Proceedings of EHR2023 Workshop on

Implementing Electronic Health Records – Cases, Concepts, Questions

Trondheim (NO), June 6, 2023

In conjunction with the ECSCW2023 conference

Organized by

Morten Hertzum

Rebecca Randell

Gunnar Ellingsen

Miria Grisot

Welcome

Welcome to the EHR2023 workshop on implementing electronic health records (EHRs).

EHRs support patient treatment by providing healthcare professionals with the means to order, document, and follow up on the steps taken to treat and care for each patient. EHRs are complex systems. Their implementation is a major undertaking, which has received sustained attention in computer-supported cooperative work (CSCW) and other research fields. While this research has provided important insights, they remain partial and somewhat disconnected. It is difficult to stay up to date.

This workshop aims to provide a forum for participants to get updated on current CSCW studies of EHR implementations and create connections with other researchers who study such implementations. More specifically, the workshop aims to stimulate:

- Cross-fertilization among the participants' cases, their concepts, and their questions
- Reflection on what CSCW contributes to the study of EHR implementation
- Discussion of the interest in further networking initiatives regarding EHR implementation

These workshop proceedings contain the five papers presented at the workshop. The copyright to the papers remains with their authors.

Table of contents

Author(s) (2023): ECSCW 2023 Workshop Position Paper Instructions. In: Proceedings of the 21th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies – Workshop position Papers, Reports of the European Society for Socially Embedded Technologies (ISSN XXX-XXXX), DOI: 10.18420/ecscw2023-to-be-added

Implementing Electronic Health Records: A case study of Helseplattformen

Nora Othilie Ringdal
Norwegian University of Science and Technology (NTNU)
nora.o.ringdal@ntnu.no

Abstract. This position paper describes the case of an electronic health record (EHR) implementation in primary and secondary healthcare in central Norway. Three different theoretical views are presented as potential perspectives to investigate the implementation process. Infrastructure theory highlights the importance of technical and social aspects of the EHR system, while affordance theory provides a lens to investigate potential for action and actualization. Generativity theory can be applied to the case to explore its implications for platformization practices. Insights from data generated during the transition from design to use show that the vendor of the EHR system is powerful in terms of the implementation process and that the owner of the EHR system has little power to make the solution their own.

Introduction

The successful implementation of electronic health record (EHR) systems is not a straightforward process, and many healthcare organizations struggle to adopt and integrate them into their workflows (Hertzum et al., 2022). In 2019, the region of

central Norway decided through a public procurement process to purchase an EHR system from the American vendor, Epic Systems. This EHR system connects primary and secondary healthcare through a common solution to provide more efficient and better healthcare to the citizens. It is critical for healthcare organizations, clinicians, and patients to understand the factors that contribute to successful EHR implementation. My doctoral research project therefore seeks to understand how such large-scale digital platforms are introduced into the public sector.

Implementing an EHR system in a country different from which it was originally developed requires that users participate in every phase of the implementation to make sure that the system meets the needs of the end-users and that a sense of ownership and acceptance is created (Fennelly et al., 2020). Even though citizens are important actors in the ecosystem, the end-users in this research are the healthcare workers in primary healthcare using Helseplattformen as a work tool. There are many benefits of implementing a common solution for primary and secondary healthcare, but it is up to the end-users in the different practices to figure out how it should be designed for their practice to realize these benefits. This is a process that continues post-implementation.

By looking at the practices of different units in the municipality, we want to investigate how the system is continuously being built and customized post-implementation, considering social relationships, the technology's capacities, and the power of the vendor.

In this paper, I will briefly explore how different theories from information systems (IS) and computer-supported cooperative work (CSCW) can be used in this research project

Background

This section introduces different theoretical views that can be used to investigate EHR implementation. The aim of examining these perspectives is to gain a more comprehensive understanding of the complex processes involved in EHR adoption and use. Each theory offers a perspective on the factors that influence the success or failure of EHR implementation.

Affordance theory

Failed implementations of enterprise systems are repeatedly documented in the literature. This is often caused by a misfit between the organization and the system (Morquin et al., 2023). Morquin et al. (2023) build on the concepts of affordances and affordance actualization to propose a method for the diagnosis and resolution of misfits between organizational processes and enterprise systems. Through an action research study in a university hospital, they found that the affordance

perspective enabled users to understand the misfit (current combination of affordances) and the solution (an appropriate recombination of affordances).

In some units in the municipality of Trondheim, it turns out that some domain experts (called subject matter experts or SMEs), even six months after going live, believe they have not gotten what they asked for. Applying the lens of affordances may provide us with the tools to discuss unintentional actualization or how affordances travel along a trajectory (ToA) (Thapa & Sein, 2018).

Affordance theory could also provide an interesting perspective to investigate generativity in Helseplattformen, looking at the boundary resources provided by the platform owner as digital affordances.

Generativity

Generativity has recently become a central topic in the development and evolution of platforms (Grisot and Vassilakopoulou, 2013; Msiska and Nielsen, 2018), where it is often regarded as a form of innovation (da Rocha and Pollock, 2019). Generativity is defined as "technology's overall capacity to produce unprompted change driven by large, varied, and uncoordinated audiences" (Zittrain, 2006, p. 1980). Importantly for practice-oriented studies, generativity is increasingly considered a complex socio-technical practice (Grisot and Vassilakopoulou, 2013; Msiska and Nielsen, 2018).

The organization that will use the platform needs to take advantage of the generativity of the platform to create its own value-adding complements by actualizing the platform's affordances (Hein et al., 2019). According to Ellingsen and Hertzum (2019, p. 2), this is a challenge because "while configuration makes some functionalities easy to set up, it also restricts the space of possible functionalities to those envisioned by the designers of the configuration facility". Despite the socio-technical aspects of generativity, only a few practice-related studies have been conducted to empirically investigate generativity in platforms (Msiska and Nielsen, 2018; da Rocha and Pollock, 2019; Vestues and Knut, 2019).

Infrastructure

The concept of information infrastructure can be helpful to understand large-scale generic systems in healthcare, as this theoretical concept focuses on large-scale issues and has a far-reaching scope (Ellingsen et al., 2022). Infrastructure is "a way of conceptualizing interconnected system collectives (rather than stand-alone information systems)" (Henfridsson & Bygstad, 2013).

Implementing generic systems in a healthcare context where the infrastructure consists of a range of systems, health professionals, institutions, and established practices require that the system is configured for local practices (Ellingsen et al., 2022). It is known that "information infrastructures can only play a global

coordinative role within healthcare if they also achieve local grounding and meaning" (Grisot and Vassilakopoulou, 2013).

Case description

Immediately after the municipality of Trondheim (primary healthcare) and the central Norway health authorities (secondary healthcare) had purchased the EHR system, a new organization was formed – the local implementation company Helseplattformen AS (owned by the hospital and the municipality). In 2022, the EHR was implemented in the municipality of Trondheim and at the University hospital of the region. Other municipalities and primary care actors are joining and taking part-ownership in the company as they join. The implementation has been widely discussed in national media who has reported on the controversy and debates surrounding the platform. The media has also reported on the delays faced by Helseplattformen, which was postponed twice before being launched on May 7th, 2022, in the municipality of Trondheim. However, the hospital's "go-live" date was further postponed to November 12th, 2022, due to perceived patient risk associated with the platform's implementation at that point in time.

For the software to be configured and customized to the Norwegian setting, Helseplattformen hired tens of application analysts. In addition, the role of subject matter experts (SMEs) was created. These are domain experts who were hired by Helseplattformen AS in 20%, 40%, or 60% positions, to represent their field of work in the design and implementation process. More than 400 SMEs were recruited from primary and secondary healthcare to represent the nearly 40 000 healthcare workers in the region. They have a key role in the evolution of the platform which includes providing direction and feedback to design the workflows and content, approving the workflows before implementation, participation in testing, and assisting in making the training materials for the end-users. Post-implementation, their role is to optimize workflows in collaboration with end-users and other SMEs.

Super users also play a key role both pre- and post-implementation, in training their colleagues to use the new system. There are approximately 900 super users in the municipality of Trondheim. The primary healthcare services in Trondheim municipality consists of more than 80 units with 9000 employees that serve 200 000 citizens.

