td>
</tr>
<tr>
<td></td>
<td>Complicated instructions for beginners</td>
</tr>
<tr>
<td></td>
<td>Lack of time for learning the use</td>
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<tr>
<td></td>
<td>Changes of documenting practices</td>
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<tr>
<td></td>
<td>Terminology changes</td>
</tr>
<tr>
<td></td>
<td>Changes at working processes</td>
</tr>
<tr>
<td></td>
<td>Documenting became visible</td>
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<tr>
<td></td>
<td>Frustrating training</td>
</tr>
<tr>
<td></td>
<td>Different levels of computer knowledge</td>
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<td></td>
<td>Lack of peer support</td>
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<tr>
<td>User-friendliness</td>
<td>Demanding entries</td>
</tr>
<tr>
<td></td>
<td>Slowness</td>
</tr>
<tr>
<td></td>
<td>Structured character of the EPR</td>
</tr>
<tr>
<td></td>
<td>Problems with allocating a new patient</td>
</tr>
<tr>
<td></td>
<td>Too many ‘clicks’</td>
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<td></td>
<td>Disconnectedness of patient views</td>
</tr>
<tr>
<td></td>
<td>Slow to open different parts of the EPR</td>
</tr>
<tr>
<td></td>
<td>Hard to get an overview of a patient</td>
</tr>
<tr>
<td></td>
<td>Limitations in browse</td>
</tr>
<tr>
<td></td>
<td>Usage cumbersome</td>
</tr>
<tr>
<td></td>
<td>To understand of a patient’s status user has to check several views</td>
</tr>
<tr>
<td></td>
<td>Warning sign not linked to patient information</td>
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<tr>
<td></td>
<td>Functionality is uncertain</td>
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<tr>
<td></td>
<td>User can check only one patient’s information at a time</td>
</tr>
<tr>
<td></td>
<td>Users mistakes are complicated to repair (entries are locked)</td>
</tr>
<tr>
<td></td>
<td>Readability of printouts is poor</td>
</tr>
<tr>
<td></td>
<td>The EPR does not support a user</td>
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<tr>
<td>Technical problems</td>
<td>Slowness</td>
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<tr>
<td></td>
<td>Breakdowns</td>
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<tr>
<td></td>
<td>The EPR logs off users</td>
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<tr>
<td></td>
<td>Function of the cordless network</td>
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<tr>
<td></td>
<td>System lock</td>
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<td></td>
<td>Lack of parallel logon on the same computer</td>
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<tr>
<td>Changes in work tasks</td>
<td>Changes in work practices</td>
</tr>
<tr>
<td></td>
<td>Patient work versus computer usage</td>
</tr>
<tr>
<td></td>
<td>Not inconsistent practice in documenting</td>
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<tr>
<td></td>
<td>Diminishing of discursive entries</td>
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<tr>
<td>New features and expectations</td>
<td>Smart card signature</td>
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<tr>
<td></td>
<td>Flying exchange</td>
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<td></td>
<td>Promise pie in the sky</td>
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### Second order issues.

<table>
<thead>
<tr>
<th>Issue group</th>
<th>Issue</th>
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<tr>
<td>Combined effects</td>
<td>Imperfect usage of the system</td>
</tr>
<tr>
<td></td>
<td>Learning the use while tending the patients</td>
</tr>
<tr>
<td></td>
<td>Information breakdowns</td>
</tr>
<tr>
<td>Prolongation of the</td>
<td>Exhaustion on implementations</td>
</tr>
<tr>
<td>implementation</td>
<td>Staff cannot trust the information in the EPR</td>
</tr>
<tr>
<td></td>
<td>Two parallel documenting methods</td>
</tr>
<tr>
<td>Vast changes</td>
<td>Changes in nursing process</td>
</tr>
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<td></td>
<td>Changes in work practices</td>
</tr>
<tr>
<td></td>
<td>Exhaustion by the users</td>
</tr>
<tr>
<td></td>
<td>Uncertainty</td>
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<tr>
<td></td>
<td>Usage resistance</td>
</tr>
<tr>
<td>Technical issues</td>
<td>Breakdowns</td>
</tr>
<tr>
<td></td>
<td>Clump of problems</td>
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<td></td>
<td>Instability of the information system</td>
</tr>
<tr>
<td></td>
<td>Slowness</td>
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<tr>
<td></td>
<td>Issues with consolidation</td>
</tr>
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<td></td>
<td>Uncertainty about the information system’s functionality</td>
</tr>
<tr>
<td></td>
<td>Incompleteness</td>
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<tr>
<td>Interpretive reasons</td>
<td>Fear about usage’s difficulties</td>
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<td></td>
<td>Work satisfaction</td>
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<td></td>
<td>Delays to repairing</td>
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<td>Information system is too significant in relation to the patient work</td>
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<td>Cultural differentials</td>
<td>Different work roles</td>
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<td>Different situational goals</td>
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<td></td>
<td>Different needs</td>
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<td></td>
<td>Different ways to use the system</td>
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<td></td>
<td>National versus local level</td>
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<td></td>
<td>Issues of circumstantial factors</td>
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<td></td>
<td>Issues with motivation</td>
</tr>
<tr>
<td>Training</td>
<td>Previous experiences</td>
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<td></td>
<td>Hierarchical differences</td>
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<td>Impact on attitude</td>
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<td>Reliability</td>
<td>Wrongly saved entries</td>
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<td>Mistakes in documenting</td>
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<td>Sophistication of functions</td>
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<td>Unsystematic breakdowns</td>
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### Third order issues.

<table>
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<tr>
<td>Co-operative action</td>
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<td>Malpractices</td>
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<td>Rationales for implementation and</td>
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<td>Category</td>
<td>Issues</td>
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<td>----------------------------------------------------------------------</td>
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<tr>
<td>Application development</td>
<td>Meaning of the documenting</td>
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<td></td>
<td>Rumours about stopping the usage</td>
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<td></td>
<td>Communication gaps</td>
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<tr>
<td>Attitudes</td>
<td>Management’s commitment</td>
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<td></td>
<td>Attitude to the information system</td>
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<tr>
<td></td>
<td>Weight of previous implementations</td>
</tr>
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<td></td>
<td>Gap between generations</td>
</tr>
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<td>Work tasks</td>
<td>Limited possibilities to influence</td>
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<tr>
<td></td>
<td>Varied practices in documenting</td>
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<td></td>
<td>Professional school differences</td>
</tr>
<tr>
<td></td>
<td>Responsibility issues</td>
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<tr>
<td></td>
<td>Information validity – patient safety</td>
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<tr>
<td>Technical issues</td>
<td>Slowness</td>
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<td></td>
<td>Breakdowns</td>
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<tr>
<td>Political viewpoint</td>
<td>Choosing the EPR system</td>
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<td></td>
<td>National requirements</td>
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<td></td>
<td>National archive project</td>
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<td>Occupational ethics and professional identity</td>
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Sustainable Mobile Information Infrastructures in Low Resource Settings

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Abstract. Developing countries represent the fastest growing mobile markets in the world. For people with no computing access, a mobile will be their first computing device. Mobile technologies offer a significant potential to strengthen health systems in developing countries with respect to community based monitoring, reporting, feedback to service providers, and strengthening communication and coordination between different health functionaries, medical officers and the community. However, there are various challenges in realizing this potential including technological such as lack of power, social, institutional and use issues. In this paper a case study from India on mobile health implementation and use will be reported. An underlying principle guiding this paper is to see mobile technology not as a “stand alone device” but potentially an integral component of an integrated mobile supported health information infrastructure.

Keywords. Health information infrastructure, mobile phones, social networks, India

1. Introduction

The developing world is engaged in addressing various public health related challenges, including strengthening of their health information systems. Mobile technology has been identified as an important tool to this strengthening process, and has led to the development of the mHealth research domain which seeks to identify appropriate mobile based applications and implementation strategies to address public health challenges.

Developing countries represent the fastest growing mobile markets in the world and hence this paper discusses the potential of tapping into this commonly available infrastructure to provide health information services. Currently, it is estimated that there are 2.2 billion mobile phones in the developing world, compared to 305 million computers [1]. For people with no computing access, a mobile phone will be their first computing device. India for example, has 25 PCs per 1,000 people, according to IDC. The U.S. number is 997. Indians, like many in the developing world, choose mobiles over computers. They are cheap, and do the job. Nine million new phones are sold in India every month, about 3 million more than the number of computers sold in an entire year. Sixty-six million people access the Internet via their handsets, according to the Telecom Regulatory Authority of India. Indian companies have invented methods, via simple SMS, to wire money to temples, pay for groceries, find jobs and send and receive e-mail on simple phones with no data connection [2]. In 2008, mobile phone penetration in developing countries had reached that of Sweden under ten years earlier;
while for infant mortality, the rate in developing countries in 2007 was at the level where Sweden was 72 years earlier [3]. This shows the irony between the progress made in mobile phone acceptance and health indicators.

Mobile technology has been identified as an important tool to strengthening of health information systems [4, 5], and has led to the development of the mHealth research domain which seeks to identify appropriate mobile based applications and implementation strategies to address public health challenges.

mHealth is the medical and public health practice supported through mobile devices for collecting community and clinical health data, delivery of healthcare information to practitioners, researchers, and patients, real-time monitoring of patient vital signs, and direct provision of care [6]. Thus, mHealth makes use of ICT such as mobile phones, PDAs, monitoring devices, wireless networks etc and everyday there is some new innovation that is happening in this field. In such a rapidly evolving field of study, it is thus quite expected that a lot of experiments would be conducted and sustainability would generally be a secondary or even tertiary thought.

In this paper we will discuss the challenges and opportunities of emergence of mobile-supported national health information systems in developing countries by describing an ongoing mobile health projects in India. The study shows that mobile applications and usage can play a key role in bringing information and communication facilities more effectively to health workers in communities in rural areas.

2. Towards an Mobile Health Information Infrastructure

Utilizing mobiles in health extends the vision of health information infrastructure to the villages drawing upon the potential of mobile IT solutions. Limited electricity and technical support renders PC less sustainable than mobile phones which are less vulnerable to such problems. The mobile phone is also largely domesticated into the everyday life of common people, including those living in rural areas, which is not the case with computers.

However the lack of electricity in especially rural areas in the developing world limits the utilization of such efforts. Approximately 1.6 billion people worldwide live without access to electricity, of which 25% live in India. Many of these live in rural areas and are unlikely to be connected to conventional grid in the near future due to their remote location and the surging demand for electricity in urban areas. For example, as of today about 50% of all Indian villages are not electrified. This limits the possibilities for socio economic development and implies huge consequences for individuals when it comes to health and education.

The mobile penetration is unevenly distributed in emergent markets. While urban areas and major cities are often close to being saturated in terms of market penetration, large parts of rural areas are under served. Mobile operators are looking to rural areas for market growth. Lack of power has led mobile service providers to use diesel generators and other forms of expensive and dirty energy to maintain their infrastructures and these providers have stopped expanding into the rural areas due to high operating costs and low ARPU (Average Revenue per User). Lack of power is not only limiting the infrastructure development but it also limits the rural population in participating in the mobile revolution. This scenario has led to a deep digital divide in emerging countries.
It is important not to look at the mobile phone as a standalone device, but with a systems perspective including various other kinds of infrastructure – such as the paper registers at the sub-centers, the computers at the district levels, the networks, the servers at the state level, and also the basic infrastructure required to support the mobile phone use (charging facilities, support, network coverage etc). One of the important questions that the research aims to address is how can mobile applications be sensitively designed and introduced in order to support the development of an integrated mobile based health information infrastructure? Information infrastructure is used in the broader sense, meaning the technological and human components, networks, systems, and processes that contribute to the functioning of the health information system. Strengthening and reinforcing the social network of health workers by creating communication possibilities across hierarchy and among peers, as well as creating feedback channels for the lowest level will be crucial.

Existing research into the topic of how sustainable mobile health information can be effectively deployed and scaled is limited, and hence this topic lies in the frontiers of health information systems research [7].

2.1. Strengthening the Social Network

Mobile phones provide rich potential to strengthen social networks, comprising for example the field level nurses, community health workers, the medical doctors and the rural population seeking health care services. Such networks are particularly important in countries lacking public safety nets, and this effort would carry out research in understanding how the mobile phone can enable the creation, evolution and sustenance of such social networks [8, 9]. Health service networks refer to the multitude of vertical and horizontal ties between health workers, possibly also clients, in low-resource environments. Given the existing insufficient support of such networks, it is relevant to investigate to what extent and in which ways health service networks can be enhanced through the use of mobile technology.

Building on a long tradition of research in sociology and network analysis, the key role of social networks for fostering sustainable innovations in communities of practice [10] and in health [11] is addressed. For example, Cross et.al [12] note the possibility of transforming informal groups into value-producing networks through improving the communication flow and knowledge reuse, and the role of technology in achieving this. Particularly related to health, a recent study in Rwanda found that mobile ownership of micro entrepreneurs had an effect on social networks; it amplified primary relations while enabling new professional ties [13].

Mobile usage has the potential to play a role in empowering female community health workers, building social capital and raising their status in the villages as well as in the health value chain. Contextualizing the design appropriately will require considering socio-cultural-institutional factors such as the mobility of women due to seasonal work patterns, the absence of a unique individual identification system, and the social practice of women going to the house of their in-laws for the period of pregnancy and delivery.
3. Mobile Health Reporting System

The Society for Health Information System (HISP India) which has more than 10 years experience of working with health information systems in India, and are developing and implementing the District Health Information System (DHIS) software for health management that is currently being deployed in almost all states in India to support sub district data registration and analysis activities. The DHIS software is focusing on providing information support to local level health workers and managers, while at the same time providing the national level with a web-enabled data warehouse for decision making. The DHIS deals with aggregated (non-patient) data collection and analysis in an integrated manner across health programs, including important monitoring of MDG 4 and 5 indicators (Mother and child health).

Implementing software solutions at the lower levels of the Indian health system is a huge undertaking due to its enormous scale in terms of the vast number of installations, system maintenance and training activities.

A mobile solution to reach the community level was implemented. In the rural areas where there are no computers and no Internet and many places did not even have stable power supply. The aim was to strengthen the work of community health workers need to be coordinated and supported by backbone systems e.g. to produce the mobile collection forms, to store, process and report the data collected by mobile phones, and generate work schedules and feedback reports back to the mobile clients. The strategy was to install such a backbone system at the Block PHC level as lower levels is hard to computerize, and link the transmission of data from the mobile (such as through a SMS) to this backbone.

A pilot project was initiated by National Health System Resource Centre in India in collaboration with HISP India. Health workers in facilities at the lowest level were provided with a tool to report routine data to the district and state level through the DHIS. The mobile application for sub-centre reporting was piloted in 5 states: Kerala, Rajasthan, Gujarat, Himachal Pradesh and Nagaland. 189 health workers were given mobiles for reporting. A Closed User Group was set up to cater the entire health workers network with low to zero cost for calling. This was reported as the first immediate result of making the communication more efficient.

The mobile application is a combination of JavaME (Java Micro-Edition) application on the mobile phone and a server-side application which reads the data received from the phone and converts it to XML which is imported into DHIS. The mobile application uses Mobile Information Device Profile (MIDP 2.0) programming interfaces and thus runs on most of the world’s Java enabled mobile phones.

Our target was the lower end phones and hence designing a simple user-interface that supported multiple languages on small screens with low memory and processing capabilities was the problem. We created forms with the standard MIDP components and separated the form as pages seen on a paper form. Our design principle was to design the interface as close as possible to the paper forms in order to minimize the training necessity. We had nine pages, separating the categories that one sees on the sub-center dataset. Each page has one field for data element and after typing value in the field the user presses the down arrow and fills the next field. After the end of one page, the user presses the center button and goes to the next page. This continues until all the pages are complete and the user is shown a completeness dialog and asks the user to send the data. The data is then saved on the device and sent as a compressed SMS to the mobile numbers that are connected to computers at the higher-level health
facilities. This compressed SMS is decompressed and converted to XML automatically which is imported into DHIS. The user can then see the data in the DHIS software like they would have if it had been entered through the normal computer interface. The data and analysis of the data can then be used at all levels in the health system through the DHIS.

4. Discussion

Introducing mobiles into the public health is not only about introducing a tool for data capturing it seems have the potential of changing the way of working and communicating which can have great effect on health provisioning.

Introducing mobile phones among health workers have changed the communication patterns and seems to go beyond what used to be hierarchical borders. For instance an HMIS manager that now could contact directly the health worker. Earlier she had to send a written request to the PHC to get them to contact the health worker about for instance to invite for a meeting. The work related communication increased and 88% said they had called other health officers for advices and 85 % said they had contacted doctors for medical help in case of emergency.

The phones are costly and the question of who shall own the phones arose. The challenge that people could lose them or sell them was there. In Rajasthan we saw that the phones were very well taken care of and seen as very valuable for them individually. In a case where a phone was stolen, the health worker was able to negotiate the phone back with help from the community by paying 500 rupees (5 USD).

The process of data-entry initially took about 10-12 minutes for a new user, but after the health workers had filled 2-3 forms, they could finish a new form in 3-4 minutes. Thus, we realized the learning curve on the application was very small and suited the hectic schedule of the health worker.

100% said they prefer this way of reporting as it saves time – they do not need to travel to report – and it is more efficient. In addition, the reporting rate has increased substantially.

The studies we performed with people from the state and HISP India showed clear acceptance of the application as a part of the health workers daily practice. There was an increased peer-to-peer communication between health workers on all kinds of issues including health system or administration. The mobile phone helped build a closer-knit community between the health workers, facility staff and community members. Calls to meetings, stock availability, health days were communicated faster and improved efficiency.

The health workers started to explore new ways of using the phone. One health worker took photos of skin rashes and showed this to the medical officer because she was unable to detect the cause of the rashes. Few health workers have advertised the phone numbers as official sub-center numbers and hence people from the catchment areas often call and discuss their health-related problems.

After analyzing at the pilot results, at least 3 states (Punjab, Nagaland and Kerala) are starting large-scale implementations of around 5000-6000 sub-centers and handsets that will be reporting through this application. There are other states which are in the process of understanding their requirements and making plans for using this application.
5. Conclusion

In leveraging the mobile technology and infrastructure, there are inter-related challenges that have been encountered. The emergence of mHealth applications and projects is a significant phenomenon – not only because of a fast rate of adoption but also the ability to achieve instant results with data handling. This can be attributed to the relatively small means with which the important issue of the lack of quality data can be addressed. In short, mobile technology provides a fundamental leverage that had been lacking in these settings – a network infrastructure for electronic data transmission. This, combined with the ease of use of mobiles compared to computers, has allowed many applications of mobile technology to emerge. It is important to note that; as this is a relatively new phenomenon, it may be too early to discuss with precision the possible success rates. But it is an important question to ask if these will translate to institutionalized systems for large-scale national systems. We have found that this is the case - mobile phones have been adopted for the day-to-day work of data handling in the case India.

We have already seen that the introduction of mobile phones among health workers has changed their communication patterns and has led to a challenge of the hierarchical borders and bureaucratic protocols often associated with public work routines. Health workers can be contacted directly by the state bypassing levels in the data flow but allowing for rapid exchange of information.

The lack of electricity that we see especially rural areas in the developing world limits the utilization ICT and need to be addressed to be sustainable and fully exploit the potential of information infrastructure. Lack of power is not only limiting the infrastructure development but it also limits the rural population in participating in the mobile revolution. This scenario has led to a deep digital divide in emerging countries.

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Where Superman Is Not On Staff
– on implementation and lacking feedback

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Abstract. Computer systems tend to deliver less than promised. In this article we investigate mechanisms that contribute to this gap through a computer system supposed to facilitate discharge planning. The aim of this system is to increase efficiency and quality, and make information exchange safer. We do the investigation from the perspective of Science and Technology Studies (STS) and skill acquisition. We find that information tends to be hindered from entering the system, rather than ending up in the wrong places as the case was before. Further knowledge that earlier was gleaned from person to person interaction is missing out. Despite being sparse and limited, the information stored in the system is sufficient to enable action. We therefore see that one risk is exchanged for another. In total, patient safety might suffer, and hence staff ought to compensate for this. This in turn reduces efficiency and hence also the promised gain from the system.

Keywords. Computer system, Information system, Meddix, Discharge planning, Records as Topic, Case management, Patient safety

Introduction

There is a rising awareness and concern that computer systems within health care tend to deliver less than promised. In this article we explore mechanisms that contribute to this gap between what was promised and what was delivered. Our case concerns Meddix, a computer system designed to facilitate discharge planning. The system is an Internet-based planning system, introduced throughout Sweden in 2005. We explored the consequences of Meddix in a social constructive perspective [1]. Material is acquired at three hospitals and their surrounding municipalities in Southern Sweden.

Discharge planning is a complicated process aimed at aligning several organizations. The process starts when a doctor considers a patient ready to leave although she is in need of further rehabilitation and/or care. This leads to an assessment of the patient’s requirements of help, which is to be provided by home nursing care, home care services, nursing homes and/or rehabilitation facilities. Meddix should increase efficiency and quality of the process, and make information exchange safer. The computer system is supposed to do this by providing information to involved actors and by consolidating information for administrative purposes.

Systems like Meddix, storing information about patients in terms of patient records, have been introduced in various settings and formats during recent decades. While

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introduction among general practitioners tends to be rather smooth and promising, introduction at the hospital level tends to be more complicated, due to hospitals being more complicated organizations than those within general practice. This makes both the coordination of use and the implementation harder [2-4]. Because of this, there is reason to believe that introduction and use of Meddix is even more demanding, since the system takes on an even more complex task. The system stores medical information, nursing instructions, rehabilitation and care plans, etc. This is submitted pre and post discharge planning meetings in main by nurses, need assessors, and occupational therapists.

We explore how Meddix influences the quality and coherence of care when responsibility for patients is transferred from hospital to their municipality. Through this we gain knowledge about why computer systems tend to deliver less than promised.

