

Connected Health Innovation: Data Access Challenges in the Interface of AI Companies and Hospitals

Laura Kemppainen, Miina Pikkarainen, Pia Hürmelinna-Laukkanen & Jarmo Reponen

“ The applications [and technology] are ready, the main reason for data access problems ... [are] ... the questions about who owns the data, where it can be stored, [and] how to keep it safe. ”

Innovation manager, AI company

The purpose of this paper is to explore the challenges and potential solutions regarding data access for innovation in the realm of connected health. Theoretically, our study combines insights from data management and innovation network orchestration studies, taking thereby a new approach into issues that have emerged in these research streams. Empirically, we study these issues in the context of a development endeavor involving an AI-driven surgery journey solution in collaboration with hospitals and companies. Our study indicates that the challenges and solutions in data access can be categorised according to the level where they emerge: individual, organisational, and institutional. Depending on the level, the challenges require solutions to be searched from different categories. While solutions are generally still scarce, organizational level solutions seem to hold wide-ranging potential in addressing many challenges. By discussing these dynamics, this paper provides new knowledge for academics and practitioners on the challenges and solutions for data access and management in networked contexts. The greatest challenges among healthcare providers and health technology companies lay on uncertainties and interpretations concerning regulation, data strategy, and guidelines. Creating guidelines for data use and access in a hospital can be a first step to creating connected health innovations in collaboration with AI companies. For their part, these companies need to put effort into gaining in-depth knowledge and understanding of the processes and standards in healthcare context. Our paper is one of the first to combine data management and innovation network orchestration literatures, and to provide empirical evidence on data access related issues in this setting.

Introduction

The contemporary environment for healthcare presents a constant need for innovations that use (heterogeneous) data (Gulbrandsen et al., 2016; Pikkarainen et al., 2018). In order to achieve social health improvements (Conway & VanLare, 2010) and cost-savings, (Meier, 2013), varying forms of data are increasingly needed in the creation and implementation of new Artificial Intelligence (AI)-based connected health innovations, for example, decision support solutions that create value for healthcare providers and patients (Down et al., 2018). The data can comprise anything from electronic health records to personal data that would have an impact on the healthcare quality, outcomes, or costs. (Meier, 2013).

The challenge is that although the technology for AI usage exists, data access is rarely straightforward, especially from the innovation management perspective. Since innovation in healthcare is often networked and collaborative in nature (Djellal & Gallouj, 2007; Gulbrandsen et al., 2016; Ramlogan et al., 2007), relevant data is stored in various places from internal hospital systems, to external network players' registers and databases. In addition, healthcare data management is governed by specific rules with regard to the access and use of data. Sensitive health and medical data about the patients is highly regulated. Due to tightening international and national data privacy regulations, innovation network players are often, quite understandably, hesitant to allow access to their data for any external partners. A dilemma thus emerges, where

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data access restrictions that are meant to safeguard patients, instead can end up limiting the possibilities of improving their healthcare environment.

Previous studies on collaborative innovation emphasize the importance of organizing data access and knowledge transfer in the collaboration process (Alhassan et al., 2018; Hurmelinna-Laukkanen & Nätti, 2018). Such need for data, information, and knowledge exchange is highly relevant in the context of AI and connected health. It has been acknowledged that emerging innovations in healthcare are and will be data-driven (Meier, 2013). This necessitates not only proper data access that allows identifying general patterns and understanding of varying cause-effect relationships based on information extracted from the aggregated data, but also very specific data access issues, such as accessing data in relation to services for specific actors, for example, access to one's own health information as a patient. In other words, data access is critically needed and highly important in the healthcare context in order to understand what kind of innovations are possible (as background information; as input in the innovation development), and to enable co-creation and use of smarter AI-based connected health innovations - the actual outputs - that are targeted either for patients, citizens, or medical experts.