Research methodology

The research strategy is an exploratory case study, and the research is based on qualitative methods in order to get an in-depth understanding of platformization practices and the user community. The data has been generated through interviews,

observations, and documents. Table 1 shows the interviews that have been conducted, while Table 2 shows the meetings and activities that have been observed. Most of the interviews were semi-structured and some were conducted online during the pandemic. Most of the interviews were also video recorded or audio recorded by consent. Some of the observations were also performed digitally and documented using extensive field notes. Observations were not recorded.

Table I. Interviews conducted in 2021 and 2022.

Year	Phase	Role	Employer	Number of interviews
2021	Test	SME	Trondheim municipality/HP	2
		Super user	Trondheim municipality	3
		Application analyst	HP	2
		Epic employee	Epic	3
2022	Post-implementation	Local implementation project	Trondheim municipality	3
		Super user	Trondheim municipality	2
		Department manager	Trondheim municipality	1
		Unit leader	Trondheim municipality	2
		SME	Trondheim municipality	2
Total				20

Table II. Activities observed in 2021 and 2022.

Year	Phase	Activity	Number of observations
2021	Test	E2E	3
		EUAT	3
		Debrief	2
		Local implementation project meetings	9
2022	Training	Information meetings	5
2022	GLRA	“E vi klar”	10
2022	Training	Classroom training	2
2022	Go-live	Local implementation project meetings	6
		Postponing go-live	3

2022	Post-implementation	Shadowing super users at two different units	2
Total			45

Conclusion

As a participant in the workshop, I am interested in discussing the different theories and theoretical framing that can be used to understand more about the complex process of EHR implementation. I see it as a great opportunity to learn more about how EHR implementations have recently been studied within CSCW and share experiences and insights with other researchers who are interested in the same topic. I am also interested in discussing opportunities for further collaboration and networking initiatives.

References

Bano, M., & Zowghi, D. (2015). A systematic review on the relationship between user involvement and system success. *Information and software technology*, 58, 148-169.

da Rocha, F. N. and N. Pollock (2019): 'Innovating in Digital Platforms: An Integrative Approach.'. In: *ICEIS (2)*. pp. 505–515.

Ellingsen, G. and M. Hertzum (2019): 'User participation in the implementation of large-scale suite systems in healthcare'. In: *Proceedings of the 7th International Conference on Infrastructures in Healthcare 2019*.

Ellingsen, G., Hertzum, M., & Melby, L. (2022). The tension between national and local concerns in preparing for large-scale generic systems in healthcare. *Computer Supported Cooperative Work (CSCW)*, 31(3), 411-441.

Fennelly, O., Cunningham, C., Grogan, L., Cronin, H., O'Shea, C., Roche, M., ... & O'Hare, N. (2020). Successfully implementing a national electronic health record: a rapid umbrella review. *International Journal of Medical Informatics*, 144, 104281.

Grisot, M. and P. Vassilakopoulou (2013): 'Infrastructures in healthcare: The interplay between generativity and standardization'. *International Journal of Medical Informatics*, vol. 82, no. 5, pp. e170–e179.

Hein, A., D. Soto Setzke, S. Hermes, and J. Weking (2019): 'The influence of digital affordances and generativity on digital platform leadership'. In: *Proceedings of the 40th International Conference on Information Systems (ICIS)*.

Henfridsson, O., & Bygstad, B. (2013). The generative mechanisms of digital infrastructure evolution. *MIS quarterly*, 907-931.

Hertzum, M., Ellingsen, G., & Cajander, Å. (2022). Implementing Large-Scale Electronic Health Records: Experiences from implementations of Epic in Denmark and Finland. *International Journal of Medical Informatics*, 167, 104868.

Morquin, D., Ologeanu-Taddei, R., Paré, G., & Wagner, G. (2023). A method for resolving organisation-enterprise system misfits: An action research study in a pluralistic organisation. *Information Systems Journal*.

Msiska, B. and P. Nielsen (2018): 'Innovation in the fringes of software ecosystems: the role of socio-technical generativity'. *Information Technology for Development*, vol. 24, no. 2, pp. 398– 421.

Ringdal, N. O., & Farshchian, B. A. (2022). The Role of Boundary Objects in Platformization Practices: A Case Study of Software Testing. In *Proceedings of 20th European Conference on Computer-Supported Cooperative Work*. European Society for Socially Embedded Technologies (EUSSET).

Thapa, D., & Sein, M. K. (2018). Trajectory of affordances: Insights from a case of telemedicine in Nepal. *Information Systems Journal*, 28 (5), 796–817.

Vestues, K. and R. Knut (2019): 'Making digital infrastructures more generative through platformization and platform-driven software development: an explorative case study'.

Zittrain, J. L. (2006): 'The Generative Internet'. *Harvard Law Review*, pp. 1974–2040.

Sand, Dahl, and Svanæs (2023): Implementing and adopting a shared electronic health record (EHR) system in Central Norway. In: 21st European Conference on Computer Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies - Workshops, Reports of the European Society for Socially Embedded Technologies

Implementing and adopting a shared electronic health record (EHR) system in Central Norway

Adrian Sand[1], Yngve Dahl[1], Dag Svanæs[1]
[1]Norwegian University of Science and Technology (NTNU)
[1]adriasa@stud.ntnu.no, [1]yngve.dahl@ntnu.no, [1]dag.svanes@ntnu.no

Abstract. Even though a considerable amount of research within CSCW and other relevant fields have been done towards the challenges with developing and implementing IT systems in healthcare, less research have been done about what challenges arise when developing and implementing large-scale IT systems. There is an urgent need to further study this phenomenon since the trend in healthcare is implementing increasingly larger IT systems. Too little is known about what challenges this brings, in particular in the context of healthcare with its many actors and often conflicting needs. In Central Norway a large-scale EHR system is currently being implemented in Trondheim municipality and at St. Olav's hospital. This brings a great opportunity to study the challenges with developing and implementing large-scale IT systems in healthcare. In addition, it brings an excellent opportunity to study how the implemented digital technology can facilitate collaboration between different healthcare stakeholders and how it changes their work-practices, as has long been an important research topic in CSCW research.

Introduction

The field of Computer Supported Cooperative Work (CSCW) has long been concerned with healthcare and how digital technology can facilitate collaboration between different healthcare stakeholders (Fitzpatrick and Ellingsen, 2013). In light of the Norway's national e-health strategy One Citizen – One Health record (Helse- og omsorgsdepartementet, 2012) the way electronic health record (EHR) systems can support collaboration both between different levels of healthcare (e.g, primary and secondary care) and between healthcare services and patients has become a highly topical issue in Norwegian healthcare.

In line with the national e-health strategy, health authorities and municipalities in Central Norway are currently in the process of introducing a new EHR system, *Helseplattformen* (English: the Health Platform), for all hospitals and municipal healthcare services in the region. The system was deployed and put to use in the autumn of 2022. The establishment of Helseplattformen is a major service innovation project where all healthcare services and all citizens of Central Norway will adopt one common patient record (Helseplattformen, 2022a). The aim of Helseplattformen is to provide increased quality in patient care, better patient safety and more usable systems. The goal of the introduction of Helseplattformen is thereby to contribute to healthcare personnel being able to carry out their work tasks in a better and more efficient way, while allowing patients to experience an increased quality of the health service (Helseplattformen, 2022a). This position paper proposes a research agenda for a case study of the implementation and adoption of Helseplattformen with the aim informing CSCW.

Helseplattformen as an opportunity for CSCW research

Helseplattformen is a large-scale EHR system, supporting a region of more than 40 000 healthcare workers and 720 000 citizens. The implementation project is thereby one of the largest e-health projects being undertaken in Norway. The implementation project has to a large extent been characterized by a high degree of user involvement in all phases of the projects. To meet regional and more local requirements, more than 500 subject matter experts (SMEs) have participated in configuring the new EHR system (Ellingsen & Hertzum, 2020; Helseplattformen, 2022b).