**Storing Patient Information**

Computer systems like Meddix are more than archiving devices. By providing the opportunity to act towards the patient even though the patient herself might be absent, these systems contain digital representations of the patients [5, 6]. This provides health professionals with the opportunity to act independently of the patient, by acting towards the information that represents the patient within the system.

In the forthcoming text, we distinguish between Meddix as a tool and Meddix as a storage facility for representations of patients. When we investigate Meddix as a tool, we attune ourselves to how the system shapes practice by being an infrastructure diverse from those it replaced - archives, faxes, phone calls and postal mail.

When we investigate Meddix as a storage facility, we look at the information shared via the infrastructure. We understand this shared information in terms of Immutable mobiles [7]. These manifest relations between actors, can be moved around, and are produced by inscription in one way or another. A map is a perfect example. It is mobile while the actual land is not. The same goes for patient records. The record is mobile independent of the patient.

In our exploration, the terms delegation, programme and anti-programme are important. Delegation involves leaving control of action to others, programme is what one is steering towards, and anti-programme refers to actions with the aim of neutralising the attempts of others to gain control. In accordance with Science and Technology Studies (STS), these ‘others’ may be both human and non-human actors.

Latour [8] discusses strategies used by hotels in order to keep possession of their keys. Three of these are: 1) the staff remind the guests to hand in their keys before they leave the building, 2) display notices that politely request the guests to hand over their keys, and 3) attach heavy key-rings to the keys. All of these are delegation, but whereas the first two involve describing a desired action, the third action is inscribed in the key.

Reminding the guests to hand in their keys convinces one group of guests, putting up a sign a larger group, and attaching heavy weights to the keys an even larger group. Those hotel guests very keen on taking their keys with them might remove the key from the key-ring. That would be an anti-programme to the hotel’s programme.
In what follows, we discuss how the delegation of information-exchange influences the discharge planning process and might pose challenges. We pay special attention to how what is inscribed in Meddix relates to practices.

As a system for the facilitation of discharge planning, Meddix is dependent both on the information stored in the system being accurate, and on users learning to interpret the information in a correct and efficient manner. To analyze the conditions for learning, we turn to one of the most popular models concerning skill acquisition: The so-called Dreyfus-model [9-11]. This suggests a five-step ladder from novice to expert.

Novices at the lowest level have no experience of the situation in which they are expected to perform. At the next level, the advanced beginner has coped with enough situations to note recurrent components. The competent stage is characterized by a feeling of mastery and the ability to cope with challenging situations. Next to the top, the proficient perceives situations as wholes, while the expert at the top no longer relies on analysis. Instead, an intuitive grasp of the situation makes it possible to zero in on the accurate region of the problem without wasteful consideration.

The difference between the first two stages and the remaining mainly concerns handling of rules. Novices’ and advanced beginners’ lacking experience makes it hard for them to discriminate between normality and what it is worth paying attention to. Besides this, they have to concentrate on the rules they have been taught. While rules are actively used in the first two stages as a basis, they receive less attention later.

From this, it becomes evident that rich feedback is important in developing skills. As partakers in the planning process, discharge planners can easily develop the skills involved in making care-plans, while the skills required in the facilitation of good care are harder to obtain due to the fact that they do not partake in the provision of care. Hence feedback from care as practiced is of great import when the quality of the care provided as a result of the discharge planning process is to be raised.

Design

This study is part of a research project conducted at three hospitals in Southern Sweden and their surrounding municipalities. Based upon qualitative interviews, this article investigates how professionals perceive their work practice with and without Meddix. The main material is multi-disciplinary and cross-organizational focus group interviews (n=6) carried out in 2005-06, making up a total of 9 hours. Interviews were conducted prior to and approximately 6 months after Meddix was introduced. Participants were recruited as a convenient sample from all involved positions within primary, secondary and tertiary care. Approximately 50% of participants (total n=46) took part in both pre- and post-implementation interviews. Focus group interviews were taped and transcribed. At one hospital, focus group interviews were extended with eight individual interviews making up a total of 5 hours, due to the lacking participation from district nurses in the group interviewed.

Data was analyzed in partnership between authors in an inductive approach inspired by grounded theory [12]. Coding was constant comparative, and theoretically informed by the theoretical framework laid out earlier, moving focus away from care processes and onto the computer system and the information stored. To increase reliability and assure validity, findings were related to and adjusted by a body of individual discharge planning investigations collected by strategic sampling at one of
the hospitals (N=27). This body is made up of video- or tape-recorded discharge meetings, individual interviews (27 older patients, 25 family members and 19 professionals), medical and social records and other documents related to the cases, as well as national regulations describing discharge planning, local routines etc. 23 cases were conducted prior to and 4 cases after the introduction of Meddix. The second author collected all the data.

The study was approved by the Ethics Committee at the Faculty of Health Sciences, Linköping University, Sweden (Dnr M87-05).

Results

When we look at Meddix as a tool, usability is in general considered to be good by users, and information safety is also judged to be adequate. Users further expressed satisfaction that Meddix provides access to information. One informant put it like this:

\textit{Information is at hand. We never had access to see and read like this before.}

\textit{[...]} \textit{So far, I think it is better for us.}

However, some challenges still remain. One example is that users argue that Meddix is more time-consuming and less effective than expected. When we look behind these quite overt and mundane features, we find a more complex picture.

As with all systems, knowledge among users is a limiting factor. With regard to Meddix, this is a particular challenge due to the relatively high turnover among staff. This, combined with Meddix being designed for competent users and thus having no built-in user guidance or security check, makes knowledge of the system an especially vulnerable area. One user puts it as follows:

\textit{Actually, I believe that the computer should ask questions like ‘are you sure?’}

\textit{[...] after all we are only human and not Superman, you know.}

At care facilities where Superman is not on staff, users can therefore create problems in the system that lead to difficulties of many kinds when action is taken on the basis of information in Meddix. Furthermore, processes also take place in parallel-systems, for example by phone. This creates extra work for discharge planners, since they ought to act as quality assurance personnel to neutralize the chance of Meddix acting as an anti-program to its own program:

\textit{One must have eagle eyes and ensure that a discharge document really has been written. If this hasn’t been done, the patient is still technically admitted.}

\textit{And if he is in another department, the system locks up.}

When we explore Meddix as a storage facility, we observe that practice contrasts with the ideal of discharge planning as a rather complicated, dynamic and iterative process that normally should involve many and diverse actors at various stages. This influences information stored in the system.

Lack of participation from staff in wards is common, and even district nurses tend to be ‘more absent than appreciated’ in the process. Also, participation from physicians initiating the discharge planning process is said to be very limited. This was also the case prior to the introduction of Meddix, but the system has put information on hand, and thus made it easier to act on limited, sparse and/or meager information. This might pose challenges to patient safety.
Prior to the implementation of Meddix, obtaining information was time-consuming since contact between personnel working in clinical practice had to be established. On the other hand, when contact had been established, rich information was exchanged since ‘off the record-information’ tended to accompany the written information. Hence prior to the introduction of Meddix, only parts of the information exchange had been taken care of by the system.

When asked about feedback practices, the discharge planners are convinced that knowledge of unsuccessful events would be provided through existing meeting places. From our knowledge of organizational structure and practices, we doubt that knowledge of mishaps in general is conveyed to the patient care coordinators responsible. Another problem arising from relying upon negative feedback is that discharge planners do not get any feedback when things go well.

An important obstacle to getting feedback is that personnel are only allowed to access the records of patients they are currently in charge of. Thus checking how something went becomes a violation of rules and not a practice the organization can endorse. Until the implementation of Meddix, this has worked fine due to small talk taking place when information was handed over in persona. Now when Meddix is responsible for the process, such knowledge exchange is missing. Also here, the delegation of information exchange to Meddix has resulted in more limited, sparse and/or meager information.

The lack of feedback processes is compounded by the aim of discharge planning, which is to provide care that is ‘good enough’. This is further aggregated by job segmentation in combination with the limited time available and a narrow time horizon. One informant puts it:

*In principle, I forget Greta when I leave the gates; she is forgotten. Because when I come back, there are five new ones waiting for me.*

An informant states that due to this, she does not feel that she needs to know how the planning turned out in practice:

*I make judgments based upon what I know now. And these decisions are good for 14 days. One must simply believe that one makes the best plans for the patient.*

**Discussion**

The aim of Meddix is to increase efficiency and quality, and make information exchange safer. Furthermore, the system should facilitate cooperation and communication between actors scattered across diverse organizations. Of great import to these are digital representations of patients that can be acted towards independently of the ‘real’ patient.

Delegating information exchange to Meddix has created better access to information, but the information tends to be more limited, sparse and/or meager. This render a digital patient that is a scarce and synthetic imitation of the ‘real’ patient. An important reason is Meddix only taking care of information exchanges that earlier took place in terms of written information. Thus feedback processes that earlier took place in the form of small talk are not taken care of by the system. Furthermore, professionals are hindered from contributing information due, for instance, to their lacking
knowledge, awareness and access. One factor is the demand for confidentiality that acts as an anti-program to the program of quality. Even though information is limited, sparse and/or meager, there is enough to undertake discharge planning. Due to both the replacement of talk with text and to rules, such as that of confidentiality, information now tends to be hindered from entering and leaving the system, rather than ending up in the wrong places. This reduces feedback and means the discharge planning team remain as novices or advanced beginners in terms of skill acquisition [11]. Their sparse contact with care as practiced, means developing skills involved in making care-plans is much easier developed than skills concerning the facilitation of good care. Also this might pose challenges to patient safety.

Conclusion

We see that the delegation of information sharing to the system supports the program of efficiency, while acting as an anti-program to the program of quality. This is caused by sparse and limited contact with care as practice, and poses challenges to practice and hence also reduces efficiency. We therefore observe that one challenge of patient safety, the one of information safety, is exchanged for another, the one of lacking awareness of and access to information, thus the opposite was the intention.

Returning to our initial concern; computer systems within health care that tend to deliver less than promised. We see in this case that the system reduces informal information exchange. Lacking attention to informal processes is easy to understand, since the mapping and development of such information channels are costly.

On this basis we conclude that at least parts of the gap between what is promised and what is delivered by computer systems within health care stem from too little attention being paid to informal work processes during the development and implementation of the system.

References

Part E

Patient
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Compliance or Patient Empowerment in Online Communities: Reformation of Health Care Services?

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Abstract New technologies enable a different organization of the public’s admission to health care services. The article discusses whether online support groups in patient treatment are to be understood in the light of patient empowerment or within the tradition of compliance. The background material of the discussion is complementary data from quantitative research on characteristics of patient support groups, and from two qualitative, in depth studies of the impact of patient networks for lung patients and for women with fertility problems. We conclude that in spite of the potential of online communities of opening up health care to the critical voice of the public, the quantitative and qualitative studies surprisingly point to a synthesis of the otherwise opposite positions of empowerment and compliance in patient care. Thereby the critical potential of online communities in health care services seems reverted into configuring ideal patients from diverse users.

Keywords Online support groups, patient roles, empowerment, compliance

Introduction

New technologies, such as social software and online communities make it possible to organize the public admission to health care services differently. But what do these new technical possibilities mean in terms of the patient’s role in health care arrangements? Are online communities to be interpreted as an interactive medium of communication that actually empowers the patient’s influence on how medicine is practiced? Or are online communities not a deliberate stance for public critique of the hegemony of doctors, but rather mirrors of the compliance tradition?

Compliance is the extent to which a person’s behaviour (in terms of taking medication, following diets, or executing lifestyle changes) coincides with health advice \([1]\). The term was coined in the 1970s and, since then, the role of self-care has been much discussed. Some argue \([2]\) that “compliance” indicates patients obeying physicians and that the actual word implies an understanding of the problem as a behavioural characteristic of the individual patient. Instead the term “adherence” is proposed which include not only behavioural attitudes but also the patient’s social and economical situation. Others \([3]\) argue that both “compliance” and “adherence” imply treatment

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problems to be due to the patients’ behaviour and claim that appropriate care requires fundamentally different sets of roles for health care professionals and patients - roles that imply a truly collaborative approach where patients and health care professionals relate as equals rather than the hierarchical approach underlying compliance and adherence. In a truly collaborative approach, the patient is responsible for managing the illness, and the role of healthcare professionals is to provide expertise, and help patients acquire knowledge necessary to make informed decisions. These efforts to equalize patients and health care professionals have also been referred to as patient empowerment [4]. Empowerment is the discovery and development of one’s inherent capacity to be responsible for one’s own life and the patients are thus empowered when they are in possession of the knowledge, skills, and self awareness necessary to identify and attain their own goals. Empowerment has some of its theoretical underpinning in the work of Freire [5] and, according to him, empowerment implies more than just an individual perspective and should be seen as a social action that involves group efforts to identify their problems, to critically assess social and historical roots of problems, and to develop strategies to overcome obstacles in achieving goals. The empowerment approach in health care is strongly supported by the use of new technology, such as online communities, where technology functions as means of reorganizing health care services towards a more patient-centred structure. Sociological studies [6, 7], though, modify the expectances of the revolutionary potential of the online groups finding the changes “less dramatic and more embedded in existing practices and power relations of everyday life” [6:449], and ask for more research on how patients are included and excluded from participating. The users’ relation to “the biomedical explanation model” seemingly play a two-sided role in late modernity of both excluding the patients, who do not fit into “the arena of successful coping”, and of including postmodern patients in the need of a stable interpretation model of how to relate to the threat of the diagnose on their lives [7:141ff].

Firstly, the following section describes some of the characteristics of patient support groups on the basis of quantitative data, and secondly presents an in depth analysis of the communication between patients in two support groups. Thirdly the findings are discussed and interpreted in light on the questions on the reformation of health care services in on-line communities.

1. Complementary studies of patient support groups

The empirical research on patient networks lies predominantly within a quantitative science tradition that leaves little room to actually understand what patient communication is about. Revealing the meaning of the patients’ communication resides within a humanistic tradition of research that favors the particularities and uniqueness of human expression. Therefore, in order to answer the overall question of the critical potential of patient networks, we want to include the quantitative results of patient network research, but also ‘hear’ the ‘qualitative part’; i.e. what are the patients actually “saying” in their online activities. The qualitative analysis of patient writings in online communities offers a deeper understanding of what their concerns are, why they are participating, how the community might contribute to their lives with illnesses and to their identities as such.
1.1. Quantitative results

In a meta-analysis of Research on Formal Computer-mediated support groups (CMSG) by Rains and Young, two hypotheses are assessed [8]. The CMSCs are defined by having both educational and group communication components, access to medical information, decision support, skills training, and an asynchronous discussion forum where participants can share information, strategies of coping, and support. Closed Membership enrollment, may include some form of expert leadership.

The first hypothesis about the health benefits suggest that CMSG participants experience more social support, become less depressed, gain more quality of life, and undergo changes in self-efficacy. The second hypothesis concern the characteristics of CMSGs were the size of the group, the technical mode(s) of synchronous and/or asynchronous communication, the frequency of contact with the group, and the duration of the intervention are expected to effect the health benefits. From the meta-analysis of data samples from 28 studies with 4,081 participants with 12 different health conditions, the first hypothesis was confirmed, whereas the impact of social benefits to specific characteristics of the interaction was not. This quantitative approach confirms some general expectations of the positive outcome of sharing experiences and learning in social groups, but offers little knowledge on our general understanding of parameters such as ‘depression’, ‘life-quality’ and ‘self-efficacy. What do these and the concomitant concept of ‘social support’ actually mean from the perspective of the participants, and how do they unfold and sustain themselves in the patients’ communication about their sufferings?

1.2. Qualitative text interpretations

Within the humanities there is a long tradition of understanding humans as intentional beings whose knowledge of the world always bears a first person perspective, i.e. an irreducible subjectivity that can only be made the object of scientific study as ‘text’ [9]. Experiences of human existence are typically expressed in written texts such as the bible, literary art works or more generally in any production by human hand and spirit, from paintings to architecture and even software design [10]. All ‘texts’ having the communicative purpose of expressing some sort of meaning. In the late modernity, the focus have shifted to the reception of ‘text’, or meaning making in itself. Qualitative studies of patient support groups methodologically offer a new stance of researching social meaning-making as the subjects in interactive media are both co-creators and co-interpreters of meaning. Thus the users do part of the textualization themselves in their reading and writing on the platform. The qualitative analysis of the patients’ writing in online communities make it possible to get a first person understanding of what their concerns are, why they are participating, how the community might contribute to their lives with illnesses, and to their identities as such in online patient groups.

On the public platform www.sundhed.dk, users can follow the communication on six patient networks. User rights to write contributions are restricted to patients in treatment, relatives and clinical staff. The text production in two of the patient support groups [11] sums up to 631 contributions on ‘Repeated miscarriages’, produced within a period of 6 months (January to August 2008), and 3650 contributions on ‘Talks about COPD’, written within a time span of 18 months (January to August 2009). The vast majority of the communication is between patients. The forum ‘Repeated miscarriages’ is about women who have pregnancy problems. The 232 patient users are all in
treatment on a special fertility unit on a university hospital - by a chief physician referred to as OBC. OBC is concurrently testing his research hypothesis that the repeated miscarriages are caused by the immune system fighting pregnancy hormones. The 398 patient users in ‘Talks on COPD’ suffer from decreased lung function diagnosed as ‘chronic obstructive pulmonary decease’, or in other words ‘smoker-lungs’, as about 85% of the injuries are related to smoking. Regional health care authorities and the Danish Lung Association are behind the site.

The users’ text production is analyzed according to the following questions: What are the main subjects? In what rhetorical style are the messages written? How do they present themselves? How do they relate to each other and to the surrounding world in their writings? From a deep semantic level [12,13], the answers to these questions enable a deduction of the patients’ projects and motivation for participating in the network.

1.2.1. Analysis of text production in ‘repeated miscarriages’

The tone of writing is very personal. Little time is spent on reading, before you understand that these strings of mails to subjects like ‘Pregnancy’, ‘Thoughts and feelings’, ‘Medical treatment’, and others are very personal, and full of grief, pain and longings. Grief over the many lost fetuses; hopes and comforts that next time they might eventually succeed. Most of the correspondences take form of stories. Individual stories that sum up personal experiences with repeated miscarriages, but also ‘dialogical stories’ that develop over longer spans of time. Often, the dialogical stories take their point of departure in a question, such as the story of ‘Pernille1975’. She asks in the heading: ‘How many have experienced that HCG didn’t rise as it was supposed to?’ (HCG is the abbreviation of a blood sample that specifies pregnancy hormones in the blood). A string of replies develops with several episodes evolving around first a pregnancy test showing two lines, which indicate pregnancy, then to some blood samples examined for antibodies and the scanning of the fetus with the observation of heart beat. After four weeks and 25 posts, the story culminates at a second scanning were there is no sign of heart activity. Finally, the story ends with the other patient users offering their condolences, showing their sympathy and encouraging Pernille1975 not to give up hope.

In order to balance the despair of the many tragic outcomes, several users call for stories with happy endings and one user witnesses the meaningfulness of their endeavors by sharing her experience of participating in her sister’s childbirth. Her story has a mythical character that conveys some core characteristics of the support group as a sisterhood. A sisterhood of women, who share a common faith and hope of a child, in which membership can only be achieved by persons with first hands experiences of repeated abortions. Only the story of ‘Anne-Mette’ deviates this. In her contribution: ‘I have made a decision’ she gives up her patient identity and by that her membership of the community. Anne-Mette’s argument is that the project of motherhood has too many personal costs in relation to her general health, to the risk of a premature baby, and to the importance of other expectations of life, such as travelling: “After this decision, my body feels much better. I don’t have “contractions” any longer, and I don’t feel as tired. In a way, my life has been on stand-by since we decided to become pregnant”.

Except from a very emotional and compassionate tone, they talk about their body in a vocabulary that is closer to clinical professionals’, than laypersons’. They develop a shared, specialized language to talk about their illness. Parallel to this scientific
language are a religious tone of voice, were beliefs and hopes of a child has a resemblance to prayer and Christian salvation. This is expressed in its most extreme form in the signatures of the users, accompanying all their mails, e.g.: "Pernille, We have been trying for nearly 6 years; please let our dream come true". “FinallyMum, after 7 years with countless fertility treatments, 6 abortions from week 5-11, a premature birth in week 21. Treated by OBC”. “Noemca, Mother of 3, two on this earth, and one in heaven”. In the signature, the users are not conventionally presenting their academic or professional merits, but life events that have an existential impact on who they are as persons, and what their life is about. But they are also facts that are not normally parts of public discourse.

The patient users complain in a tone of irony and sarcastic humor about the lack of other people’s support of their life-project. The relations to colleagues, mothers-in-law, and friends and families with children are clearly stigmatized by the repeated abortions. But it also becomes clear that the many emotional, physical and relational costs of participating in numerous fertility treatments, of the miscarriages over and over again, and of the ‘burials’ of the dead fetuses are not directly discussed among the users. Indirectly, it becomes evident that the pregnancy project comes at a high price that involves ethical dilemmas; the breaking off of marriages/partnership and of social isolation in regard of the surrounding people’s failing understanding and support of the partly self-inflicted costs.

1.2.2. Analysis of text production in 'Talks about COPD'

Recurring themes in "Talk about COPD" is exercise and smoking, and the communication thus exactly reflects the primary advices from the established system to the chronic COPD patients: smoking cessation and rehabilitation courses. The tone of communication is positive and constructive, and covers a wide range of issues from practical information through exchange of experiences and advice to more abstract and philosophical reflections about what it means to live with a COPD diagnosis. People communicate about e.g. electrical bicycles, retirement- and disability pensions, flexible jobs, and dialogues about these topics often link to information pages along with own experiences with the issue in question.

