Implementing Electronic Health Records – Cases, Concepts, Questions

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Abstract. Electronic health records (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 and their implementation is a major undertaking, which has received sustained attention in computer-supported cooperative work (CSCW) and other research fields. This workshop aims to provide a forum for participants to get updated on current CSCW studies of EHR implementations and create connections with a select group of other CSCW researchers who study such implementations. Within the overall topic of EHR implementation, the workshop themes include, but are not limited to, case analyses, theoretically oriented pieces, discussion essays, stakeholder analyses, methodological reflections, and comparative pieces. The key activities at the workshop will be presentations of the participants' position papers and thematic discussions in break-out groups.

Introduction

Research on the implementation of electronic health records (EHRs) spans computer-supported cooperative work (CSCW), health informatics, information systems, and other fields. While the research in each of these fields has provided important insights, they remain partial and somewhat disconnected. Within CSCW alone, healthcare is a domain that has received sustained attention (Fitzpatrick and Ellingsen, 2012). This long-term attention continues in studies of many recent and ongoing EHR implementations (e.g., Zahlsen et al., 2022; Zhang et al., 2022). It is difficult to stay up to date. This workshop provides a forum for getting updated on current studies and creating connections with other researchers in CSCW (and beyond) who study EHR implementations.

EHR implementation and use

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. Previously, this information was held in paper records, which were only available to one healthcare professional at a time. When EHRs started to replace paper records, the electronic records also started a long-term transition toward increased information sharing among healthcare professionals. This transition is particularly evident in large-scale EHR suites, such as those supplied by CERNER and EPIC. In addition to integrating still more intra-organization information into one database, these EHRs also increasingly support interorganizational workflows, with grand claims made for the impact of such implementations (Randell et al., 2019). The extension in scope is for example visible in three implementations of EPIC in the Nordic countries. In Denmark the implementation was restricted to hospitals; in Norway it spans hospitals, nursing homes, home-care services, and general practitioner (GP) clinics; and in Finland it spans all these institutions as well as part of the social services in the municipalities (Ellingsen et al., 2022; Hertzum et al., 2022). Furthermore, the transition toward increased information sharing among healthcare professionals takes place also via smaller projects characterized by bottom-up and user-driven processes. In these smaller projects, the adoption and scaling of EHRs are not mandated but rather happen through processes of gradual enrollment (Aanestad and Jensen, 2011; Dæhlen and Grisot, 2021; Grisot et al., 2014).

EHR implementation is a complex endeavor that challenges healthcare organizations. The challenges include seemingly mundane details such as user authentication (Bardram, 2005), grand-scale issues such as persistent user non-adoption (Aarts et al., 2004), and a host of problems related to organizing and running the implementation process. These process problems for example concern

ineffective user participation (Zahlsen et al., 2022), tensions between standardization and localization (Hanseth et al., 2006), errors in the interfaces for integrating the EHR with other health information systems (Viitanen et al., 2011), and cumbersome procedures for post-implementation improvements (Bansler, 2021). The broad scope of EHRs and their many user groups add to the complexity of the implementation process. As a result, the implementation of EHRs tends to be a lengthy and costly process with contracts for large-scale EHRs amounting to several hundred million euros (Hertzum et al., 2022).

The implementation of EHRs continues into their use. Healthcare professionals appropriate and otherwise respond to EHRs in their day-to-day use of them. For example, the comprehensive patient record in EHRs has been found to afford joint clinical decision-making based on shared data, but at the same time to constrain mutual understanding of those data because they are accessed through specialty-specific user interfaces and mostly communicated about through asynchronous messages (Vos et al., 2020). EHRs have also been associated with task drift (Tang et al., 2015), demands for increased levels of documentation (Zhang et al., 2022), increased documentation burden (Baumann et al., 2018), and expectations of improved possibilities for secondary use of the recorded data, for example for process improvement (Munoz-Gama et al., 2022). Contrary to intentions about reducing data fragmentation, EHRs have in some cases obstructed the building of a coherent patient history (Varpio et al., 2015) and necessitated workarounds to coordinate clinical workflows (Mörike et al., 2022). However, healthcare has become critically dependent on EHRs though paper records are still used to some extent and for some purposes (Cabitza et al., 2019).

