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Epic disappointment: Physicians' experiences of steerability in data-driven healthcare☆

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ABSTRACT

This paper examines discrepancies between expectations and actual data management practices in healthcare. It develops the concept of *steerability* to demonstrate how guidance provided by integrated, multipurpose patient data management systems functions as a sociotechnical feature and a core value in emerging data-driven healthcare, and what happens when the promises of an all-encompassing data infrastructure fail. The paper analyses physician's accounts and criticisms over an Epic-based patient data management system, Apotti, implemented in a public healthcare organization in Finland's capital region. Apotti aimed to standardize care and enhance oversight of the entire healthcare organization through data, following the idea that steerable healthcare functions better. While physicians did not oppose the datafication reform itself, their experiences reveal a stark misalignment between Apotti's steerability and their wants and needs, as it paradoxically both over- and understeered them. Clinicians felt the system fundamentally disrupted the core practices and values of their work, limiting their abilities in providing care. The paper shows how this deep mismatch was related to Apotti's poor fit with the Finnish healthcare system and the healthcare organization's more radical steerability objectives. Given the unfounded promises and misaligned effects, it raises the question of what role steerability plays in driving forward data-driven healthcare.

1. Introduction

The advance of datafication in healthcare seems paradoxical (Hoeyer, 2023), with its salient characteristic being the parallel, and sometimes entangled, existence of two opposite experiences. On the one hand, healthcare managers and advocates of change envision that data-driven technologies and AI will enable more precise diagnostics and treatment, seamlessly functioning organizations, and more time for patient care as technologies relieve medical professionals from paperwork (e.g. Hoeyer, 2023, pp. 42–48; (Helén & Tarkkala, 2024). On the other hand, widespread perplexity and disappointment over datafication seem to prevail among professionals, as they experience multipurpose data management systems, analytics devices, and AI disrupting their clinical practice and creating additional, 'meaningless' data work (Hoeyer & Wadmann, 2020; Hoeyer, 2023, pp. 97–105; Choroszewicz, 2024).

In this paper, we study the discrepancies between expectations and actual data management practices in healthcare. We focus on the adoption of Apotti, an integrated, multipurpose patient data management system, in clinical practices within public healthcare organizations in Finland's capital region. Comprehensive, multipurpose systems for sourcing, circulating and utilizing patient and performance data are considered a cornerstone of data-driven healthcare (e.g. Blobel, 2018). Developed by the Finnish Apotti Ltd and the U.S.-based electronic health record (EHR) vendor Epic Systems Ltd, the Apotti project was especially ambitious. It aimed at building the world's first integrated patient and client data management and enterprise resource planning (ERP) system for both healthcare and social services (Apotti, 2023; Hertzum et al.,

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2022). The scope of data and clinical and administrative activities to be managed by Apotti was unprecedented, even for Epic's experts and developers. We study how the adoption and adaptation of this complex system are experienced in a healthcare environment, focusing on the objective and hope that the system will oversee the organization, personnel and their practices - including clinical care. We focus on the issue of *steerability,* arguing that the guidance provided by the patient data management system functions as a sociotechnical feature and a core value in emerging data-driven healthcare. We then analyse what happens when the promises of an all-encompassing data infrastructure fail.

Using the notion of steerability as an analytical lens, we examine physicians' accounts concerning the Apotti system and their criticisms of its dysfunctionality, misguidance and interference in clinical work. Such dissatisfaction is not new: numerous studies on medical professionals' experiences with EHRs and other medical information systems and devices demonstrate that adopting ICT in clinical work often involves friction (e.g. Berg et al., 2003; Chaudhry et al., 2006; Holden, 2010; Jensen & Aanestad, 2007; Kjeldskov, Skov & Stage, 2007; Meade et al., 2009; Viitanen et al., 2011). Regular Finnish surveys since the early 2000s confirm this view: most physicians have been neutral or moderately satisfied with EHR systems, whereas 20–30 percent have consistently expressed criticism or dissatisfaction (Vänskä et al. 2010, 2014; Viitanen et al., 2011; Saastamoinen et al., 2018). In recent studies, the situation has remained similar for all other EHR systems except Apotti. Fewer than 5 percent of physicians were satisfied with Apotti's usability, and fewer than 10 percent considered that it properly supported their work (Hertzum et al., 2022; Viitanen et al., 2024). To examine physicians' dissatisfaction with the system in greater depth, we convened workshops with physicians using Apotti in their daily work. We analyse the experiences and critical arguments they shared in group conversations to understand why the new information system, expected to guide and improve healthcare, has become utterly disliked among the professionals.

Practitioners' criticism against new data-driven systems is often framed as resistance to change or as a reactive attempt to protect their privileges in the organizational hierarchy under the threat of 'automatisation' (e.g., Jensen & Aanestad, 2007; Walter & Succi Lopez, 2008). Our approach is different, highlighting that the physicians' critique did not oppose the Apotti system or the datafication reform itself. Instead, they believed Apotti could be highly useful in clinical work and provide tools for data-driven management at the organizational level, thereby endorsing the value and aim of steerability. However, their experiences reveal a stark misalignment between Apotti's steering and their needs as its guidance was paradoxically insufficient yet overbearing. Apotti failed to provide support where needed, while inducing steering in other areas, which clinicians felt fundamentally disrupting the core practices and values of their work. In addition to its dysfunctionality in clinical work, Apotti failed to meet the organizational objective of integrated data management, leaving physicians disillusioned by its promises. Thus, Apotti reveals data paradoxes (Hoeyer, 2023) not only in the gap between the expectations and realities of data-driven health, but also in its effects on clinical practice and the harms it produces. We examine how and why this discrepancy emerged between expectations and real-life experiences regarding Apotti's objectives of steering both professionals' clinical work and the larger healthcare organization.