Despite significant investments and efforts, implementing and adopting large-scale ICT systems in healthcare, like an EHR system, have proved a challenging task (Greenhalgh et al, 2009; Greenhalgh et al, 2010). There are several reasons why implementing and adopting information and communication technology

(ICT) systems in healthcare is challenging. Healthcare services span across primary, secondary and tertiary care sectors, and involves interaction between diverse professional groups and services. In addition, there is a tension between the national concern regarding standardization and streamlining of work practices to reduce variations in the care given, and the local concerns for the system to be tailored to their specific work practices and how they give care (Ellingsen, Hertzum & Melby, 2022). Despite enthusiasm for the role ICT systems can play in healthcare to reduce cost and improve efficiency, there are still a lot of challenges for this potential to be realized (Procter et al., 2006; Black et al, 2011). Particularly challenges related to changes in work practices among healthcare workers and collaboration between different healthcare workers has proven to be an obstacle (Vos et al., 2020). Another problem is that modern computer systems are typically single-user oriented, and not designed for collaborative work (Bardram, 2009). One of the main objectives of EHR systems is to enhance collaboration among healthcare professionals. Knowledge of how EHR systems actually affect collaborative practices, however, is limited (Vos et al., 2020), partially because systematically accounting for collaborative aspects of medical work is difficult (Pratt, 2004). Based on the above, implementation and adoption of a large-scale EHR system such as Helseplattformen, is a challenging process.

The implementation of Helseplattformen in Central Norway, presents a unique opportunity to investigate challenges and possibilities that new large-scale health information systems, present with respect to coordination and collaboration between different levels of helthcare. In this regard it is important to learn from the experience from similar projects in other countries and the challenges that followed these implementations (Hertzum & Ellingsen, 2019; Hertzum, Ellingsen & Cajander, 2022).

Objectives, research questions, and methods

The overall objective of our case study of Helseplattformen is to form a qualitative understanding of the implementation and adoption of the new EHR system in primary and secondary healthcare and the perceived benefits and challenges it introduces on work practices and collaboration between stakeholders. In particular, the case study is guided by three research questions (RQs):

- RQ1: How do healthcare workers in primary and secondary care perceive their involvement in the development process of the EHR system and how do they perceive the resulting EHR system?
- RQ2: How does the adoption of the new EHR system affect collaborative work between healthcare workers in primary and secondary care?

- RQ3: How does the adoption of the new EHR system affect collaboration between primary and secondary care and their patients?

The plan is to address the above questions by means of a case study that focuses on a specific diagnosis group and where the EHR system is central in the (digital) collaboration between relevant stakeholders (see Figure 1).

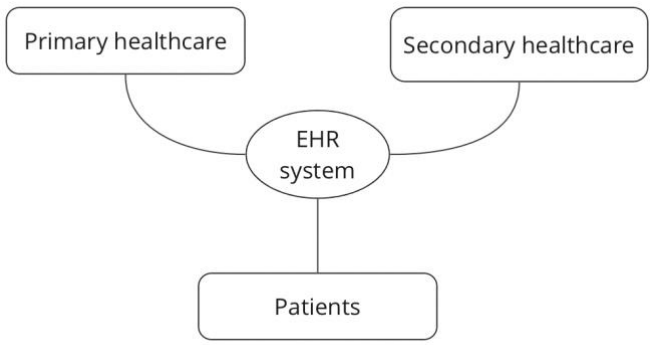

Figure 1: Illustration of how an EHR system facilitates collaboration between primary and secondary healthcare and patients.

As part of the case study, different data generation methods will be used including interviews, observations, questionnaires, and document analyses.

Aims and Desires for the Workshop

We would appreciate the opportunity to participate in the *Implementing Electronic Health Records – Cases, Concepts, Questions* CSCW workshop because of its relevance to the described case study. Our primary aims and desires for the workshop is as follows:

1) Gather valuable feedback on the proposed case study with the aim of increasing its relevance for CSCW.
2) Share our experiences from doing research on Helseplatformen with fellow workshop participants.
3) Connect with other CSCW researchers in the hope of establishing future research collaboration related to the topic of the workshop.

Biography

Adrian Sand is a Ph.D. candidate in Computer Science at the Norwegian University of Science and Technology (NTNU). He is particularly interested in how digital technology shapes work-practices and collaboration in health care and

other public sector, in addition to the challenges of implementing large-scale IT systems.

Yngve Dahl is Associate Professor at the Department of Computer and Information Science. He belongs to the research group for Information Systems and Software Engineering. Dahl holds a PhD in Computer science from NTNU. His academic interests are in the field of Human–Computer Interaction (HCI). Dahl has conducted HCI research in areas such as of user-centered design, usability evaluation methodology, participatory design, values in design and CSCW since the early 2000s. The majority of Dahl's work consists of empirical design-oriented research with real users, with a particular focus on digital health care technology for clinical and assistive use. The results of his research have been published in leading international scientific HCI journals and conference proceedings.

Dag Svanæs is Professor at the Department of Computer and Information Science, NTNU. He received his Ph.D. in Human- Computer Interaction (HCI) from the same university. His research over the last 25 years has been in the fields of HCI and Interaction Design. His main focus has been on user-centered design methods and basic theory of interaction. He has also extensive experience from conducting HCI and CSCW studies in relation to health care.

References

Bardram, J. (2009) Activity-based computing for medical work in hospitals, *ACM transactions on computer-human interaction, 16(2)*, pp. 1–36. doi: 10.1145/1534903.1534907

Black, A.D. et al. (2011) The Impact of eHealth on the Quality and Safety of Health Care: A Systematic Overview, *PLoS medicine, 8(1)*, p. e1000387. doi: 10.1371/journal.pmed.1000387

Ellingsen, G. & Hertzum, M. (2020) User requirements meet large-scale EHR suites: Norwegian preparations for Epic, *Studies in Health Technology and Informatics, 270(1)*, pp. 703-707. doi: 10.3233/SHTI200251

Ellingsen, G., Hertzum, M. & Melby, L. (2022) The Tension between National and Local Concerns in Preparing for Large-Scale Generic Systems in Healthcare, *Computer supported cooperative work, 31(3)*, pp. 411–441. doi: 10.1007/s10606-022-09424-9

Fitzpatrick, G. & Ellingsen, G. (2013) A Review of 25 Years of CSCW Research in Healthcare: Contributions, Challenges and Future Agendas, *Computer supported cooperative work, 22(4-6)*, pp. 609–665. doi: 10.1007/s10606-012-9168-0

Greenhalgh, T. et al. (2009) Tensions and Paradoxes in Electronic Patient Record Research: A Systematic Literature Review Using the Meta-narrative Method, *The Milbank quarterly, 87(4)*, pp. 729–788. doi: 10.1111/j.1468-0009.2009.00578.x

Greenhalgh, T. et al. (2010) Adoption and non-adoption of a shared electronic summary record in England: a mixed-method case study, *BMJ, 340(7761)*, p. 1399. doi: 10.1136/bmj.c3111

Helse- og omsorgsdepartementet (2012). En innbygger - en journal. Digitale tjenester i helse- og omsorgssektoren (Meld. St. 9 2012-2013). Collected from: https://www.regjeringen.no

Helseplattformen (2022 a) *Forskning.* Available from: https://helseplattformen.no/om-oss/prosjektet/forskning (Collected: 24.10.2022)

Hertzum, M. & Ellingsen, G. (2019) The implementation of an electronic health record: Comparing preparations for Epic in Norway with experiences from the UK and Denmark, *International journal of medical informatics, 129(1)*, pp. 312-317. doi: 10.1016/j.ijmedinf.2019.06.026

Hertzum, M., Ellingsen, G. & Cajander, Å. (2022) Implementing Large-Scale Electronic Health Records: Experiences from implementations of Epic in Denmark and Finland, *International journal of medical informatics, 167(1)*, p. 104868. doi: 10.1016/j.ijmedinf.2022.104868

Pratt, W. et al. (2004) Incorporating ideas from computer-supported cooperative work, *Journal of Biomedical Informatics, 37(2)*, pp. 128–137. doi: 10.1016/j.jbi.2004.04.001

Procter, R. et al. (2006) Special issue: CSCW and dependable healthcare systems, *Computer supported cooperative work, 15(5-6)*, pp. 413–418. doi: 10.1007/s10606-006-9037-9