The multi-layered nature of the need for data access (with which we refer to periodical vs. continuous, and general vs. specific needs) becomes highlighted even more when varying actors from the network come together with quite different motivations with respect to accessible data. Many innovation endeavors call for network orchestration where information and knowledge mobility are promoted with different means (Dhanaraj & Parkhe, 2006), and healthcare innovations are no exception. Generally, scholarly discussion has already addressed the question of information mobility and data sharing. Different means have been identified that allow data, information, and knowledge transfer for innovation in networked settings (Dhanaraj & Parkhe, 2006; Nambisan & Sawhney, 2011). However, there is a lack of research on how (or if) data access can be managed by means of innovation network orchestration when data access is inherently restricted, and when there are clearly articulated but diverse motivations and well-grounded reasons for such diversity. In addition, while the general challenge associated with data access is acknowledged, research insights are lacking about the precise nature and various dimensions of this challenge. Yet, this kind of information is urgently needed by both researchers and practitioners who are interested in contributing to the development of viable connected

health innovations in order to overcome the related challenges.

In this study, we attempt to address this gap by identifying and discussing managerial data access challenges faced by AI-based connected health companies that are part of innovation networks operating in the healthcare sector. We also discuss potential solutions that could overcome these challenges, from the point of view of innovation network orchestrators. The research question is formulated as follows: Where do data access challenges in AI-based connected health stem from, and how can they be addressed by means of innovation network orchestration? We examine issues related to this question by integrating insights from a literature review and case study.

The paper is organized as follows. The next section briefly outlines the existing knowledge on connection points of network orchestration and data management (especially data access). This is followed by description of the empirical research design and evidence. Analysis of the data, and description of the findings then precede the concluding remarks, where new insights are reflected upon regarding existing theorization, and where managerial implications are introduced.

Network Orchestration and Data Management in Connected Health

This paper is based on the integration of theoretical frameworks on data management activities (Alhassan et al., 2018), and on information (knowledge) mobility as a central innovation network orchestration activity (Hurmelinna-Laukkanen & Nätti, 2018; Nambisan et al., 2017; Nambisan & Sawhney, 2011; Sabatier et al., 2010). Such integration enables a better understanding of innovation network orchestration challenges from the perspective of data access in the healthcare sector.

"Innovation network orchestration" refers to taking systematic, purposeful actions that focus on initiating and managing innovation processes with many stakeholders (Dhanaraj & Parkhe, 2006). This comprises various activities needed to facilitate innovation co-creation (Hurmelinna-Laukkanen & Nätti, 2018). These activities include promoting actor mobilization and network stability, ensuring knowledge mobility, and innovation appropriability, as well as setting an agenda for the network and coordinating follow-up activities (see Hurmelinna-Laukkanen & Nätti, 2018; Möller & Halinen, 2017). In this paper, the focus is placed on

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information mobility since it has been frequently identified as crucial in the context of connected health environments (Pikkarainen et al., 2017). Information mobility refers to making sure that relevant knowledge or data is available in the innovation network (Dhanaraj & Parkhe 2006, Hurmelinna-Laukkanen & Nätti, 2018).

Information transfer is also a central issue in data management. Based on a study that analysed 61 scientific publications on data governance, Ibrahim Alhassan, David Sammon, and Mary Daly (2018) suggest a data governance activity framework that includes eight categories: data policies, data standards, data roles and responsibilities, data technologies, data requirements, data processes and procedures, data strategy, and data guidelines. One can see that the transfer of information is just one aspect of data management (Cavoukian & Jonas, 2012; Corso & Paolucci, 2001), though a highly relevant one. According to Alhassan et al.'s (2018) framework, data access challenges and solutions can lie in any of the mentioned eight activities, or lack of them in any given situation.

These eight categories of activity, together with the information mobility dimension of innovation network orchestration, form key elements in the conceptual framework of this study, towards helping people understand data access problems and solutions in connected health environments. We suggest that the orchestration challenges and solutions are to be found at the intersection areas of these dimensions (See Figure 1).

Our central idea derived from the earlier theories is that outcomes of networked innovation endeavours depend critically on specific ways of dealing with data access

challenges. Such challenges need to be identified and solved for all participating stakeholders (Corso & Paolucci, 2001; Möller & Halinen, 2017), which means that practical problems emerge from the collision between individual data management activities and collective knowledge, and information mobility (innovation network orchestration) activities. A systematic study of these collisions requires empirical studies focusing on detailed case studies.

Research Design and Context

Methodology

The present study adopts an auto-ethnographical approach (Rashid et al., 2015) to address the topic of interest. Ethnography is a research approach that focuses on a single case study and aims to develop deeper insights about the phenomenon under study (Myers, 1997). In auto-ethnographical work, micro- and macro-levels can be combined, as the researchers are immersed in the study topic. The context and the researchers' experiences therefore are in focus, to keep in mind the socio-cultural backdrops (Boyle & Parry, 2007; Chang, 2008).