In the following sections, we outline the Apotti project's trajectory and objectives, define the concept of sociotechnical steerability and clarify how we use it. After explaining our methodological choices, we analyse issues with Apotti's steerability reported by physicians, including poor usability, mismatched guidance in clinical practice, and unfulfilled promises of information management. We conclude by discussing how Apotti's poor fit with the Finnish healthcare system and the hospital district's ambitious steerability objectives contributed to physicians' frustration, as Apotti's standardization and steering mechanisms undermined the specificities of clinical care instead of facilitating physicians' work.

2. Apotti: A 'new generation' multipurpose patient information system

In April 2016, Apotti Ltd and Epic Systems Ltd made a collaboration agreement in which Epic committed to plan, implement and maintain an integrated patient and client data management system with ERP functionalities for public healthcare and social services, covering over 1.5 million inhabitants in Southern Finland (Grön, 2021; Apotti, 2023). Apotti Ltd is a company jointly founded and owned by Helsinki-Uusimaa hospital district (HUS), City of Helsinki, and several other municipalities to run the Apotti system (Grön, 2019, pp. 30–33; Apotti, 2023). In contrast, the U.S.-based corporation Epic is one of the leading providers of EHRs and other healthcare data management systems worldwide (Bansler, 2021).

The Apotti project began in 2012 when the capital region healthcare organizations mentioned above started preparing to acquire a new information system for healthcare and social services (Grön, 2019, pp. 30–32). At that time, national and regional authorities discussed issues with electronic data management systems in public healthcare and launched projects for technical and organizational reforms. Two dominant objectives directed the planning, with the first being to build nationally centralized EHR-type reservoirs for patient and client data. This was realized with the national patient record database (Kanta) that was gradually deployed between 2010 and 2018 and later complemented by a similar database for social services, implemented between 2018 and 2026. The second objective was to replace the motley collage of often incompatible programmes, databases, and devices in regional public healthcare with integrated data management systems covering all healthcare and social services in each hospital district and its municipalities (from 2023 onwards, Wellbeing Services Counties). The Apotti project was the first to introduce an all-encompassing integrated data management system for regional healthcare and social services. The acquisition process took place between 2012 and 2016, and as a result, Apotti Ltd and the committed municipalities decided to choose Epic as the supplier. Between 2016 and 2018, Epic and Apotti Ltd carried out an extensive planning and implementation project, and in November 2018, the first part of Apotti data management system was launched at Peijas hospital in Vantaa (Grön, 2019, pp. 30–36; Hertzum et al., 2022; Apotti, 2023). Finalized in 2022, Apotti's implementation took about four years, while the entire project spanned a decade.

Many developers and advocates viewed the Apotti project as a reform of organizational and professional practices, not just a change to the EHR system (Grön, 2019, pp. 52–60). They assigned multiple tasks to Apotti and its associated data management technologies (e.g., data sourcing devices, automated decision-making [ADM] or AI solutions) (Grön, 2019, pp. 52–60; 2021; Apotti, 2023). Apotti was envisioned to automate standard tasks and provide an orienting framework, allowing clinical practitioners, administrators, and managers to focus on essential aspects of patient care and healthcare management. Importantly, one main objective for Apotti was to improve the quality and equality of care by facilitating data-enabled standardization of treatment and other clinical practices. Apotti was envisioned to compile and summarize patient data, highlight information relevant to diagnosis and treatment, and provide alerts and suggestions for diagnosis, medication, and referrals. It was supposed to enable tracking already executed and upcoming clinical practices, while monitoring ongoing progress. Moreover, Apotti was expected to embed the Finnish Medical Society Duodecim's Current Care Guidelines, making adherence in clinical work almost automatic and providing new ways to monitor clinician compliance.

All along, Apotti project's concept of an all-encompassing data management system from a single provider company was controversial, facing criticism from both medical and ICT experts (Grön, 2019, pp. 30–32; 46–48). In fact, Espoo, one of the major cities in the capital

region with over 300 000 inhabitants, withdrew from Apotti early on due to profound disagreements. Furthermore, the choice of Epic as the system provider faced criticism because it was considered technically outdated and expensive. In the late 2010s, warning signs arose from Denmark, where Epic's *Sundhedplatformen* was introduced in 2016 as an integrated EHR system for hospitals in Copenhagen and Zealand region, covering 2.6 million inhabitants. During implementation, healthcare practitioners expressed disappointment over unexpected difficulties with the new system both in professional and public forums. In the first years of its use, public outcry over *Sundhedplatformen's* shortcomings, incompetence, and costs grew (Winkler et al., 2020; Bansler, 2021; Hoeyer, 2023, pp. 97–102). 'Lost in translation' was the title under which Arthur Allen (2019) described in *Politico* the failures of Epic's system, its catastrophic mismatch with the Danish healthcare system, and the resulting frustration of professionals (see also Hertzum & Ellingsen, 2019; Bansler, 2021; Hertzum et al., 2022; Hoeyer, 2023, pp. 98–102). Despite criticism and likely challenges ahead, the Finnish Apotti project moved forward resolutely, pursuing a plan more ambitious than Epic's endeavour with Danish patient records.

