MASTER'S THESIS

Challenges in the process towards providing video consultations amidst the COVID-19 pandemic

A hospitals technological perspective on the process towards delivering video consultations to its patients

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Abstract

This study focusses on discovering the technological challenges encountered in the process towards providing video consultations amidst the COVID-19 pandemic. The theoretical framework studies relevant scientific literature on the challenges encountered during the implementation of video consultations. The theoretical framework concludes with four themes summarizing challenges of implementing and eventually adopting video consultations. This study has an explorative character and used a single case study with semi structured interviews to describe the process towards providing video consultations in an academic hospital in The Netherlands and the challenges encountered. This study in contrary with existing studies looks at the implementation and adoption process from a technological perspective. The case study showed that the process towards providing video consultations could be divided in three phases; design, implementation and use and adoption. The potential challenges derived from the existing literature were not explicitly recognized by the case organization. Although this study clearly shows some major challenges in each of the three phases towards delivering video consultations. By means of exploratory research this study shows that an accelerated technical focused implementation with limited involvement of the right stakeholders and their requirements does not contribute to the adoption of an enterprise scale video consultation solution.

Key terms

Video consultations, Telehealth, Health information technology

Summary

This study explored the road towards providing video consultations for hospitals amidst the COVID-19 pandemic and the challenges it encountered during the implementation and adoption of this technology. The technological focus of this study gives another perspective on the implementation of video consultations.

The empirical data in this study is gathered by means of a single case study in an academic hospital in The Netherlands. The case organization started implementing an enterprise proof integrated video consultation solution at the start of the pandemic in March 2020. The data was gathered by means of an exploratory study including six semi structured interviews with interviewees in technical positions or on the edge of business and IT to understand the technological perspective. Including the six interviews one medical specialist was interviewed to get a better understanding of the user perspective. The exploratory nature of this study aims at understanding the challenges of the implementation and adoption process towards providing video consultations.

The theoretical findings were not directly recognized by the case organization although other challenges were discovered. The interview data was analyzed by use of a thematic analysis. Codes and themes are derived from the data and are therefore not limited or directly related to existing theory. The interviews clearly showed that the process towards providing video consultations consists of three phases; design, implementation and use and adoption. The interview data shows that the first two phases were executed in an accelerated pace. Mainly due to the pressing demand for a video consultation solution driven by the COVID-19 pandemic and preventive measures to minimize the spread of the virus. The implementation phase had a strong technical focus and did not include the input and requirements of the end users. The use and eventual adoption of the video consultation solution in the case organization was very limited. After the analysis on the amount of video consultation appointments it clearly showed a state of non-adoption. The organization created a core team including end users and formulated tactics and targets in an adoption plan.

This study shows that the process towards providing an enterprise scale video consultation solution through three distinct phases. Each of these phases do come with its own challenges which could potentially impact the eventual adoption of the implemented video consultation solution. This study delivered a description of the identified phases in the process leading towards providing video consultation and the challenges encountered in these identified phases.

Contents

1. Introduction

1.1. Background

On March 11, 2020, the World Health Organization made the assessment that the coronavirus disease 2019 (COVID-19) outbreak could be characterized as a pandemic (World Health Organization, 2020). The Covid-19 pandemic has forced many organizations to rethink their service models, including the healthcare sector. Healthcare facilities could be as source of contagion and infections, in a much-needed healthcare facility Covid-19 outbreaks could have severe impact on the continuity of providing care.

Therefore healthcare facilities focused on ways of providing safe health care to minimize the risk of spread(Jiménez-Rodríguez et al., 2020). Next to implementing strict safety measures and testing policies in addition to governmental measures, healthcare organizations needed to leverage on existing technology in providing remote care. The pandemic accelerated the interest in video consultations in particular to avoid face-to-face contact. This raises the question of what the challenges are in rapidly scaling up this service model of providing remote healthcare by use of video consultations (Greenhalgh, Wherton, Shaw, & Morrison, 2020). This study aims at investigating these challenges in relation towards providing video consultations in a hospital environment.

1.2 Exploration of the topic

In the healthcare sector the application of computers and technology supporting healthcare is referred to as health information technology (HIT) (Hersh, 2009). HIT is part of a broader IT infrastructure which according to Chung, Rainer Jr, and Lewis (2003) consists out of two major components. A Technical and human IT infrastructure component and in oversimplified terms aims at integrating technology components with business needs. There is a variety of terms related to providing digital remote healthcare making use of HIT. One of the most popular terms now being used in research is E-health. According to Eysenbach (2001):

"e-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology."