Our study builds on data collection from a 12-month multi-disciplinary research project. In this project, a total of four hospitals in Finland and Singapore, and several companies came together to co-create an intelligent and patient-centric solution for adults who had to have surgery. In this project, the researchers acted as orchestrators and enablers for the data access needed in the process of researching, designing, and developing the solution. They therefore had firsthand experience with innovation network orchestration in a

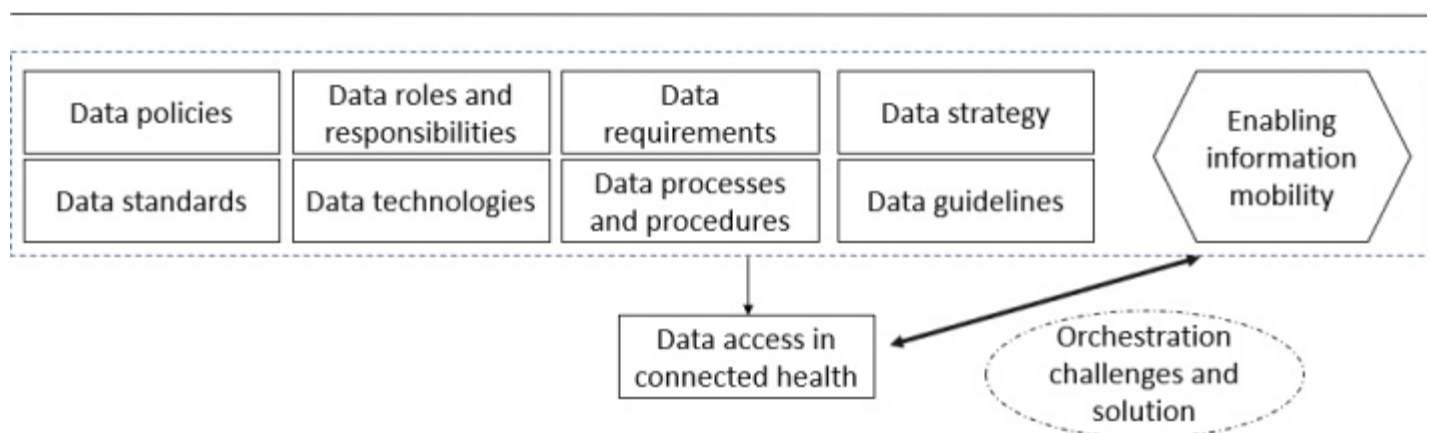


Figure 1. Conceptual framework on managerial orchestration challenges and solutions in data access for connected health.

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complex real life setting.

The research process of this study included the following steps:

- Initiating the development endeavor, including documentation
- Defining the research topic based on accumulating experiences
- Literature review involving managerial orchestration challenges and solutions in data access for connected health
- Conversational workshops and interviews were conducted in four hospitals in order to define needs and challenges related to surgery solutions development
- Field notes were taken in meetings where companies discussed data access issues with hospitals when co-creating their solution for surgery care
- Memos were created from all of the discussions
- Ethical permission writing was kept in a diary about data challenge issues that were discussed in the meetings between hospitals and companies.
- Data analysis by researchers led to drafting a narrative to capturing their experiences
- Further questioning and analysis that included external researchers to add general, cultural elements
- Documentation and categorization of the empirical findings using a thematic analysis

Reflection in light of existing theorizing

In the course of the project, various forms of research data were collected. While notes documenting the

researchers' experiences as such were of central relevance, during observations, the research team also generated materials on conversational interviews and workshops for an in-depth discussion of the data access issues and to understand the nature of the related challenges (see the activities in Figure 1).

The conversational workshops and interviews were conducted in the hospitals involving healthcare providers and connected health companies. Data was collected through a field diary and memos taken during meetings with the hospital IT and law departments. In addition, field notes were taken during the workshops that involved representatives of innovation network orchestration, such as healthcare providers (doctors and nurses) and healthcare technology providers (see Table 1).