An example of postings that reflect the fact of living with COPD diagnosis is entitled: "my head has not understood my body is sick", the user (BS) writes that he keeps thinking that he can do the things that he used to do before he became ill: “We all know how it is. We will just do an ordinary thing as emptying the dishwasher, and it is already done in our head, but we have not even started and already lost our breath”. Many agree, saying it is the “horrible truth” and thus reflect on how difficult it is to completely accept a COPD diagnosis. Here, to accept is tantamount to understanding that you cannot do anymore what you could before. Another example shows a contrast between a personal experience and an external expertise. The dialogue starts by a user recommending others to attend rehabilitation courses. "Toria", respond by telling how hard she thought it was to participate in such a course and that she does not dare to join again as she felt she got worse. In response to this, other users write that she has to pull herself together and get out of bed and do something. "Toria" choose to listen to the "expertise", represented here by the other users, and thus also to drop her own concrete experience of getting worse when attending rehabilitation.

The joint project for users in "talk about COPD" is the desire to maintain motivation and the belief that smoking cessation and exercise can actually prolong life
for them. In a cheerful and ironic tone they repeat again and again for each other: you must keep faith in medical recommendations. Notwithstanding that the situation is experienced as a great loss, e.g. to stop smoking, the message is that you must take responsibility for yourselves and take up the fight against yourself and the deadly diagnosis. The message is that you can fight (if not defeat) the diagnosis. Help is smoking cessation, exercise, and the consistent support of other users. Users of "talk about COPD" thus help each other to maintain the motivation to comply with the advice and guidelines issued by health authorities for treatment of COPD patients.

2. Discussion

The empirical studies showed the benefits of patient support groups as activities of expressing personal health experiences and developing a shared identity as a member of a group with common interests and hopes. In this sense, online patient groups are a means to empower patients in relation to giving them the possibility of managing their illness, from collaboration with co-patients and by guidance of professional health care information. The collaboration consists in information sharing and rituals of confirming each other’s endeavours to follow health instructions. This again points to the compliance tradition of health care services as the main effect of the online groups. The communication is about adhering to the recommended treatment, eventually becoming a good patient who either, in the two qualitative cases, is rewarded by bearing a child or by prolonging life, even tough the quality of their ‘normal life’ has changed substantially. The patient users of ‘repeated miscarriages’ pay a physically and socially high price of inactivity and isolation, whereas the COPD patients have to find other qualities of life when smoking is to be replaced by diets and exercise. Therefore, critiques of health care services and of the inherent understanding of a good life in the prescribed treatments are simply not part of their communication.

3. Conclusion

This paper has discussed the questions of the role of patients and online communities in health care services. The answers include otherwise dichomitous positions of empowerment and compliance, as patients are given a voice and room for collaboration in the communities, as well as their communicational behavior on the site are concerned with adhering to the treatment of the health care authorities. New services of online patient groups therefore seem to configure ‘the ideal patient’, i.e. a patient that is responsible for his or her own health situation, managing it in collaboration with co-citizens with the same sufferings, and in concordance with professional recommendations of treatment. This conclusion reflects back on the expectation of the online community as a collaborative medium, which seems to have an amazingly quantitative potential of including many utterances, but at the same time qualitatively, leaving little room for diversity towards body perceptions and expectancies towards life beginnings and endings. The reformatory potential of the online community there for seems to be conservative in regard of health practices and power relations, configuring users into ideal patients of health care authorities.
References

Does telehomeconsultation lead to substitution of home visits?
Analysis and implications of a telehomecare program

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Abstract. This study’s objective was to determine and to explain the potential substitution effects of a nurse-led video teleconsultation service for homecare clients. To that end the largest program in the Netherlands up till 2009 was analyzed. This program’s aim was to realize partly substitution of homecare visits by telecare for carefully selected clients. The study was multi-method. Each video contact was registered, and a sample was described on forms during an 8-month period starting half a year after implementation. (Changes in) the homecare visit consumption of the subscribing (n=335) and of a non-subscribing group (n=288) were compared. Moreover, we interviewed care coordinators, clients, managers, and telenurses and observed the latter’s work. Results show that the frequency of telehomecare contacts varied greatly. For this homecare client population the sheer provision of a video channel to nurses does not lead to substitution. Only for a few clients substitution of the regular homecare visits proved feasible. The discussion section explains this disappointing outcome by technology push and an inconsistent implementation mode. It is argued that telehomecare can potentially serve four different goals, including substitution. For future research we propose consistent implementation modes to realize these goals.

Keywords. Telecare, telehomeconsultation, substitution, homecare, virtual visits, client acceptance, implementation

1. Introduction

This paper focuses on telehomecare, denoting the delivery of care services in clients’ own homes by telenurses. Home telehealth is a practice that is being considered by homecare agencies to help manage costs and to enable independence for seniors wanting to stay at home. The expectation seems to be that telehealth will at the same time lower the care delivery costs while performing better than traditional homecare in enabling frail people to live at home.

In line with this expectation, the number of telehomecare projects is growing. However, these initiatives mostly concern small-scale trials and pilots. Translating such projects into large-scale practices proves difficult. From a societal perspective
it has been demonstrated that video visits are only cost-effective compared to face-to-face visits if virtual consultations reach a threshold workload. Consequently, volume is important.

This paper analyses a Dutch service, called Koala care, consisting of nurse-managed telehomeconsultation through video visits and asks the following: To what extent and why does the deployment of teleconsultation within home care delivery lead to substitution of home visits, and does the experienced effectiveness remain unchanged? The next section provides information on the context and method of study. After reporting the main findings, the potential for substitution of nurses’ home visits by virtual visits within the homecare sector will be discussed. Finally, we argue that the low degree of substitution may be explained by an inconsistent implementation approach. Therefore, we propose four possible goals of telehomecare and four consistent implementation modes to achieve these goals.

2. Context and methods

In the Netherlands, like elsewhere, homecare agencies struggle to deliver high-quality services while staying within ever-stricter financial limitations imposed. In the Dutch healthcare system clients are eligible for homecare services in a publicly funded system. Personal care and housecleaning concern predominantly manual work that is not amenable to substitution by telecare. The initiating homecare agency’s management expected that the following activities would not necessarily require nurses’ physical presence and could probably be substituted: The monitoring activities within the nursing service (e.g. taking the right medicines on the right time), and ‘supportive coaching’ (e.g. helping people to keep to a timetable; stimulating social participation).

The audio-visual connection is realized through clients’ own television set with a set-top box. Pushing a single button on the TV remote control enables clients to contact the service center. On the nurse’s screen appears next to the client a summary of the client’s information. The clients’ participation was voluntary and the teleconsultation, including the equipment and connection, as were offered for free for the length of the pilot period. The local teams consisting of care coordinators, home nurses and other carers were informed about, but had no say in the project. Managers ordered the care coordinators to approach suitable clients, but any decisions about substituting part of the home visits were left to the discretion of the clients and their care coordinator.

The agency’s management developed inclusion criteria to select a suitable client group. This selection produced a list with 463 eligible clients that had to be approached by the care coordinators. In a second wave criteria were stretched based on shorter connection times. Finally, 335 clients were connected at the start of the research period. Their homecare services’ consumption before and after implementation was compared with a comparable group of non-subscribers that had refused telecare (n=288).
3 Results

3.1 Development in use

From June 1st 2007 until January 31st 2008, 3345 video visits were registered. During the pilot period the frequency increased slightly: 289 in July, 301 in August, 358 in September, and about 560 both in October and November. However, then it started to decrease again to around 450 calls. While this is on average only 1 or 2 calls monthly per client, a huge variance in use was encountered: 80 clients (24%) did not use the connection and the majority of them unsubscribed. The rate of unsubscribing being 4 to 5 clients a week during the 8-months period. Over this same period 76% (n= 255), contacted the service center at least once. Forty of those clients used it once (12%). About half used it not more than once per month (n=155, 46%). Another group used the connection at best ‘weekly’ that is between 9 and 31 calls (n=49, 15%). These users tended to test the working of the system from time to time, but have not put it to any regular use. According to the qualitative data, they have it for emergencies, to feel safer ‘just in case’, and sometimes to reassure their relatives with their 24/7 access to a qualified nurse. Only three percent used the system more often than weekly and of them, only five (among which 3 women) had 10 or more video visits per month. In the last group we find periods of frequent, daily use. The frequency of use is not significantly related to any personal characteristics measured, or to the type or length of formal indication for homecare services.

3.2 Perceived substitution by telenurses

The telenurses are experienced registered nurses. In their perceptions a virtual visit substituted a home visit in 39.3% of the contacts for which a form was filled out. In interpreting these results the following needs to be taken into account:

- This substitution involves only few of the connected clients; that is 14 clients consumed 84% of the video visits that were registered to substitute a home visit. The other clients had 2 video visits at most registered as substituting a home visit.
- The proportion of care contacts increased over time (r=.21, p<.01), while the technical (r=-.14, p<.01) and social (r=-.12, p<.01) contacts somewhat decreased. However, a higher use of teleconsultation for care purposes does correlate with a higher number of social and technical contacts (sign. p<.001). This needs to be included when building a business case.

Other care contacts than home visits were also substituted. The nurses’ perception is that priory 12% of the video visits would have been processed by audio-contact. The video visits also substituted a limited part of the family provided care (9%). The nurses’ perceived only a small percentage of contacts with healthcare professionals elsewhere in the supply chain to be substituted (mostly consults with one’s GP).

3.3 A closer look at regular users

No significant differences in homecare services’ consumption (in proportion to days for which the care was indicated) in 5-month periods before and after were observed between the telecare subscribers and the non-subscribers. Because telecare use was low in general, these results are understandable. Therefore, the change in traditional home visits consumption was assessed separately for the small group of clients (n=15) that
did use telecare on a regular basis. In terms of age, gender, household, rural or city residence this subgroup is diverse, e.g. their ages vary from 22 to 85 years. They all had a chronic health condition. For 9 of these 15 clients the registered consumption of ‘nursing’ services did decrease between the before and the after measurements. The decreases could not be explained by any changes in indication level. Examples of substitution involve ‘reminding to take medication’, ‘support in self administering insulin’, ‘monitoring a client at night who feels unwell’. The clients’ satisfaction with the homecare services delivered did not significantly change, although added value of telecare was experienced: (feelings of) safety [11x]; contributions to independent living [4x]; improved health status and preventing illnesses [4x]; more attention for my physical well-being [3x]; more attention for my emotional well-being [2x]; contributes to self-management [1x].

4 Discussion

The limited substitution can be understood in the light of the project’s apparent technology push not being balanced by a users’ pull. This finding seems in line with telecare barriers earlier identified 11-12. First, to generate sufficient volume for the new technology a diverse group of clients was selected. Another study with a diverse client group reported high non-eligibility (65.2%) and client refusals (75.2%) 13. In our study initially relatively more clients accepted telehomecare. However, after having been connected for 8 months, only very few actively used telehomecare. Second, the majority’s underutilization of the video-connection has also been reported before 14-15. A video-channel is not yet a service. In our study most clients had no a-priori expectations of telehomecare’s usefulness. This suggests that clients will not pro-actively start using the system, and so the local care team’s attitude becomes decisive. Their appreciation of telehomecare varied greatly. Many care coordinators and carers did not automatically find it in their interest to stimulate the replacement of home visits by telehomecare. Third, as clients’ subscription to telehomecare was voluntary, the care coordinators may have found it also hard to discuss and effectuate home visits’ substitution with existing clients: Clients indicated that care coordinators or carers had told them the telehomecare was additional. Three new clients, however, got offered a mix of video and (comparatively less) home visits from the start. That clients are always afraid to lose home visits is a prejudice: The clients that agreed to partly substitute home visits, evaluated video visits as more suited than either telephone calls or home visits for these purposes. Fourth, the service center was situated far from the 47 geographically dispersed teams, which serve the clients and coordinate the delivery of regular homecare. Because of the center’s positioning, the care teams were relatively unaware of how to integrate telehomecare into their regular care processes.

Based on the above-mentioned issues, we conclude that the implementation mode was unbalanced, and insufficiently aligned with the initial aim of substitution. That is, a balanced implementation mode also implies alignment among stakeholders’ goals, technological change, and coupled changes in the care services offered, their delivery and organization. Based on a further analysis of the interview data we worked towards a proposal for more consistent implementation modes. We labelled the various means and ends voiced during the project. We categorised these into four distinct modes of telehomecare implementation, which were acknowledged, discussed, and refined by the stakeholders’ representatives during feedback meetings. The four modes are the following: 1) Telehomecare for substitution of specified services mode is based on the
notion that care can be divided into separate parts, which can be delivered by different suppliers through different channels against different costs. 2) **Telehomecare for general substitution** mode states that technology can replace homecare by telecare for a large percentage of clients. It emphasises the ubiquitous and omnipotent nature of technology, which makes it possible to support people in increasing and often unexpected ways. 3) **Telehomecare for complementary services** mode is based on the view that homecare cannot be easily replaced by telecare. Home care is physical and social in nature, whereas telecare is informational and remote. 4) **Telehomecare for experimentation** mode is based on the view that it is not clear how and when this technology could contribute to the quality and cost-effectiveness of care. Table 1 shows these modes and offers a preliminary proposal for alignment in terms of goals, stakeholders, technology, structure and implementation process.

<table>
<thead>
<tr>
<th>Telehomecare for</th>
<th>Substitution of specified services</th>
<th>General substitution</th>
<th>Complementary services</th>
<th>Experimentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals</td>
<td>To replace specified services of specified clients by telehomecare e.g. diabetes.</td>
<td>To save costs and to replace current modes of home care provision by telehomecare as much as possible.</td>
<td>To deliver new, additional services to clients who are prepared to pay. Focus on client needs and demands.</td>
<td>Telehomecare to experiment with new technologies by carers and clients on a voluntary basis.</td>
</tr>
<tr>
<td>Stakeholders</td>
<td>Clients</td>
<td>Carers</td>
<td>Care coordinators</td>
<td>Tele-agents</td>
</tr>
<tr>
<td></td>
<td>Have no choice and receive telecare for specific needs as integral part of the homecare package.</td>
<td>They may loose part of their clients. For these clients homecare is replaced by telehomecare.</td>
<td>Support substitution and integration of telehomecare within homecare delivery</td>
<td>Specialized and cost effective. Narrow and focused.</td>
</tr>
<tr>
<td></td>
<td>Have no choice and receive telehomecare in case of certain conditions.</td>
<td>Carers continue to deliver homecare since telehomecare is complementary to home care.</td>
<td>Have to support substitution strategy.</td>
<td>Generalist and cost effective (by use of protocols).</td>
</tr>
<tr>
<td></td>
<td>Clients are customers who choose to receive telehomecare services in addition to other forms of care.</td>
<td>Carers must be willing to experiment and cooperate with clients, managers and MSC to develop new telecare services.</td>
<td>Effective in advice and in coordinating various channels of care.</td>
<td>Service and customer oriented. Friendly, flexible and broad overview.</td>
</tr>
<tr>
<td></td>
<td>Clients are able and willing to experiment with telehomecare and to share experiences.</td>
<td>Client must be willing to experiment and cooperate with clients, managers and MSC to develop new telecare services.</td>
<td>Facilitate learning and experimentation. Motivation to learn.</td>
<td>High-skilled and communicative. Keen to learn and develop new modes of care.</td>
</tr>
<tr>
<td></td>
<td>Technology is focused. It can deliver a predetermined range of services, and it is geared to the needs of specific target groups.</td>
<td>Technology is able to replace a wide range of home care services in protocolled ways. Joint electronic client record is necessary to coordinate forms of care.</td>
<td>Technology can connect client to various health care providers and other services. Joint electronic client record is necessary to coordinate services</td>
<td>Technology is inherently flexible and can assist in developing new kinds of care. Rapid application development tools.</td>
</tr>
</tbody>
</table>
Structure (role of service center)

| Large scale SC replaces certain home care services in pre-described cases. |
| Large scale SC replaces home carers in pre-described cases. |
| Range of service providers, including an SC acting as customer and service oriented node. |
| Small scale SC co-operates with carers and clients in search of new modes of care. |

Implementation Process

| After targeted testing and refinement, defined care products are substituted. Deterministic, top down and planned. |
| Deterministic, planned and top down approach. Not much room to experiment. Mix of top down and bottom-up. Promoting effective communication with MSC, carers and clients. |
| Interaction, emerging, developing, learning, trust. Communication and collaboration. |

The telehomecare program itself provides on the one hand an easy to use, rich, multi-purpose video channel that is staffed by professional nurses and available 24/7. On the other hand, management’s decision to invite a large, diverse client group to adopt it without first specifying the services to be delivered to targeted groups was risky, especially in view of the aim to evaluate the potential for partly substitution of home visits.

Acknowledgement We are indebted to all participants of the Koala project.

References

IT for Learning Diabetes

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Abstract. This paper calls for IT supporting learning of diabetes self-management. Challenges of self-management and traditional IT tools for self-management are outlined – problems with data discipline, motivation of self-management, and learning as only an add-on to existing technologies. There is a call for IT focused on supporting learning in educational settings in an engaging manner. Two central self-management skills are identified: counting of carbohydrates and the understanding of the dynamics of diabetes factors. Three prototypes designed to support the learning of these skills are presented. Results from the prototype explorations emphasize the need for considering social aspects in learning with IT.

Keywords. Diabetes, self-management, learning, IT

Introduction

Living with the chronic illness diabetes mellitus is a lifelong responsibility of care and treatment. The diabetics manage the illness on a daily basis often with the help of their relatives. The term “self-management” is a keyword in the lives of diabetes. Diabetics are confronted with tasks like regulating the blood sugar, calculating insulin doses or medication, counting carbohydrates in food, logging and monitoring measurements. The use of Information Technology (IT) to support diabetes self-management has increased, in particular those of mobile technology [1]. Most of these solutions support registration and management of diabetes data: A recent literature review on mobile terminal-based applications describes how 26 out of 28 studies present self-management tools focus on tracking personal data, e.g. blood glucose measurements, physical activity, food intake [1]. The remaining two studies relate to an information system and an educational game. Our own technology review (from 2008) pointed towards the same conclusion: the primary occupation for design of IT applications is to register, to analyze and to store data from daily measurements and treatment [2].

In this paper we call for a focus on IT to support learning of diabetes self-management. Since 2007 we have worked on understanding and designing IT to support everyday living with diabetes. We have co-operated with more than 70 diabetics and several family members from Denmark and Germany accordingly. Participants have been between three and 67 years old and type 1 diabetics (T1D) or type 2 diabetics (T2D). Some participants were newly diagnosed and others had more than 20 years of diabetes experience. In the following, we present central learning
challenges for self-management derived from our empirical work and related research. We combine this with discussions of traditional IT solutions for diabetes self-management and argue for a focus on the design and development of new learning tools. Second, we present two central skills important in diabetes self-management: counting of carbohydrates and understanding the dynamics of diabetes factors. Three digital learning prototypes were designed to address one or both of these diabetes skills. Finally, results from design explorations are summarized.

1. Learning challenges of self-management tools

Learning challenges of self-management tools are identified as learning problems that are often not supported by traditional IT based self-management tools.

1.1. The problem with patients – the reality of being human

From a clinical perspective, diabetics, especially T1D, need strict control of the blood glucose level obtained by balancing within a triangle of food, exercise and insulin (treatment). Self-management tools are primarily designed to support management of diabetes related data. However, success of these tools depends on the diabetic’s discipline (rather than the IT application). Several studies point out the problem of motivation in self-management and long term adherence in IT use (cf. [1] for references), referring to the tension between medical ideals and everyday living [2]. Tatara concludes that there is a necessity of “fundamental education regarding self-management of diabetes (…) due to a low interest in self-management” [1:172]. This supports our call for a focus on learning self-management. However, our aim is to design learning tools for diabetes which are not based on the assumption of patients with data-, self-management discipline, and health rationality. Disciplined or not, diabetics still need to be able to read, analyze, and transfer diabetes related data into their everyday living in order to improve adherence. As described by Mamykina “many health monitoring applications continue to rely on a naive assumption that once the data is collected and presented to the individuals, they will draw appropriate inferences unproblematically” [3:929].

1.2. The problem with the swiss knife – learning as more than an add-on

Learning perspectives are argued to be found in traditional self-management systems on the basis of registered data. Self-management systems can be used in a “learning mode” where the analytic use of standard diabetes data is regarded as support for reflection on action [4]. As shown in [5] data can support recall and recollection. Mamykina argued that learning requires more than memory support [6]. From an interaction design perspective, we understand this problem as the problem with the swiss knife. Norman [7] presented that the swiss knife is ideal because it is an “all-in-one” application. However, this all-in-one requires a tradeoff and none of its tools are ideal compared to knives, scissors, tweezers and screwdrivers in an ordinary household. We emphasize the risk of regarding learning as an add-on feature. It is too dependent on other functionalities – if self-management, i.e. tracking of medical data, is not performed, learning based on the tracked data cannot result either. Norman stated “Some people will prefer appliances optimized for the task, others will prefer them
optimized for all-in-one convenience [7:62]. Our aim is to support learning. Consequently, we see learning as more than an add-on to self-management tools.

1.3. The burden of self-management – the fun of gaming

Self-management can be a burden to diabetics – especially to young diabetics (and their families) [2,8]. Our empirical work shows that learning self-management is not necessarily fun either. Our empirical work has casted light on the enjoyment of gaming. Gaming is not the first idea that pops into your mind as a designer when working on a design that needs to counter serious health threats like diabetes. However, participants in our studies have called for and appreciated tools which enable them to play with diabetes factors and introduce and train central diabetes activities in an entertaining way. Especially young diabetics have called for games and presented their own innovations e.g. how they game with blood glucose measurements (the lowest and the highest loose) [2]. Relating these empirical findings to repeated calls for “motivation in self-management” [1] we work with gaming (vs. controlling) for motivated learning.

2. Two central self-management skills

Grounded in the empirical data of our project, we present two central skills in self-management, which we want to address with learning tools.

2.1. The challenges of counting carbohydrates

Carbohydrate counting is one possible strategy for dietary treatment in diabetes care [9]. The strategy is central for T1D. Its application for T2D is dependent on therapy, but also discussed [10]. The strategy requires the assessment of the amount of carbohydrates in food, e.g. by exchange lists, advanced carbohydrate counting. But it allows a greater variety of food consumption. Our project participants reported challenges in everyday practice according to estimation and calculation of carbohydrates, i.e. difficulties to handle nutrition tables and a lack of information and unknown quantities [2]. Research literature states difficulties with numeracy in general [10], and carbohydrate counting, in particular [11] and calls for improvements.