In their review of the literature on health information systems (HIS), Sligo et al. (2017) conclude that "*Evaluating the implementation of HIS has been historically inadequate, plagued by simplistic and diverse approaches making it difficult to generalise the results.*" To understand EHR implementation, it is necessary to attend to the details of the individual cases, to the concepts applied in studying them, and to the questions that arise in comparing and contrasting different cases.

Aim

With this workshop, we aim to provide a forum for participants to get updated on current CSCW studies of EHR implementations and create connections with a select group of other researchers in CSCW (and beyond) who study such implementations. Three additional aims supplement this primary aim. By bringing the workshop participants together, we hope that cross-fertilization will ensue among their cases, their concepts, and their questions. Second, we will collaboratively reflect on what CSCW contributes to the study of EHR implementations and how we, as individuals and a community, can facilitate the

transfer of these contributions to practitioners. Third, we will discuss the interest in further collaboration and networking initiatives regarding EHR implementation, for example the interest in a second workshop at the next ECSCW conference.

Workshop themes

The workshop is about implementing EHRs. Within this overall topic, the workshop themes include, but are not limited to, the following:

- Case analyses of empirical projects at different stages of completion – from preparations, through go-live, to continued use and design-in-use
- Theoretically oriented pieces that propose or refine concepts for understanding EHR implementation and begin to apply them
- Discussions that raise questions about important features of EHR implementations, such as their scope, clinical implications, and so forth
- Studies of the many stakeholder groups that are connected and reconnected by EHRs, including how these groups participate in EHR projects
- Methodological reflections on how to conduct studies, manage research data, and behave ethically amid clinicians, patients, and EHR vendors
- Comparative pieces that investigate similarities and differences across EHR implementations or between groups, sites, or stages in an implementation

Participant recruitment and selection

The workshop can accommodate a maximum of ten participants (in addition to the organizers). Participants will be recruited from the CSCW, health informatics, and information systems communities. The organizers will reach out to these communities through their extended research networks and by circulating a call for participation on relevant mailing lists, such as EUSSET. Detailed information about the workshop will be made available at our workshop website.

Participation in the workshop requires the submission of a position paper. We encourage potential participants to explain their interest in the workshop and particularly welcome position papers that address one (or more) of the workshop themes outlined above. Position papers are limited to a maximum of six pages (excluding references) in the ECSCW paper format.

The submitted position papers will be reviewed by the organizers and accepted on the basis of the relevance and development of their content. If the number of people interested in attending the workshop exceeds its capacity, the organizers will prioritize submissions that make for rich presentations and discussions, while also seeking diversity among the participants. We specifically encourage both

junior and senior researchers to submit position papers. To promote broader participation, in particular from practitioners, we also offer the option of submitting alternative material of rough equivalence to a position paper (e.g., an experience report or abridged implementation plan).

Workshop activities

The workshop is a half-day event. It will consist of four activities:

- *Introductions*. The organizers introduce the workshop, including its aim and agenda. Participants introduce themselves and their interest in EHR implementation.
- *Paper presentations in similar-topic panels*. Participants will be grouped according to the topic of their position paper. Based on this grouping, all participants will give a short presentation followed by discussion. The grouping into similar-topic panels provides for cross-presentation issues to emerge.
- *Thematic discussions in break-out groups*. Participants will split into groups of about four people to explore the workshop themes further. Each group will be assigned different themes. The aim of these discussions is to delve deeper into issues from the presentations and to direct participants' attention to themes that may not have been prominent in the presentations.
- *Wrap-up*. To summarize the workshop, the break-out groups will give highlights from their discussions. The organizers will also probe the interest in a second workshop at the next ECSCW conference or in other ways of supporting further networking and collaboration.

Equipment needs

In addition to a room with wifi and projector, we will merely need flipchart-size paper and markers.

Organizers

The workshop is organized by four senior researchers who have investigated EHR implementations for decades and are currently involved in research projects about such implementations. The workshop organizers have a longstanding engagement with the CSCW community.

Morten Hertzum is professor of digital technology and welfare at Roskilde University, Denmark. His research interests are in CSCW, health informatics, human-computer interaction, information seeking, and organizational

implementation. He has been studying the implementation of information technology in healthcare for the past two decades. Currently, he is involved in projects about electronic medication management and the Norwegian implementation of EPIC's EHR.