In addition to the core research group working hands on in development, two other researchers joined the team when analysing the collected empirical data and writing down the findings. These two researchers are co-authors in this paper and have a different role compared to the roles of researchers working in the research project. These two researchers stayed away from the actual project, embracing rather a role of asking questions and challenging the thinking of others from a new perspective (see Chang, 2008). The story below was written in collaboration with all the authors in this paper. Data analysis was done in an inductive thematic manner, with the purpose of categorizing themes and key data access challenges, along with solutions emerging from collected data.

Table 1. Innovation network orchestration activities and data collection details.

Innovation orchestration and data collection activity	Participants
Interviews, personal notes and interpretations	8 companies (10 people)
1 st workshop with doctors, nurses and companies (University Hospital), personal notes and interpretations	1 hospital; 3 research organisations; 6 companies
2 nd workshop with doctors, nurses and companies (with Singaporean Hospitals and researchers), personal notes and interpretations	2 hospitals; 2 research organisations; 7 companies; 2 national organisations
3 rd workshop with integration provider company and AI company, personal notes and interpretations	2 companies (3 people); 4 researchers
Meeting memos from project sprint days, observation and project diary by the project facilitators (researchers)	All project stakeholders

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A connected health network

Altogether 12 researchers were involved in the research project, with two of them leading it. These two researchers were the main orchestrators of the project. The role of the orchestrators was to enable the dialogue between participants, connect the interests, and find and facilitate opportunities for collaboration among companies, and between companies and hospitals (see Dhanaraj & Parkhe, 2006; Möller & Halinen, 2017 for a description of orchestration tasks).

The project involved many stakeholders who were needed to develop and test a new solution in a live hospital environment. The network included four hospitals, three research organisations, two gaming start-ups in the health sector, a small video communication company, a large device provider, an integration provider, a patient engagement platform organization, and one AI company. When starting the work in our consortium, one company in the network had a monopoly in the Finnish market with strong relations to hospital systems and access to clinical data in Finland. Another company was continuously collecting patient data through a mobile solution. They held data from 1,400 patients from different hospitals. Yet another company was setting up video connections between patients and health professionals, but the company was hesitant to suggest any form of data collection or data usage to their hospital-customers because they felt that it would significantly decrease their possibilities to get access to the hospital market because of data privacy issues. The AI company had the capabilities to make data analysis and AI solutions, but no data to realize this potential.

In this network, the various participants had a common interest to create an AI-based connected health solution that supports patients and healthcare experts in activities related to the orthopedic surgery journey from home to hospital, and back to home. A key assumption of the project was the idea that getting access to data in the hospital systems requires tight collaboration. Data access was of interest to all stakeholders because it was the key resource that was necessary to build innovative solutions together.

During the project, we arranged continuous negotiations and discussions between the various stakeholders regarding data, access to data, data privacy, and project activities. Our field notes and interviews indicate that challenges became evident early in the project. The focus of the discussions shifted to understanding the

types of challenges, so that orchestration activities could be directed to solving them.

Analysis and Findings

Challenges in data management

Our observations show that heterogeneous data was seen as a highly relevant resource in both the creation and actual application of innovative AI solutions. This was an issue brought up by multiple actors, from company representatives to the leading medical doctors at the hospitals. One company representative expressed this as follows:

“when we have a lot of data...I think that’s really valuable in studies and researches, developing new care protocols, treating methods. But if you just develop some algorithms that makes maybe some alarms or something like that, I think that those should be really part of the platforms and the kind of service providers like us. Or third-party can sell them.” (Company CEO)

In many cases during our study, however, the managers of connected health companies faced major difficulties especially when negotiating about data accessibility with hospital management and the IT department. We saw several key reasons why data access is currently so painful, especially for the AI company in the project consortium. These observations created managerial implications and raised several issues to consider for connected health companies and hospitals.

First, data protection rules and regulations were changing in the European Union during our research project. The target of the new regulations was both to enable the secondary use of health data, and to create better data protection for individuals. For the former, “primary use” refers to using health data for the main purpose of treating a patient. Outside of this purpose, data sharing for research or development use is not legal, without specific permissions that cover particular situations. Regarding the secondary use of data, because practical guidelines for implementation and data use in digital innovations were still missing, the regulations seemed to have partly opposite consequences. Regarding better data protection, the EU general data protection directive added stricter organizational responsibilities in data processing, and sanctions in case of data breaches or unauthorized use.