Vos, J.F.J. et al. (2020) The influence of electronic health record use on collaboration among medical specialties, *BMC health services research, 20(1)*, pp. 1–11. doi: 10.1186/s12913-020-05542-6

Sardoge, Nerland, Grisot (2023): ECSCW 2023 Workshop position paper. In: Proceedings of the 21st European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies - Workshops, Reports of the European Society for Socially Embedded Technologies

The role of intermediary objects in the design of an EHR infrastructure

Christopher Sadorge[1], Monika Nerland[1] and Miria Grisot[2]
[1]Department of Education, University of Oslo, Norway; [2]Department of Informatics, University of Oslo, Norway.
chrissad@uio.no, *m.b.nerland@iped.uio.no*, *miriag@uio.no*

Abstract. In this study we explore the role of intermediary objects in the design of an EHR infrastructure in the context of municipal care services. The EHR infrastructure supports patients' handover across health units, services and levels of care, and ensure continuity of care. Patients' handover is a vulnerable passage in healthcare when essential data are transferred for patient safety and which occurs within and across clinical settings and disciplinary boundaries. We take the perspective of the participants contributing to infrastructure design and focus on the micro-dynamics of collaborative design work on design problems as it evolves through acts of knowledge creation.

Introduction

As in several other countries, the Norwegian health sector is increasingly aiming at greater integration of fragmented parts of health services to provide better health services to patients and to better limit and prevent diseases (see the white paper to the parliament, Meld. St. 47 2008–2009). In this regard, certain responsibilities have been relocated, displacing care from secondary care (specialist healthcare, such as in hospitals) to primary care (care providers in municipalities). One implication of this displacement is that treatments might start

in hospitals, but patients are discharged earlier, and treatment is continued in primary care. Continued care provided to patients between services and its supporting information infrastructure thus becomes central in integrating services across institutions.

In this position paper we propose to focus on the design and implementation of Electronic health records (EHRs) supporting patient handovers among health services and health organizations. Such EHRs are information infrastructures that support collaborative work among various health professionals, levels of care, types of health services and need also to relate to the existing different installed bases of the various health contexts in which the care work is performed (Aanestad et al 2017). Design and implementation becomes thus a complex process where many different interests meet and are negotiated with the aim to create durable connections. This type of infrastructure design work is framed in CSCW research as infrastructuring i.e. the ongoing and continual processes of creating and enacting information infrastructures (Karasti and Blomberg 2017).

In this paper we focus on the role of objects in infrastructuring. Objects are representations and reference points for explanations and interpretations that are key to design work (Eckert and Boujut 2003; Vinck 2012). In design work, objects can be artefacts of different kind such as paper forms, probes, drawings, prototypes, models, screenshots as well as conceptual tools. They are useful tools as they concretize ideas, facilitate testing and design negotiations. Specifically, we are interested in the knowledge generation dynamics objects trigger and how these dynamics drive design work.

Empirically, we zoom in on the design practices of a design team in the context of an initiative setting up an EHR infrastructure to coordinate care across institutions and to make patient information available in various contexts of care. We take the perspective of the participants contributing to infrastructure design and focus on the micro-dynamics of collaborative design work on design problems as it evolves through acts of knowledge creation.

Our aim is to contribute to the understanding of the practices of EHR infrastructure design and implementation.

Theoretical framing

In this study, we use the concept ‘intermediary objects’ (Vinck 2012) which has been used to examine collaborative aspects of design work. Vinck shows how intermediary objects can function as a mediator, where materiality acts as a focal point for ambiguity to be sorted out, where potential surprises may appear and where the translation of meaning can be observed in the design work (Vinck, 2012). In addition, the intermediary object can function as a representation in temporary versions of the information system that build and restrict dynamics at work, and where inputs from multiple actors can be coordinated. In this way, the

emergence of solutions can be observed and followed through the way intermediary objects are instantiated. Third, intermediary objects work as references that frame actions and structure the activity by defining a space for action for participants. This implicit structure intermediary objects constitute can be accepted, unwanted or negotiated as new departure points are constructed. Possible openings or exclusions of further avenues for professional work (e.g., who should account for what and who controls this part of the object) can be traced by following material instantiations of intermediary objects.

We use the concept of intermediary objects to analyze explorative, fine-grained and generative knowledge processes of design work that branch out in different directions and drive object construction.

Case Description

Our empirical case study is a design and implementation effort of an EHR infrastructure in primary care in a large Norwegian city. The initiative started in 2018 as a joint initiative between four city districts with the aim of enhancing coordination and improving the quality of patient handover between care units and services in the city. From 2020, the city's central health agency took ownership of the initiative and a core design team was established and consisted of a project leader (PL), a developer, 3–6 healthcare workers from different city districts and care units, referred to as 'implementation coordinators' (ICs). At the moment of writing, the EHR infrastructure has been partially implemented in selected healthcare units and city districts, while further functionality is in design and development, and the plan to scale to all city districts and nursing homes is in place.

The core of the EHR infrastructure is an application built on a data platform that harvests data from the main health registers, will have APIs towards the municipal patient record system and includes existing standards, such as the National Early Warning Score (NEWS) for the detection of clinical deteriorations in patients or the Mini Nutritional Assessment (MNA). The data platform is a low-code development platform with a simplified app-building process that allows non-experts to build apps. The platform also supports a continuous design approach in which parts of the app can be in design, test and implementation without requiring the solution to be fully developed. For the project, this means that design, development and implementation activities run in parallel. As many different care practices will be supported, the EHR infrastructure is designed with interfaces for personal computers (PCs), digital whiteboards and mobile phones.

Research methodology

This paper is based on a longitudinal case study conducted over a period of two years (2020–2022) in which we followed the design of the EHR infrastructure. The empirical material consists of an extended data set from meeting observations (178 hours), interviews (3) and talks (74) with key participants, as well as project documents (e.g., meeting agendas, historical documentation, presentations, screenshots of the system and strategy documents) accessed through the project's digital portal. In this position paper, we use data collected from October 2020 to July 2021 from weekly talks with key participants and observations of design meetings. During this period, the design work was organised in regular meetings carried out once or twice per week. Due to the COVID-19 pandemic, all meetings were carried out digitally through the Microsoft Teams platform. Observations of the meetings were either made using video or voice recorded and supplemented with handwritten field notes.

The data analysis was conducted in several steps: (i) initial coding of design problems in the meeting discussions; (ii) selection of 24 meetings focused on issues of visualising patient information; (iii) detailed analysis of meetings' excerpts where the design team constructed and explored a series of intermediary objects (Vinck 2012). We focused the analysis on how partial problems were framed and instantiated, how this framing guided the possible routes for exploration and action, and the outcomes of the explorative processes.

Findings

Decisions on care are often made by reflecting on past events with the aim of preventing future exacerbations. When a patient's follow-up is taken over by a new care unit, the ways of registering and using information in the two locations become matters of coordination. It is critical that care workers have access to updated and structured information, and that this information is visualized to convey the core information.

The findings focus on design problems related to the flow of information required to support patient handover. Our findings, show how design work evolves through object construction within three different temporal and spatial frames: designing for information sharing at the boundary between units, standardisation of categories and routines for registering and sharing information across units, and ways of retrieving and displaying vital information in the system to monitor patients over time. Due to limitations of this paper, we elaborate on the first design problem here.

Designing for information sharing at the boundary between units. The first design problem relates to how to display the most important information for the receiving care unit. This problem is multifaceted, as it involves issues, such as what information needs to be available for the receiving unit, how it can be accessed and used to start a new phase in the care work and the implications of these considerations for the design of interfaces and functionalities.

Example
During a design meeting, the project leader of the team scrolls through the interface of the EHR under development and stops at a previously discussed and materialized category of '*Start-up conversation executed'* (with a red dot beneath and the word *No*) as she ask 'What do you think of the way it is shown now'? This framing of an intermediary object provided a focal point for the team to start exploring two interrelated problems: how information at patients' arrivals can be registered in the EHR and what kind of routines for registration exist when new patients are transferred to a health unit. What happens next is that the intermediate object branches out as new questions arise, leading to an exploration of potential variations in routines across health units. In extensive discussions, differences in how such conversations are conducted and what functions they serve are further explored, illustrated here by one of the implementation coordinators:

> It is not only that. It is three different functions that are supposed to account for three different start-up conversations, so it is quite complex if you are to cover this entire logic. I'm thinking that if you have done a mapping or assessment and the last date for that assessment, then you know the last date and who executed it.

