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Urgent Digital Change – Learning from the COVID-19 Pandemic

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Abstract. This paper investigates the digital transition that occurred during the COVID-19 pandemic. We elicit 3 cases of digital transition that took place at part of the contingency plan, that was executed in the Danish healthcare sector. It was a necessity in order to support the physical distancing between patient and healthcare staff and new treatment trajectories. We analyze the 3 digital transitions by looking at the constraining and enabling factors for implementation the transitions and discuss how the transitions where related to the installed base (EPIC/HER system) and its governance model of IT-infrastructures in the Danish healthcare system.

Introduction

The COVID-19 pandemic required swift and decisive digital initiatives from decision makers in all public sectors to meet a new reality, where the public sphere was a potent arena for the infection of citizens and public workers.

In the Danish healthcare sector, COVID-19 initiated a digital change force majeure that required both the rapid adaptation of new digital solutions and digital workflows in the interest of keeping citizens safe from infection during healthcare visits and keeping healthcare staff protected from infection exposure. In the Capital

Region of Denmark and Region Zealand (two of Denmark's five regions), the EPIC system[1], an electronic health record (EHR) system, formed the backbone of the digital response. The urgency of the COVID-19 pandemic led to a rapid and unprecedented digital change, where the existing governance model, with its well-planned yearly releases, had to be abandoned. The rapid digital change was conducted by maintaining a top-down approach with swift region-wide rollouts with high levels of standardization across all clinical specialties and their clinical practices (Bansler, 2019; Bansler, 2021). This provided a fruitful opportunity to roll out digital solutions and innovations to fit the new clinical reality. However, the standardized region-wide rollouts were also met by an emerging need for local and clinical specialty-specific needs for handling the pandemic.

In the following section, we first outline our method and the case. Then we present an analysis of real-life experiences from the digital change, including new IT capabilities and changes to the EHR infrastructure. Finally, we discuss implications from the perspective of ensuring successful change in future scenarios where there is an urgent need for digital change.

Methodology

This study comprises three cases that were followed during the first and second waves of the COVID-19 pandemic. The data collection was conducted by three co-authors and Ph.D. students involved in scholarships for three different projects while closely collaborating with two health care regions. The co-authors were all situated at their respective hospitals as the cases unfolded. This enabled them to closely observe the case and engage in open-minded discussions with fellow clinicians and technical staff. They had access to hospital IT infrastructure, regional documentation of initiatives, and various clinical department newsletters. In order to gain a better insight of the rapid digital initiative, semi-structured interviews were conducted with the Chief physician and Leading development and implementation manager from Capital region. Second interview was with a Project manager and her colleague, a Business relations manager from the IT department of the Capital Region. The third and last interview was with an experienced nurse now leading digital initiatives at the Hospital. Alle Interviews were virtually conducted using Microsoft Teams. Answers were recorded on Teams with consent.

[1] www.epic.com

Case description

Patients infected with COVID-19 present an illness trajectory similar to other viral upper respiratory illnesses. There are three major trajectories for COVID-19: mild disease with upper respiratory symptoms, non-severe pneumonia, and severe pneumonia complicated by acute respiratory distress syndrome (ARDS). (Chavez et al., 2020). COVID-19 introduces an uncommon need for isolating patients during infection due to a potential incubation period of up to 14 days from initial exposure. COVID-19 is known to infect through both physical contact between people and exposure to airborne secretes from those infected. Infected individuals are required to self-isolate during the incubation period, and as a consequence, healthcare personnel treating patients in the last two categories of illness trajectories are at increased risk of becoming infected themselves.

In Denmark, the diagnosis and treatment of COVID-19 patients are organized through COVID-19 test centers, where citizens can order a test slot at any available test center through an online portal[2] and get an online reply within 24 hours after the test sample has been taken. Test-results are shared with healthcare personnel through the national data infrastructure and can be viewed by the personnel inside the individual patient journals in the regional EHR systems.

To be able to handle a potential rapid uptake in COVID-19 patients with respiratory complications, many clinical departments (i.e., outside respiratory illness) were forced to reorganize toward an uptake in both hospital beds and personnel capable of providing care and treatment of said patients. Consequently, many planned procedures were canceled or postponed through the EHR system to create both digital and hospital capacity in ward overview tools for the personnel to support planning and coordination.