Due to uncertainties, many players in the innovation

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network saw the changed laws and regulations rather as a problem than as an opportunity for future connected health innovations. Especially hospital personnel, for example, management and IT staff, were really frustrated about the continuous changes, and they felt it was difficult to proceed with companies before more information was available on interpreting and executing the new rules and regulations. Our experience was that this is an important message for hospital managers: one of the reasons for challenges in creating innovative solutions with external companies is in fact the lack of information and practical guidelines for implementing of the new rules. In some cases, it felt like the hospitals were lacking resources to get a better understanding about data usage potential. Companies saw that hospitals were hesitant to provide even anonymous data, or to allow those companies that held their data, to service it further.

“I think the hospital is protecting their own data for many reasons. Yeah, safety but also there can be I think ethical reasons for too that, who they want to give the data. Even if it is anonymous data.”

(Manager, AI Company)

It is important to note that the secondary use of health information is not allowed even in anonymized form if the patient has not given his or her specific consent for anonymizing, or if permissions have not been granted from authorities. As the information cannot be modified from one use to another, and since R&D further requires their own permission processes, the situation is quite complex and sometimes organizations outside of core health care provision have a hard time comprehending the full picture. For example, in one case the hospital IT personnel needed to deny data usage and integrations from a company who, in principle, already had all the data that the AI company would have needed for their solution development. This was because of legal issues with regulations stating that a company technically storing and analysing data for a health care provider, does not have a legal basis for its further usage. The situation caused frustration among the parties, both in the company who had the data, and in the company who needed the data for solution development.

Related, but distinctive reasons for the hospital resistance, and issues for innovation managers in hospitals to consider, were the hospital personnels' uncertainty about the new practices and needs for securing private information. The hospitals also lack data governance processes.

“I feel like the process is missing from the hospital side to give the AI company the access to data. So, kind of process is somehow too complicated or too much bureaucracy or, it's hard to get in.”

(Company Manager)

Regarding other uncertainties felt by the actors, hospital staff mentioned, for instance, the possibility that a small company goes bankrupt, and the patient data stays locked and inaccessible in some cloud server. Another example mentioned in discussion was the fear that the AI company would take the hospital data and start sending bills back to the hospital regarding its usage. For health technology companies, an important managerial implication of this study is that being transparent over how data will be used in an innovation, and where the data is stored can reduce the uncertainty and perhaps also the anxieties of some hospital personnel. This could be one way to more seamlessly co-create data-driven services within and between hospitals.

We tried to trace back to the reasons behind the worries beyond the obvious uncertainties interpreting the new legislation. One example was that one of the companies in our project consortium had previously had an attempt to get their solution to be adopted in the hospital, although not all protocols set up by the hospital's IT organization were followed. We got the impression that because of their previous experience, this hospital IT department had “set the company in their black list”, which we believe had quite long-lived effects. The IT organization of the hospital continuously advertised this company as an example of how the hospital should not work with startups in their own innovation networks. In general, the earlier experiences that gave a negative imprint, together with a lack of adequate resources, as well as uncertainty about the regulations, emerged as core reasons why companies in our project found it hard to get access to anonymized or pseudonymized health-related data. At the same time, the data holders faced challenges of not violating any privacy regulations, along with the need to better understand the technological solutions' consequences regarding data use, especially long-term.

Adding to the challenges, it was not completely evident if the common resistance towards specific parts of the AI solution development was based on previous real experiences, or on beliefs and rumors. We learned, however, that at the same hospital, several parallel failed AI innovation cases had emerged. While these were not connected to our project or the particular innovation network, these parallel problems seemed to generate a

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negative reflection on the attitude of hospital personnel in our innovation network as well.

Emerging solutions

Our study has managerial implications for hospitals and health technology companies in showing that involved actors can identify several plausible ways to solve data access challenges. Our field notes considered that the orchestrators from each objective research team needed to take a coordinating role in order to help facilitate solutions for data access issues. In particular, numerous misunderstandings in the communication between companies and hospitals were considered as a hurdle for any progress with data access. Therefore, orchestrators needed to ‘translate’ the motivations and concerns between players in the innovation network. Relatedly, one solution identified to address the challenge was simply to continuously maintain an ongoing discussion between the companies and hospital employees in different departments, meaning the doctors, nurses, IT, and law department about data access issues.