After some extensive discussion around the variations of conversations, they temporarily cease the discussion while the project leader describes the work and visualization flow of receiving a new patient at the care unit. The project leader then re-instantiates the object they started out with, with the question of how to visualize this information for health care personnel to quickly orient themselves.

Commentary. In this example, the framing of an intermediary object provided a focal point for the team to start exploring what key information should be displayed to get an overview of a newly arrived patient. However, rather than generating a solution to this problem, the intermediary object branched out in many directions by generating questions about registering information at arrival in the system and in the services. These categories, denoting types of conversations, tasks and appointments, mobilised back and forth explorations between the interface and its envisioned use in the services, which spurred further object construction. As such, the explorations served to reveal interdependencies

between the categorisation of information in the system and the care practices in the service units and to connect instances of practice across time and space.

Discussion

In this study we show that how aspects of care work at handover are accounted for in the design process depends on the way intermediary objects are framed and examined. Moreover, such processes are typically iterative in the sense that design problems re-emerge in different phases as temporarily agreed-upon solutions are opened up for further exploration. Our analysis has shown how design work evolves through a series of object explorations related to partial design problems in the design of the EHR infrastructure. Rather than arising as clear problems in need of being resolved, these design problems need to be identified, framed and instantiated to become 'workable'. These processes of framing and instantiating intermediary objects are not straight-forward. Rather, they require considerable negotiation and exploration within and between the interdependencies that become relevant in the design process. As pointed to in other studies of design processes in health care, interdependencies across work contexts are unveiled as the design process evolves, and generate a need to simultaneously explore the envisioned use of the information system in various user contexts and the way the technological and visual design can support work in these contexts (Berg et al. 1999; Ellingsen and Monteiro 2006).

By focusing analytically on the role of intermediary objects in design, our study provides insight in how these objects make it possible to handle the complexity of design work in infrastructures in practice. Following Vinck (2012), intermediary objects take different potential functions in the design process that make it possible to act and collaborate: they frame design problems and form a point from which the emergence of solutions can be observed, they mediate a common ground where ambiguity can be sorted out, and they construct new departure points and define a space for action. In our analysis, we observed these functions as the design participants went about to explore and define relations between design elements as problem spaces.

References

Aanestad, M., Grisot, M., Hanseth, O., & Vassilakopoulou, P. (2017). Information infrastructures and the challenge of the installed base. Information infrastructures within European health care: Working with the installed base, 25-33.

Berg, Marc; and Els Goorman (1999). The contextual nature of medical information. International journal of medical informatics, vol. 56 no. 1-3, pp. 51-60.

Eckert, Claudia; and Jean-François Boujut (2003). The role of objects in design co-operation: Communication through physical or virtual objects. Computer Supported Cooperative Work (CSCW), vol. 12, no. 2, pp. 145–151.

Karasti, H., & Blomberg, J. (2018). Studying infrastructuring ethnographically. Computer Supported Cooperative Work (CSCW), 27, 233-265.

Eckert, Claudia; and Jean-François Boujut (2003). The role of objects in design co-operation: Communication through physical or virtual objects. Computer Supported Cooperative Work (CSCW), vol. 12, no. 2, pp. 145–151.

Ellingsen, G., & Monteiro, E. (2006). Seamless integration: standardisation across multiple local settings. Computer Supported Cooperative Work (CSCW), 15, 443-466.

Vinck, Dominique (2012). Accessing material culture by following intermediary objects. In L. Naidoo (ed): An Ethnography of Global Landscapes and Corridors. InTech.

Fosse, K. Z. & Toussaint, P. J. (2023): ECSCW 2023 Exploratory Papers Instructions. In: Proceedings of the 18th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centered Computing on the Design of Cooperation Technologies - Exploratory Papers, Reports of the European Society for Socially Embedded Technologies (ISSN XXX-XXXX), DOI: 10.18420/ecscw2023-to-be-added

Understanding Implementation of Electronic Medication Management Systems: A Planned Review

Kjersti Zakariassen Fosse & Pieter Jelle Toussaint
Norway
Email: kjersti.z.fosse@ntnu.no; Email: pieter@ntnu.no

Abstract. Implementing new electronic health records (EHR) impact the health care workers who must change their workflows and adapt to the new system. One aspect of EHRs comprises changes in the electronic management system (EMMS), an essential part of medical treatments. Researching and writing this review is planned for 2024-2025. The aim is to gain an overview of how previous implementations of EMMSs have affected workflow and common user experiences among health care workers as a result. Part of EMMS are closed loop medication management (CLMM), systems made to ensure continuous registration and information on medication. The review will in turn examen essential changes and challenges associated with implementing CLMMs.

Introduction

Today's health care is dependent on new systems to support the technological development and growing patient population. New electronic health records (EHR) offer the ability to keep track of patient records, improve information communication, update treatment information, provide overview of medications, and collect medical data for research (Boonstra et al., 2014; Helseplattformen, 2019). As a part of the implementation of an EHR, several systems are being implemented simultaneously, such as electronic medication management systems (EMMS), to ensure quality in managing medications (Bjørnstad, 2017). This review, planned researched for and written in 2024-2025, will give an overview of the main challenges encountered in implementing EMMSs through looking at changes in workflow experienced due to implementations and user experiences with new EHRs.

Medication management is considered anything to do with managing medications within health care, including ordering prescriptions, and distributing, handling, and administrating medication (Bjørnstad & Ellingsen, 2022). Importantly, for an EMMS to work properly it must communicate with the EHR in an efficient way (Bjørnstad, 2017). A challenge which often arise is how to document information correctly when working within both an EHR and an EMMS, because a mistake in documentation of medication management can have severe consequences (Bjørnstad, 2017). Each year up to 1000 people die due to medication management issues (Vendil, 2015), showing the importance of an reliable and efficient EMMS.

One way some EMMSs are offering a more reliable system is through closed loop medication management (CLMM) (Bjørnstad & Ellingsen, 2022). A CLMM ensures the medication is registered within the system throughout the entire process. The aim of a CLMM is to perserve patient safety and offering decision support by adding distinct electronic barcodes to all medications (Bjørnstad & Ellingsen, 2022). Not all EMMSs use a CLMM, and some only use CLMM partly due to the complexity of containing medications in an electronic system (Bjørnstad & Ellingsen, 2022). Still, CLMMs are an increasingly used part of EMMSs and can therefore not be ignored when looking at user experience of EMMSs. Another focus of this review will therefore be to seek an understanding of the challenges end users meet when implementing a CLMM in their work.

Aims

From 2022, a new EHR begun its implementation process in Central Norway based on a system from the vendor Epic (Helseplattformen, 2019). This system,

called the Health Platform, is planned implemented in several hospitals and municipalities in the region, offering great changes to the way hospitals and health care services are run (Helseplattformen, 2019). One of the large changes being applied is adding a new EMMS, an integrated function of the new system (Helseplattformen, 2019). To understand how this system may affect the health services, this review will look at other places where similar EMMSs have previously been implemented, such as the UK, Canada, Denmark, the Netherlands, and similar implementations in other regions in Norway (Andersen, 2020; Bjørnstad, 2017; Bjørnstad & Ellingsen, 2019; Ellingsen, 2022; Hertzum & Ellingsen, 2019; Hertzum & Simonsen, 2019; Nguyen et al., 2014; Song et al., 2022; Zurynski et al., 2021). This review aims to gain a greater understanding of what can be expected throughout and after the implementation of the Health Platform. By limiting the search to these countries, the aim is to find systems which are similar to the Norwegian health care system, thus eliminating implementations in the USA.