3. Sociotechnical steerability

As described in the previous section, Apotti's major intended change was an organizational reform achieved through deeper integration of automated data management with clinical work, along with subtler steering of professionals and clinical activities. When analysing physicians' accounts and criticism of Apotti, we noticed that this topic of steering appeared repeatedly, with them referring to how it 'guided' or 'directed' clinical work. Because data-enabled guidance is configured as the core of the Apotti project (Grön, 2019), and since we found similar emphasis in developers' reasoning in another Finnish project involving the implementation of an integrated patient information system in regional healthcare and social services (Helén & Tarkkala, 2024), we decided to focus on the topic of steering.

We developed the concept of 'steerability' to organize our observations and to use it as a lens through which to understand HUS physicians' disappointment with Apotti. We borrowed the concept from the expert discourse of machine learning. Steerability of machine learning or generative AI models refers to the ability to fine-tune, correct, or otherwise guide the models to operate more in line with the expectations and ethics of their owners or users (e.g., Digital Fluency, 2023; Jahanian et al., 2019). Steerability could involve, for instance, adjusting certain parameters or adding specific instructions to influence the style, content, or other aspects of the generated output. Steerability also means enhancing models' flexibility and utility by allowing users to tailor outputs according to their needs or preferences.

For the purposes of our analysis, we modify the concept of steerability to refer to an expectation, objective, or value whereby an algorithmic system can steer the healthcare organization, encompassing both clinical practices and administrative or managerial activities. As a value, steerability reaches beyond the sheer functionality of ICT, having at least three interlaced layers. First, IT developers should ensure the information system and its algorithms are steerable to accomplish assigned tasks appropriately; second, technical steerability should enable the information system to guide clinical practices and standardize them throughout the healthcare organization; and, finally, organizational steerability means guiding the activities and 'flows' throughout the healthcare organization, enabling seamless functioning as well as holistic and anticipatory management.

For us, steerability not only designates the inherent technical capacities of an algorithm, AI, or information system, but is better characterized as 'sociotechnical', a term coined in British work psychology in the 1940s, and today familiar in both organization studies (e.g., Berg et al., 2003; Geels, 2004; Pasmore, Winby, Mohrmand, & Vanasse, 2019) and science and technology studies (STS) (Latour, 2005; Law, 2009; Jasanoff, & Sang-HyunKim, 2015). Our use of 'sociotechnical' is inspired by STS approaches, referring to processual entanglement of human practices, technical devices, artefacts, and material entities (Bijker, 1997; Latour, 2005). Moreover, we believe sociotechnical steerability should be seen to characterize a wider whole of datafication, referred to by scholars as 'data assemblages' or 'algorithmic assemblages' (Dalton & Thatcher, 2014; Kitchin, 2017; Kitchin & Lauriault, 2018). These concepts suggest that data management technology should be studied as embedded in practices and institutions. As we will demonstrate, physicians' experiences and complaints about Apotti are shaped by their interactions with the data management platform, which involves technical, material, and human elements. We emphasize the reciprocal influence of technology and human practices: advanced ICT modifies healthcare professionals' practices and reasoning, while data management systems and algorithms depend on input from planners, developers, and users.

To approach the entanglement of ICT and human practices in the Apotti case, STS literature offers, for example, discussions on information infrastructures (e.g. Edwards et al., 2009; Bowker, Baker, Millerand, & Ribes, 2009). From this perspective, physicians' troubles could be seen as caused by shortcomings in the 'negotiation' between new technologies, technical and epistemic standards, and organizational and professional practices. We did not adopt this interpretation, however, as it risks overemphasizing technical devices and epistemic standards. Instead, we proceeded with the idea that sociotechnical steerability is not merely a factual feature of the Apotti system or healthcare practices, but a *promissory value* embraced by the Apotti project: healthcare, including clinical work, should become guided by an algorithmic system, and once it does, it will function better. This goal set a criterion for Apotti: the integrated data management platform should enable steering across the HUS organization, including all healthcare and social service organizations, clinical work, and other activities. In Apotti discourse, the system's multifaceted guidance defines the direction and higher purpose of datafication, instilling hope and a sense of progress. This is essential for envisioning and striving toward data-driven future healthcare, and for motivating Apotti users to endure difficulties in pursuit of better steerability.

Conceptualizing steerability this way reveals that issues with Apotti are not merely about the reciprocal relationship between individual physicians and the data management system, where ICT deprives them of professional autonomy – a value negotiated and entangled with technology uses, and supported by means of situational mastery (Savolainen & Ruckenstein, 2024; Tanninen et al., 2022). Instead, the concept of steerability helps us discern that the misalignment of physicians' experiences with steering Apotti induced in their clinical and other practices are situated within the wider sociotechnical milieu of HUS. Therefore, doctors' disappointment stems from Apotti's failure to effectively guide the overall functioning of the healthcare organization and professionals' practices at the clinic.