Initiatives were taken in the EHR system to create new data categories for informing cancelations, including informing patients with appointments of new times for procedures, prescribing standardized medical treatment for patients across departments, and demanding a readiness for clinical and digital change for the involved clinical departments. The digital change included, among others, "Smart Texts" and electronic letters to patients postponing non-critical treatments, video-consulting facilities, workflow supporting (postponed) visitations, and ambulatory bookings. Furthermore, it incorporated registration of COVID-19 symptoms, diagnosis, and treatment; various reports supporting overview, planning, and

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[2] www.coronaprover.dk

statistics of the COVID-19 cases; tools for contact tracing; as well as booking, registration, and workflow support for COVID-19 PCR[3] tests and vaccination.

Analysis

In this section, three examples of the necessary digital changes that occurred during the pandemic are presented. The first example is video consultancy with clinicians. The second example is contact tracing, which represents the introduction of new IT capabilities to keep healthcare staff away from potential COVID-19 positive patients and to support contact tracing of infected patients. The third example is infrastructuring the COVID-19 illness trajectories. This represents changes to the EHR and the necessary organizational and clinical processes to ensure consistent and standardized treatment of COVID-19 patients.

Video consultations with clinical staff

Exposing clinical staff to patients with COVID-19, thereby putting essential staff at risk of contracting the virus, poses one of the major risks of the national healthcare system as it reaches the brim of its capacity. A range of initiatives were introduced to minimize staff exposure to citizens, and an important digital tool for achieving this was an existing video consultation feature in the EHR system that was rolled out and activated to all clinical departments across the two regions.

Prior to the pandemic, the video-consultancy feature had been shown to be a controversial and political change (Stuart et al. 2020; Stommel et al. 2019; Kitamura and Wong 2010) toward the vision of Danish hospitals with more flexibility toward patient appointment types, treatments, and diagnostics. Video consultation was adopted relatively quickly. Therefore, it promoted physical distancing and enabled medical support without increasing the risk of transmission.

To ensure implementation during the first weeks of the first wave, department *champions* (i.e., secretaries, nurses, or doctors) were elected as partners for the region to (1) refer and communicate, (2) be responsible for adaption among staff, and (3) be responsible for department-level adaption of the video-consultancy tool.

The feature was activated in the regional EHR system, with the patients getting access via a dedicated patient portal, MyChart[4]. It was considered to have a positive effect on minimizing exposure and ensuring doctors had a new way of working remotely while keeping relatively good patient contact. Figure 1 illustrates the

[3] Polymerase Chain Reaction

[4] www.mychart.com

uptake of video consultations during the first two pandemic waves in Denmark in the spring and winter of 2020.

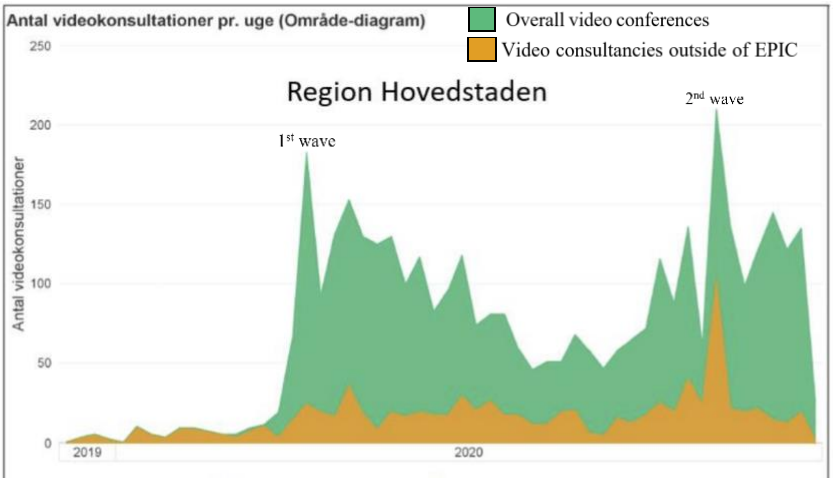

Figure 1 - Number of video consultations per week from 2019–2020 in the major Capital Regional hospital. Observe peaks during waves one and two.

