Introducing Lightweight IT - A Way to Build Flexibility for Healthcare Organizations?

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Abstract. The paper addresses socio technical relations of implementing a lightweight IT app in Norway. The focus is on how such technology will influence the possibilities for an organization connected to a large-scale heavyweight IT infrastructure to provide more rapid changes in line with healthcare worker's needs. The research question is therefore: How can lightweight IT support rapid organizational changes? The empirical site is one of the first health trusts in Norway implementing lightweight technology integrated to their Electronic Health Record (EHR). The lightweight technology is a nursing app for registering early- warning score (NEWS) bedside the patients. The paper is based on a qualitative interpretive approach, and the results are discussed in line with information infrastructure theory.

Keywords. Lightweight IT, Heavyweight IT, organizational change

1. Introduction

Large heavyweight IT constellations are becoming increasingly complex and rigid, requiring extensive time and effort to facilitate change and to meet innovation needs. Hence, such solutions make it is difficult for organizations to continue their digital development and adapt their IT portfolio to emerging user needs [1].

Increasingly, lightweight IT applications, complimentary to the existing heavyweight IT, is entering the e-health field. These innovative and agile applications that supports immediate user needs and work processes, with simple applications like apps [2]. The introduction and use of lightweight IT represents a paradigmatic shift in IT infrastructures in the Norwegian healthcare [2]. Hence, there is a need for knowledge for how this technology will affect users, clinical practices, and regional IT collaborations.

To address this knowledge gap, the paper uses a socio-technical perspective to investigate the implementation of a lightweight IT application. Previous research has shown how technology and devices can support clinical workflow, reduce clinicians time spend on transferring information, and reduce error in clinical documentation [3,4] This paper has a broader focus and investigate how lightweight technology can be a means for more rapid organizational changes in line with healthcare professionals' needs and emerging requirements. Our research question is therefore: *How can lightweight IT support rapid organizational changes?*

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The empirical site is the first health trusts (hereby called HT1) in Norway implementing a nursing app for registering early- warning score (NEWS) at the patient's bedside [5].

We adopt a theoretical perspective from the information infrastructure theory [6,7], and the principle of bootstrapping in relation to designing for instant usefulness, and connections to the existing system (installed base) [7].

2. Method

This paper is positioned within a qualitative interpretive paradigm, concerned with evolving and improving the understanding of a lightweight technology influencing organizational changes [9]. This is a qualitative inductive study, and the empirical data was collected one year after the nursing app was implemented.

The data included 22 semi-structured interviews with actors involved in the implementation and use of the app to get a broader overview of the socio technical implications. Informants include 26 healthcare professionals, 6 managers at HT1, 10 representatives from regional IT, and the vendors of the app and the EHR. The data collection also encompassed a demonstration of the app, and meetings and workshops with HT1. The interview guide encompassed questions on technology, work process and organization to provide an overview of the socio-technical aspects of the implementation process. The interview data was transcribed verbatim and subsequently categorized and analysed using systematic text condensation inspired by Malterud [10].

3. Results

The nursing app was implemented in 2020, with the aim of decreasing the use of paper, exploring mobile solutions in clinical settings, and simplifying the work with vital parameters and NEWS score. NEWS is a scoring tool used to detect and respond to clinical deterioration in adult patients and is a key element of patient safety and improving patient outcomes [5]. The score includes respiratory rate, blood oxygen saturation, temperature, systolic blood pressure, heart rate and a consciousness score [5]. In addition to improving the users' workflow and patient safety, the app was implemented to pilot digital procedures for clinical practice using mobile phones for registration, intended to increase digital competencies.

3.1. From Paper-notes to Nursing App

HT1 had priorly implemented a procedure of registering NEWS for all patients both in somatic and psychiatric care. This implied that the nurses had to observe and measure the patient's vital signs at the bedside and write the results of the measures on a paper note. Back in the ward office, they transferred the vital signs into a paper-schema and calculated the NEWS for each patient. The procedure of registering NEWS was conducted every morning before the doctor's ward round. The doctors had to go to the ward and search for the paper to update the NEWS status for their patients. Calculating NEWS implied double and triple registration of vital signs and the registration frequency increased if the patient status worsened. Accordingly, it was a time-consuming process

for the nurses, with an extensive risk of errors due to the complex transmissions of the data. Hence, HT1 sought to improve the workflow and procedure of registering vital signs and calculating NEWS, in addition to their overall aim of removing paper forms and making the data more accessible for both nurses and doctors. This required an app that was sufficiently user friendly and intuitive to use it in a busy clinical setting. In addition, it was necessary that the app could be integrated with the existing IT infrastructure and automatically transfer data to the EHR system. In early 2020, HT1 came to an agreement with a vendor offering a mobile app for registration of NEWS that met these requirements. The vendor had already established a collaboration with the regional EHR vendor to enable data exchange between the systems.

The app was piloted and implemented in an internal medicine ward before it was made available to the rest of the HT1. The feedback from the pilot ward was overall positive. Representing a potential barrier, the wards needed to actively request the app installed from the IT department. However, through a snowball effect more and more wards got the app installed. By January 2022, 26 wards, including almost all medical, surgical, and psychiatric wards, have installed the app.