Against this background, we approach HUS physicians' accounts and complaints about Apotti by asking the following questions: What was the physicians' response to steerability, and how did they experience their professional alignment with Apotti in clinical work? According to physicians' accounts, in which respects did realignment become misalignment, and why did steerability fail with Apotti?

4. Methodology

All information systems undergo an installation period during which gaps and errors are detected and fixed. We wanted to see if Apotti's situation had improved and the critique was gradually fading. In March 2023, our research project arranged workshops for medical doctors to explore what had changed with Apotti and how possible work disruptions were managed. Physician recruitment was conducted in collaboration with the Finnish Medical Society, Duodecim, which published an open invitation in their journal and on their website and helped organize the workshops at their premises. A total of four workshops were held,

involving between four and nine participants per session, with 25 physicians participating overall. Except for one participant, all used Apotti daily; this paper focuses on the experiences of these 24 daily users. Among them, 19 were specialist doctors, three were specializing doctors, and two were non-specialized doctors. Many of the 24 daily users worked across multiple units: ten in primary health care, 21 in conservative specialties, and four in surgical specialties. Their experience as medical doctors ranged from two to thirty-five years. Most (21) had been using Apotti for over a year, while the remainder had been using it for 3–12 months. Aware of the critique surrounding Apotti, we inquired physicians' attitudes toward Apotti, which were negative (18), neutral (5), or positive (1).

Workshops are an established method for explorative and collaborative research (Ørngreen & Levinsen, 2017), enabling iterative approaches where insights from earlier sessions inform later ones. In the first three workshops, which had larger numbers of participants, each group was divided into two parallel sessions. Participants were encouraged to describe their observations from everyday work to concretely capture changes following Apotti's implementation. Both participants and facilitators wrote these observations on post-it notes, which were then displayed and discussed in a joint final session with all workshop participants. In the final workshop, which included only four participants, a similar exploration of experiences was conducted within a single session. Trained facilitators moderated the discussion to keep it productive despite emotionally charged topics. In addition to the facilitators and participants, researchers (2–4 per workshop) were present to observe and provide their insights at the end of each workshop. All discussions were recorded and transcribed. The workshops were conducted in Finnish and the data extracts presented in the analysis were translated into English. Following the Finnish guidelines for ethical review in human sciences, the research did not require an evaluation from an ethical review board. However, given the public controversy around Apotti and the narrow medical specialties in the capital region healthcare we protect participants' anonymity by withholding their professional details and omitting personal information from interview extracts and analysis. We refer to participants by assigned numbers (P1-P24), reflecting their order of appearance in the workshop data.

Unlike typical workshops, where different in opinions and observations surface and people engage in speculative conversations, our workshops showed uniformity: physicians shared an understanding that they could treat fewer patients and struggled to find relevant information, as Apotti offered inadequate support and guidance. Such consensus was not surprising, given previous research indicating deep dissatisfaction with the system (Hertzum et al., 2022; Viitanen et al., 2024). However, the physicians who responded to our open research call may have held particularly strong (negative) opinions about Apotti, as some seemed motivated by a perception that internal channels or official complaints did not allow their voices to be heard. Thus, our study may not capture the full range of experiences with Apotti; moreover, it relies on previous research and document materials to contextualize Apotti Ltd's aims and reasoning. Despite these limitations, the focus on the primarily negative experiences is warranted, given their prevalence and significance for understanding how data-driven health is being developed and organized.

When analysing the workshop discussions, we paid attention to how the participants supported and built upon one another's statements, using these interactional dynamics to guide our analysis (Halkier, 2010; Kitzinger, 1995). This directed our attention to how physicians discussed the lacking and excessive presence of Apotti, and, as said, we noticed that steering emerged as a core theme. We adopted the topic as a broader framework to make sense of the physicians' encounters with Apotti and accordingly developed the concept of sociotechnical steerability. When reading the workshop transcripts, we systematically marked all traces where the topic of steerability either implicitly featured in the discussions or was explicitly addressed by the physicians. This allowed us to focus on what steerability, or the lack of it, means in clinical practice. The explicit framing of steerability for workshop participants primarily focused on clinical work, highlighting usability issues and the lack of support mechanisms for everyday collaboration with Apotti. Physicians described this with phrases such as "It is not intuitive" or "It does not steer the user". The lack of steerability appeared symptomatic of the broader difficulty in using a system that fails to arrange and distribute information as expected. Despite these frustrations, workshop participants still cherished steerability as an organizational ideal for improving healthcare by aligning data use and work practices across units. This hope shows how the theme of steerability encompassed both organizational issues and clinical and professional practices, yet these dimensions appear enmeshed in the discussions. In the following, we first present our analysis of steerability issues with Apotti in clinical work, followed by the physicians' reasoning on Apotti's failing in organizational steerability. By separating different strands of the conversation, we aim to open a layered vista into the sociotechnical features of the healthcare organization.