The video consultation feature was announced by the region to be here to stay after the pandemic and was available for use by all clinical staff with patient contact after the first wave of the pandemic.

Contact tracing of COVID-19 infected patients

During the first COVID-19 wave in 2020, the EPIC released a tool for contact tracing to prevent the potential spread of COVID-19 (see Figure 2).

First, this tool can trace which wards and/or ambulatories a patient has been to. Second, it can trace patients or staff with whom an infected patient has been in contact with. The contact tracing tool generates a report for clinicians to use, which eases contact tracing. This process of generating a report should be compared to manually looking up patient journals one by one. The manual process could pose a risk of overlooking important

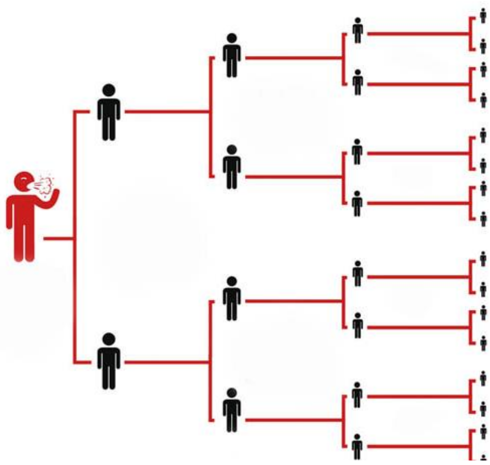

Figure 2: This figure shows the spread of COVID-19 from an infected person, if it is not prevented by contact tracing or other measures (illustrated with a contact number of two, i.e. an infected person spreads the disease to two others).

details, as well as taking up a significant amount of time for the clinicians. One nurse stated:

> "It is easy to work with, and it saves a lot of time. Previously we had to look up each patient and would spend half a day on contact tracing for just one patient. Now it is done in half an hour."

This automated contact tracing takes approximately one minute instead of the manual process taking approximately 2-3 hours. The tool received very positive feedback from healthcare workers using it. So far, the tool has been used primarily for COVID-19, but it can be used for other purposes when contact tracing is needed. The tool was made available for free during COVID-19 by EPIC, but with the positive feedback received from users, the hospitals will attempt to budget to make the tool permanent after the pandemic.

As a result of successful cooperation between the hospitals and the IT organization servicing the EHR, the tool was quickly implemented:

> "It was great to see the way the clinicians and IT worked together for a quick implementation" (application coordinator working within the IT organization)."

Infrastructuring COVID-19 illness trajectories

One of the main integrated and highly used features in the EHR system is order sets supporting clinical workflows for patient trajectories. Order sets are a structured collection of clinical guidelines, which physicians use for prescribing and ordering things, including blood samples, X-ray admissions, medications. These sets can be modified to meet the individual needs of the patient. Furthermore, it helps physicians to choose the right medicine and dosage along with other necessary information, such as instructions for the administration of the medicine and other decision support. Order sets are implemented to ensure standardized and consistent patient care across staff and similar departments across hospitals.

As an initiative to meet COVID-19, the cross-regional IT team initiated a taskforce (consisting of senior clinicians as IT product owners and members from the cross-regional IT team) to facilitate, support, develop, and optimize COVID-19-related work processes in both regions with new order sets. The project owner stated:

> "Having our own people at the table with decision makers has been a success"

The new work processes were implemented after the taskforce had aligned and developed the new order sets. The implementation happened rapidly and top-down to all clinical specialties across all hospitals in both regions.

COVID-19 order sets from the first wave ensured correct medication and diagnosis registration, which met all clinical guidelines. The product owner along with the cross-regional IT team frequently updated the order sets with the necessary items during the second wave caused disruption for clinicians.

While the implementation of the first COVID-19-related order sets went smoothly, feedback from clinical departments with COVID-19 patients started to reveal implications for the governing process of the digital initiative.

Initially, implications arose from the local physicians, who felt overwhelmed by many daily e-mails and newsletters accompanying the new order set rollouts for which the leading secretaries from each clinical specialty were appointed to be responsible for. The procedure for the centrally governed rollout prescribed that the responsible secretaries report any problems to the relevant project taskforce from the central IT service. Due to the amount of feedback that came from clinicians in response to the many newsletters and guidelines, the leading secretaries could not keep up with attaining feedback and sending it through the system to the project taskforce.