Rebecca Randell is professor of digital innovations in healthcare at the University of Bradford and the Wolfson Centre for Applied Health Research. She has a background in human-computer interaction and her research sits at the intersection of health informatics and health services research. Recent work has included a realist review of the impact of inter-organizational EHRs on patient safety and a study of falls risk assessment and prevention in hospitals and how this is supported (or not) by EHRs.

Gunnar Ellingsen is professor in health sciences at UiT - The Arctic University of Norway, Department of Health and Care Sciences. Gunnar has for several years studied the implementation and use of large-scale Electronic Patient Records in Norwegian hospitals. Currently, he is engaged in the Norwegian implementation of EPIC's EHR, artificial intelligence in radiology practices, and electronic medication management. His research interests are in information systems, CSCW, and health informatics.

Miria Grisot is associate professor in Information Systems in the Digital Innovation group at the Department of Informatics, University of Oslo. Her research interests are in information systems, CSCW and health informatics with a focus on user organizations and user-driven approaches, information infrastructures and infrastructuring, collaborative design-in-use and continuous design. Currently she is involved in projects about the implementation and scaling of digital technologies for remote care in Norway and China, and about the development and design-in-use of inter-organizational infrastructures in primary care.

Acknowledgments

References

Aanestad, M. and Jensen, T. B. (2011): 'Building nation-wide information infrastructures in healthcare through modular implementation strategies', *Journal of Strategic Information Systems*, vol. 20, no. 2, 2011, pp. 161-176. https://doi.org/10.1016/j.jsis.2011.03.006

Aarts, J., Doorewaard, H. and Berg, M. (2004): 'Understanding implementation: The case of a computerized physician order entry system in a large Dutch university medical center', *Journal of the American Medical Association*, vol. 11, no. 3, 2004, pp. 207–216. https://doi.org/10.1197/jamia.M1372

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*, vol. 148, 2021, article 104394. https://doi.org/10.1016/j.ijmedinf.2021.104394

Bardram, J. E. (2005): 'The trouble with login: on usability and computer security in ubiquitous computing', *Personal and Ubiquitous Computing*, vol. 9, no. 6, 2005, pp. 357–367. https://doi.org/10.1007/s00779-005-0347-6

Baumann, L., Baker, J. and Elshaug, A. (2018): 'The impact of electronic health record systems on clinical documentation times: A systematic review', *Health Policy*, vol. 122, no. 8, 2018, pp. 827-836. https://doi.org/10.1016/j.healthpol.2018.05.014

Cabitza, F., Ellingsen, G., Locoro, A. and Simone, C. (2019): 'Repetita iuvant: Exploring and supporting redundancy in hospital practices', *Computer Supported Cooperative Work*, vol. 28, nos. 1–2, 2019, pp. 61–94. https://doi.org/10.1007/s10606-017-9303-z

Dæhlen, Å. and Grisot, M. (2021): 'User mobilization in bottom-up infrastructural transformation', in: *InfraHealth2021: Proceedings of the 8th International Conference on Infrastructures for Healthcare*, EUSSET Reports, vol. 5, no. 4, 2021. https://doi.org/10.18420/ihc2021_017

Ellingsen, G., Hertzum, M. and Melby, L. (2022): 'The tension between national and local concerns in preparing for large-scale generic systems in healthcare', *Computer Supported Cooperative Work*, vol. 31, no. 3, 2022, pp. 411–441. https://doi.org/10.1007/s10606-022-09424-9

Fitzpatrick, G. and Ellingsen, G. (2012): 'A review of 25 years of CSCW research in healthcare: Contributions, challenges and future agendas', *Computer Supported Cooperative Work*, vol. 22, nos. 4–6, 2012, pp. 609–665. https://doi.org/10.1007/s10606-012-9168-0

Grisot, M., Hanseth, O. and Thorseng, A. A. (2014): 'Innovation of, in, on infrastructures: Articulating the role of architecture in information infrastructure evolution', *Journal of the Association for Information Systems*, vol. 15, no. 4, 2014, article 2. https://doi.org/10.17705/1jais.00357