5. Poor usability

Usability and user experience (UX) issues within EHRs are longstanding (Ratwani, Reider & Singh, 2019), but physicians felt that Apotti's usability problems were unusually severe. Physicians reported that, unlike other EHR systems that could be grasped 'after half a day of use', Apotti required extensive training; one participant described that 'even after 20 h of training' he was still 'helpless'. This difficulty in learning the system was experienced across professions, ages, and levels of IT experience. Even a physician serving as an Apotti support person admitted to being 'completely lost' despite 'absurd amounts of training', and a participant with a computer science degree argued that technical competence did not guarantee mastery of the system. The difficulties were particularly pronounced for new users, creating ongoing problems in an environment with frequent staff turnover and rotation between tasks and wards. Apotti Ltd. offered continuous training, but many physicians saw it as a reactive measure rather than a solution to the root cause.

In more concrete terms, physicians thought that Apotti's poor usability was connected to its visually busy and cluttered display:

> P4: Everything unnecessary should be removed from the everyday user interface. Simple tasks that could be completed with one or two clicks now require at least ten. Each of these pathways should be streamlined. Currently, you can use Apotti if you have enough time and a distraction-free working environment, but I find it vulnerable to interruptions and slow due to all the clicking. It is suitable for assembly line work: for simple and clear procedures.

The quote highlights how, what another workshop participant described as 'junk' in the Apotti display, makes finding relevant information difficult. Removing unnecessary features and 'technical jargon' from the user interface was seen as key to improving usability. Physicians adjusted their own user interfaces, and those of new employees, to create clearer pathways for use and help newcomers get started. In this context, 'pathway' stands for a visible aspect of steerability, as pathways aid finding one's way in the information system (Markham, 2021). Clarifying pathways was crucial, as finding uninterrupted time to concentrate on using Apotti was often unrealistic.

The difficulties continued when using templates and protocols by which Apotti aimed at standardizing clinical practices. Even though a physician thought that steering practices through routine protocols was 'a great idea' for ensuring the 'uniform quality of treatment [for] patients across the HUS area', he admitted to not actually using them, stating that '[the protocol] is somewhere [in Apotti], but I don't know where.' Commenting on not being able to locate the protocols in the system and the search function not yielding any results, he continued: 'In general, you need to know everything to find something. You

probably need to know a command, but I don't know what it is.' Workshop participants described similar struggles: search commands had to be exact, and as the system lacked advanced algorithmic assistance, physicians discussed spending excessive time scrolling, clicking and filling text boxes to locate information and get ahead in the system.

The technical shortcomings discussed above could be seen as straightforward usability issues. However, considering Apotti's aim to move beyond being a mere information management system and become a tool for restructuring medical care through the guidance and standardization of practices, its effects must be examined in a broader context. Below, we discuss how Apotti's attempts at steerability unfold in a fundamentally mismatched way in relation to physicians' needs, and how this mismatch is affecting the very core of the medical practice.

6. Lack of guidance

A key method for Apotti to steer clinical practice was through structured documentation of patients and procedures. While physicians have typically operated by writing and dictating patient narratives, Apotti required them to record using separate text fields. This approach promised benefits, such as more uniform care and better patient information management. However, for physicians, the shift from narratives to structured documentation was difficult to tolerate:

> P8: We've somehow allowed the idea to take hold in the field that when things are structured and turned into checklists and symptom lists, it makes the doctor's job easier. In my opinion that's a strange and erroneous idea. No doctor thinks with checklists and symptom lists, we think with narratives.

Physicians saw this push to steer medical practice as following 'an engineering logic'. Highlighting that their opinions and insights were overlooked during the development of Apotti, one clinician commented bluntly: 'You can tell that it has been developed by coders or engineers who know nothing about clinicians' work.' Criticism of structured documentation extended beyond its perceived unsuitability for clinical practice. Physicians highlighted persistent technical issues with Apotti's structured documentation, which they said were severely undermining their ability to provide medical care. While patient narratives had traditionally guided and coordinated care, Apotti fragmented medical information into separate text fields, all of which physicians had to manually check to understand the patient's situation - a practice that strained their cognitive ergonomics.

> P7: We need to manage a large amount of data, and so far, we haven't had any tools to help filter out those pieces of information for us (–) Apotti doesn't offer any improvement in this regard, quite the opposite, the information fragments, you can't find the thread there: what has been done to the patient, what happened then, what procedures have been done, they are all mixed up in there. As I said, nowadays it's moving towards having artificial intelligence read a million online books, and synthesizes them for you (–) Now it's the other way around, it's just completely fragmented information, from which we can't get any synthesis out, it just breaks it down into such small pieces that we can't form a complete picture anymore.

The physicians complained about the lack of hierarchy between the text fields, which made it difficult to distinguish relevant patient information from irrelevant. They described searching for clues about a patient's situation by peering into 'tiny text boxes', or 'using a crochet hook' to piece the needed information together. They often had to scroll through hundreds of lines or know precisely what to look for to 'find the details that I should know without asking', as a physician put it. Consequently, physicians felt that they were losing the overall picture of the patient – an outcome contrary to the vision of a data-driven, holistic view (see Helén & Tarkkala, 2024). They felt left in the dark, forced to check every box, including irrelevant ones, in search of something that might have happened. They described heightened anxiety and 'ethical stress', fearing that missing important information could endanger patient safety. Consequently, they were left hyper alert about their actions, unable to rely on the system:

> P20: Nowadays, I am afraid that I might miss some critical information and, as a result, endanger the patient's health. I never had this fear before with other patient record systems – that a system could be the reason I might miss something critical.