According to Boogerd, Arts, Engelen, and van De Belt (2015) the availability of terms relating to e-health might be confusing. Terms as mHealth, telecare, and telehealth are not identical but do seem to overlap and are used interchangeably. Another term which is used to describe remote digital healthcare is telemedicine. Telemedicine has a narrower definition than telehealth, Flodgren, Rachas, Farmer, Inzitari, and Shepperd (2015) define telemedicine as: *"Telemedicine uses telecommunication systems to deliver health care at a distance."*

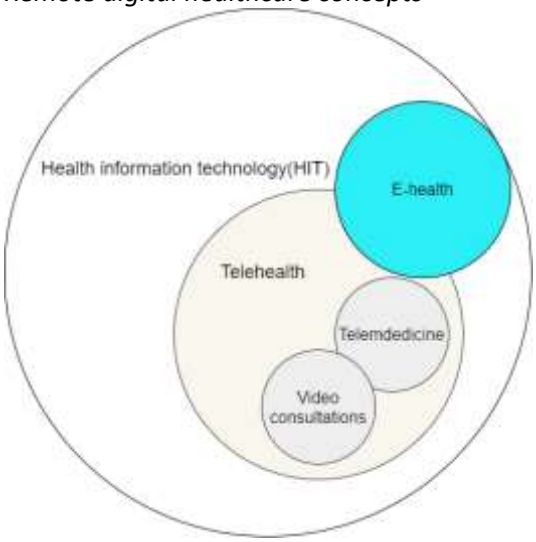
For the scope of this research, we will work with the definition of telehealth and telemedicine since this narrow down the focus on communication between care provider and patient, patient and technology or the communication between care providers (Tuckson, Edmunds, & Hodgkins, 2017). According to Mechanic, Persaud, and Kimball (2020) telehealth could be defined as:

"Telehealth is the use of a technology-based virtual platform to deliver various aspects of health information, prevention, monitoring, and medical care. "

The literature divides telehealth in several components, Tuckson et al. (2017) states that telehealth technologies, tools and services are an important component of the telehealth care system. Furthermore, the article describes three types of telehealth use cases, from clinician to clinician, from clinician to patient and from patient to health technology. This study focusses on the technological challenges towards providing video consultations from a hospital's perspective. This use case directly relates to providing a safe alternative to patients in providing healthcare. This alternative was in high demand during the pandemic to support in providing much needed care.

It has to be mentioned that video consultations are not merely about installing and using new technology. Wherton, Shaw, Papoutsi, Seuren, and Greenhalgh (2020) developed an evidence-based guidance on setting up and conducting remote video consultations. The article focusses on three key areas; IT infrastructure, Organizational routines and workflows and interactional work of video consultations. Literature does not clearly describe the process of implementing and adopting video consultations and the challenges it comes with. The eventual goal of implementing a new technology or service is for it to be offered to their customers or patients and to be adopted. Implementing a new technology without it being used does not add value to an organization. The position of video consultations in the health technology landscape could be put in perspective; health information systems make use of health information technology (HIT). HIT is used to facilitate in providing digital remote healthcare, there is a wide variety of terminology describing digital remote healthcare and what it consists of. A definition of the concepts encountered during the exploration of discovering technological challenges of providing video consultations is given. The relationship between these remote healthcare concepts and on how these concepts fit into a broader category are depicted in figure 1.1.

Figure 1.1
Remote digital healthcare concepts



1.3 Problem statement

The Covid-19 pandemic accelerated the demand and use of telehealth and specifically the use video consultations. Therefore, organizations had to implement or scale video consultation technology to accommodate in the immediate growing need for providing remote healthcare. To minimize the risk of spread of the Covid-19 virus, healthcare organizations aimed at providing video consultations whenever suitable. At this point organizations do not always leverage on the benefits of this form of remote healthcare. Meaning that organizations do not always utilize the use of video consultations due to it not being fully implemented and adopted. According to Greenhalgh et al. (2018) *"As with*

other technological innovations, some clinicians will adopt video consultations readily, whereas others will need incentives and support. There are complex challenges to embedding video consultation services within routine practice in health care organizations that are hesitant to change, especially at a time of austerity." Therefore, potential challenges towards providing video consultations have to be identified and managed to leverage on the value of this emerging technology. Organizations have gained more experience with the implementation and use of video consultations due to the Covid-19 pandemic which could contribute to getting a better understanding of the challenges encountered towards providing video consultations.