This was not a straightforward process, however, as the discussions and subsequent calls for action required use of scarce resources. This was observed, for example, in the behavior of hospital IT departments and upper management who, in the end, did not want to discuss about the possibility of creating a data lake in the research project, that is, a secure place for data for the use of innovative services. This is because they were concerned that this possibility would take all their resources from other more crucial development actions. Our takeaway was that in the end individual perceptions and organizational resources were of essential importance.

Problems of withdrawal from the discussions escalated across the network. However, for the AI company, tight collaboration with healthcare providers, hospital IT departments, and the connected health companies was essential. Although the actors in the innovation network realized that orchestration activities would accommodate granting access to data by generating procedures of trust among healthcare providers and AI companies, in practice, this process became quite demanding and required personal connections in between participants. The AI company mentioned that they had managed to become a trusted partner for one hospital earlier, but that hospital was not involved in our innovation network. The earlier example pointed towards potential solutions (that is, creating individual level trusted relationships), yet in this case, the positive and negative experiences in different parts of the

network, did not really align in a manner that would have promoted collaboration.

Nevertheless, the role of intermediaries became quite clear during the search for solutions. Company managers, in particular, highlighted it, together with developing clear responsibilities among actors in the innovation network.

“Somebody who is... providing services to, let’s say hospitals, needs to be somehow as an integrator or management of the overall solution, towards the hospital. Then different parties inside the overall solution will get their revenue based on some split that we as a group decide.” (Company Manager)

Determining a leading organization was, however, very difficult for the companies involved. In particular, they often seemed to be extremely worried that the other players would become their competitors. The relatively small market was a special cause of concern. Again, a solution came with new tensions and challenges at the wider, contextual level.

Considering the solutions for data access as such, the missing processes and protocols in and between organizations were looked at under closer scrutiny. In the discussion with the hospital IT teams, it became evident that having a clear process and increased knowledge about the protocols for data sharing, and for granting data access for digital innovations would be a way to streamline the data access process and requirements for the AI companies. In practice, for example in Finland, there are many national level standards for the use of information and communication technology (see, for example, Reponen et al., 2017). However, the problem is that while the hospitals have many standards and protocols in use, their utilization requires special knowledge, which ordinary clinical units do not have. Thus, both in Finland and Singapore, it requires time for the involved innovation coordinators and medical doctors to clarify the protocols and standards to be followed in a particular situation in their own hospital.

In our innovation project, there would have been a possibility to use the project efforts to create a common framework design together with the companies and hospitals. In reality, however, the innovation project network had to adapt to the existing data management and equipment purchase policies in the local hospital environments. Consulting time for innovation network activities was limited mostly to clarifying the most

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urgent issues. This highlights the limited resources hospitals have for ad hoc innovation activities.

an easy place to go and just start to create new data models.” (Manager, AI Company)

Finally, the study realized that more efforts are needed also at the governmental and national levels in order to enable AI innovation development. Comparisons are thus being made all the time to seek solutions:

“I think the bureaucracy and world is kind of changing, but I think that Singapore is a good example of having this governmental sandbox for AI companies where there is already all the patient history data anonymously. So, AI companies have

Categorizing data access challenges and solutions
Analyzing the available materials, specific categories of the challenges and solutions started to emerge. These may be grouped into three general categories: individual level (referring to representatives of different organizations), organizational level (referring to stakeholder organizations such as hospitals, companies, government agencies), and institutional level (that is, regional, national, and international frames for working beyond organizational boundaries, including legislation

Table 2. Managerial Orchestration Challenges and Solutions.

Area of data governance	Individual level	Organisational level	Institutional level (frames)
Data policies	C: There are many interpretations of the new laws and what they mean for data access and privacy	C: Hospital is protecting data for legal reasons S: Clearly define what data is needed and for what reason	C: New data privacy laws C: IT innovations are complex S: New regulation on data privacy and use
Data standards	N/A	C: There were many standards and protocols existing in the hospitals, but it takes time to clarify them	S: Standards defined/agreed to use at national level
Data roles and responsibilities	C: Interpersonal relationships and trust affect decision making and willingness to collaborate C: Misunderstandings affect decision making and willingness to collaborate	C: Lack of trust among the hospitals and service providers who ask for data access S: Define which parties need access to data S: Verify that data access requests comply with permissions and laws S: Partner with the right system providers	N/A
Data technologies	C: Limited knowledge with actual regard to tech properties	S: The integrations are in place and technology ready for data access	N/A

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Table 2. Managerial Orchestration Challenges and Solutions (cont'd).