Given Apotti's shortcomings, physicians ended up performing tasks that they believed an algorithm or AI should handle, namely, interpreting structured data to inform and guide their practices. Many workshop participants thought that more advanced technologies, such as AI, should be integrated into Apotti to enable the (partial) automation of routine tasks, providing guidance within the system, and reducing the physician's workload in documentation. However, this kind of automatisation was far from reality, as was described by a workshop participant:

> P7: This is yet another example of as-if structuring. I am instructed to structure [it like this]: "Take this pill as follows – one in the morning at 8 a.m. and [one in the evening] at 8 p.m.". But this damn system cannot generate a medicine list for me. If there is [a selection between] morning, day, afternoon and night, it does not know how to select "morning and night", even though I just entered that [information]. I have to go and click, click, click it myself.

The clinicians did not get much in return for their labour-intensive production of structured data, which left them feeling that their data work was meaningless or even absurd (see Hoeyer & Wadmann, 2020). While Apotti lacked steering capacity due to its poor usability and inability to produce relevant insights from structured patient data, in other aspects, it tried to actively direct physicians' conduct, a topic we turn to next.

7. Too much steering

Successful cases of steering with Apotti occurred when physicians developed their own templates to standardize selected procedures. For example, new physicians in geriatrics used such a template as a memory aid during house calls. However, the standardized logic of steerability showed notable shortcomings and failed to work in all units. A workshop participant remarked that 'It is also part of Apotti's ideal that we can create these templates into which people must fit, even if they don't', reflecting on the uniqueness of patients and procedures. Others noted that templates effectively turned all patients into 'model cases', obscuring the specific features and problems of individual patients, making them harder to distinguish and remember.

Another example of Apotti's standardization and excessive steering is its use of push notifications reminding physicians to perform certain tasks. Some workshop participants welcomed such features, envisioning a system that could deliver meaningful analyses and notifications on lifestyle issues like smoking cessation, helping them initiate conversations with patients. However, physicians found Apotti's pop-up warnings mostly irrelevant, distracting them from their priorities.

> P14: It's like this "cry wolf" situation, where [Apotti] is constantly complaining about everything, and then you don't notice the real dangers.
> P15: Yes.
> P13: The discharge navigator is just like that; it's made by some engineer who thinks that the doctor can't think for themselves what the patient needs when they leave. There are dozens of points that need to be gone through, different checkpoints. Then the medication

section, like you said, when it gets stuck, then there's no way out of it. You can't discharge a patient from the ward –
P14: Exactly, yeah.
P13: if there's some expired prescription there, the discharge navigator gets stuck on it. (–) the information system crashes, and you can't discharge a patient from the ward or admit a new one in their place, because of Apotti.
P15: It's becoming ridiculous, because just last weekend we had a patient die in the ward in the early morning. They couldn't be moved to the morgue because –
P14: You couldn't discharge them?
P15: Exactly. It was, I don't know, it was about eight –
P14: Luckily it wasn't summer.
P15: 9 h waiting there.

Physicians frequently compared Apotti's push notifications to Aesop's fable 'The Boy Who Cried Wolf', noting that unnecessary warnings – such as multiple steps required to discharge a patient – diverted attention from more critical tasks. Apotti frequently suggested allergy tests unrelated to the patient's reason for care and issued warnings about the 'dangers of prescribing vitamin D' – alerts that clinicians found unnecessary, intrusive, and undermining of their professional expertise. As the excerpt above shows, sometimes the consequences of active steering extended beyond interruptions and frustrating pop-ups to absurd or even morbid levels, in this case, blocking physicians from sending a deceased patient to the morgue because Apotti discharge navigator disallowed it.

Many physicians associated push warnings and suggestions for unnecessary medical tests with a liability logic rooted in the U.S. healthcare context, where the Epic system originates. They noted that Apotti aimed to prevent medical staff from overlooking potential liability issues, possibly linked to the U.S. privatized insurance-based medical care. The physicians felt uneasy with this foreign logic, seeing it as a poor fit for Finnish public healthcare and reflecting the systems' inherent distrust of their professional judgement. They worried that with Apotti's implementation, HUS was unknowingly degrading valued aspects of the Finnish system, following top-down, data-driven trends to make it 'more U.S.-like' with an emphasis on liability and billing.

Besides being annoyed by the interruptions, physicians raised serious concerns that misguided steering could compromise the quality of medical care. One workshop participant noted that some of Apotti's warnings and push notifications contradicted the Current Care Guidelines – paradoxically undermining its goal of promoting adherence to them:

P11: With some medications, we have strived for decades to move away from unnecessary laboratory examinations [following] The Current Care Guidelines and monitoring [the patient's condition] clinically. Now, every time, it pops up in your face: check the natrium level or check something else. This is rather peculiar, as part of these [suggestions] have, for a long time, been against The Current Care Guidelines.

Additionally, physicians thought that Apotti impacted care quality by making diagnoses more imprecise. They attributed this to the system's clunkiness, slow performance and, partially, active steering. Physicians noted that Apotti readily labels diagnosis as long-term even when conditions are not, which pushes physicians to give more vague diagnoses to avoid errors. Moreover, a physician described how Apotti affected urgent care situations, where its clunky interface and misaligned guidance had unintended consequences for treatment and patient safety:

P1: [Apotti] was the master, not the servant, especially in the beginning. If a patient came to the hospital with thyroxine, a thyroid medication, whose dosage changes every day, you couldn't enter that without spending 2 h of the on-call doctor's time on clicking. As a result, nobody had changed doses, they just slapped something on there. Really safe.