Hanseth, O., Jacucci, E., Grisot, M. and Aanestad, M. (2006): 'Reflexive standardization: Side effects and complexity in standard making', *MIS Quarterly*, vol. 30, 2006, pp. 563–581. https://doi.org/10.2307/25148773

Hertzum, M., Ellingsen, G. and Cajander, Å. (2022): 'Implementing large-scale electronic health records: Experiences from implementations of Epic in Denmark and Finland', *International Journal of Medical Informatics*, vol. 167, 2022, article 104868. https://doi.org/10.1016/j.ijmedinf.2022.104868

Mörike, F., Spiehl, H. L. and Feufel, M. A. (2022): 'Workarounds in the shadow system: An ethnographic study of requirements for documentation and cooperation in a clinical advisory center', *Human Factors*, in press. https://doi.org/10.1177/00187208221087013

Munoz-Gama, J., Martin, N., Fernandez-Llatas, C., Johnson, O. A., Sepúlveda, M., Helm, E., Galvez-Yanjari, V., Rojas, E., Martinez-Millana, A., Aloini, D., Amantea, I. A., Andrews, R., Arias, M., Beerepoot, I., Benevento, E., Burattin, A., Capurro, D., Carmona, J., Comuzzi, M., ... Zerbato, F. (2022): 'Process mining for healthcare: Characteristics and challenges', *Journal of Biomedical Informatics*, vol. 127, 2022, article 103994. https://doi.org/10.1016/j.jbi.2022.103994

Randell, R., Abdulwahid, M., Greenhalgh, J., King, N., Wright, J. and Keen, J. (2019): 'How and in what contexts does networked health IT improve patient safety? Elicitation of theories from the literature', *Studies in Health Technology & Informatics*, vol. 264, pp. 753-757. https://doi.org/10.3233/shti190324

Sligo, J., Gauld, R., Roberts, V. and Villa, L. (2017): 'A literature review for large-scale health information system project planning, implementation and evaluation', *International Journal of Medical Informatics*, vol. 97, 2017, pp. 86–97. https://doi.org/10.1016/j.ijmedinf.2016.09.007

Tang, C., Chen, Y., Semaan, B. C. and Roberson, J. A. (2015): 'Restructuring human infrastructure: The impact of EHR deployment in a volunteer-dependent clinic', in: *Proceedings of the CSCW2015 Conference on Computer-Supported Cooperative Work and Social Computing*, ACM, New York, 2015, pp. 649–661. https://doi.org/10.1145/2675133.2675277

Varpio, L., Rashotte, J., Day, K., King, J., Kuziemsky, C. and Parush, A. (2015): 'The EHR and building the patient's story: A qualitative investigation of how EHR use obstructs a vital clinical activity', *International Journal of Medical Informatics*, vol. 84, no. 12, 2015, pp. 1019–1028. https://doi.org/10.1016/j.ijmedinf.2015.09.004

Viitanen, J., Hyppönen, H., Lääveri, T., Vänskä, J., Reponen, J. and Winblad, I. (2011): 'National questionnaire study on clinical ICT systems proofs: Physicians suffer from poor usability', *International Journal of Medical Informatics*, vol. 80, no. 10, 2011, pp. 708–725. https://doi.org/10.1016/j.ijmedinf.2011.06.010

Vos, J. F. J., Boonstra, A., Kooistra, A., Seelen, M. and van Offenbeek, M. (2020): 'The influence of electronic health record use on collaboration among medical specialties', *BMC Health Services Research*, vol. 20, no. 1, 2020, article 676. https://doi.org/10.1186/s12913-020-05542-6

Zahlsen, Ø. K., Svanæs, D. and Dahl, Y. (2022): 'Representative participation in a large-scale health IT project', *Computer Supported Cooperative Work*, in press. https://doi.org/10.1007/s10606-022-09457-0

Zhang, Z., Joy, K., Harris, R. and Park, S. Y. (2022): 'Characteristics and challenges of clinical documentation in self-organized fast-paced medical work', *Proceedings of the ACM on Human-Computer Interaction*, vol. 6, no. CSCW2, 2022, paper 386. https://doi.org/10.1145/3555111