Data requirements	N/A	C: Companies have unrealistic expectations for data access C: Hard to decide where the data should exist S: Decide where data should be stored (e.g., Hospital Data Lakes) S: Using training data	N/A
Data processes and procedures	S: Discussing with hospital employees e.g. doctors, IT, and legal department	C: There are many guidelines in the hospital but they are often unknown C: Companies and hospitals collect data into different databases C: Bureaucracy in the hospitals C: Companies' limited understanding of hospital systems	S: There are national baseline interpretations of the regulations and permission processes
Data strategy	N/A	C: There is no data strategy in place at the hospital S: Have a discussion with the hospital district about data access	N/A
Data guidelines	C: Hospitals are afraid that something could go wrong if data access is granted	C: No clear guidelines how to use existing data in research and solution development S: Define what you need the data for S: Verify legal aspects	S: National level reports and framework created to support the use of data in new digital solutions

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and policies) factors. These categories can be approached based on data management activities (see Alhassan et al., 2018). Summarizing the above discussion, and going into more fine-grained detail, we identify managerial orchestration challenges and solutions as mapped in Table 2 below.

The findings suggest, first, that challenges in data access may emerge at the individual level, meaning that the impressions and relationships between people at the hospitals and technology providers have an effect on how access to data is perceived. In particular, personal relationships between the hospitals and technology providers, for example, an AI company, become crucial for establishing and maintaining trust. For managers, it is good to understand that at the individual level, challenges and solutions may sometimes build on expectations and beliefs, rather than the actual state of things, and that many of these can be invisible. Therefore, although getting all the right parties at the same table is challenging (and may first introduce new problems), it is crucial for getting access to the data, and therefore to be reckoned with when it comes to orchestration.

In the examined project, the most (visible) orchestration challenges and solutions with regard data access seemed to occur at the organizational level. In particular, with respect to the (lack of) matching processes and protocols, uncertainties related to storing of the data, the extent to which, and what kind of, data should be available, and questions on securing privacy issues, were considered as central organization-level issues. While not surprising as such, these issues reside in the middle ground between individual and institutional levels, thus seem to provide the best possibilities for orchestration. As entry points, these organization-level issues are concrete enough (to define how representatives of a specific organization operate and interact with representatives of other organizations), and they are not taken too personally.

Finally, institutional level challenges and solutions are external to existing innovation network structures. What is noteworthy here is that institutional level issues are easily perceived as problematic rather than something that can be utilized as a stepping stone. However, upon closer look, in most areas of data governance, they are not strongly present at all, and they also can provide the needed frameworks for organizations and individuals to approach data access challenges and generate needed solutions. Markets and regulation could be explored for opportunities regarding differentiation, for example.

Members of the various impacted networks could also try to influence these frames, if the possibilities for such action were recognized. Again, what was found is that network orchestration may provide the needed tools to realize such possibilities, especially if influential power can be aggregated efficiently and effectively.

Conclusions

As Thune and Mina (2016: 1546) note, hospitals are “central nodes in health-care networks because they perform multiple roles at key intersections of the system” (see also Ramlogan et al., 2007). This also means that they are organizations placed at the intersection of many varying, and even opposing expectations, which inherently affects innovation endeavors in this context (Djellal & Gallouj, 2005; 2007).

This study provided insight on the paradoxical features of data access and innovation network orchestration related to it. By identifying challenges and potential solutions at the intersection of innovation network orchestration and data management in the context of connected health, it adds to the existing knowledge that assumes data availability as a central part of network orchestration, and/or expects that securing information mobility is a matter of motivating the parties to share their data and knowledge (see, for example, Dhanaraj & Parkhe, 2006; Möller & Halinen, 2017). Likewise, it adds to the discussion on managing data from the point of view of privacy concerns (see Alhassan et al., 2018; Corso & Paolucci, 2001). This study therefore contributes to the innovation management and network orchestration literatures in the context of connected health, where data-driven innovations such as AI-based decision support solutions need to be continuously developed in order to improve the quality of care and cost-effectiveness (Pikkarainen et al., 2018).