Due to the troubles with the information system, some physicians admitted withholding certain medical treatments, thereby altering the care they might have otherwise provided to patients:

P14: I even notice that sometimes, when [a treatment] is not absolutely necessary and when I realize how difficult it would be to [administer] in Apotti, I don't prescribe it to the patient. If I'm on the fence, I don't prescribe it, but this might not align with medical ethics.

These examples show that Apotti's steering exceeds its limits, with issues reaching beyond usability into the core of medical practice. Instances where physicians are unable to get an overall picture of the patient, become distracted by unnecessary warnings, and encounter instructions that contradict care recommendations, worsen diagnoses, and diminish the quality of medical treatment, all reveal the fundamentally mismatched quality of Apotti's steerability.

8. From no reports to promises of AI-enhanced steerability

Besides actively steering clinical work, Apotti was intended to enhance organizational steerability by providing precise data for better information management, enabling a 'bird's eye' or a '360-degrees' view of each patient and the HUS organization. Apotti was envisioned to enable multiple 'secondary uses' of data in administration and management, ensure data protection liability, and make healthcare operate more seamlessly, precisely, and cost-effectively (see Hoeyer, 2023, pp. 37–54; Helén & Tarkkala, 2024). Physicians were excited about these prospects, highlighting their interest in using Apotti-generated data for research or small-scale epidemiological studies. However, they felt that the promises of improved information management were not realized in their units, as since Apotti's introduction, units were unable to retrieve information they previously could:

P16: At unit scale, we currently lack all reports. In our unit, after Apotti we don't really know anything, which is quite sad because the idea was that with this, we would achieve data-driven management. That's what we imagined, but unfortunately, the truth was different in this regard. No matter how hard we try, we can't get a report out. We don't even know how many patients there are.

Physicians described losing access to even the most basic reports, including patient numbers, performed operations, resource usage, and appointment counts. Similarly, the ability to track quality metrics, such as the number of bedsores, had vanished. To help the units cope, some clinicians described nurses using alternative documentation methods, such as tally marks, to track essential clinical information. The missing reports were devastating to physicians, undermining broader visibility and their ability to direct unit actions. Furthermore, they made scrutinizing Apotti's impact difficult. Workshop participants felt that their individual and unit productivity had plummeted since Apotti was introduced, but proving this was challenging. With Apotti failing as a multipurpose system for finances and HR, physicians had a deepening sense that it was a 'production reduction system' rather than a 'production control system'.

Physicians believed that the lack of oversight was severe across the entire HUS organization:

P17: You can't retrieve any data at HUS either. It is thought that [Apotti] has started to work seamlessly, but for a long time, you could not retrieve anything … After all, that was the big reason for using it, but you could not get the administrative data out, which is

important. That was the reason they wanted us to go and fill in their statistics.

Problems at the HUS level left physicians disillusioned, feeling their manual data work was wasted. A workshop participant suggested that Apotti's reliance on overly complicated manual data entry was a key reason why the system failed to produce promised reports and insights. He argued that the premise of Apotti's data generation was flawed, as 'structured data is what computers handle, not people'. Basing Apotti on medical staff's manual entries made little sense, especially since the system was not sophisticated enough to process subpar data.

Beyond troubles within the HUS infrastructure, Apotti struggled to align with the broader Finnish operational landscape. First, physicians reported ongoing communication issues between Apotti and other systems, especially the national patient data repository Kanta. One clinician questioned 'why Kela [Social Insurance Institution of Finland] or Valvira [National Supervisory Authority for Welfare and Health] or whoever certified it as interoperable with Kanta', stating that 'it should not be used in Finland'. Second, Apotti's promise to integrate healthcare and social services data into a single system proved legally unattainable in Finland, so the feature was not introduced. This mishap puzzled physicians, given Apotti's focus on liability and the complex acquisition process. They wondered how the restrictions in combining social and health data went unnoticed, as 'everybody knows that they are legally distinct registers.'

Apotti aimed to bring standardization, efficiency, and control to the HUS organization, but physicians felt it had the opposite effect. Promised improvements in information management remained unmet, undermining physicians' and units' ability to oversee and communicate with other systems and actors. Despite feedback and official complaints, the vision of steering HUS through Apotti's data-intensive logic seems to persist among upper management and Apotti Ltd. Physicians described that the company continually promises a new, better horizon. Apotti managers admitted the original system had issues but are now focused on the promised benefits of introducing AI upon Apotti. While this aligns with physicians' hopes for Apotti to use algorithmic tools to extract relevant patient information, they remained sceptical of the grand-scale visions, of even more grand-scale information management and feeling alienated by the discrepancy between top managers' portrayal of the situation and their experiences.

9. Discussion

Physicians have long had ambivalent opinions about EHRs, often criticising their clumsiness in everyday work. Even against this background, Apotti stood out in Finnish surveys, with an exceptionally high number of medical experts expressing dissatisfaction and fewer than 10 percent reporting no complaints. Focusing on sociotechnical steerability, we aimed to understand why physicians regard Apotti as fundamentally flawed. Our analysis revealed that the core issue lay in the *misalignment* of the steerability Apotti was meant to provide for both clinical practices and the entire HUS organization, as it paradoxically both under- and over-steered healthcare practices and information management.