Self-management tools often do not address the issue of carbohydrate counting. Most of the tools in the review [1], which offer data input according to food intake (15 out of 28) either require to specify the amount of carbohydrates, e.g., [12], 13], or use more general categories (e.g., smaller, usual carbohydrate meals), e.g., [14]. Only two studies addresses carbohydrate counting, one by offering a food database to look up information [15] and one facilitated reflection on own photographs, text, and supported feedback from educators [6]. While the first assumes to look up data regularly, the later addresses the learning approach by implementing the concept of social scaffolding [16].

2.2. The challenges of understanding of the dynamics of diabetes

Managing diabetes can sometimes be like an equation with many unknown variables, since blood glucose is influenced by different partly individual factors. It is important to look back on past experiences in order to enable to discover patterns [6] and apply it
in recurrent situations. These reflection skills have to be learned and guided and require engagement rather than large amount of data [6]. Nevertheless, reflection on past experiences does not prevent to be confronted with new unpredictable situations, where trial and error is needed. While some of our participants are open to face new situations, others are scared of new “experiments”, since they cannot overview the consequences [2]. Our target group is limited on traditional material, books, booklets, and their social network and on learning by doing [2] to understand the dynamics of diabetes and thus call for interactive tools to experiment and learn with. Also, in a study, parents and caregivers articulate a need for better educational material (36%) for their children [17]. Research on educational games about diabetes [18,19] have been made, which is similar to our approach, i.e. allowing to experiment with new situations in a safe and enjoyable ways. These studies have shown positive effects on the process of self-management, e.g. knowledge, self-efficacy.

3. Three examples of IT learning tools for diabetes

We have worked on the above-mentioned learning challenges by creating three prototypes addressing learning in an enjoyable way (Table 1). All were low-level prototypes tested the first time with diabetic users and focussed on specific functionality for the feasibility. The purpose was to get new insights for future design.

Table 1. Prototypes for learning about diabetes

<table>
<thead>
<tr>
<th>Prototype</th>
<th>Skills addressed</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>The food quiz</td>
<td>Counting carbohydrates</td>
<td>Mobile game for young diabetics (10+). Photographed portions or labels of food are presented and users suggest carbohydrate numbers. The level defines the difficulty and the degree of help. A score is given to allow comparison with others and previous sessions.</td>
</tr>
<tr>
<td>The dragon quest game</td>
<td>Counting carbohydrates, understanding the dynamics of diabetes</td>
<td>A mobile game scenario for young diabetics (10+) which focuses on an active, collaborative, problem-based learning approach. The game is framed by a story about a dragon needing help on diabetes management. The game includes diabetes related tasks that focus on numerical understanding to be solved in different location of a diabetes camp.</td>
</tr>
<tr>
<td>MaXine/glucose simulator</td>
<td>Understanding the dynamics of diabetes</td>
<td>A PC based learning simulator allowing to experiment with the dynamics of diabetes in an interactive and intuitive model. Basic elements influencing the blood glucose value are used to experience visualized effect over time.</td>
</tr>
</tbody>
</table>

The analysis of the data after testing each prototype with diabetics concludes different possibilities and challenges according to their individual evaluation goals [20,21]. The results are generally positive and point out a series of opportunities to build on in future design of IT to support the learning of diabetes.

One all-embracing outcome of the tests is the need to focus on promoting learning as a social activity. Participants emphasized the use of the prototypes in dialogue with others. Prototypes designed for individual use (i.e., the quiz, the simulator) were
transformed by the participants into a social setting to enable discussion and shared learning. All the designs showed opportunities to incorporated them in learning settings like diabetes education camps, diabetes seminars, but also in the family (vs. add-ons to everyday self-management). Even new usage scenario revealed by proposing the games as awareness tools, e.g. to inform classmates or others about the disease.

The explorations [20,21] showed that most participants found the prototypes engaging and appreciated new ways of learning about diabetes. Basic affordances of IT interactivity, visualization, and feedback were emphasized as positive and in huge contrast to material accessible to the participating diabetics currently (e.g., traditional books). Nevertheless, the long-term effects are unknown and calls for further research to measure the effect on learning and on self-management. Existing research on learning has, however, pointed out general problems faced with the ability and/or motivation to apply skills and knowledge from educational settings to everyday living [22]. The presented prototypes face this challenge by creating learning experiences, which tries to be closer to everyday practices than traditional learning material.

4. Conclusion

In this paper we have positioned our view to put efforts on the learning aspect in IT designed to support diabetes self-management. Whereas it is possible to integrate learning aspects in self-management tools to allow reflection on action, we claim to push learning tools as complementing branch. We have presented learning problems related to traditional self-management tools and argued for the importance of IT focused on supporting learning in an engaging manner. We have presented two central self-management skills and three prototypes designed to support the learning of these skills in different settings. The test of the prototypes showed that the users are interested in social interaction and learning in co-operation with others. This is very different from thinking in designing personal self-management tools. Therefore, future work should focus on technology integrating social aspects in learning.

References


Use of “serious health games” in health care: a review

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Abstract. This inter-disciplinary literature review examines current and potential uses of so-called “Serious Games” in health care. Based on a core body of 51 articles about Serious Games (12 pertaining specifically to health care), it briefly examines examples of use for training professionals, but focuses mostly on how games are used for patient treatment or education and how they can be used for disease prevention and health promotion. This article highlights considerations that must be made when designing and implementing Serious Games for these purposes.

Keywords. Health promotion, patient education, consumer health, serious games

Introduction

As internet use increases and new web applications emerge, ideas about how different applications can be used to various ends in health care continue to change and shift. Although the potential to use the web to educate patients, facilitate peer interaction and aid in the structure and storage of personal health information is recognized, studies of end-user behavior have also indicated that low levels of literacy and technological access, as well as limits on skill, can prevent the type of use that is generally expected. [1] Because text is still the primary mode of communication via most websites, especially issues of (health) literacy and the need for alternatives to text for presenting information cannot be ignored. [2]

Developments in web applications make it increasingly easier to provide interactive information that is not text based. [3] Videos, images and charts and graphs can now easily be uploaded or even created using the applications readily available on many sites. Another type of application that has been signaled as potentially beneficial for health education is the web-based game, which is visual and interactive but not necessarily text-based. Games are receiving more and more attention because their development, implementation and use addresses changing information competencies needed in the current information environment. Development and use of games enables broadening not only the context and methods of health promotion, but also more personal forms of communication and community-based outreach. [2, 4-5] They enable

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a new form of learning by doing that strongly exploits the potential of web-based technologies. [6]

Particularly interesting for health educators and practitioners are the so-called “serious games”: full-fledged, playable games that are deemed “serious” because they are developed not for entertainment, but rather with specific educational goals in mind. [7] Serious games are slowly becoming their own genre in game development. Such games have been successfully used, for example, in business [6], tourism and cultural heritage [8-9], political science [10]), training for various types of managers and professionals [11-13] and are still being developed for use in other areas.

The development and use of serious games in health, however, has been rather limited until now. Despite the aforementioned recognition of potentially using web-based games for patient education, there is still a dearth of information on health-related serious games in academic literature. Developments appear to be isolated and sporadic, and limited to certain medical disciplines, such as psychology and psychotherapy. Nonetheless, interest in using games both in direct patient care/therapy and in health education, policy and management is growing. [4]

This paper presents the results of an inter-disciplinary literature review conducted in 2009 as part of a new study on the potential use of serious games in health care for patient education and disease prevention/health promotion activities. It focuses on current initiatives in place for using games in health care and highlights specific aspects of these for further research.

1. Materials and Methods

In October, 2009, a literature search on serious games was conducted using Scopus, an Elsevier abstract and citation index which, in addition to covering Medline, also returns results from social science publications and the web. It includes access to Open Access Journals, Conference Proceedings, Trade Publications and Book Series. [14] Search terms included “serious games,” “edugames” and “edutainment”, used alone and in conjunction with the terms “health” and “promotion”.

This search returned 62 items – mostly conference papers, peer-reviewed articles and institutional reports. Based on title and abstract, ten of these were discarded because they were irrelevant (e.g.: the word serious was used to describe the nature of a given situation or the word games referred to sports) and one duplicate result was discarded. This left a core body of 51 texts, 12 of which specifically pertained to health.

These articles were reviewed for the following themes: how serious games are currently used in health care; potential future uses of serious games for health; practical considerations. The 12 articles pertaining to health were used for the first two themes, while all articles were reviewed for the third theme.

2. Results

2.1. Current use of serious games in health care – use with professionals

Six articles [4, 12-13, 15-17] examined the use of games in health care from a professional perspective – focusing on the use of games in medical training and
educating young professionals. These included practice exercises to refine skills needed for performing surgery [4, 16], emergency response and disaster preparedness [4, 12], making theoretical medical knowledge more accessible in junior doctor training through home-based programs [15] and simulations for health care management situations [17]. The authors of [13] point to the fact that each new generation of medical students has had more exposure to video games and interactive technologies, whereby these increasingly align with prior experiences and learning activities. Outside of health care, [18] argues a similar point and goes even further by stating that subsequent generations of youth will expect more non-linear modes of learning, such as those seen in serious games.

2.2. Current use of serious games in health care – use with patients in treatment

Such exposure to video games is also a consideration in determining a target group for which such an intervention is appropriate. “Play” is critical in social development – especially for children whose formation rests on testing ideas and developing certain skills and roles. [7] This need for play, coupled on increasing exposure of children in Western societies to video games in daily life means that children, especially, are considered to be a crucial audience for public health initiatives and health education through serious games. [19-23] However, as [20] points out, small children and male teens are the most obvious target populations, but not the only populations. A well-tailored game can reach any population.

For use as a treatment or therapy for patients, it is important to consider what skills and roles need to be learned through a game, for example, specific knowledge about how to live with a certain chronic illness, or more general knowledge about healthy living, including lessons about diet and exercise. Howell [4] gives an overview of multiple projects that have been initiated over the last few years to develop games for treatment and therapy. These include virtual reality exposure therapy via a three-dimensional computer simulation for panic and anxiety disorders, such as fear of heights or fear of driving and video games designed to improve prevention and self-care behavior among children and adolescents for asthma and diabetes. For the latter, players must manage their character’s blood glucose by monitoring insulin use and food selections while engaging in various game activities over a specific period of time.

A similar approach was used in a new Dutch game that helps diabetes patients (and their parents) learn about self-management and which choices need to be made in which situations. [24] The game is for children between the ages of 7-11 years old and is part of a more comprehensive program of education. In the game, children must complete a series of tasks, while at the same time monitoring the glucose levels of their character. If the glucose is too high or too low, then this influences what happens in the game – for example, the image on the screen becomes blurry. This game helps children recognize symptoms and also the proper course of action in response to those actions.

A more recent example of a patient-targeted project is Playmancer, a game program for patients with psychological conditions. [25-27] Games are used in the Playmancer project as therapeutic support and/or motor rehabilitation for patients already in treatment for a range of conditions including schizophrenia, eating disorders, anxiety disorders, post-traumatic stress, addictive behaviors and asthma. [26] The goals of the games vary, but include illustrating difficult-to-explain concepts, providing sensory and emotional feedback, enhancing positive attitudes, assisting in problem solving and modifying behaviors in order to increase compliance. [25-26]
2.3. Potential use of serious games in health care – use for disease prevention and health promotion

Use of games for prevention activities is cited as a possibility in the literature [4] but concrete examples of successful programs are scarce. The closest example is found in the related field of exergaming (games that facilitate exercise, such as the well-known Wii games). However, such games are commercial products and have only been studied since release to the market. Existing studies, such as [28] are descriptive or deliver social critique about such “commodification of healthcare.” [29] With this critique, [29] points to the normative questions related to commercial capitalization upon health promotion tools and ideologies.

One example that is available and can be found online is, “The Great Flu,” from the Ranj Corporation. [30] This web-based game teaches users how a virus works and what resources are necessary to counter-act/contain the spread of a pathogen and to prevent the outbreak of an epidemic. Although reading some text is necessary to playing the game, the instructions are a blend of text and image. Other information, such as the introduction to the game and additional information for those interested in learning about viruses, is provided in video format.

2.4. Practical considerations

The various articles point to a number of different practical considerations. First, because of the novelty of serious games, especially in health care, there is little information available about the efficacy of this approach. Howell’s review [4] gives some hope. One of the projects discussed pointed to a significant difference between the control and experimental groups. In that project, which included a game to teach about diabetes self-management, the number of urgent care and emergency visits was reduced by 77%. [4] Daley [31], however, could only find three small trials on exergaming – and with mixed results. It is important to remember in this case that exergaming products are not only commercial, but they are similar to other public health initiatives – the actual effects can only be measured over the long term. This study does, however, point to the need for more information about both the positive and negative effects of using games for the various purposes mentioned in this paper. Negative effects, such as addiction, tend to receive more publicity, but [21] argues that more research is needed about both negative and positive effects in order to understand how serious games can be most effectively used in health care.

Another issue is specifying what users are supposed to learn from the game. Gunter et al [32] warn against rushing to pour educational content into games in an ad hoc manner and then merely hoping that this works. In addition to a user-centered design cycle [25], sound educational principles and theories must also be used. [32] What competencies are users supposed to have and how can they learn these through the game’s activities? An important part of assessment is how individuals actually transfer the skills learned in the game context to real-life health decisions about their health and how this is made observable within the health system. [7, 33-34]

Given that health and health education for diverse populations are also complex, the task at hand for developers is a large one. Furthermore, as information technologies continue to develop and shift, their use in health care becomes increasingly personalized, with new applications and products targeting the preferences and experiences of the individual. [28] It is necessary, therefore, not only to identify the
specific characteristics of target groups and figure out how to incorporate them into the games, but to consider individual aspects, as well. The importance of enrolling the target groups as co-creators of the games in question should not be underestimated.

Two additional considerations about target groups must be made. First, although persons with disabilities are one group that stands to benefit from ICT [19], there are multiple issues regarding how to package information for these groups, and how to identify the gradation of the learning curve necessary – first to play a game and then to take something away from it. Second, despite the point made by [20] that video games can be beneficial for a variety of groups, it is important to consider that many games have a gendered nature. Girls tend to be more interested in games when they are younger, and lose interest as they get older. [35] This importantly suggests that even relatively well-defined user populations reflect important differences in sub-populations, in this case along both gender and age lines.

Finally, there are also issues of access. The projects reviewed in [4] point to a number of barriers encountered in the design phase, related to the release of projects. Major barriers that cannot be ignored are the invested time and expense of game development [5, 25, 36] as well as regulations that may delay the release of games. [4] In addition to these, it is also important to consider issues of user access once games are developed and released. Many of the persons who stand to benefit most from information technologies do not have access to them. It is still problematic to assume that all patients have regular access, for example, to a computer or the internet. [37] Authors have pointed, however, to the possibility of providing access to health information (including games) through mobile telephones. [34, 38-39] Mobile telephones are more pervasive in daily life and can even be a status symbol among certain groups. Moreover, they have special features that are suitable for the creation of new types of games, but which have yet to be fully explored. [34] The choice to offer games through mobile devices is important because these are potentially “always on” and physically co-present with the intended user. This can make them more tempting to use, which means that essentially, target populations have access to the game at all points during the day. [38]

3. Discussion

There is great potential to develop a number of games that can be used in health care, not only for training professionals or treating patients with specific conditions, but also for more general purposes of disease prevention and health promotion. However, there are many unknowns about the efficacy of such games in practice. Although there are rules governing game design and learning, the process of achieving a successful game for health care is still a slow one, leading to diversity and isolation of initiatives, uneven distribution with respect to different patient groups and a number of unexplored areas for possible use.

It is extremely important to understand the work practices that contribute not only to the technical and social development, but also to the substantiation of use, of serious health games. This aspect was not mentioned in any of the studies reviewed here, even though some of them did point to the complexity and expense of this process. [5, 25, 36] Programmers and researchers must identify and understand the social processes that connect targeted learners to the devices, people, ideologies and situations captured in the game. [38] Currently, there is a variety of genres and modes of play in games,
which leads to an eclectic combination of design approaches. [5] Additionally, the interventions reviewed above are not only about encouraging play to develop skills or teach a lesson, but also about tracking progress, which means monitoring, supervision, and assessment of compliance. [20] Even a single-player game is not an isolated activity. That is, it has a specific rule structure, and also contains specific forms of expertise and normative implications that are important to consider in future research projects. Research must therefore draw on multi-modal design in the development phase, and a multi-disciplinary approach in the analysis.

All technologies must be understood as, at once, both human/social and technical. They cannot be addressed, discussed, studied or understood as a single entity standing alone for individuals to use, but rather, as a complex heterogeneous network – an assemblage of persons and materials that contributes to and supports them. Because serious games are new and still very much in development, the presentation of health-related information through such games (and the human and technical structure around them) is still being shaped. This is exciting and challenging because the decisions that are made now are not without consequence, as these will further shape how serious health games are directed, used and perceived in the future. Research on their further diffusion in health care is therefore imperative.

References


Part F

Safety
From Clinical Practice Guidelines, to Clinical Guidance in Practice–Implications for Design of Computerized Guidance

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Abstract. This paper presents a case study of clinical guidance within oncology clinics. Close to all patients treated within the observed clinics were treated according to a research or standard treatment protocol. The protocol artifacts were however rarely applied in clinical practice instead we found an extensive application of what we have named second order guiding artifacts. The deployed protocols underwent a local adaptation and transformation process when initiated. The protocols were adapted to match the local resources and transformed into several activity specific second order guiding artifacts. The transformation from protocols was executed according to a standard operating procedure. Each activity type had a standardized template ensuring uniformity across second order guiding artifacts. The guiding artifacts were multi-functional and a wide variety of standardized graphical attributes were applied to support effortless appliance. The implications for computerization of clinical practice guidelines are discussed.

Keywords. Clinical Practice Guidelines, Health Information Systems

Introduction

In the last decades Electronic Health Records (EHRs) have been introduced in hospitals with the purpose of improving the quality of care\(^1\) [2]. Concurrently Clinical Practice Guidelines (CPGs) have been extensively introduced, for the same reason [3]. CPGs can be defined as: “systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances” [4]. CPGs may provide both support for decision-making in relation to care of a patient and process support for planning of care activities. CPG application has however not been comprehensive in clinical practice [5, 6] as well as the demonstrated impact of CPGs on clinical outcome is scanty [7]. Therefore attempts have been made on promoting computerized CPGs as part of the computerization within hospitals. CPGs have been computerized either as computer interpretable guidelines (CIG) [8], computer executable guidelines (CEG) [9] or integrated to the EHR [10]. However none of the systems are presently comprehensively applied. Most computerizations of CPGs have been technology driven [9]. Applying a more user-centered approach in the design may help overcoming some of the obstacles for application in practice [11].

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\(^1\) Quality of care includes effectiveness, efficiency, patient orientation, timeliness safety, and equity [1]
Within oncology close to all patients are treated according to a CPG. Therefore we have found it of interest to study how CPGs are brought into clinical practice within oncology and to analyze the implications it may have for computerization of CPGs.

1. Methods

Protocols are a special type of CPGs, providing recommendations for a specific cure for a specific disease. Protocols have its origin within clinical research, where research protocols provide a detailed description of aims and activities in a research project. When a scientific study is over and the examined cure has proven superior to existing treatment, it has become a tradition within oncology to remove all research specific parts and turn the protocol into a standard treatment protocol. Standard treatment protocols are thus less comprehensive than research protocols both regarding format and content. Protocols include a standard patient pathway for the disease in case, 20-25% of the patients within oncology are treated according to a research protocol, the rest are treated according a standard treatment protocol.

1.1. Methodology

An observation study of guideline usage was made in three Danish oncology clinics in spring 2008. Two observers (a physician (the author) and an anthropologist) each made two full days of observations in three oncology clinics, all in all 12 days of observations. Two of the observed clinics are situated in large university hospitals, and one clinic in a big regional hospital. The application of guidance was observed and ad-hoc interviews were made with end-users. Further interviews were made with those who where responsible for transforming protocols into the guiding artefacts applied in practice. In analysis of the data material the following steps were taken: familiarization with material, identification of keys issues, indexing of data, charting and mapping and finally interpretation [12]. In all the clinics computerized patient administration systems (PAS) as well as CPOE for laboratories have been in use for decades. A medication- administration-and-order-entry application was under implementation and a module for physician’s notes were being introduced during the observation period. Computers were accessible in all offices, including the examination rooms in the outpatient clinic but not in the treatment rooms. All clinical staff had access to the clinical IT systems.

2. Findings

We found that in clinical practice CPGs and protocols were scarcely deployed [13]. However, we found comprehensive application of what we have named second order guiding artifacts; forms and standard order sets that have been transformed from CPGs and protocols according to a standard operating procedure (SOP).
2.1. Transformation of protocols to second order guiding artifacts

All the clinics have a research or project unit, staffed with experienced oncology nurses, where research protocols and standard treatment protocols are managed. There is an articulated standard operating procedure (SOP) for starting up of a new protocol. When a new protocol is brought forward a preliminary ‘treatment and examination’ form is made, presenting an overview of activities = resource consumption. This form constitutes the basis for a managerial decision on rejection or initiation of the protocol. Initiation will often include adaptations to local work practice and resources. When adaptations are carried out the project nurse subsequently start the transformation of the protocol into second order guiding artifacts according to the SOP. During the transformation process the project nurse consult relevant actors for discussions of details in the configuration of the second order guiding artifacts. An overview of the adaptation and transformation process is provided in Figure I.

In the transformation process protocols were chopped into bits matching specific clinical activities, each bit was providing guidance on a specific activity. A protocol may in one chapter state how chemotherapy should be administered, in another chapter there may be information on monitoring and in a third place (protocol or a CPG) there may be information on what kinds of adjuvant therapy that should be administered in relation to the chemotherapy. All these bits of information were in the transformation process brought together in one guiding artifact to support the specific activity.