Additional goals for this review are that an understanding of what challenges similar system implementations faced can help us understand what to expect. Through this knowledge, the hope is that we can better understand the process of the new Health Platform and be prepared for potential outcomes. However, it is still crucial to remember that every implementation will be different from each other and that even a recognisable pattern in the new implementation may not indicate how the future will play out. The following research questions are made to meet these aims:

- *RQ1 – How has workflow changed for health care workers as end user after implementation of a new EHR?*
    - *RQ1.1 – What common user experiences can be found among end users of new EMMSs?*
- *RQ2 – Which challenges have end users met during the implementation of a CLMM?*

Methods

This review will be a literary assessment of research on the implementation of EMMSs. As the research phase commence, an informed selection will be made based on similarities between implementations of previous systems and the newly implemented and planned implementation of the Health Platform. The selection will be based on finding relevant information from previous implementations to help understand the process of the implementation of the Health Platform today and in the future. Inclusion criteria entail that previous implementations have factors which are relatable with the Health Platform, such as being an Epic

system, implementations happening within a hospital setting, and systems affecting everyday work life of the health care end user group, mainly regarding changes in medication management. Other psychosocial and socio-economic factors may be used as exclusion criteria where the health care settings may be too different for a realistic comparison to happen.

Along with EMMS, articles on CLMM systems will be a part of the inclusion of the literature in the review. This due to CLMMs important role in several EMMSs as it affects the health care end user experience. However, CLMMs are not being used in all EMMSs, and articles not including CLMMs may therefore not be seen as an exclusion criterion.

Discussion

By identifying challenges in the field, it is possible to better understand the ongoing implementation of the new Health Platform in Central Norway. Uncovering the experience of end users from other projects will enable the possibility of what can be expected when the implementation of the Health Platform is happening, as well as finding social, economic, and psychological differences between the health care end user groups. This will help to understand why some user groups may find the implementation of a new EMMS more useful than others, internal differences in work life and flow, and uncover psychosocial and socio-economic differences among health care workers as an end user group.

Implementations in Norway

As EHRs are gaining importance in healthcare similar systems to the Health Platform have already been implemented in other regions in Norway which can inform the implementation in Central Norway. In the implementation of a new EHR in Northern Norway several challenges were found (Bjørnstad, 2017). Bjørnstad and colleagues (2017) identified issues, such as problems combining physical existing lists of medications with updated medication list upon admitting patients, differences in how medication is registered in the electronic patient record and electronic medication management system, user having to work with both an EHR and EMMS, information having to be manually transferred between the EHR and EMMS.

Among the challenges mentioned, separate issues can be found at inter-personal or local levels. Some of these may include lack of information and training, attitude found among co-workers and leaders, as well as other societal influences.

By looking at similar implementations to the Health Platform as this example, this planned review is hoping to identify important challenges when implementing a new EMMS. Thus, such studies are an important part of answering the research questions (RQ 1 and 1.1.).

Limitations

This planned review will look at literature of implemented systems where medication management has been a part of the implementation of larger EHR. Although this will enable the researcher to understand how the ongoing implementation of the Health Platform is progressing and potential upcoming challenges, it is important to be aware that each implementation process will be affected by the people involved in the process and regional differences.

Furthermore, this review will only show a selection of the available literature from, highlighting relevant literature with similar health care facilities or systems to the Health Platform in Central Norway. This due to the review aiming to inform the implementation of the Health Platform. Literature will include, but will not be limited to, literature concerning the vendor of the Health Platform, Epic. The selection will also be limited to publications after 2010, as older content may contain outdated elements of an implementation process.

References

Andersen, M. F., Ajslev, J., Tanggaard, L., & Svendsen, P. A. . (2020). Skakmat - kan prisen for indflydelse blive for stor? *Tidsskrift for Arbejdsliv*, *22*(3), 9-24.

Bjørnstad, C., Christensen, B. and Ellingsen, G. . (2017). Medication, integration and practice. *Proceedings of 15th European Conference on Computer-Supported Cooperative Work Exploratory Papers, Reports of the European Society for Socially Embedded Technologies* https://doi.org/10.18420/ecscw2017-18

Bjørnstad, C., & Ellingsen, G. (2019). Data work: A condition for integrations in health care. *Health Informatics Journal*, *25*(3), 526-535. https://doi.org/10.1177/1460458219833114

Bjørnstad, C., & Ellingsen, G. (2022). Medication quality and work practice. *Procedia Computer Science*, *196*, 673-683. https://doi.org/https://doi.org/10.1016/j.procs.2021.12.063

Boonstra, A., Versluis, A., & Vos, J. F. (2014). Implementing electronic health records in hospitals: a systematic literature review. *BMC Health Serv Res*, *14*, 370. https://doi.org/10.1186/1472-6963-14-370

Ellingsen, G., Hertzum, M. & Melby, M. (2022). *The Tension between National and Local Concerns in Preparing for Large-Scale Generic Systems in Healthcare* Computer Supported Cooperative Work (CSCW),

Helseplattformen. (2019). *Helseplattformen AS*. https://helseplattformen.no/om-oss/helseplattformen-as

Hertzum, M., & Ellingsen, G. (2019). The Implementation of an Electronic Health Record: Comparing Preparations for Epic in Norway with Experiences from the UK and Denmark. *International Journal of Medical Informatics*, *129*. https://doi.org/10.1016/j.ijmedinf.2019.06.026

Hertzum, M., & Simonsen, J. (2019). Configuring information systems and work practices for each other: What competences are needed locally? *International Journal of Human-Computer Studies*, *122*, 242-255. https://doi.org/https://doi.org/10.1016/j.ijhcs.2018.10.006

Nguyen, L., Bellucci, E., & Nguyen, L. T. (2014). Electronic health records implementation: An evaluation of information system impact and contingency factors. *International Journal of Medical Informatics*, *83*(11), 779-796. https://doi.org/https://doi.org/10.1016/j.ijmedinf.2014.06.011

Song, Y., MacEachern, L., Doupe, M. B., Ginsburg, L., Chamberlain, S. A., Cranley, L., Easterbrook, A., Hoben, M., Knopp-Sihota, J., Reid, R. C., Wagg, A., Estabrooks, C. A., Keefe, J. M., Rappon, T., & Berta, W. B. (2022). Influences of post-implementation factors on the sustainability, sustainment, and intra-organizational spread of complex interventions. *BMC Health Serv Res*, *22*(1), 666. https://doi.org/10.1186/s12913-022-08026-x

Vendil, Å. (2015). Fakta om feil legemiddelbruk. *Norsk legemiddelforening*, *1*(123).

Zurynski, Y., Ellis, L. A., Tong, H. L., Laranjo, L., Clay-Williams, R., Testa, L., Meulenbroeks, I., Turton, C., & Sara, G. (2021). Implementation of Electronic Medical Records in Mental Health Settings: Scoping Review. *JMIR Ment Health*, *8*(9), e30564. https://doi.org/10.2196/30564

Claus Bossen & Naja H. Møller (2023): ECSCW 2023 Workshop position paper.
In: Proceedings of the 18th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies - Exploratory Papers, Reports of the European Society for Socially Embedded Technologies (ISSN XXX-XXXX), DOI: 10.18420/ecscw2019-to-be-added

EHR implementation and the importance of repair work.

Claus Bossen; Naja H. Møller
Information Studies, Aarhus University; Computer Science, Copenhagen University
clausbossen@cc.au.dk; naja@di.ku.dk

Abstract. In this paper, we focus on the re-organisation of work practices and IT systems after the implementation of a large, comprehensive Electronic Health Record in Denmark, and a successful process of 'repair work' in the post-implementation phase. By 'repair work' we have in mind the efforts to keep infrastructures in a working state despite breakdown (e.g. Steinhardt 2016). As can be expected the new EHR entailed multiple changes in organization of work and work of division between professions, and in this case clinical staff's experiences with the new EHR led to widespread frustration and slowed down work. Some physicians even published a book called 'Destructive digitalisation' to call attention to the detrimental effects of the EHR. In the midst of these frustrations, the department in focus here engaged in a process of repairing and resurrecting adequate work processes in the aftermath of the changes caused by the implementation of the new EHR. In particular, we focus on the role of a proactive local management as well as leadership and technological expertise to succeed with repairing work at the department.