3.2. The Adoption of the Nursing App – from Manual to Mobile Registration

Already in 2012, HT1 had implemented mobile phones as the solution for telephony, including emergency alerts and bed alerts. To improve the registration procedure for NEWS, HT1 had been looking for a solution to test out using the same phones for clinical work at the bedside. Most of the nurses found the mobile app intuitive and easy to use. The shift from paper schema to registering NEWS directly in the app did not demand extensive e-learning or classroom lessons. The IT department distributed a quick guide of instructions for using the app. The nurses accessed it from the existing mobile phones to register the vital signs necessary for the app to automatically calculate the NEWS score. The vital signs and the score were then automatically transferred from the app to the EHR system, as well as to the electronic whiteboard at the ward offices. The majority of the nurses instantly found the app useful and time saving since they did not need to register on paper anymore. However, some needed assistant to start registration of NEWS electronically due to low digital competence, and some described it as a barrier to use a mobile phone in front of patients. They worried that the technology would take the focus away from observing the patient assessment and communication with the patient. However, they solved it by explaining the purpose of using a phone at patient's bedside, to ensure that patients knew they were not "surfing on Facebook."

3.3. The Nursing App – Contributing to Improving Workflow

Since the functionality in the app was aimed for a specific clinical purpose, the implementation did not change the nurses existing workflow. They still had to measure and observe the patients to register the vital signs. However, the app had an evolving influence on work practices. By using the app, the nurse reported a better overview of the patients in relation to when to NEWS which patients and the total number of NEWS scores to do. They no longer depended on finding the paper chart or asking a colleague to know when it was time to do the next NEWS. Hence, the app ensured that everybody always had the same information about the patients' NEWS. The doctors highlighted that the patients' NEWS was available in the EHR from their office before ward rounds. This allowed the doctors to discuss the patients' conditions on doctors' meetings without

having to go get the paper chart first. In the EHR, they now got an important overview of each patient's NEWS trend over time, not only the latest NEWS score. Several of the ward managers described the app as not necessarily time saving for the nurses in terms of minutes saved for each registration. Instead, they emphasized how a busy clinical setting required the nurses to always prioritize their tasks. This meant that it often was challenging to find time to transfer vital signs scribbled down on a note, to the paper schema in the ward office, immediately after the measurements were taken. Hence, NEWS could be significantly changed without anybody knowing it for a long time. Using the app made this transfer automatically and immediately, thus improv the overall workflow for the healthcare professionals in the ward. After using the app for a while, the nurses at different wards required new schemas to be digitalized and installed in the app, e.g., the risk assessment forms for decubitus ulcers, nutrition and fall tendency, the forms for submission and admission, but also forms for more specific observations and scoring schemas tailored to a specialized hospital ward. The app was quickly adapted to the nurses' work practice, however, implementing it demanded for a complex overall regional collaboration.

3.4. The Relation Between the App and the Existing IT Infrastructure

Within the health region, HT1 was one of four health trusts participating in a regional IT collaboration. Hence, all implementations of clinical systems were conducted in a regional program where all health trusts had to agree upon the solution. The result was a complex and cumbersome processes, requiring years of negotiation and coordination before an app was implemented. However, the regional IT portfolio did not include all possible solutions the hospitals needed. The introduction of lightweight IT was therefore a step towards more flexibility for the health trusts, in terms of adding smaller solutions to the IT infrastructure without damaging the regional collaboration. HT1 had a mature IT organization and they had worked for years improving their IT portfolio and the work processes for their users. When HT1 found the app vendor for NEWS, they presented the solution at a regional level for approval.

In addition, the app vendor and the EHR vendor established a close collaboration to make the implementation, integration, and data exchange as smooth as possible. The app was integrated with the existing EHR system, and automatically transferred the NEWS data and generated a document in the EHR. The NEWS document was continuously updated with new registrations of vital signs. There was also a close collaboration between the vendors, the health trust, and the regional IT department on testing out and improve the mobile infrastructure to register clinical data and designing integrations to make the actual data exchange possible. All the actors involved had an interest in testing out mobile documentation for the healthcare domain which made this an efficient implementation process.

4. Concluding discussion

Traditionally, IT implementations in healthcare has consisted of introducing large-scale systems with a wide range of functionality for a heterogenous user group. Implementing complex solutions intended for addressing numerous user needs has proven cumbersome and demanding, challenging the realization of expected effects and benefits of the technology. Consequently, healthcare professionals have developed skepticism towards

new technological solutions. Implementing a mobile app designed for one specific purpose is a new way of introducing technology to support specific needs in clinical practice, without making large-scale changes to the existing II and the installed base [7].

The implementation of an app for documenting NEWS had a rapid and positive effect on the organization at different levels. First, in accordance with the bootstrapping principle [7], the app provided the users an instant value of improving the workflow without the need for demanding and comprehensive reorganization of work practices. In addition, the app generated changes in other parts of the organization, both related to the doctors' workflow and the overall overview at the wards. Even if the implementation of the app was done only to improve the NEWS procedure, it also generated new needs among the nurses. Second, since HT1 was part of a regional II, the work they did with testing and implementing the mobile app positively influenced the other health trust in the region as well. The installed base (the existing EHR) was used as the basis for how to integrate the app in relation to how information would be exchanged and distributed. This means that when another health trust wants to implement the app, it demands for minimum effort to their organization since all integrations to the EHR and collaborations between the necessary actors already are in place. This makes it possible for a health trust to complement their IT portfolio without large tender processes, complex implementations, and the risk of compromising the regional collaboration.

Although challenges in relation to how to procure and govern this new type of IT solutions for healthcare remains to be addressed, these solutions represent a promising step towards further digital development in healthcare. The fast adoption and the snowballing effect described in the present study, illustrates that lightweight IT has a potential to facilitate rapid organizational changes at different levels of healthcare. This includes, influencing several user groups and work processes both within the HT1 and in the overall regional infrastructure.

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