All protocols where found to have the same types of second order guiding artifacts. The second order guiding artifacts were activity specific. This implied that forms were developed for a specific clinical activity like ‘start up’, ‘treatment and examination overview’, ‘ordering of chemotherapy’, or ‘toxicity classification’. For standard
protocols there were 7-10 forms, for a research protocol there was additionally 10-12 forms. In praxis a standard treatment protocols may be constituted only of a set of second order guiding artifacts. The applied second order artifacts were continuously sophisticated based on an on-going dialogue between the project nurses and the clinicians. Although the majority of protocols were applied in all the observed clinics, the second order guiding artifacts were all transformed locally. The types of second order guiding artifacts were found to be close to similar in all the clinics, although variations in the organization of work entailed some differences. It was however stated by the project nurses that it would be possible and maybe even desirable to exchange forms as they were based on the same protocols and the clinics already were cooperating in different ways.

2.2. Characteristic features applied in second order guiding artifacts

The second order guiding artifacts were designed to provide clinicians with an overview of appropriate healthcare for a specific clinical circumstance at a glance. The paper forms were kept as one sheet of paper often printed on both sites. A wide variety of standardized features were applied in the design of second order guiding artifacts—see Table I to ensure a unique presentation of the artifact.

The second order guiding artifacts were found to be activity specific and support several aims like guidance and documentation concurrently [14]. Second order guiding artifacts were due to the portable format present at the point of care and due to the support of multiple aims they were deeply embedded in the work practice.

<table>
<thead>
<tr>
<th>Functionality and features</th>
<th>Example</th>
</tr>
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<tbody>
<tr>
<td>Decision support</td>
<td>- Table for calculation of dosage based on surface area</td>
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<tr>
<td></td>
<td>- Tables for classification of adverse effects</td>
</tr>
<tr>
<td>Process support</td>
<td>- Overview of standard treatment and examination plan</td>
</tr>
<tr>
<td></td>
<td>- Monitoring schema for chemotherapy infusions</td>
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<tr>
<td>Standardized templates for documentation</td>
<td>- Check boxes</td>
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<td></td>
<td>- Vital values</td>
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<td></td>
<td>- Signatures</td>
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<tr>
<td>Physical presentation</td>
<td>- Colored paper forms, with dedicated colors for specific activities</td>
</tr>
<tr>
<td></td>
<td>- Standard order sets integrated in CPOE</td>
</tr>
<tr>
<td>Graphical features</td>
<td>- Standardized positioning of information</td>
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<td>- Tables</td>
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<td>- Underlining</td>
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Table I. Overview of functionalities and features commonly applied in second order guiding artifacts

The second order guiding artifacts supported both decision-making like dosage calculation and process tasks like planning of activities. A good part of data in relation to management of chemotherapy was only registered in a form. The forms were thus archived like medical records.
3. Implications for computerization of CPGs

There is an imperfect evidence base informing decisions on how to translate medical knowledge into routine practice [5]. However within oncology there is a tradition for practicing according to protocols that holds the current best medical knowledge, therefore it is an obvious place to study the translation process. The protocol artifacts were however not found to be deployed in clinical practice; instead a large number of second order guiding artifacts transformed from protocols were observed in action [13]. Second order guiding artifacts are designed to support a specific activity at the point of care and are profoundly embedded in the work practice. This finding is in good accordance with others who argue that presentation of relevant guidance at the point of care is a suitable way to obtain desired behavior [15, 16].

Substituting the observed second order guiding artifacts with computerized guidance entail a series of challenges. In order to support computerized activity specific guidance there is a need to develop activity aware systems [17]. This will imply sensors for activity recognition [18] as well as pervasive computing [19]. In the observed second order guiding artifacts a large number of features were applied to make the artifact activity specific (see Table I). Each artifact had some characteristic functionality and features. To substitute this in a computerized solution development of activity specific interfaces will have to be developed [20]. Activity specific guidance and room for documentation were freely intermixed in the second order guiding artifacts. This is in good accordance with clinical practice, where tasks are mingled although it violates the current concept of task specific information systems.

The second order guiding artifacts did hold both decision and process support [21, 22]. The decision support was typically presented as a table for classification or as calculation tables reliant on patient data. Process support was outlining recommended activities in standard pathways. Both types of support put heavy demands on application logic and semantic interoperability [23] when computerized.

The project nurses were unconsciously applying a participatory design approach in the process of transforming protocols into second order guiding artifacts. This is a suitable and well established method for design of tools for work process support [24]. The continuously ongoing sophistication of the second order guiding artifacts implies that there will be a need for end user development [25] if the current guidance are to be substituted by computerized solutions.

Clinical practice is complex thus it is no surprise that complex tools are required to support it. It can be discussed whether all second order guiding artifacts have to be substituted by computerized solutions. However growing demands on evidence based care and transparency of care will require computerized solutions for support of clinical work [1].

4. Conclusions

Computerization of CPGs for application in clinical practice is a complex job. Examination of how CPGs currently are brought into practice may though give some hints on how to do. Comprehensive narrative CPGs are not applied in clinical practice. Instead numerous activity specific second order guiding artifacts that have been adapted and transformed to the local context are applied. An important issue in my findings is that a wide array of functionality and features are applied in the
transformation. Cooperation across a wide range of research areas will therefore be required to be able to computerize CPGs.

References


Improving Health IT through Understanding the Cultural Production of Safety in Clinical Settings

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Abstract. Health IT is said to have the potential to improve the safety and effectiveness of care. However, it is known that the implementation of health IT can introduce new risks into the environment of care as a result of design failures, implementation failures, and unintended consequences. The design and implementation of health IT systems reflect explicit or implicit assumptions about what constitutes safe practice. These assumptions may clash with those held by patients and clinicians who are the intended users and subjects of the technology. Current perspectives on risk are discussed and an anthropological approach to understanding the construction of safe practices in the clinical setting is explored using research in barcode medication administration.

Keywords. Risk, Health IT, Patient Safety, Practice Theory, Barcode Medication Administration

Introduction

The topics of health information technology (IT) design and implementation provide a canvas onto which engineers, clinicians, administrators and politicians paint a variety of idealized states of clinical practice and patient engagement. Health IT is said to have the potential to improve the safety and effectiveness of care [1-4]. However, it is known that the implementation of health IT can introduce new risks into the environment of care as a result of design failures [5], implementation failures [6] and unintended consequences [7]. Indeed, when faced with the question of a national mandate for Computerized Provider Order Entry (CPOE) systems in the United States, the field of medical informatics was divided in its response [8].

The role of Health IT in patient safety (both as a facilitator and an inhibitor) is an important topic of research for engineers, psychologists, clinicians and health IT professionals. The fields of sociology and anthropology have played a limited role in the development of theoretical and practical contributions in the sphere of informatics and patient safety. This paper explores the potential for an anthropological method of understanding safe practices to make a contribution to the improvement of health IT design and implementation. First, perspectives on risk are reviewed. An illustration of a cultural perspective on risk analysis is offered, with implications for health IT design and implementation. The paper concludes with potentially useful research directions.
1. Perspectives on Risk

Perspectives on risk vary among academic disciplines. Renn [9] describes two “extremes” in conceptualization of risk. At one end is the purely positivistic notion that risk is an objective, measurable feature of an activity. This perspective is aligned with the “rational actor” view of human behavior: that there is one rationality that should guide behavior, and that behavior can be assessed normatively against the expected rational actions. At the other extreme is the purely relativistic view, which sees all risk as socially constructed. Proponents of this end of the risk spectrum, such as adherents to the governmentality perspective that emerges from the writings of Foucault [10], examine the ways that risk is defined by groups in power, such as governments, and how those constructions of risk are used to control the population. Much of the research on risk lies conceptually in between these two extremes. Renn offers a classification system that includes “technical” approaches to risk, economics of risk, psychology of risk, and social and cultural theories of risk. These categories are reviewed and updated below.

1.1. Technical Calculations of Risk

Assigning a numerical value to various risky alternatives is highly appealing to policy makers, insurance managers and others responsible for resource allocation and political advocacy. In the insurance industry, actuarial data provide accurate guidance for allocation of resources and pricing at the population level. Epidemiological and toxicological analyses of environmental risks assist policymakers and advocates in arguing for public resources and regulatory control. The important role of engineering in risk modeling cannot be underestimated. Probabilistic Risk Analysis (PRA), which emerged in the U.S. from work by engineers at National Aeronautics and Space Administration and subsequently the Nuclear Regulatory Commission, quantifies multiple failure points within systems and estimates the probability and consequences of systemic failure. PRA brings together the concept of hazard, or source of danger, and probability, or quantified uncertainty of the likelihood of a bad outcome [11].

1.2. Economic Risk Analysis

Economists are likely now engaged in research examining the implications of the global financial crisis on traditional assumptions about economic risk in capitalist political economies, which have often equated risk with “opportunity” rather than “danger”. Much economic risk assessment takes the form of cost-benefit analysis. Benefits are calculated in terms of money or other assets that have some utility determined by stakeholders in the project being assessed. Despite the fact that economics provides a model for the “rational economic actor” (maximizing utilities), many economists have eschewed or modified the notion, introducing “bounded rationality”[12] or more psychological explanations for behavior. Risk is a key concept for economic analysis at the policy level, the level of the firm and the level of individual financial decision-making. Each of these levels is relevant to health IT evaluation; examples include national policies that encourage adoption of technology in clinics, hospital level analyses of tradeoffs among capital projects, and individual physicians assessing the cost of increased documentation time of an electronic chart vs. the benefit of seeing a few more patients in a day.
1.3. Psychological Perspective on Risk

Psychology provides frameworks for exploring the individual beliefs, attitudes, perceptions of probabilities and uncertainty, and other subjective contextual variables that define risk. These frameworks provide for the theorizing about mental models, heuristics and taxonomies that describe subjectively-held perceptions of risk [13]. These frameworks assume a rational, risk-averse subject. The fields of Cognitive Engineering and Human Factors, while strongly influenced by psychological concepts of risk, have expanded the notion to define properties of systems that produce objective risks, such as “oversimplification” and “brittleness” [14].

1.4 Technology and Culture

Risk and safety in sociotechnical systems has been examined in organizational research [15-18] and science, technology and society (STS) studies [19-21]. These studies examine the meaning and production of risk and safety as elements of sociotechnical systems. Bijker extends analytical possibilities by introducing the notion of vulnerability as an inevitable and potentially desirable characteristic of “technological culture” [19]. A sociotechnical systems viewpoint increasingly informs the work of disciplines such as human factors engineering, as technology becomes pervasive in everyday life.

1.5 Social Theories of Risk

Risk is a central topic of sociological and anthropological theory and research. Most commonly cited are Beck [22] and Giddens [23], who write about risk as a structural component of society in late modernity, including environmental risk, lifestyle risk and perceptions of risk. Douglas and Wildavsky, on the other hand, introduced an explanatory framework for understanding differences in perceptions of risk among cultural groups [24]. These societal perspectives may have limited pragmatic utility for technology designers and implementers; however, ethnographic research is emerging that sheds light on social constructions of risk and safety that reflect individual and group strategies for resisting or reproducing cultural, structural and institutional motifs of risk [25, 26]. Recent examples include a study of sterile techniques in neonatal intensive care by Mesman that brings forth new ideas about the role of spatial ordering and spatial competence in the production of patient safety [27], and work by Waring that examines the “re-constructions” of patient safety incident narratives to reproduce institutional and professional structures [28].

2. Understanding Sociotechnical Risks in Clinical Settings

Barcode medication administration (BCMA) is being implemented widely in the U.S. The vendor-based systems vary, but generally require the clinician administering the medication to scan the medication and the patient at the administration time to ensure that the medication is intended for that patient, at that time, and in the dose and form indicated by the barcode. Research has shown that BCMA and its associated hardware, software and process requirements, produces changes in workflow [29]. Workarounds
to the system have been documented, including the introduction of new “threats” to patient safety [5, 30], using observational methods and human factors paradigms for interpreting results. The perspectives of human factors [31] and cognitive engineering [32] continue to produce valuable insights to the design and implementation of health IT. However, paradigms grounded in engineering are difficult to transpose onto many aspects of health care work that are fundamentally social. A few scholars with technical and social science training have attempted to bridge these disciplines in other settings [33-35], but there remains an opportunity to examine the social construction of safe practice among clinicians in a way that informs technology design.

2.1. Ethnographic Research in BCMA

Ethnographic research conducted among nurses and informatics support personnel during the rollout of a BCMA system produced insights into the challenges faced by nurses dealing with new technology [29]. The ethnographer observed nurses in training, using the BCMA system and being coached by support personnel. Also, the ethnographer attended meetings of the informatics support team and analyzed email communications among the team. The informatics support team assisted the nurses in understanding the new risks posed by the system, and conditioned them to the criticality and appropriate responses to information and alerts flowing out of the system.

The “Overdue Medications” report provides an example of how the BCMA system produced new structural rules for the nurses. The BCMA system was linked to the Computerized Provider Order Entry (CPOE) system, and thus contained a record of each medication order. As the nurse scanned the patient and scanned each medication to be administered, the system checked the orders to ensure the proper actions were being taken. The timing of the barcode scan was kept in the system. The nurses were presented with “Overdue Medications” reports, which listed medication orders that had not been administered as of one hour (or more) past the ordered time. Many medications had not been administered for valid clinical reasons, such as the patient being off the unit, limitations in IV access, or the patient condition. One nurse was observed not giving a medication because the patient was asleep, and in her clinical judgment, that particular medication could wait. However, there was concern among the nurses about responding to the Overdue Medications Report, which resulted in some inappropriate actions in the system to address the “overdue” status. One response was to document the dose as “not given”, even if the dose might eventually be given. This resulted in the dose being unavailable to document against at a later time. If the nurse did need to give the dose, she would be forced to take the next dose in the schedule, which created a cascade of dose scheduling problems that affected subsequent shifts. As the leader of the informatics support team described it, some nurses “perceive the Overdue Meds list as a tool to punish forgetful nurses rather than the safety tool it’s meant to be seen as”. This brief example demonstrates how informatics technologies can change nurses’ goals by attending to one component (on-time medications) in the overall sociotechnical system of safe medication practices, and unintentionally impacting other practices within the system. The problem with the Overdue Medications Report could be addressed with alterations in the technology, the management policies related to use of the information, and/or nursing practice. As participatory design techniques are refined and implemented more widely, practitioners will have increased access to the skills and language to effectively participate in technology design that impacts local work.
2.2. Using Anthropological Theory to Examine Risk in Clinical Settings

An opportunity exists to marry insights on the impact of technology on nursing practice to emerging knowledge of how nurses construct notions of safety and risk in the clinical setting. Hazlehurst and McMullen conducted ethnographic research that examined nursing practice in the intensive care unit [36] and found a number of “orienting frames” that operated as structural resources in the nurses’ everyday production of safe care. The researchers conceptualize orienting frames as shared schema that “provide resources for action in the world and develop through response to action in the world. As such, orienting frames take on their meaning by reference to situated action.” [36] This practice-oriented perspective evokes Bourdieu’s notion of \textit{habitus} [37], or subjectively held but socially shared structures that guide practices. Lupton has suggested that the \textit{habitus} may present an opportunity to explore risk perspectives that can only be accessed through research on everyday practices, where subjectively held dispositions and bodily techniques reveal themselves [13]. Designers and implementers of technology, who now rely on the opinion of expert outsiders on what constitutes safe practice, will receive fresh insights from research on the “risk \textit{habitus}” of clinicians and patients. A better understanding of how safety is produced by clinicians and patients will complement human factors and cognitive engineering perspectives on the role of technology in safe practice.

3. Conclusion

Health IT design and implementation are influenced by explicit and implicit theories of risk. Technical, economic, psychological and human factors approaches to risk dominate this conceptual landscape. Practice-based anthropological research on the social production of safe clinical practice by patients and clinicians will complement other perspectives on risk, producing useful insights for health IT designers and implementers.

References


Integrating Technology-Centric and User-Centric System Testing Methods: Ensuring Healthcare System Usability and Safety

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Abstract. The objective of this paper is to describe a framework for system testing in response to the need to ensure both the usability and safety of healthcare information systems. The approach includes consideration of methods that include both conventional computer software testing approaches (i.e. technology-centric approaches) and extends conventional testing to include consideration of system impact in terms of both usability and workflow (i.e. user-centric testing approaches) prior to system release. The paper describes these main approaches. It is argued that both technology and user-centered approaches should be employed before the release of a complex health information system in order to ensure that it is safe and does not inadvertently introduce error.

Keywords. Software testing, usability testing, workflow, safety, medical error

Introduction

Software testing is a highly evolved area within computer science and software engineering and a wide variety of approaches and methods have been described in these literatures. The approaches emerging from computer science have typically focused on methods for assessing the correctness of code and operation of systems, largely from what we refer to as a computer or “technology-centric” perspective. For example, approaches ranging from “white box” testing (where computer code is examined internally by the programming team to detect error) to “black box” testing (where for specific inputs to a system, the outputs are compared to expected outputs in order to detect error) have become widely used in the software industry, including in development of healthcare information systems [1-2]. Indeed in the healthcare software industry these approaches have become adopted as standard testing methods. A somewhat separate and large literature has also evolved around another type of testing – namely usability engineering and human-factors approaches to system testing, which we will refer to as “user-centric software testing” (as the focus is on the interaction of the software with the user) [3-4]. Despite the large potential overlap and expected complementary nature of technology-centric and user-centric testing, the literatures on these topics have and continue to remain surprisingly separate. Furthermore in

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healthcare, the testing of healthcare systems, including the electronic health record system, remains to be conducted in a coherent and coordinated manner that includes mandatory testing from both the technology-centric and user-centric perspectives.

It is important to note that although in a complex domain such as healthcare, where technology-centric approaches have been widely applied, the additional complementary application of rigorous user-centric testing approaches has been the exception rather than the norm. For example, many current systems are released for use by healthcare professionals without having undergone basic usability testing with representative subsets of potential end users, while other user-centric testing methods (such as usability inspection and the application of clinical simulations to assess system impact) are applied far less often to ensure the safety of healthcare systems before their release. The issue of safety has come to the fore in healthcare. Studies have shown that systems may introduce a range of errors due to cognitive or social aspects of their use [5-7].

1. From Traditional Software Testing To Usability Testing

Traditional approaches to software testing are essential however they focus on ensuring the correct operation of a program at a basic technology-centric level only. For example, in the approach known as black box testing this typically involves creation of test scripts that describe specific inputs to a system along with the expected outputs [1]. In contrast, in white box testing (also called “glass box” testing) the tester has access to and can see the actual program code and can systematically examine it to test that the program code is working correctly (e.g. explicitly testing parts of the software that may involve decisions or iteration). The above methods of testing have become routinely used prior to release of healthcare software [2]. Despite being commonly applied, the rigor of such testing in healthcare can vary considerably, as evidenced by the large number of documented computer software related errors occurring in healthcare.

Furthermore, a growing body of literature has emerged describing issues in adoption and deployment of healthcare information systems that centers around what may be termed socio-technical issues that will not be addressed through traditional software testing. These include, but are not limited to the following: (1) inadvertent and potentially negative changes in complex healthcare workflow resulting from implementation of healthcare information systems, (2) the occurrence of “technology-induced errors”, which although not typical software errors, can lead to erroneous decisions, the ordering of incorrect medications and potentially lethal consequences [7], and (3) inadvertent changes in the social structure, workflow processes, reporting structure, and other organizational structures as a result of implementation of a new system. For the authors, of particular concern is the potential for what has become known as “technology-induced error” [7]. Technology-induced errors are not errors or programming bugs in the traditional sense of software testing in that they themselves are not likely to be caught during black box testing -- instead they may induce or lead to complex cognitive errors.

In our previous work we have shown that features of the user interface to health information systems that may not in themselves be considered “errors” (and hence would not be detected by white and black box testing) may none-the-less lead to serious medical error [7]. For example, based on studies of users of a hand-held prescription writing program we have been able to determine the statistical relationship
between occurrence of less than desirable usability design decisions (e.g. about how to display a menu of drug options) with the actual occurrence of error in medication entry. In order to test for such inadvertent consequences we have had to go beyond traditional software testing methods and have extended approaches that have emerged from the area of usability engineering and human-in-the-loop simulations, as will be described.

Usability inspection methods involve a tester examining healthcare software using an approach that is complementary to but greatly extends traditional program code walkthroughs and white and black box testing to include capabilities for assessing user interactions and potential for technology-induced error. For example, one approach we have used extensively, known as the “cognitive walkthrough” focuses on the tester methodically stepping through a program, system or user interface while noting actions taken by the user, system responses and anticipating potential problems that could occur for typical users [8]. A related method, namely heuristic evaluation, involves comparison of the design and interface features of a system with a set of heuristics or guidelines to detect violations of good user interface design [3].

As important as usability inspection has been in our initial work, we have moved to work on attempting to predict and eliminate more complex cognitive and social problems that arise in the context of real use of a system (either in clinical or larger work group settings). To do this we have employed, adapted and extended usability testing methods. Usability testing moves the analysis of error to more realistic settings and contexts. In our work in rapid low-cost usability testing [10] we have recommended taking video recording equipment into real healthcare contexts (e.g. in hospital wards, clinics etc.) and recording representative user of such systems under realistic conditions (i.e. as they carry out a set of tasks that the system is designed to support) during usability testing. This approach has the advantage of allowing a high level of fidelity in usability testing (since testing is conducted “in-situ” in real settings).