This study took as its starting point a search for answers to the question: “where do data access challenges in AI-based connected health stem from, and how can they be addressed by means of innovation network orchestration? A key finding of the study is that healthcare providers and health technology providers already now identify quite well the challenges in terms data access and use in data-driven connected health innovations. However, they struggle with identifying the best solutions to overcome the challenges. Based on theoretical and empirical examination, it was suggested that the challenges in data access for AI companies can

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be considered at three levels: individual, organizational and institutional.

In many cases, challenges seem to emerge especially from diverging perceptions, or misinterpretation of factors that reside on varying levels. Individual level obstacles for data access may start from individuals' earlier organizational collaboration failures, lack of organization specific guidelines for data use or from different interpretations.. Lack of organizational level guidelines, may, in turn, result from uncertainty regarding institutional level regulations and policies.

Our study shows that the greatest challenges in connected health and in creating innovative data-driven and patient-centric solutions, stem from tightening data privacy regulations that reside at the institutional level (that is, beyond individual organization) and, in particular, interpret in different ways at the individual and organizational levels. Likewise, the lack of processes and data strategies at an organizational level is an important contributor to how challenges are faced. Their absence tends to limit access to data especially in hospitals. As such, this is not surprising. However, when connected more directly to the different levels, the challenges change, and become more difficult and less solvable.

This leads us to the second part of the research question: It seems that innovation network orchestration holds the most potential when it is focused on the organizational level, and on inter-organizational relationships. The research above suggests that solutions for data access challenges are mainly organizational, which means covering actions such as improving the processes and data strategy of the hospital. While there is also a need for national level interpretations of institutional regulations and guidelines for healthcare organizations so that the data access and data management policies do not differ between organisations, it is a matter of organizations making this information visible among their members and collaborators. In this, orchestrators can be relevant intermediaries. However, more indirect elements are also present.

Individual level challenges and solutions may take quite different forms, and be even irrational if they build solely on beliefs and perceptions rather than facts. The above findings point towards personal connections, discussions, and relationships having a crucial role in breaking down barriers and finding solutions to create innovative connected health solutions in collaboration

with hospitals and AI companies. This means, on one hand, that carefully selected orchestrators may be in a position that allows development to start on data access systems, and to move from there to actual innovation generation; individual-level issues are brought to the organizational level. On the other hand, an orchestrator has a central task of building the premises for discussions among network actors, so that the beliefs and perceptions of participants can come closer to each other. This approach may be much more discrete than coordinating for data access systems, but nevertheless relevant for an institution's ultimate goals.

This study leads to managerial implications that may impact AI companies targeting the healthcare market. It is important for AI companies to understand that in order to succeed with data access they need to, 1) find the right orchestrators, 2) build personal connections and trust among hospital personnel, 3) understand and follow the rules, regulations, and guidelines related to data protection, transfer and storage.

One of the key managerial findings of our study is that the greatest challenges among healthcare providers and health technology companies lay at the organizational level, covering issues such as a lack of data strategy and guidelines in a hospital. Network orchestration can therefore be approached efficiently at this level. Creating and communicating clearly about hospital level rules and protocols for data use and access in a hospital can be a first step to creating connected health innovations in collaboration with AI companies. Companies, in turn, can be provided with educational materials about regulations concerning health care data access, so that expectations can be adjusted realistically. If requests for data are already suited within the existing legislation, this means they will have more success in proceeding.

Additionally, orchestrators need to be aware of varying perceptions and expectations, understand the resource limits, and be able to target the discussions and activities efficiently. Understanding the central factors across different levels allows them to promote practices that ease data access challenges without jeopardizing confidentiality and privacy needs. Excessive access restrictions can thus be avoided, and data management eased so that innovative solutions can emerge and function properly. Indeed, we suggest that privacy issues in data management are problems only if they are problematized, which means that they can also become part of the solution.

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In practice, the central issues are selecting the orchestrator carefully (a neutral translator and intermediary may be needed), bringing the central actors together to increase common understanding, and placing the challenges (and solutions) at the organizational level, rather than the institutional or individual level in order to avoid overly abstract institutional elements, misconceptions and personalization of issues.

The limitations of this study lie in the single case context. Examining one specific network is bound to bring up one set of aspects while perhaps not showing signs of others. However, we believe that the general framing can be adapted to other research contexts, in a way that allows for testing the ideas presented here, as well as finding relevant new issues.

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