Introduction

In 2016, a new Electronic Health Record (EHR) was implemted in two healthcare regions in Denmark. The EHR called the 'HealthPlatform' (HP) replaced a number previous EHR modules that were not integrated had become out of date. The aim of HP was to provide healthcare professionals as well as patients with a broad overview of patient data and enhance patient safety (Region Hovedstaden 2019). The procurement of the HP was Denmark's largest and most complex health-IT project to date after EHRs from other vendors had been implemented in other healthcare regions. Implementation of HP began in 2016 at one large and one small hospital, and since then the HP was implemented at the remaining 12 hospitals in the two health regions.

The off-the-shelf EHR from the vendor EPIC in the USA had already been implemented in a number of countries, including the United Kingdom, Netherlands, and now also Denmark and Norway (Hertzum and Ellingsen 2019). The experiences there pointed to significant challenges in the wake of implementing the HP (Rigsrevisionen 2018), and in Denmark productivity in the two regions declined by more than 5% per year after the implementation of HP (ibid). Frustrations were so high that a group of senior physicians published a book called "Destructive digitalization" in which the described the problems and challenges they encountered. However, their call to switch to another EHR was not accommondated, and HP is still the EHR of the two healthcare regions.

Especially the profession of medical secretaries was severely affected by HP. Part of the business case for HP was the assumption that documentation work of medical secretaries would decline or could be taken over by physicians and nurses, since HP would have numerous tick-off boxed to replace free text in the patient records, and based on that assumption 400+ medical secretaries were fired. Their role in the healthcare infrastructure was seen to change significantly and become one of fixing data errors in the EHR and being secretaries in the ordinary presumption of answering phones and welcoming visitors to the wards. Much different from their previous roles of ensuring efficient patient trajectories in a increasingly complex and specialized healthcare sector (N. H. Møller et al., 2020; N. L. H. Møller, 2018).

In the midst of the debates and public frustrations about HP and the fate of medical secretaries, we encountered a department that was claimed to have successfully implemented HP *and* achieved a high work life satisfaction by staff in general and medical secretaries in particular. Based on interviews with management, staff and observations of medical secretaries' work, we explored the possible factors leading to this achievement.

Case and methods

The Department is part of large university hospital in the capital region of Denmark. It has an emergency department, an outpatient clinic, a day hospital and inpatient wards. The 270+ staff include physicians, nurse, medical secretaries, social- and health care assistants, and more, who take care of approximately 20,000 patient annually.

HP was implemented in 2017 and led to new divisions of work and work practices for physicians, nurses and medical secretaries in particular. The wake of implementing HP, work life satisfaction and the department was low according to the yearly survey, turnaround of medical secretaries was high, the previous tight and functioning cooperation between physicians and medical secretaries had deteriorated, and there was a high backlog of items on the so-called work and error lists in HP. These lists itemized errors and work items in the HP that medical secretaries were supposed to solve.

Methods

In 2021, we conducted six interviews with medical secretaries one of which specialized in registrations in HP. Two of them had been at the department before the implementation of HP, four had started work thereafter, and their work experience as medical secretaries varied from one to 30+ years. We also interviewed, the head physician, head nurse and head medical secretary as well as a clerk specialized in registration of healthcare data, and a consultant from the HP implementation organization. These 11 interviews amounted to 552 minutes and were subsequently transcribed and coded based on an iterative phronetic (grounded theory inspired) approach (Tracy, 2019).

Also in 2021, we also conducted observations of the medical secretaries' work in order to achieve an understanding of them as they were after having been successfully reorganized and 'repaired'.

Based on observations and the 11 interviews we made a tentative list of central themes that we considered central for understanding and analyzing the post-implementation process that lead to an improved work situation at the Department. The list included 24 themes or codes that were subsequently applied and iteratively re-assessed based on coding of the interviews.

The present study is limited by the fact that due to the stress and sensitivity of the process that the Department had been through, we were not allowed to interview staff that had left during or immediately after HP was implemented. Hence, the case analysis is retrospective and based on staff that decided to remain at the Department or was hired after the implementation of HP. The head physician and head nurse were the same before and after implementation of HP, whereas the head medical secretary was new (See process outline below).

Analysis

In the following, we will briefly out the process of change that took place at the Department, describe the initiatives that led to a 'successful' repair process as well as the preconditions that contributed to a fertile context for those initiatives. By successful, we refer to the positive information we got from management, medical secretaries as well as statistics on workplace satisfaction and absence due to sickness.

Processes of change at the Department: An overview

The processes of change can be briefly be describes as the following: HP is implemented media 2017 on the hospital and on the Department and entails new work processes for physicians, nurse and medical secretaries. The process leads to dissatisfaction amongst medical secretaries, deterioration of collaboration with physicians who are the main profession with whom medical secretaries cooperate, and a huge backlog of items of the work and error lists in HP.

The overall policy of the HP implementation organisation of viewing the work of medical secretaries as becoming redundant (Møller et al., 2020; Møller, 2018) had already led to laying off medical secretaries and created insecurity amongst this group. One additional factor leading to dissatisfaction amongst them was the division of work embedded in HP: Physicians, nurses and medical secretaries had different access rights and different views into HP, which meant that they could not cooperate in the same ways as pre-HP, and also meant that physicians were to take over tasks of documentation and registering data from medical secretaries, which were left with tedious tasks of correcting data errors in HP with little interaction with physicians and patients, which they had and appreciated in the pre-HP division of work.

The management of the Department had been proactive in connection with the implementation of HP teaching how to use HP and appointing a local senior physician as 'builder': a function that takes care of redesign and local adaptation of HP. However, because the HP organization at that time emphasize standardization across departments and hospital, opportunities for department specific adaptations were few (Bansler, 2021), which however did not deter local management nor the builder from pursuing a strategy of local adaptations to adapt and redesign as much as they could.

Mid-2018 the Department moved to new buildings within the hospital, which meant a new round of reorganization for work between staff. Dissatisfaction between medical secretaries increased, cooperation with physicians decreased and medical secretaries quit. This continued into 2019 when the head medical secretary quit too, and medical secretaries instead were under the management of the head nurse. Throughout 2019, turnaround between medical secretaries is

relatively high with experienced staff quitting and new hires quitting too after a short period of employment.

2020 is a turning point with the arrival of a new head of medical secretaries (HMS). She starts an iterative process of reorganization of medical secretaries' work, collaboration with physicians, and a process of optimizing documentation done by physicians, nurses and medical secretaries with the aim reducing errors and getting rid of the long list of items on the work and error lists in HP. Additionally, the HP implementation organization changes its strict standardization policy and opens up for local adaptations of HP. Overall, whereas the Department in 2017 had 22 medical secretaries, in 2021 there were four less. By 2021, according to management, workplace assessments and interviews with medical secretaries, turnover amongst medical secretaries was low, job satisfaction high, absence due to sickness is low, and the cooperation between professions had improved. Hence, according to management and medical secretaries themselves the repair process after the implementation of HP could be said to have been successful. Table 1 below provides an overview of the timeline of the process.

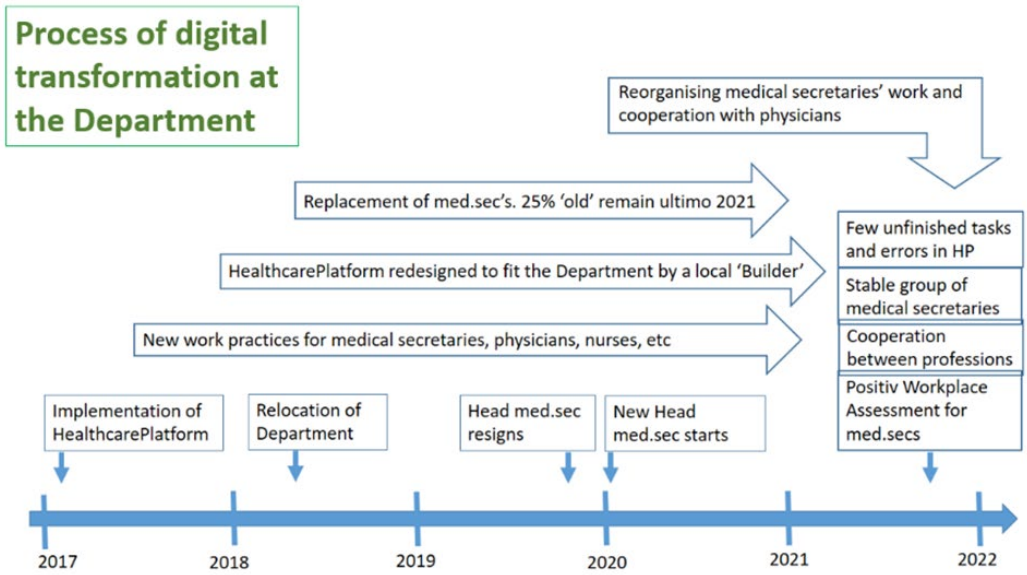

Figure 1. Timeline of the change process at the Department

Initiatives at the Department

Especially four initiatives at the Department contributed to the outcomes.