2. Clinical Simulations to Predict Socio-Technical Issues and Problems

Over the past several years, our work in software testing has evolved from conducting traditional usability inspection and usability testing to what we refer to in this paper as “clinical” (or “physical”) simulations. In these clinical simulations we attempt to mimic as closely as possible both the technical and social conditions under which a system will be used, both in terms of setting reality and task workflow as well as social interaction. For example, in a line of studies we have conducted in a Japanese hospital we have examined the impact of a medication administration system by setting up cameras in a hospital room to record all physician and nurse activities while interacting with the system and patients. In addition, borrowing from our work in usability testing we deployed low-cost screen recording programs on all the computers present in the room to obtain data on both the computer actions and all human physical actions during the complex process of administering medications to a patient (while at the same time interacting with a new medication administration system). Furthermore, through role playing and addition of multiple “players” in the simulation (e.g. doctors and nurses) we have been able to evaluate the impact of such systems on group communication and workflow. For example, in testing in this manner a commercial system that was about to be released we found that if a nurse or physician was accessing patient information and then was called away from the computer, the system could potentially lock other
health professionals out from the patient information and thereby create a communication gap and safety issue. Based on this type of testing recommendations were made for examining and modifying the level at which patient record information could be locked out by a single user. In further work with this system we also showed that under emergency conditions the nurse or physician using the system might end up being locked into a rigid sequence of operations that might reduce safety (of the patient being administered medication). Hence under emergency conditions (based on our simulation work) we have recommended an emergency override capability that would release the health professional from time-consuming sequences that might impede safety.

In related work we are examining the implementation of a large institutional health record system. In this work we have been able to determine from simulations that use of the system in isolation (i.e. asking users to enter medications into the system) was generally done correctly by a group of first time electronic record users one month after initial training (using test scripts that were modified from those employed during black box testing). However, when data from actual doctor-patient-computer interactions were considered (from situations where such interaction was video recorded and analyzed) it was clearly detected that there were a number of issues and problems related to use of the system by the physicians while patients were present in the encounters. This feedback (which was not determined until clinical simulations were conducted) was used to modify subsequent training of new users with advice on styles of use of the system during the complex social interaction with patients. In addition, feedback was provided to the system implementers regarding customizing screen defaults and information to reflect local cultural standards.

3. Moving from Clinical Simulations to “In-Situ” Naturalistic Studies

The approach we have taken in examining socio-technical aspects of healthcare system use has evolved and emerged from our experimental work in usability testing. Our current approach has extended this to involve: (a) clinical simulations conducted “in-vivo” (i.e. within the actual setting of use of the technology but involving simulated situations) and (b) naturalistic recording of live user interactions with the technology, also in “in-situ” (typically conducted as a follow-up to completion of an initial phase involving clinical simulations). Using this approach, an initial clinical simulation can be used to gain a baseline assessment of errors that may result from the complex human-computer interaction in a work-task setting (e.g. in a clinical setting). In order to confirm our predictions, we then typically enter a phase where the same recording equipment (put in place) is then used to record live interactions (e.g. computer screens, external video recordings) [10].

4. Towards Integration of Technology-Centric and User-Centric Approaches

Given that healthcare information technology is a safety critical domain, it would seem imperative that a full range of software testing methods not only be recommended prior to release of systems, but that this also be mandated. In our applied work in attempting to make healthcare IT safer and to create practical approaches that consider both the
technical and social aspects of healthcare information systems, we have developed a framework that essentially serves as a “checklist” of types of testing that should be conducted prior to releasing new or customized systems in healthcare settings (see Figure 1). In addition, we argue that such testing ethically be conducted before systems are released for real use, despite the fact that post-implementation studies of system error are also needed (i.e. studies that have been and continue to be conducted after a system has been released for real use, e.g. [5]). It is argued that we must also become more proactive in predicting and preventing system error long before system release using methods emerging from usability testing and clinical simulation.

Moving from left to right across the continuum in Figure 1, we see an increased focus on the quality of user-interaction with the system, starting at the individual level (i.e. the level of a user interacting with a system in isolation) and then moving to testing methods that can be applied (e.g. usability testing and clinical simulations) to analyze more complex work activities and assess the safety of systems involving multiple players. It should be noted that the continuum corresponds to a multi-layer model of human-computer interaction we have developed and extended to healthcare (based on the work of Eason [9]). This model consists of three layers of human-computer interaction: (1) the layer of the individual’s interaction with a healthcare information system in isolation, where technology and low-level usability issues are the focus (2) the layer of the user using a healthcare information system to carry out an isolated work task, and (3) the layer of use of the system in the broader organizational and social context of the healthcare workplace. From our project work described in the previous section, we have found that all the above approaches need to be applied prior to system deployment in order to ensure system safety in healthcare. It is our ethical responsibility as system evaluators to ensure that each of the types of system testing approaches depicted in Figure 1 are adequately applied before system release.

5. Comparing Advantages and Strengths of Approaches and Need for their Integration in Healthcare Software Testing

Each of the methodological approaches depicted in Figure 1 have their strengths and weaknesses, necessitating the use of each of the methods depicted prior to releasing systems for real use. For example, white box and black box testing methods focus on
proving system logic correctness and thus are necessary tools in preventing system errors and consequent adverse events. However, as illustrated in examples of our work described above, systems may, and still are routinely released for use without the healthcare organization understanding what the full impact of the system will be on workflow, error, social interaction, communication and coordination. Usability testing methods do move the focus of testing to more realistic settings and contexts but still typically involve presentation to users of fixed artificial scripts. Moving to clinical simulation allows for a higher level of fidelity and for dynamic testing of systems under close to real settings, workflows and contexts of use. Finally, by moving to naturalistic studies we can validate our predictions (from simulations) regarding the socio-technical impact of technology. We argue that all of the above methods must be applied in standard practice so that progress will be made in ensuring system safety.

6. Discussion

There are many methods that can be used to study the impact of computer systems in healthcare. For example, commonly used post-implementation methods (e.g. interviews with users, observation of users interacting with systems and focus groups) have revealed a number of classes of errors that may result from use of a new system [5-6]. However, to ensure the safety of our healthcare systems it will be critically important to extend typical software testing that is conducted to routinely include methods such as usability testing and clinical simulation that can used to detect important implications of systems prior to their actual release (and furthermore these predictions can then be compared to the results of real use [10]). Indeed we feel that health informatics should take a more proactive role to improving system safety by recommending the mandating of a more complete and full range and spectrum of testing approaches for healthcare system prior to their release. This should include application of the approaches described in the paper to pinpoint specific system features and aspects that impact on healthcare cognition, workflow as well as social processes.

References

Towards safer medication use
– in practice

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Abstract. We study the drug order and delivery process for patients receiving
municipal home care services in Norway. Using interpretative qualitative methods
we document an extensive but “invisible” manual and distributed quality assurance
among the involved health care providers. We call for selective automation of
medication use processes in this setting as these distributed, highly manual micro-
practices are vital to quality assurance in practice.

Keywords. medication safety, medication errors, municipal health care,
éutomation, invisible work

Introduction

Studies of safety of care have identified the medication use process as one of the
greatest risk to patients [1] and in 1999 the US Institute of Medicine estimated that
medication error was the eighth leading cause of death in the United States [2]. While
these insights are applicable to most western countries [3] recent research suggests that
these estimates are understated [1]. Efforts towards reducing preventable adverse drug
events2 include surveillance and reporting, and automated systems for prescription and
drug dispensing [1, 4]. The emphasis on automation is illustrated by the Norwegian
Minister of Health and Care services in her recent comment on the use of multi-dose
machine dispensing in home care and nursing homes: “This will give patients safety. ..
The quality assurance is good and this is the safest alternative we can offer patients
when it comes to medications” [5].

Adequate collaboration among involved health providers in a patient treatment
chain is crucial yet challenging as the new bill on Coordination Reform in Norwegian
health care points out [6]. As “more [medication] errors will be eliminated by focusing
on systems than on individuals” [p.40, 7] collaboration is crucial also to safe
medication. The focus of our paper is on non-individual, preventable adverse drug
events – tied to medication use as a distributed process for patients receiving municipal
home care services. These patients are chronically ill, mostly elderly, and often with an
above average need of drugs. And, the associated drug order and delivery process often
involves numerous health care providers: the general practice, hospital, nursing home,

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2 Medication errors and adverse drug events are two different categories of events whose overlap –
preventable adverse events - are targeted by improvement efforts in the field of patient safety [p.142, 1].
pharmacy and the home care service. Information follows the patient across the many geographical, institutional and professional boundaries within Norwegian health care, but every actor in a treatment chain typically has focus on their own available information and setting. We study how the informational foundation for this particular drug order, dispensing and delivery process is generated, read and maintained locally.

The city council in our study initiated a project in 2004 to develop a common electronic drug chart for reducing the risk of medication errors for these patients. The goal was to have one common drug chart to be employed by all those involved in the medication use process. We study organisational and technical routines within and between home care, pharmacy and general practice before such a common drug chart is established, focusing on the quality assurance of the informational foundation and how it connects to practicalities for ordering, dispensing and administrating drugs: who does what, when? We document an extensive but “invisible” manual and distributed quality assurance that might be circumvented by current automation efforts. A biased focus on the benefits of automating individual events [7] in the medication use process threatens the foundations for today’s distributed quality assurance of the process. This is not an argument against automation, but a call for selective automation.

1. Methods

This study took place in a mid-sized city in Norway dubbed CityN (population 170,000), where close to 2000 individuals living in private homes receive assistance from the home care service with procuring, handling and administrating their drugs. Our qualitative interpretative approach [8] seeks to contextualise the collaborating actors in the drug order-delivery process on their own terms. We focus on the different local practices as well as the collaboration between them. Observations were conducted regularly over two periods of 3 months in 2007 and 2008 by two of the authors. We observed nurses in two of the city’s 10 home care zones, health secretaries in one general practice, pharmacists in one pharmacy, and we conducted semi-structured interviews with the health manager in each of the observed units. Data analysis and data collection overlapped and we have on two occasions presented early interpretations in meetings with several of the study subjects. The authors collectively went through data analysis sessions where interpretative categories were developed from iterative coding of data.

2. Case

All medication use assisted by home care in CityN is considered for multi-dose drug dispensing. Multi-dose drug dispensing means that drugs are machine-dispensed into units of labelled disposable bags. Each unit bag holds all drugs intended for one dose occasion and a patient’s multi-dose delivery typically contains a fortnight’s medication. Only the patient’s general practitioner (GP) may order multi-dose dispensing which requires the GP to keep a complete and current list of the patient’s regular medications. The GP faxes a printout of this list to the local pharmacy to update or initiate a new multi-dose order. This list is the basis for the order established by the pharmacy in their multi-dose supplier’s electronic ordering system. Home care in turn receives multi-dose packages from the pharmacy and delivers and assists in the administration of drugs.
according to individual patient needs. In the following subsections we present three representative case vignettes illustrating quality assurance strategies as observed in practice.

2.1. The General Practice

The GPs in CityN on average treat 13 patients receiving medication use assistance from the home care service. At this general practice there are 4 GPs, one intern and five health secretaries. We are observing in the reception area, behind the workplaces of two health secretaries. When the doors open at 08:00 a.m. there is already a group of people waiting. The doctors collect their own patients in the waiting room, and the secretaries keep track of the doctors’ progress as the patients later come by the reception to pay for their consultation.

The phones are opened for incoming calls at 08.30 but only flashing lights reveal the soundless calls on all incoming lines. Medical appointments are not available for several weeks, and only a limited number of appointments are available for emergencies. The health secretaries are therefore repeatedly involved in negotiations over the time and availability of the GPs, while the GPs on their part need to handle patients on both prescheduled and emergency appointments, as well as occasionally being called to assist in the emergency room.

Calls to their ‘secret’ number are not silent. This number is used by home care and the pharmacy to allow priority over other calls. In principle these calls should always be put through directly to the GP. However, if the GP doesn’t answer, the negotiations begin. “Is Dr. NN particularly busy today, or is he out of the office? Have we already bothered him a lot today?” – They discuss whether they should call him themselves or if they should take a message and leave a hand-written note in the GPs mail tray. Home care often receives nursing reports with a list of medications when patients are discharged from the hospital. The GP however may have to wait up to four weeks to receive the official discharge letter. One of the GPs tells us about receiving a note from the reception, after being out of the office all day. A multi-dose patient had returned from the hospital and there were changes to her medications: “They [home care] call us, and say you have to update .. and give a message to the pharmacy”. To the question whether he updated the multi-dose order based on this paper note, he responds: “Yes, I did. I asked in the reception about the note the next day. Then I double check the discharge letters when I receive them to assure that they are consistent with what I order”. Being responsible for a patient’s multi-dose order requires awareness of when changes to the order are needed, but there are no standard procedures for timely communication about changes across actors. In a busy work day, health secretaries then often act as intermediaries to ensure timely flow of information.

2.2. The Pharmacy

About 500.000 prescriptions are issued in CityN each year and the city council has contracted one pharmacy chain for their multi-dose orders. There are two pharmacists and two pharmacy technicians at work in the observed pharmacy, which is quite small and crowded. The doors open at 09.00 and they all pay attention to whether the customers are served; with the sound of opening doors they all lift their heads to check. Accordingly interruptions abound, and they spend five minutes here, five minutes there.
One of the pharmacists sits by the computer updating the multi-dose order on a patient whose drug delivery is to be changed. She makes notes in the margin of the fax sheet from the GP as she compares it to the previous electronic multi-dose order on screen. The ordering system sorts the drugs as according to ‘in the bag’, ‘other regular’ or ‘in need’. The GP on the other hand lists all regular drugs together, indicating that it could all (in theory) go into the multi-dose, although only solid pills are suited to machine packing. This difference often necessitates detective work at the pharmacy; in addition to that this GP has not indicated what the changes are since the last order. Moving down the GP list she is puzzled when reaching ‘Cipramil 20 mg, 1½ tablet, (i.e. 30mg x1)’ (Figure 1, to the left). The local multi-dose order lists an equivalent drug: ‘Citalopram 10mg’. After some searching she finds another entry further down the multi-dose order screen (Figure 1, to the right) where it says ‘Citalopram 20mg’. “I don’t know why it comes up like this. Maybe it is because of the start-up dates. And these pills can’t be divided – that’s why there are two different ones.” Further down, she also finds inconsistencies in the timing of intake. By the drug Haldol it says: “1 tabl. Vesp” while in the multi-dose order it says “1 tabl.” in the column for 08.00 a.m. “Is this an intended change, or did we get this wrong from the beginning”? The pharmacy is concerned with drug-drug interactions and the different modes of dispensing and delivery of drugs and these differences in foci requires the pharmacist to establish what will constitute the new – correct – multi-dose order for automatic machine dispensing.

2.3. The Home Care Service

One of the observed home care zone offices serves about 250 individuals of whom almost 150 receive some level of medication use assistance. Today there are 11 enrolled nurses and two trained nurses on duty, and the office is busy during their 45 minutes handover conference before they all start their patient rounds at 08:15. The weekly drug delivery has arrived from the pharmacy and after her patient visits the responsible nurse prepares the drugs for distribution to the patients’ homes.

She is in the medicine room and the loose-leaf binder containing printouts of home care’s patient medication charts sits next to her on the desk as she runs through each delivered multi-dose package. Ever so often she gets interrupted by the other nurses as they stop by the medicine room or phone to ask her questions. It turns out that all but three of the 25 multi-dose packages delivered this week need extra attention, either by adding medications or repacking the multi-dose content into a regular pill dispenser.
“This has to go into a pill dispenser. Albyl-E is in here and he shouldn’t have that anymore. And the sleeping pills are not here either, and we have to add them, and then it is just as easy to rip the multi-dose open and put it all into a pill dispenser.” She transfers the multi-dose content into a pill dispenser with 4x7 compartments covering a week’s intake. The small plastic bags are ripped open and the pills are dropped into the compartment for the appointed time.

Later, the other nurse performs the required dose and identity control of the manually dispensed drugs. This nurse graduated only six months ago and has limited experience with drug dispensing. She needs to identify each pill, and empties one compartment and tries to place its content with the respective drug name on the printed drug chart. As she only recognises one of them, she looks up the internet version of the Physicians’ Desk Reference. By comparing pills to photographs on screen she is able to identify which pill is which drug. She then proceeds to check the number of tablets in each compartment. Her first reaction is that this is wrong. Then she finds that the alternate day pattern of one drug has been displaced by one day. She uses a pair of tweezers to replace them before putting a white tape across the pill dispenser to indicate that her quality control is complete.

The nurses spend a lot of time making sure they receive up to date information, revising it if more current information is available locally, and compensate for missing information, missing drugs or lack of resources and experience.

3. Discussion and Conclusion

A systems approach to studying medication errors and adverse drug events suggests that “although individuals make errors, characteristics of the systems within which they work can make errors more likely and also more difficult to detect and correct” [p. 40, 7]. Leape et al. [7] thus argue for the need to search for the Third-order Whys; 1st) why did the incident occur (what was the error), 2nd) why did the error occur (what was the proximal cause 5), and 3rd) why did the proximal cause occur (what was the underlying system failure)? Drawing on their work, we adapt it to an inter- rather than intra- organisational setting. We are concerned with the second and third order whys along the distributed chain of drug order and delivery. We analyse the manual quality assurance strategies observed in this study according to their function – to prevent possible errors. We find; First, they seek to establish trust in the information they receive from others by evaluating and sorting it according to their local informational foundation. Secondly, they compensate for missing, incomplete and/or inaccurate information by requesting missing information from others, revising according to local knowledge or seeking clarification. And third, they have strategies for handing over tokens to alert the next in line in the process of the need to take action (in a busy work day). And in line with Leape et al. [7] we find that these functions seek to counter the underlying systems’ failures of ensuring availability of timely and up to date drug and patient information in standardised formats, enough qualified staffing, and medication order tracking and conflict resolution.

Having multiple handlers increases the risks of errors. Ideas of end-to-end automation in the medication-use process materialize in a range from computer assisted physician order entry (CPOE), robotic handling, packaging and sorting of drugs at the

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5 Proximal cause is defined by Leape et al. [7] as the apparent “reason” the error was made.
pharmacy, to stand-alone nursing-unit based cabinets at the point of administration of
drug to patient. Electronic transfer of medication information between the observed
actors in this study may reduce errors compared to taking phone messages that are
transferred on paper notes. And automatic drug dispensing may reduce errors in dose
and identity checking. But still, the GP must be made aware of the need to update the
order and health secretaries may still need to act as intermediaries. Pharmacists will
have to question the order from the GP and update the multi-dose order according to
their professional competence and local information. And the drug order by the GP will
sometimes be outdated by the time the automatic dispensed drugs reach the home care
nurse and will require manual repacking. Home care nurses may then lack the
appropriate experience and resources to safely perform the dose and identity check.
The GP – being first in line in this process – also has no chance of knowing about all
possible contingencies at the time of ordering the drugs. So, while current automation
efforts may help in many aspects, they address that which Leape et al. [7] call first
order errors or individual incidents. The chance that errors are intercepted however also
increases with the number of handlers [7] and as automation potentially makes these
processes less transparent, intercepting errors along the chain may be increasingly
difficult. Thus, these distributed, highly manual micro-practices – of comparing,
adjusting, triangulating and double checking information – are vital to quality
assurance in practice. They take place alongside the patient’s trajectory across the chain
of institutions and units involved in treating the patient – over time. Given the
potentially serious consequences of medication errors, no wonder national health
authorities are anxious to minimise the risks. We contribute to the call for well
considered automation efforts that consider the social aspects of technology
implementation [4, 9] and the collaborative aspects of safe medication use.

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Patient Safety and Sociotechnical Considerations for Electronic Handover Tools in an Australian eHealth Landscape

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Abstract. The Australian Commission for Safety and Quality in Health Care (ACSQHC) coordinates national improvements in a range of complex health system problems including clinical handover, and has funded a range of handover improvement projects in Australia. One of these, the SafeTECH project in South Australia has developed guidelines for safe use of electronic handover tools. These guidelines were developed using evidence from three hospital case studies into the use of an electronic tool to support different types of shift-to-shift handover. This paper provides an overview of the project, and highlights challenges for patient safety in the design and use of electronic tools to support clinical handover in a busy clinical environment. The paper then considers these challenges within the broader context of the Australian eHealth landscape. Australia’s National eHealth Transition Authority (NEHTA) is actively developing eHealth standards and infrastructure requirements for the electronic collection and secure exchange of health information. The paper argues for flexible standardisation in the design and implementation of electronic handover tools to ensure that all key dimensions of the challenges faced in ensuring patient safety are addressed.

Keywords. clinical handover, electronic handover tools, patient safety, human centred design, eHealth

Introduction

“The challenge of patient safety is not only clinical, but also organisational. To succeed, patient safety initiatives must be designed and executed using change management principles such as congruent changes targeting multiple components, specific change management roles for different participants in the care-delivery process, implementation through dedicated support structures and multiple tactics, and institutionalisation through enhanced workforce capabilities and opportunities for continuous learning.” [1]

The Australian Medical Association defines clinical handover as “the transfer of professional responsibility and accountability for some or all aspects of care for a
patient, or group of patients, to another person or professional group on a temporary or permanent basis.” [2]. The Australian Commission for Safety and Quality in Health Care (ACSQHC) has identified handover as one of its top priorities, and also takes the lead role on handover on behalf of Australia in the World Health Organisation’s ‘High Fives’ initiative [3]. The ACSQHC has funded a number of handover improvement initiatives in Australia, including the SafeTECH project in South Australia.

For the purposes of this paper, we identify two types of handover. The first, “shift-to-shift handover”, is transfer of responsibility and accountability between treating teams during an episode of care, typically at change of shift during a hospital admission. The second, “discharge handover”, occurs at the end of an episode, when a patient is discharged from hospital, for example. For convenience, we refer to these activities as “handover” and “discharge” respectively.

This paper describes the SafeTECH project, considers safety issues in the context of handover, and goes on to discuss the interrelationship between data collected during handover and data standards for discharge summaries. The paper argues for flexible standardisation in the design and implementation of electronic handover tools to ensure key dimensions of the challenges faced in ensuring patient safety are addressed.

1. Shift-to-shift handover

Handover within an episode typically involves a team. During a normal weekday, a handful of medical “teams” may be responsible for 70 or 80 patients; at the end of the day responsibility is transferred to a smaller group of (say) three medical staff; the next morning, responsibility is transferred back to the larger team. Handover covers many patients, and there may not be an opportunity for one-to-one discussion about individuals. Sicker patients will receive more attention; a stable patient may get a brief mention, or none at all. Reduced working hours for hospital clinicians have led to an increased number of shifts, and more clinicians caring for the same patient.