Physicians found that Apotti's attempt to steer clinical work created difficulties due to flawed usability. The system lacked support mechanisms for everyday collaboration and did not allow doctors to intuitively determine the next step when searching for or documenting patient data. They talked about these gaps and discontinuities, referring to the lack of information architecture and missing pathways. Absent pathways might require memorizing the order in which pages need to be clicked open or a long sequence of codes to navigate the system. The system might also fail to communicate what error has been made. At the same time, Apotti excessively steered physicians in wrong places, 'screaming and complaining' for no reason, disrupting their workflows and limiting their ability to provide care.

Physicians' accounts at our workshops clearly reflected that Apotti was very different from the older EHR systems they had worked with. Most patient information systems used in Finland were – and still are – rather detached from actual clinical work, resembling electronic archives or repositories where practitioners store and retrieve patient data. Apotti, on the contrary, was designed to integrate with everyday clinical practices through multiple data sourcing and documentation duties, circulating patient data and other information, and data-driven guidance of clinical work.

In physicians' view, Apotti's attempt to transform treatment procedures and clinical decision-making to be more steerable and standardized was the key issue interfering with their work. Our workshop participants did not oppose the idea that an integrated information system like Apotti would support their clinical practices and help with managing, searching and using patient data and other medical information. They were accustomed to EHRs and the guidance of clinical practices by Current Care Guidelines, and they considered the use and circulation of electronic patient information essential for their work. What made physicians feel disappointed, critical or even desperate with Apotti was not the new system per se, but the misalignment between its steering and their professional understanding and routines – a contradiction that made them feel their profession was being shaped by an external 'engineering logic'.

Our workshop participants saw this misalignment as being caused by Apotti's inability to recognize how clinical practices and patient work function within Finnish healthcare, highlighting the sense of Apotti being 'American'. Apotti was built on the Epic information system developed for US hospitals and privatized insurance-based care systems. Although Apotti was a customized version, it did not fit particularly well with Finnish public healthcare as it highlighted billing and liability while being unable to support ground level of medical care. Similar mismatch is demonstrated by the studies on the implementation of Epic's system in Denmark (Bansler, 2021; Hertzum et al., 2022; Hoeyer, 2023).

However, we suggest that, perhaps more importantly, the mismatch is related to how the organizational value and objective of steerability was realized. Practitioners wanted help and guidance from the advanced information system to increase their autonomy and capacities to make better clinical decisions and provide better care, both individually and collectively. However, HUS as the subscriber of Apotti, and the developers of the system promoted steerability that went far beyond clinicians' professional expectations. The ambition with Apotti was to induce comprehensive organizational reform using data-driven and algorithmic steering. This pursuit involved not just introducing a new information system and training personnel to use it but a profound change in work practices within the healthcare organization (Grön, 2019, pp. 52–60).

For physicians' clinical work, this transformation meant making clinical practices seamless and standardized through more intimate and ubiquitous 'automatic' steering of everyday clinical work, facilitated by an integrative information system. Quite obviously, physicians' complaints reflected frictions, or even a collision, between their expectations and the ultimate objective of the Apotti project. While Apotti served quite well for routine tasks and procedures, when something extraordinary or unusual appeared or needed to be done at the clinic, physicians found Apotti more of a hindrance than help. Although much of their work is routine, physicians believed that clinical expertise involves managing deviations from the ordinary and providing specific care for unique patients. For them, an information system that forcefully pushes both patients and clinical practices to fit standardized templates and protocols is fundamentally unequipped for that task.

10. Conclusion

The major organizational change that we have discussed through the notion of sociotechnical steerability focuses on the entanglement of

automated data management with clinical work and the more tacit steering of the professionals and activities at the clinic. We have argued that steerability figures as an organizational value and objective, with the idea that when healthcare becomes steerable, it will function better. Yet, when the ideal of steerability fails, we can see how unfounded its promises might be. Our analysis details the failed and misaligned practices of steering, which not only disrupt clinical practices but also lead to losing visibility of the patient's situation and the overall functioning of the healthcare organization, paradoxically undermining the objective of enhanced steerability.

The analytical strength of sociotechnical steerability lies in showing how the expectations of the datafication of health are adopted and experienced in clinical practice. Physicians' experiences and complaints are shaped by their encounters with the data management platform, and so are their expectations. Aligning with the organizational ideals, they envision that advanced information systems and AI could support and guide them, increasing their capacity and autonomy to make better clinical decisions and deliver high-quality care, both individually and collectively. The demand for more data-driven techniques highlights that physicians do not oppose renewal. However, their disappointment over Apotti's unfounded promises and misaligned effects raises questions about the role of the value of steerability in data-driven healthcare: what interests and purposes does it serve and how much burden should professionals and organizations bear to realize it?

CRediT authorship contribution statement

Maiju Tanninen: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ilpo Helén:** Writing – original draft, Investigation, Formal analysis, Conceptualization, Methodology, Funding acquisition. **Minna Ruckenstein:** Writing – original draft, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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