First, the new HMS initiated a reorganization of medical secretaries' work. The new division of work in HP entailed a fragmented work process in which medical secretaries primarily worked based on a list of items on data errors in HP. Work became tedious and meaningless working on solving items on lists that had even more items the next day. Some medical secretaries got manual tasks such as ordering basic stuff for the department or taking care of storage. The new HMS reorganized work so that each medical secretary was assigned a specific patient group and hence collaborated with a specific group of physicians around documentation and ensuring coherent treatment and care trajectories for this specific group of patients. They would work across lists and follow patients and their trajectories. Also, the new HMS engaged in a process of fitting work tasks and internal placement to the competences and wishes of the individual medical secretary. As one secretary said: *"They asked you, you and not constantly fobbed of tasks"*. In all, their work changed from being tedious and fragmented to become meaningful.

Second, management and especially the new HMS engaged in a process of redesigning cross-professional collaboration with the use of HP. Working against the rigid division of work in HP, they implemented new redesigns of HP in a process where the 'builder' had a central role. Due to the builder being a well-respected senior physician, who knew the work of physicians in detail, and his status within the physicians, he was able to suggest redesign of work practices as well as of HP and implement it in HP. Supplementing him was the fact that the new HMS similarly new HP in detail as well as the work of medical secretaries. In collaboration, they could point at not only how to redesign HP and work practices, but also implement them.

Third, the department engages in a dedicated effort to reduce documentation errors. Data can be entered in HP in various ways for the same item or process, and depending on how it is done it will produce an error warning and thus a new item on the error list. Staff are not necessarily warned while documenting and the result was the ever-increasing number of items on the lists that medical secretaries were supposed to fix. Through a detailed inspection of which kinds of errors were prevalent and who did it – this can be tracked in HP – one medical secretary engaged in fixing errors, while her colleagues engaged in 'proper' work around patients and with physicians. Redesign of interfaces, talks with the various professions about how to document properly and pointing out that the less errors medical secretaries had to fix, the more they could assist the other professions in doing 'proper' healthcare work instead of documentation.

Fourth, at department meetings management emphasized the important role that medical secretaries had had and continued to have for the department. Countering the discourse of 'become obsolete' by the HP implementation organization, they stressed the role of medical secretaries and of cross-professional cooperation. As one manager said: *"A patient trajectory stands on*

three legs. Physicians examine and prescribe treatment; nurses take care of patients 24/7 for the patient to become well; and medical secretaries take care of the administrative stuff necessary for smart, optimal, streamlined and high quality patient trajectories." (Manager).

In summary, management initiated processes of reorganizing medical secretaries' work internally, reorganizing cross-professional collaboration, reduction of data errors, and addressed medical secretaries' role as central and important to the department. In the next section, we address some the contributing preconditions provided a beneficial context for these initiatives.

Contributing preconditions at the Department

As we analysed the interviews and stories about the change processes, we arrived at five contributing factors that provided a fertile ground for the above four initiatives.

First, Department management hired a new HMS who had detailed knowledge upon HP and had proved to be able to provide solid leadership. She was hence able to initiate redesign of medical secretaries work processes as well as collaborate with the physician 'builder' in the redesign of HP.

Second, local management had from the beginning been proactively engaged in the implementation of HP taken upon themselves to teach how to use it rather than leave this to others.

Third and in line with the above, local management in the early phase of pre-implementation appointed a senior, well-respected physician to become 'builder': He got time of to enter the 'builder'-program and had reduced work load in order to work as such subsequently.

Fourth, management emphasized the importance of cross-professional collaboration as well of the equal importance of all professions to patient treatment and care.

Finally, fifth, the department was fortunate in having already pre-HP a local administrative staff who was highly skilled in coding and registration of healthcare data, and post-HP able to hire a medical secretary with a flair and dedication to solving data errors.

An overview of the initiatives and contributing preconditions can be seen below in Figure 2.

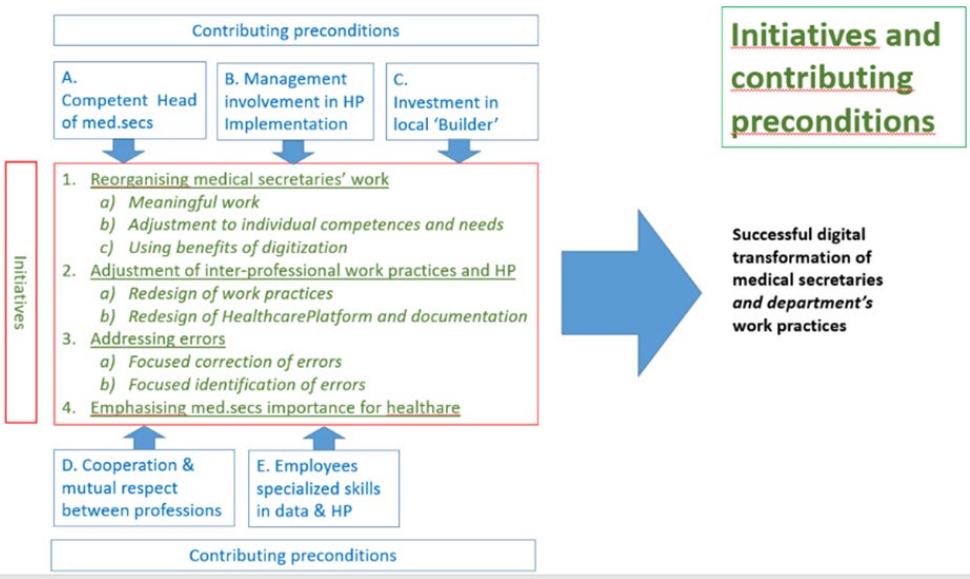

Figure 2. Initiatives and contributing preconditions for the successful digital transformation process.

Discussion

We have somewhat called this a case of 'successful' digital transformation based on the interviews with management, medical secretaries and positive (anonymous) workplace assessments and low absence statistics. The case cannot be generalized to other departments' experiences in the two regions. Other departments may have had similar successes, but while the debates around HP have become quiet now seven years after implementation, our impression is that is remains controversial.

However, we think there some take-aways from this case. Even in cases where an IT system is designed to reorganize divisions of work to the detriment of specific professions and where this is supported by the policy of the implementation organization, it is sometimes possible to proactively counter the design and policy through leadership, technical expertise and emphasis on cross-professional cooperation. In this case, management and especially a competent head of medical secretaries in combination with detailed technical expertise into HP through the 'builder', the HMS and local staff were able to redesign the EHR as well as collaborative work at the department. In future analysis and research, we will develop this case in the light of 'repair work', since this promises to be a promising approach. However, we welcome other suggestions from workshop participants.

Acknowledgments

Our since thanks to management, staff and medical secretaries at the Department for their cooperation and time.

References

Bansler, J. P. (2021). Challenges in user-driven optimization of EHR: A case study of a large Epic implementation in Denmark. *International Journal of Medical Informatics*, *148*, 104394.

Møller, N. H., Eriksen, M. G., & Bossen, C. (2020). A Worker-Driven Common Information Space: Interventions into a Digital Future. *Computer Supported Cooperative Work (CSCW)*, *29*, 497–531.

Møller, N. L. H. (2018). The future of clerical work is precarious. *Interactions*, *25*(4), 75–77.

Tracy, S. J. (2019). *Qualitative research methods: Collecting evidence, crafting analysis, communicating impact*. John Wiley & Sons.