Handover is important for continuity of patient care, and inadequate handover can lead to poor patient outcomes [4]. Effective and efficient handover of information, responsibility and accountability is now recognised as crucial for the delivery of safe high quality health care [5], and shift-to-shift medical handovers have been identified as high-risk areas in need of urgent attention [6]. Despite this awareness there is limited evidence about best practice, and few frameworks for enhancing understanding, improvement or evaluation of handover [7]. However, until the recent projects funded by the ACSQHC there was little work that directly engaged end-users or addressed the transfer of both responsibility and accountability [8,9]. At the same time, there has been research into the design and use of electronic systems to improve handover [10]. This research is positioned within the broader diffusion of information and communication technologies in health care, premised on the anticipated benefits of ehealth:

“Electronic health information (or e-health) systems that can securely and efficiently exchange data can significantly improve how important clinical and administrative information is communicated between healthcare professionals. As a result, e-health systems have the potential to unlock substantially greater quality, safety and efficiency benefits.” [11].

While ehealth systems can improve information access and delivery, they also raise sociotechnical, clinical and legal challenges which become apparent when
sophisticated solutions meet with mixed success, or fail to generate their anticipated benefits [12-14]. These shortcomings have led to calls for the use of sociotechnical approaches to design, implementation and evaluation of health projects involving information systems [15,16]. Despite an awareness of the need, ‘engaging users’, remains difficult, with only a few case studies illustrating the benefits of involving clinicians as co-participants in the development, use and evaluation of systems [17-19].

2. SafeTECH

The ACSQHC funded the SafeTECH project to develop national guidelines [20] for the safe use of electronic handover tools based on the results of case-studies in three South Australian hospitals using an electronic handover module to support handover. The module was purpose built within the Open Architecture Clinical Information System (OACIS), and provides a screen showing six fields with headings specific to the transfer of information at handover. They record: Current Problems; Current Plans; Management Plans; Discharge Plans; Handover Notes; and Other Notes. Clinicians can use these screens to enter and update the handover notes for each patient.

The research compared baseline data on handover practices at each hospital with practice, communication and indicators of safety after implementation of the handover tool. Each hospital had differing quality improvement processes, staff rotations and approaches to ICT training; hence not all of the observed changes could be confidently attributed to use of the handover tool. However, findings from the three case studies enabled the development of the guidelines for safe use of electronic handover tools. Detailed findings of the SafeTECH research are documented in a separate report [21].

3. Shift Handover – Safe Use of Electronic Tools

Improving the safety and quality of clinical handover is challenging. Considerable effort is required to manage cultural and behavioural change, and any electronic tools need careful design and implementation. A simple technology-based model of information exchange based on standard protocols may not find universal acceptance. For example, “[n]ot all clinicians involved in this study were in favour of SBAR 2 as a communication framework for clinical handover…one participant did not consider it a ‘normal’ way of communicating.” [21, p51].

Convenience and reliability of access to the tool can become a safety issue. Fixed workstations may not be suitable for bedside handover, and mobile solutions may need to be considered. The reliability of each technical component of the system must match the clinical requirements for its use. The physical space used for handover also matters. Space, comfort and lack of distraction will improve the handover process: “cramped space, interruptions, distractions, risks to patient confidentiality, single computer screen for shared use and lack of chairs all appeared to reduce clinician comfort, make handover difficult and introduced risks of errors to handover” [21, p64].

New systems must be quick and convenient to use in ‘normally’ busy clinical settings. A system which is abandoned when staff are under pressure could be a major

2 SBAR is a handover model which specifically considers Situation, Background, Assessment and Recommendation for each patient.
safety risk. Use of a new tool for handover will inevitably be seen as one more task added to a shift, and taking extra time. “Observations suggest that when the electronic tool is not updated this leads to extra effort and time in handover.” [21, p22]. Use of a tool may also lead to a reallocation of time between tasks during a shift, although reuse of data entered using while using the tool could “give back” some of the lost time.

Some data and communication risks became evident during the project. “The use of the electronic tool often caused multiple screens to be open on the computer. This necessitated quick switching between them, and invited the possibility of mismatch between screens and patient data entry.” [21, p21]. The tool could also distract attention from concurrent discussions about handover – tasks or clinical details could be missed: “the on-coming RMO who sat at the computer…did not appear to communicate with the off-going registrar” [21, p26].

Based on Australian experiences with clinical handover improvement and electronic tools, it is imperative that the tools are seen as mechanisms to support, not replace good clinical handover communication; patient safety must be an embedded property of the entire system [22]. Study “interviewees were eager to state that technology should not be allowed to replace direct or verbal communication” [21, p51]. It is also important to differentiate between safe use of an electronic tool and any implicit assumption that this will inevitably lead to safer clinical care; safety in the delivery of care requires continuing vigilance and review in each setting where a new system is introduced, and then periodically thereafter [23].

Many of these issues have aspects in common with the use of ehealth in other clinical settings; good practice for handover mirrors good practice for ehealth in general.

4. NEHTA Data Standards

The challenges faced in safely developing and using electronic handover tools cannot be addressed in isolation from other ehealth initiatives. Australia’s National eHealth Transition Authority (NEHTA) is responsible for developing national ehealth standards and infrastructure for the collection and exchange of health information. NEHTA’s work covers specific categories of healthcare information and communications; identifiers for patients, providers and products; moves towards an individual electronic health record (iEHR); and linked discussions on privacy, security, access control, authentication and consent. NEHTA’s recent focus has been on standards for the exchange of information, including discharge communications, between organisations. Health sector stakeholders can use NEHTA’s emerging standards to ensure they can safely engage in electronic information exchanges beyond their organisational boundaries, although NEHTA is not currently developing standards at the level of functionality within clinical systems and has not developed standards or guidelines for clinical handover.

Communications during clinical handover are conceptually different from those at discharge. Transitions at handover are less well delineated, and represent a passing on of clinical activities within a current active care process to another provider. Data include clinical notes about work in progress; they may include tentative or differential diagnoses which are subsequently discarded, or task lists for specific clinical actions; they may also include current medication and treatment, but much of the detail is relevant only within an episode, as a component of the patient’s hospital record.
Discharge is a more formal process; it represents a milestone in the patient’s care pathway and indicates that a phase of clinical work is complete. Communication usually states the patient’s diagnosis, details treatment and medications, summarises the hospital admission, and outlines plans for continuing care. Details of the patient’s medication at the time of discharge will be included, along with changes from medications on admission (with reasons for any changes), but not every therapeutic intervention will be included. General practitioners do not welcome copious details which they perceive as being of limited relevance for ongoing care.

There is limited potential for reuse of handover data as a part of a discharge summary. Data collected using the tool tended to be unstructured, and provided a colloquial account of current activity related to each patient. [21] Significant additional interpretation would be required in order to make the information suitable for use in a more formal discharge summary. As Winthereik notes [24], preparation of a discharge summary requires interpretation and translation as well as straightforward communication.

Braa [25] has described the use of a flexible approach to standardisation in three settings; data which is needed for high-level reporting across organisations is collected using agreed or mandated national standards, but flexibility is allowed at regional and local levels where appropriate for ‘internal’ work. This concept raises questions about whether Australia’s attempt to adopt comprehensive national data standards for clinical documents will prove to be appropriate or workable.

This approach offers a solution for handover tools; ‘flexible standardisation’ can provide a consistent over-arching interface for electronic handover tools while maintaining flexibility for individual fields to be tailored to local requirements. This approach underlines the central tension between standardisation and customisation for any safe use of electronic tools. In many respects safety and quality is underpinned by the need for a coherency and standardisation while at the same allowing for individual variety and the exceptions case often handled by autonomy in clinical decision-making.

5. Conclusion

By recognising the sociotechnical challenges of electronic handover tools and considering them within the broader context of the Australian ehealth landscape this paper has argued for the utility of an approach embodying flexible standardisation. Electronic handover tools should be designed and implemented as mechanisms to support and not to replace good, safe clinical handover practices. It also advocates that these tools and the information they communicate should accommodate emerging ehealth standards while ensuring interoperability with clinical information systems in the specific clinical contexts of the handover practices being supported. To maintain patient safety during the design and implementation of electronic clinical handover organisations must maintain a safety culture first, second and last; they should have clear and well defined processes in place prior to the introduction of electronic tools, and emphasise end-user engagement to support adoption and use of tools that are available; change management, education and training to ensure sustainability of safe practices. Finally they should differentiating between safe use of electronic tool and any implicit assumption that this will, in and of itself, ensure safe clinical handover.
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Patient safety, resilience and ICT
A reason for concern?

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Abstract. During my studies of the implementation of a new hospital wide information system for medical charts, the project’s impact on patient safety emerged as a topic of interest for the clinicians involved. While Karl Weick [1] applies the law of requisite variety to illustrate the correlation between professional variety and medical errors, it is argued here that a similar notion could be applied to the variety in modes of information in hospitals. Based on this, the question is raised whether or not the introduction of standardized computer systems at the expense of existing solutions could pose a threat to this variety, and subsequently to the hospital’s resilience in handling uncertainty.

Keywords. Hospital information systems, the law of requisite variety, resilience, patient safety.

Introduction

Patient safety in hospitals often depends on clinicians having access to the right information in the right place at the right time. This could include information about medications, allergies or about the patients’ medical history in general. It is commonly envisioned that ICT is the solution to assure such availability of information. Based on experiences from an ongoing hospital ICT project and the law of requisite variety [1], this notion is questioned by arguing that the implementation and subsequent reliance on standardized ICT solutions in some aspects might defy the resilience necessary to ensure patient safety.

In the case described, patient safety and quality of care were maintained at a level almost as good as prior to the introduction of the new tool, even though this system failed in providing the right information in the right place at the right time. The reason for this low level of negative impact was simply the fact that the clinicians’ lack of faith in the new system made them keep double books, in the sense of also maintaining a parallel version of the information on paper. This was what they were already accustomed to, so the only real impact of the implementation was an extra workload on the clinicians – as they also had to keep the electronic system up to date.

Thus no real damage was done. But what will happen when faith in the new tool reaches a level where the clinicians are no longer accustomed to using, and might even have forgotten how to use, the paper records? It is no secret that ICT tools occasionally fail. In most service level agreements (SLAs), an uptime of 99% is considered a fairly high degree of reliability. But for an organization dependant on up to the minute information 24 hours a day 7 days a week, 99% still means 88 hours yearly when the
information is unavailable. Could this compromise patient safety, and ultimately cause severe damage and even casualties?

Whenever the introduction of new tools in critical systems reduces system variety, for instance through standardization, it does so at the risk of compromising the system’s resilience. And this resilience is, according to the law of prerequisite variety, what makes the system capable of handling the unexpected and the extraordinary – like for instance when the tools don’t work; which is something we know occasionally will happen in the case of ICT tools – we just don’t know when, where and why.

1. The law of requisite variety

With Karl Weick’s claim about medical errors that variety mitigates adversity [1] as point of departure, the theoretical foundation for expressing concern over what might prove to be a risky business in a more long term perspective is presented. In shorthand Weick’s argument can be summarized as three assumptions and one subsequent postulate:

- Assumption 1: Variety is requisite to resilience.
- Assumption 2: Resilience is requisite to cope with uncertainty.
- Assumption 3: Uncertainty is a characterizing feature of hospitals.
- Postulate: Variety is essential for hospitals in order to handle uncertainty.

Stemming from the field of cybernetics, the law of requisite variety basically says that in the face of complex problems the apparatus required to deal with them has to be equally or even more complex [2][3]. The general idea is that richness of variety in this apparatus promotes a wider repertoire of action, and that this is imperative in order to handle the uncertainty and unpredictability that emerges from complex and aggregate problems or disturbances [4]. Thus, in relation to problems and disturbances, variety generates complexity and unpredictability, while in relation to problem solving institutions and mechanisms, variety generates resilience and generativity [1][4].

It is not hard to find both general and more specific examples from 21st century hospitals that can serve to illustrate this. With increased medical specialization, pretty much any clinical problem becomes aggregate, as no single care giver is anymore capable of providing the full answers required to address the patient’s condition as a whole rather than as parts of an aggregate condition [5]. Combined with a trend of patient conditions in general becoming more aggregate, this issue is constantly increasing in relevance. In other words; the complexity of the problems are increasing [6]. Anticipating this, the variety in the apparatus required to solve them should thus be increasing as well, according to the law of requisite variety. In some areas it seems to do so, while in others it seems to be moving in the opposite direction. Weick [1] applies the law of requisite variety primarily to professional and disciplinary domains, pointing to the importance and challenges of maintaining the “big picture” with increasing specialization. The progress of medical specialization is in it self a force that continuously promotes variety. In fact this internal divergence is also a driving force in the production of more aggregate and complex problems, as patient conditions can be diagnosed within a frame of increased nuances. This also leads to an increased variety of information, as details of the patients’ conditions that previously would go unnoticed are now clinical observations made available through new knowledge and technology.
New tools for producing, storing, distributing and retrieving such information supports this by being able to handle larger and more varied datasets. But these technologies also come with the potential to enforce a move towards less variety, and subsequently decreased resilience in the system as such. Computerized tools are by nature based on formalization and standardization, and when introduced in hospitals they are often supposed to replace a variety of other means of communication and information handling. The fundamental idea of both formalization and standardization is that one size fits all; it is just a question of finding the right size. This does not promote resilience in the sense of matching the potential complexity of the problems. On the contrary, it might reduce resilience, especially when such solutions are implemented in order to replace a variety of other tools that traditionally have been supporting resilience. To discuss this, the law of requisite variety is here applied to the presence (present-at-handedness) and availability (ready-to-handedness) of such tools. While the powers of paper in clinical settings previously have been thematized in the literature [7, 8], applying the principle of requisite variety to the means of recording and utilizing patient information and the impact this has on patient safety adds a new dimension to this topic in a socio-technical perspective.

2. Research methodology and approach to the field

The fieldwork from which the data presented here is derived started ultimo 2007. As the project is still ongoing, so is the fieldwork. Primary sources of information include: (1) Interviews with members of the project-group, clinicians directly involved in or influenced by the project as well as other (more or less peripheral) stakeholders. Eleven semi structured interviews have been conducted until now; all recorded and most of them meticulously transcribed. (2) Field notes from participant observation in project-group meetings as well as in the clinic. Ten such sessions have been conducted until now, most of them in relation to project-group activities. (3) Relevant documents and correspondence; both internal and official. Including the project’s requirements specification, the internal evaluation of the pilot as well as strategic documents from different levels, this amounts to several hundred pages of written material.

As the study initially was of a very exploratory nature, most “focal points” were tentative and many of them were subsequently rejected as patterns of more interesting topics started to emerge from the material. The subset of data employed here is an extract of statements directly or indirectly related to the new system’s experienced and/or anticipated impact on patient safety, an issue not initially part of my enquiry. The analysis is thus based on an interpretive approach [9] where focus has been on identifying the participants’ own perceptions of issues relevant to the project’s potential impact on patient safety and system resilience – both during the project and after.

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1 Based on Heidegger, the distinction between present-at-hand and ready-to-hand is used here to point to the physical presence of tools versus whether or not it intuitively falls natural for the practitioners to use them.
3. Resilience and medical charts

Hospitals will normally embed a rich variety in modes of information, in the sense of producing, collecting, storing, transmitting or conveying and retrieving information. This ranges from bodily and oral communication, through various forms of materially mediated forms of communication. The two most commonly used mediums for the latter are paper and computers, where computers are currently taking over many of the domains previously dominated by paper. In Norway electronic versions of the patient records and patient administrative systems replaced the old paper versions of these systems several years ago. As the medical charts are considered the last third of a complete patient information infrastructure, focus is currently on replacing the paper based version of this as well. But the nature of the medical charts and how they are being used differs from the EPR and PAS in some significant ways, of which several have direct relevance to patient safety.

The aim of the project presented here was, and still is, to replace an existing paper based medical charts system with an electronic one. The project started in 2004. The primary domains of the medical charts are operating rooms and intensive care units, but they are also in use in post operative units and to some extent in inpatient wards as well. The main distinguishing characteristic of the charts is probably that they at any time will contain up to the minute information crucial to the treatment of patients who normally are in a critical condition. As one of the nurses put it: “We can’t manage for five minutes without the medical charts. Then the patient would be dead – many would die if we didn’t have this information. So this is essential – that it works”.

The importance of having this up to date information available at all times is also illustrated by the fact that the paper chart will never leave the patient as long as the information is required; if the patient moves to another unit, department or hospital, the charts move along. In regards of availability, the weakness of the paper charts is that they are at any given time only available in one location. The strength is that they are always available where they are most needed; by the patient. So what is this information that is so important, and why is it so crucial to patient safety?

The charts provide (in a blink for a trained eye) an instant overview of the patient’s current condition as well as the direction in which it is evolving. Indicators include heart rates, blood pressures, blood gasses and respiration as well as a range of other vital signs that are being constantly monitored. All medication is also prescribed and administered by the means of the charts – it is the prime medium for communication between doctors (who prescribe) and nurses (who administer) in regards of medication as well as fluids. It is also a legal document, as no prescription should be effectuated until the doctor has signed it. This entails in itself a form of quality assurance relevant to patient safety, as a medical degree is required in order to prescribe medication.

In Rikshospitalet (the national hospital), where the project described here took place, the paper based medical charts have been in use and continuously evolved into a well working solution over a period of 100-150 years. As a result of a consolidation and harmonization project during the mid 1990ies where the aim was to reduce the number of different forms in use in the hospital, the number of different paper sheets was reduced to six different forms. These are more overlapping than complementary, as they are intended for different domains of use according to the current status of the patient’s condition. As such the most extensive form is the Intensive Care form, which
contains all the information found in the other forms as well as some extra fields that
are only considered necessary when the patient is in his or hers most critical phase.
This reduction in variety of the medical charts that started 15 years ago is now about to
be completed by introducing an electronic version, where there will only be one
standardized interface for all domains and applications.

3.1. The medical charts pilot

As most ICT projects in (Norwegian) hospitals, the implementation of the electronic
medical charts was initiated with a pilot installation. This took place in the thorax
surgical department, based on the assumption that if it would work there it would work
anywhere. And – also rather the rule than the exception – several expected and
unexpected problems emerged. I will leave the ones related to faulty data and bugs
aside for now, and focus on a more fundamental issue related to the prescription and
administering of medication. While each medicine prescribed on the paper chart took
seconds to be entered or altered, the user interface on the computerized system
radically changed this. As one of the doctors put it:

“Before we started using MetaVision, it took me 10-12 minutes to prescribe all
medications and remove the thorax drain for the two patients in post op. Then I had also
evaluated the patients; can they be moved to the in-patient ward, or must they stay one more
day. After we started to use MetaVision I use 50 minutes on the same procedure”.

This exceptional increase in time consumption required for prescriptions had direct
consequences for the quality of patient care and safety, as well as the clinicians’
working conditions, especially in relation to the doctors’ morning-round. As one of the
nurses put it:

“Some of the younger doctors spent an hour extra every morning because it took
so much longer to do the prescriptions. That put us in a time squeeze. Some of
the doctors doing the morning-round were due for surgery later. They then had
two choices; they could leave the sedated patient waiting in the OR for half an
hour, or they could skip the prescription of medication. They chose the latter.
When they left before doing the prescriptions, we nurses didn’t have the written
prescriptions needed for us to effectuate them. So we only administered what we
were certain the patients should have – the rest was put on hold. The result was
that patients who needed important medications at 9-10 didn’t get them until 12-
1-2. And the timing is critical, so the doctors became mad that we hadn’t given
the medication at the correct time”.

Resilience – in the form of double book keeping – was the only thing standing between
the patients and potential disaster:

“Me: So the paper charts were maintained all along?
Nurse: Yes – absolutely all the time. Exactly because… everything I have described here
goes to show that MetaVision didn’t work. It was not trustworthy and it was too slow
and too cumbersome to be a useful and reliable tool”.

E. Skorve / Patient Safety, Resilience and ICT. A Reason for Concern?
203
3.2. Implications for future scenarios

The paper charts which supposedly should be eliminated by the EMC project thus eventually came to save the day for the EMC pilot. Fortunately, the conditions for such a rescue operation were highly favorable: (1) the clinicians immediately recognized the new tool’s shortcomings, and subsequently anticipated the problems this could cause. (2) The paper charts were still present in the department. (3) Use of the paper charts were by everyone still perceived as such an integrate part of daily operations that it was hardly conceived as an extra burden to maintain them in parallel. The extra burden was rather attributed to the new tool.

So no patients died as a result of the project, and the problems described here can easily be attributed to the fact that the new tool was too immature to be put to work in critical clinical operations. Thus it could be argued that the issues put forward here are not really relevant once the electronic medical charts reaches a level of maturity appropriate for such applications. However, it is not difficult to imagine future scenarios where these issues again could become very relevant, as well as how the conditions for coping with failing computer based tools could then be less favorable. What will the situation be like when faith in the new tool reaches a level where the clinicians are no longer accustomed to using, and might even have forgotten how to use, the paper charts? It is no secret that ICT tools occasionally fail. In most service level agreements (SLAs), an uptime of 99 % is considered a fairly high degree of reliability. But for an organization dependant on up to the minute information 24 hours a day 7 days a week, 99 % still means 88 hours yearly where the information will not be available through the computer based tool. How will this be cope with if the variety and subsequent resilience provided by the paper charts is eliminated?

4. Conclusions

Many a learning experience was harvested by the EMC project from the pilot in the thorax surgical department, and as a result of this several of the project’s goals are currently about to be achieved. But rather than obliterating the concerns put forward here, this emphasizes them. If and when the project succeeds in replacing the paper based medical charts, what will the implications be for the resilience of the system as such to cope with uncertainty and unpredictability? Will the focus on a standardized one size fits all solution render the hospital incapable of handling the situations that fall outside of the routines of normal operations? These are questions that still remain to be answered, and only the future will tell. However, this contribution should serve as an illustration that there could be reasons for concern, or at least that the 88 yearly hours of downtime with a 99 % uptime should be considered a part of the equation when implementing new computer based patient information systems.