The physicians experienced that their feedback given to appointed clinical secretaries was not received at the taskforce level. It turned out that a lot of critical workflow feedback was never reported into the taskforce, which was expecting feedback to come as properly recorded complaint cases through the systems' standard reporting facilities. For example, the clinicians reported that there was not a well-understood practice for reporting patients cured after the 14-day incubation period. Therefore, patients that were no longer infected retained the status of being COVID-19 infected in the EHR system, causing a chain of problems regarding the continued patient trajectory. The problem escalated into a debate regarding the extent to which physicians had the autonomy to bypass the consequences of the EHR system workflow misunderstandings or whether situations where exceptions to the standard had to be taken to honor primary care purposes.

For a long period, the consequence of this was that physicians could not trust her system indicators of patients in their incubation periods, and this seriously compromised individual patient treatment as well as planning and coordinating patient care trajectories. A follow-up interview with the taskforce physician revealed that the feedback was never received at a high level.

Discussion and conclusion

The digital changes following the COVID-19 pandemic can be seen as an example of the swift and exemplary introduction and implementation of new digital responses to acute and severe healthcare situations. This opens a valuable experience of alternative approaches to digital governance and change. However, we also observe that there are fundamental differences in the premise of how well digital change affects the installed base of infrastructure supporting integrated patient trajectories.

Two new IT capabilities were identified, video consultation and contact tracing, which quickly found their relevance during the first wave of the pandemic. These loosely coupled technologies did not (at least at a surface level) have trouble being implemented and taken into widespread use. The two examples had a common characteristic of being relatively well received across clinical specialties, with little to no need for iteration or configuration.

The capability of video consultation capability has been identified as an example of a technology challenged by ongoing organizational resistance in a well-known conservative healthcare environment that was redeemed and reevaluated for emerging clinical needs during COVID-19. This digital solution had an immediate cross-specialty perspective and relevance that proved to be adapted across Danish hospitals, with no need for local technical configuration. While the technology had little need for technical configuration post-global implementation, it was noted that the technology had a foreseeable effect on the local clinical organization. For instance, physicians insisting on seeing their patients in real life had to either adapt to the technology or not see their patients during the first waves of the pandemic, thereby establishing itself as controversial.

Video consultancy had been introduced into the Danish healthcare sector prior to the pandemic with mixed results (Wentzer, 2013; Danmark, 2018), and there was resistance among healthcare staff that anecdotally preferred and insisted on seeing and examining their patients physically (Catapan et al., 2020). Thus, until the pandemic, most hospital staff insisted on the personal attendance of patients at the hospital as the dominating standard procedure of all diagnostics and treatments. A report conducted by the Capital Region of Denmark based on 22 patient interviews (RegionH, 2020) concluded that while the video constancy feature could help many patients, the ability of patients and doctors to choose for themselves was still recommended.

Similarly, we see the facility for contact tracing of COVID-19 infected patients as a stand-alone tool that in its premise and potential impact had immediate cross-specialty relevance. The tool quickly found clinical cooperation partners in hospitals that championed the technology toward good use to support safe clinical workflows.

These two technologies, while not unproblematic, had quick implementation success by not requiring complex integration with local clinical workflows, and the perspectives of both examples were cross-specialty relevant in nature. Such tools pose an example of a successful implementation driven by local needs, and the implementation shows that local and quick implementations can be carried out successfully when the stakeholders in question are collaborating with clinical staff. Furthermore, this implementation, which met an urgent local need, has shown potential for permanent and more extensive use, possibly after local adaptation, to meet the needs of other areas within the healthcare sector.

Our examples regarding infrastructuring COVID-19 illness trajectories demonstrate a greater level of implications and need for local adaption that was not allowed or met by the centrally governed digital change. As a heavily sociotechnical embedded change, this immediately led to the requirements of greater sensitivity to specialty needs, a need for an iterative approach to the implementation, and the possibility to make local configurations. We observe that this digital change received a rough start due to its high need for documentation, local adaption, technological re-education of staff, and strict guidelines that, locally, were poorly supported. Feedback from users was not properly responded to, and the command line of feedback from users was not clear to the clinical staff.

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