References

Socio-technical Challenges in Implementing Safe Patient Handovers

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Abstract. Ineffective handovers in patient care, including those where information loss occurs between care providers, have been identified as a risk to patient safety. Computerization of health information is often offered as a solution to improve the quality of care handovers and decrease adverse events related to patient safety. Drawing on three ethnographic case studies we identify and discuss socio-technical issues which must be addressed if computerized health information systems are to achieve improvements in patient safety related to handovers in care. We suggest that the contextual nature of information, ethical and medico-legal issues arising in relation to information handover and data standards and system integration warrant ongoing research in socio-technical aspects of care handovers.

Keywords. Patient safety, handovers, electronic patient records, socio-technical

Introduction

In healthcare, care provision often requires tracking and managing bodies across diverse information systems (e.g., from a family physician to a specialist), and involves numerous information handovers. Handover communication consists of the processes of passing patient-specific information from one caregiver to another or from a team of caregivers to another team, and to the transfer of information from one healthcare organization to another. Ineffective handovers of patient information have been associated with adverse medical events for patients, and delays in treatment which can have deleterious effects in seriously ill patients. The problematic nature of handovers has been widely recognized, and standardized handovers have been identified as a National Patient Safety Goal in the U.S. [1]. Improving “the effectiveness and coordination of communication among care/ service providers and with the recipients of care/service across the continuum” has been identified as a patient safety goal [2].

EHRs are often introduced to improve informational continuity of care, (“the use of information on past events and personal circumstances to make current care appropriate for each individual” [3, p. 1220]), and to meet goals such as improved information exchange amongst providers [4], improved administrative efficiency [5], patient safety [6] or communication between patients and providers [7], and to improve evidence upon which care decisions are made [8]. Progress supporting safer handovers
in care through electronic means has been slow, though optimism about the potential benefits of electronic handovers remains high. In this paper, we draw on insights gained through three ethnographic case studies to identify socio-technical issues and barriers related to computerization of care handovers, which we suggest must be addressed before significant progress can be made. After briefly describing our case studies and discussing handovers in care, we identify five types of socio-technical issues and challenges arising in relation to computerized patient handovers.

1. Overview of Case Studies and Methods

In this paper, we draw on three in-depth ethnographic case studies which have contributed to our understanding of issues arising in relation to handover of patient care. While working on a case study of pre-hospital care in 2008 we realized that handovers in care presented socio-technical challenges in several of our other studies, including a study of duplicate medical charts (ghost charts), and a study of computerization of a primary care clinic. Each of these studies is briefly outlined below. In all cases, our work was undertaken within the broader context of gaining insights that could inform the design of electronic record systems. Ethnographic observations and interviews were undertaken with a sensitivity towards science, technology and society issues.

1.1. Case 1: The Pre-Hospital Care (PHC Case)

In 2008, we began exploring information handovers related to pre-hospital care in the context of ski area injuries. Conducting epidemiological research related to ski area injuries and health outcomes is difficult, due in part to an inability to track patients and the care they receive across multiple jurisdictions (ski area, ambulance, clinic, ambulance, emergency department) involved in pre-hospital care. After conducting informal interviews with stakeholders we began collecting data in 2009. Subsequently, we conducted several formal interviews with stakeholders involved in ski area operations, and we observed collection and processing of on-hill injury data during the ski hill’s summer (bike park and hiking) and winter operations.

1.2. Case 2: The Ghost Chart Case (GC Case)

We carried out a multi-method multi-site case study (begun in August, 2007, ongoing) in order to understand the phenomenon of duplicate medical charts, also known as ghost charts (GCs). We conducted interviews with stakeholders at the hospital which has served as our study site, and carried out in-depth ethnographic observation of work on two ambulatory care settings, which included all work which occurs in relation to charts outside of clinical encounters (e.g., chart use by nurses, clerical and administrative staff, researchers and trainees). We also carried out observation of chart use during clinical encounters (e.g., doctors’ use of charts during patient visits) on three clinical units and conducted ongoing observations in the hospital’s health records department over a 15 month period.
1.3. Case 3: The Primary Care Case (PC Case)

In 2004, before a clinic’s purchase of an electronic record system, we began research in order to assist the clinic in identifying and addressing socio-technical issues arising as they computerized administrative and clinical practices. We developed an understanding of work flows prior to computerization through observation and interviews, and, tracked issues and problems identified during an initial period of electronic health record (EHR) introduction, a settling-in period [9], and during a subsequent major hardware and software upgrade [10].

2. Designing Computer Systems to Support Handovers in Care

As we began work on the PHC case, we learned that there was significant variation in how handovers in care were defined and that these differences were often left unaddressed in discussions of handover in care. Patient safety literature emphasized improving the accurate transmission of information between care providers, and research articles tended to look at a single handover scenario (e.g., shift handovers or ambulance to emergency room handovers) rather than a range of handover scenarios. We considered multiple types of handovers as we contemplated the challenges of designing computer-based systems to support safer handovers in care, and also realized that socio-technical issues we had observed in other case studies (the GC case and the PC case) often had a dimension related to handovers in care. We identified several issues which have socio-technical implications which will need to be addressed in order to achieve sought after reductions in adverse events related to handovers in care.

2.1. What is Handed Over? The Contextual Nature of Information

Several issues related to the context in which information is handed over emerged in our PHC case. First, each type of care provider (e.g., ambulance personnel vs. medical staff) is trained to construct a view of the patient through a disciplinary lens, and different disciplinary lenses necessitate collection of different constellations of data. While there may be some overlap in data collection across provider groups (e.g., blood pressure), the relative importance of data points changes across types of providers. This point was reinforced in our GC case, where each clinical area used a different summary sheet to provide a quick overview of the patient to specialists. In the PHC chain, where each successive handover is generally to a higher level of care, successive care providers may have access to different tests and different problem solving skills, and hence may require information that differs somewhat from what was handed over by the patient’s previous care provider. In addition, as a patient’s condition changes, some data may become more relevant (such as a longitudinal view of blood pressure).

Through the PHC case, we also observed the collection of information required to meet the informational needs of numerous agencies such as the workers’ compensation boards, insurance companies, etc. Also, some information was collected about patients for purely administrative purposes. Information varied with the context of use and the specific substance and format of fields often reflecting the differing needs of agencies.
2.2. **Ethical Issues: Information Handover, New Care Activities and New Roles**

In our PC case, we faced ethical issues related to handover of health information. Professional codes require that only those directly involved in care view health data. However, new norms in chronic disease management necessitated that anonymized patient data be transmitted to the provincial government which used data to identify people with symptoms suggestive of the presence of chronic diseases (e.g., diabetes). This raised ethical issues as patients had not consented to have their data shared with an outside agency. A related issue arose in relation to the secondary use of data collected through the EHR for research purposes. Additional personnel were required to perform searches to identify sub-populations of patients (e.g., those with diabetes). This necessitated that staff members other than direct care providers or administrative staff interact with records, which contravened the physicians’ professional code.

2.3. **Medico-Legal Issue: Handing Over to Higher Levels of Care**

A similar issue arose in the PHC case. We learned that pre-hospital care providers often sought information about the outcome of patients they treated (for example, whether or not a patient had lived, or complications had been avoided, etc.), in part because they wanted to know if their initial diagnosis and treatment were correct. We learned it was often difficult to trace a patient across multiple jurisdictions involved in pre-hospital care, which we hoped to facilitate through standardization of recording format for demographic information. Standardization of demographic data across jurisdictions and providers might also place fewer demands on patients who often complain about having to repeat demographic information and information about their illness or injury with each new care encounter. We subsequently learned, however, that medico-legal norms prohibited pre-hospital care providers from accessing patient information once a patient was released from the provider’s care, and that each practitioner was required to re-check demographic information and respond to any test results they received.

In the PHC case, only the care provider responsible for current care was permitted to view patient data. In our GC case, we observed a phenomenon in which a computer-based system sent results to all care providers within the computer-based system associated with a patient’s name and did not make a distinction between past care providers and the provider currently responsible for the patient’s care. Consequently, specialists often received lab result reports for patients no longer under their care. Upon receiving such results the specialists were required under professional codes to act on any results they received. They had to look up the patient, review their care, and determine whether or not they were the physician responsible for care. One of the clinics studied in our GC case was overwhelmed with lab results, placing unnecessary demands on already busy specialists. Through anecdotal information, we realized that the process of formally handing care over to another provider was often unclear, and that this lack of clarity was reflected in algorithms in the lab results reporting system which sent results to an arguably inappropriately large group of recipients.

2.4. **Data Standards vs. Standardization of Data and Professional Norms**

In our PHC case, several practitioners complained that the need for patients to provide demographic information to each new provider in the care trajectory slowed down care and could also lead to miscommunication. Standardizing data architectures across
provider groups would make it possible to more easily share demographic information across these groups; however, it would not address professional norms and standards which currently require each new provider to re-check this information. Ideally, multi-provider groups could reach an agreement about which data could be handed from provider to provider without being re-checked. Subsequently, standardization in data architectures (e.g., making sure that dates are collected in a flexible format so that they can be transformed to a common format so records can be linked) could be introduced across provider groups. Development of end-stage data format standards should not be confused with standardization of data collection methods across multiple provider groups. Input fields and the means of inputting data can vary to accommodate unique work practices while data standards can be introduced to underlying architecture.

2.5. System Integration and System Coupling: Dealing with Constant Change

Observational work undertaken in the context of developing computer-based tools to support care work in relation to each of the settings discussed here illuminated the issue of system coupling and data integration when multiple stakeholder groups are involved in information provision or sharing. Agencies upgrade hardware and software systems frequently, and with each new upgrade or system change, the coupling of one system (such as an acute care information system) to another (such as an ambulance information system) has to be re-configured. If data formats change significantly, new approaches to data integration across systems have to be worked out.

3. Discussion

The contextual nature of information needs suggests that it is pertinent to insure that EHRs can display information in varied ways, and that collected information can be output in formats to meet the needs of varied off-stage stakeholder groups (e.g., insurance providers). In the context of direct care, ideally EHR systems would allow some information to be foregrounded and other information to remain in the background, so that as care providers change or a patient’s condition changes, how a patient is viewed can be changed as required. Unlike paper records, computer systems are suited to allow for the provision of multiple views on the same data and “offer the ability to decouple information from its representations” [11] to enhance collaboration between the different professional groups that are involved in patient care. Of particular interest is the need to see current health status and aspects of health status (e.g., vital signs) over time. Some attention to standardization of input formats of a few data points could accommodate different information users in designing their own user-specific views of data. However, in order to maintain consistency with medico-legal and ethical norms, any data flexibility ought to be combined with confidentiality protection which is consistent with medico-legal norms and professional standards.

A need for new kinds of staff members to view patient data in the context of improving management of chronic diseases exists; however, ethical norms and standards have yet to recognize this need in many jurisdictions, and as these challenges become more widespread it is likely that ethical guidelines, norms and standards will change. This suggests that systems should be designed in a manner where levels of permission for access to patient data can be changed and reconfigured as ethical norms and laws change over time. Such flexibility would make it possible to alter access to
patient records in order to allow health care providers to check the outcome of their patients after patients are released from care.

Design of EHRs should support multiple views of patient data, especially with respect to the use of data for direct care versus research purposes. Care providers need access to demographic information to be able to identify the patient in handovers whereas secondary usage of data for research purposes does not require access to all demographic data. Research use of data may require transformation of the data and work is required to disentangle the information from the context in which it has been produced [12] so it can be ethically used for research purposes, and yet retains enough contextual information to be meaningful [13].

Clarity about which care providers are responsible for care is an important patient safety issue, which also has implications for the development of algorithms used in EHR systems (e.g., in determining where test results are sent). Once greater clarity has been reached about handing over responsibility of care between practitioners, electronic record systems could be used to signal to practitioners who are responsible for care, which could reduce ambiguity about whether test results require action.

The distinction between data standards and standardization is important because each professional group has informational responsibilities to report to varied stakeholders. Each stakeholder may require data in a specific format. Hence, standardization of data formats at the point of data collection will always present problems and challenges for some groups while facilitating the work of other groups [compare 14]. Input forms should support and facilitate the work of those who must collect data, and work required to produce data for specific stakeholders should occur out of view from front line providers.

Because the development of health information systems in the Canadian context is distributed across multiple jurisdictions, agencies, professional groups and information technology platforms, coupling, or joining those systems together, presents significant challenges [13]. Hence, coupling and data integration need to be built on development of data formats that can support the environment of constant change that exists at present. We need to create systems that recognize the current state of legal and ethical affairs, and yet can function differently in the event that ethical and medico-legal norms change. We also need to develop data formats and system architectures that support information sharing across existing IT platforms, and yet at the same time are flexible enough to change as external systems change over time.

4. Conclusion

Our ethnographic work undertaken to inform system design in relation to 3 different health settings and problem areas yielded insights we hope will be further explored by others and examined in other settings. Insights about the contextual nature of information handed over during a patient’s care trajectory suggest that system design should support a multiplicity of views of a patient, which can be reconfigured as the patient’s condition changes or the informational needs of practitioners change. Because each stakeholder is embedded in a network of relations with other stakeholders who provide and receive information related to patients, data formats which support multiple output configurations as required by numerous stakeholders should be introduced, especially for key demographic data. Systems architectures should remain open enough to accommodate the constant technological change and fluctuation that
occurs across multiple agencies. Through our cases it has become clear that our ability to build systems often out-paces ethical and medico-legal norms and socio-technical processes, which must be addressed before varied professional groups can fully embrace computer-based tools.

References


<table>
<thead>
<tr>
<th>Subject Index</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>action research</td>
<td>99</td>
<td>homecare</td>
</tr>
<tr>
<td>actor network theory</td>
<td>31</td>
<td>hospital information systems</td>
</tr>
<tr>
<td>adverse events</td>
<td>31</td>
<td>human centred design</td>
</tr>
<tr>
<td>agile development</td>
<td>47</td>
<td>human factors</td>
</tr>
<tr>
<td>anticipated-based change</td>
<td>18</td>
<td>implementation</td>
</tr>
<tr>
<td>architecture</td>
<td>38</td>
<td>improvisational change management</td>
</tr>
<tr>
<td>automation</td>
<td>187</td>
<td>India</td>
</tr>
<tr>
<td>barcode medication</td>
<td></td>
<td>individual care plan</td>
</tr>
<tr>
<td>administration</td>
<td>175</td>
<td>information sharing</td>
</tr>
<tr>
<td>boundary spanners</td>
<td>106</td>
<td>information system(s)</td>
</tr>
<tr>
<td>case management</td>
<td>133</td>
<td>interaction design</td>
</tr>
<tr>
<td>chronic diseases</td>
<td>53</td>
<td>invisible work</td>
</tr>
<tr>
<td>client acceptance</td>
<td>148</td>
<td>issue order</td>
</tr>
<tr>
<td>clinical decision-support systems</td>
<td>79</td>
<td>iterative prototyping</td>
</tr>
<tr>
<td>clinical handover</td>
<td>193</td>
<td>language-games</td>
</tr>
<tr>
<td>clinical practice</td>
<td>79</td>
<td>learning</td>
</tr>
<tr>
<td>clinical practice guidelines</td>
<td>169</td>
<td>medical error</td>
</tr>
<tr>
<td>collaboration</td>
<td>66, 106</td>
<td>medical order entry system</td>
</tr>
<tr>
<td>communication</td>
<td>72, 112</td>
<td>medication error(s)</td>
</tr>
<tr>
<td>compliance</td>
<td>141</td>
<td>medication safety</td>
</tr>
<tr>
<td>consumer health</td>
<td>160</td>
<td>mobile phones</td>
</tr>
<tr>
<td>continuing medical education</td>
<td>79</td>
<td>motivation</td>
</tr>
<tr>
<td>contractual relations</td>
<td>7</td>
<td>municipal health care</td>
</tr>
<tr>
<td>dementia</td>
<td>79</td>
<td>nursing classification</td>
</tr>
<tr>
<td>diabetes</td>
<td>154</td>
<td>nursing work</td>
</tr>
<tr>
<td>diffusion</td>
<td>106</td>
<td>online support groups</td>
</tr>
<tr>
<td>discharge planning</td>
<td>133</td>
<td>opportunity-based change</td>
</tr>
<tr>
<td>efficiency</td>
<td>91</td>
<td>organizational change</td>
</tr>
<tr>
<td>ehealth</td>
<td>193</td>
<td>organizational implementation</td>
</tr>
<tr>
<td>ehealth</td>
<td>91</td>
<td>organizations</td>
</tr>
<tr>
<td>EHRs</td>
<td>38</td>
<td>PACS (radiology)</td>
</tr>
<tr>
<td>electronic handover tools</td>
<td>193</td>
<td>participatory design</td>
</tr>
<tr>
<td>electronic medical records</td>
<td>53</td>
<td>patient care management</td>
</tr>
<tr>
<td>electronic patient record(s)</td>
<td>85, 118, 206</td>
<td>patient education</td>
</tr>
<tr>
<td>emergent-based change</td>
<td>18</td>
<td>patient roles</td>
</tr>
<tr>
<td>empowerment</td>
<td>141</td>
<td>patient safety</td>
</tr>
<tr>
<td>evaluation</td>
<td>79</td>
<td>patient-centered medical home</td>
</tr>
<tr>
<td>handovers</td>
<td>206</td>
<td>patient-centred care</td>
</tr>
<tr>
<td>health care</td>
<td>25, 106</td>
<td>pilot implementation</td>
</tr>
<tr>
<td>health informatics</td>
<td>1, 175</td>
<td>practice consultants</td>
</tr>
<tr>
<td>health information infrastructure</td>
<td>127</td>
<td>practice redesign</td>
</tr>
<tr>
<td>health information systems</td>
<td>169</td>
<td></td>
</tr>
<tr>
<td>health promotion</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>Topic</td>
<td>Page</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>practice theory</td>
<td>175</td>
<td></td>
</tr>
<tr>
<td>primary care</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>profession</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>prototyping</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>quality</td>
<td>91</td>
<td></td>
</tr>
<tr>
<td>radiology information systems</td>
<td>99</td>
<td></td>
</tr>
<tr>
<td>referrals</td>
<td>106</td>
<td></td>
</tr>
<tr>
<td>resilience</td>
<td>199</td>
<td></td>
</tr>
<tr>
<td>risk</td>
<td>175</td>
<td></td>
</tr>
<tr>
<td>route cause analysis</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>safety</td>
<td>181</td>
<td></td>
</tr>
<tr>
<td>self-management</td>
<td>154</td>
<td></td>
</tr>
<tr>
<td>serious games</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>shared care</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>social networks</td>
<td>127</td>
<td></td>
</tr>
<tr>
<td>social structures</td>
<td>118</td>
<td></td>
</tr>
<tr>
<td>socio-technical</td>
<td>1, 25, 31, 79, 206</td>
<td></td>
</tr>
<tr>
<td>socio-technical system</td>
<td>112</td>
<td></td>
</tr>
<tr>
<td>software testing</td>
<td>181</td>
<td></td>
</tr>
<tr>
<td>standardization</td>
<td>85, 91</td>
<td></td>
</tr>
<tr>
<td>standards</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>substitution</td>
<td>148</td>
<td></td>
</tr>
<tr>
<td>system development</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>telecare</td>
<td>148</td>
<td></td>
</tr>
<tr>
<td>telehomeconsultation</td>
<td>148</td>
<td></td>
</tr>
<tr>
<td>usability</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>usability testing</td>
<td>181</td>
<td></td>
</tr>
<tr>
<td>user participation</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>virtual visits</td>
<td>148</td>
<td></td>
</tr>
<tr>
<td>workflow</td>
<td>7, 181</td>
<td></td>
</tr>
</tbody>
</table>
Author Index

Aarts, J. v, 1 Kushniruk, A. 181
Adams, S.A. 160 Kuwata, S. 181
Alonso, A. 66 Lindgren, H. 79
Balka, E. 206 Lyng, K.M. 169
Bansler, J.P. 53 Meum, T. 85
Berntsen, K.E. 187 Miller, S. 193
Bertelsen, P. 72 Monsted, T. 53
Beuscart-Zephir, M.-C. 112 Monteiro, E. 85, 91, 187
Bjerkan, J. 66 Niss, K.U. 99
Bjoernes, C.D. 72 Nørh, C. v, 1
Boonstra, A. 148 Novak, L.L. 175
Boyricki, E. 181 Pedersen, R. 91
Botin, L. 38 Pelayo, S. 112
Braa, K. 127 Petersen, L.S. 72
Bygholm, A. 141 Petarakaki, D. 25
Coates, S. 206 Pirone, C. 193
Cornford, T. 25 Purkayastha, S. 127
Danhol, P. 31 Ralston, J.D. 59
Ellingsen, G. 85, 91 Reid, R.J. 59
Eriksson, S. 79 Showell, C. 193
Forsell, A. 118 Simonsen, J. 18
Gabrielson-Järhult, F. 133 Skjoet, P. 15
Gammon, D. 47 Skorve, E. 199
Glasemann, M. 154 Stokken, R. 133
Hamre, G.A. 187 Tarczy-Hornoch, P. 59
Havn, E.C. 53 Thomas, M. 193
Heimly, V. 106 Tolar, M. 206
Hellebek, A. 15 Tufano, J.T. 59
Igesund, H. 85 Turner, P. 193
Johannessen, L.K. 47 van Offenbeek, M.A.G. 148
Kanstrup, A.M. 154 Vuokko, R. 118
Karsten, H. 118 Wangensteen, G. 85
Klecun, E. 25 Wentzer, H. 141
Koppel, R. 7 Whitehouse, S. 206
Kreda, D.A. 7 Wong, M.C. 193
Kuo, M.-H. 181 Yee, K.C. 193