In contrary to many existing studies that focus on the patient's perspective of adopting ways of remote healthcare. This study focusses on exploring the technological challenges in providing remote healthcare from a healthcare providers perspective. Meaning that it takes a technological perspective on the implementation and adoption of video consultations, which is different than many existing studies. This facilitates in providing an insight in the challenges which hospitals encountered when providing video consultations to its patients. This insight can be useful to provide better understanding on challenges influencing the eventual use and adoption of video consultations.

1.4 Research objective and questions

Goal

This study aims to describe the challenges in implementing and adopting video consultations in a hospital setting. The theoretical framework explores the challenges as formulated in existing scientific literature with a technological focus. The empirical part of this research uses an exploratory approach and aims at describing what potential technological and organizational challenges hospitals encountered when implementing and adopting video consultations amidst the Covid-19 pandemic. The technological perspective is not yet explored in existing literature and could therefore add value to the scientific community. A technological challenge in the context of 'providing' video consultations can be more extensive than a purely technical component. In principle, one could count that a technological challenge in this context encompasses every challenge related towards providing video consultations. The video consultation software could in itself be seen as a technological development. A challenge is defined as a technological requirement which is not implemented. Or could include issues or bottlenecks encountered during the implantation, adoption or process towards providing video consultations.

Research question

The main research question is formulated as follows:

"What are the challenges in implementing video consultation technology amidst the COVID-19 pandemic in a hospital environment."

To answer the main research question, a theoretical framework is developed in chapter 2 that answers a set of sub questions as formulated in chapter 2.2. Based on the results of the theoretical framework a set of sub questions is developed for the empirical part of this study as formulated in chapter 3.2.

1.5 Motivation/relevance

Scientific relevance

This research contributes to the body of knowledge in the field of telehealth and video consultations. The Covid-19 pandemic accelerated the use of telehealth and specifically video consultations although the literature currently doesn't provide a complete overview of the challenges organizations encounter towards providing video consultations as an integral part of the IT infrastructure and the organization as a whole.

Practical relevance

The increased use of video conferencing is in line with the further digitization of healthcare and relates to the concepts of e-health and telehealth. This study provides practical guidance in what challenges hospitals encounter when implementing and adopting video consultations in addition or as an alternative to for example teleconsulting appointments. These identified challenges could provide guidance in designing and implementing a successful enterprise scale video consultation solution. This research might contribute to further adoption of remote healthcare practices in general. Since these challenges might not specifically be limited to the provision of video consultations and could therefore potentially be placed in the broader perspective of telehealth implementations.

1.6 Main lines of approach

Chapter 2 outlines the theoretical framework and answers the theoretical sub questions. Chapter 3 describes the approach to the empirical research and answers the empirical sub questions. Chapter 4 presents the results of the empirical research. Chapter 5 synthesizes the theoretical and empirical findings into a final conclusion and recommendations for further research.

2 Theoretical framework

The theoretical framework builds on the exploration of the topic and answers a set of sub question formulated in chapter 2.1. Chapter 2.2 describes the approach in selecting relevant literature and includes an overview of the articles selected based on the additional search terms.

2.1 Research approach

The aim of the literature review is to discover the technological and organizational challenges encountered when implementing video consultations. The theoretical framework is developed based on existing relevant scientific literature. The research question focusses on video consultations as being part of the broader concept of telehealth. The theoretical framework primarily uses literature focused on video consultations although it either makes use of literature related to telehealth, health information technology and IT infrastructure. Since the technological challenges encountered towards providing any form of telehealth might either be applicable to the provision of video consultations. The following iterative process as described by Saunders, Lewis, and Thornhill (2019) is followed. The literature is critically reviewed and the findings are presented in a research model in table 2.2. These findings are eventually categorized in descriptive themes to get a better overview of the findings in context of this study.

- Define and revise search parameters
- Generate and refine search terms
- Conduct research

- Obtain literature
- Evaluate literature
- Record findings
- Draft and update literature review

The literature aims to answers the following sub questions. These sub question aim to get a better understanding of technological challenges as identified in previous research. The literature does not specifically focus on hospital environments or video consultations. It looks at providing telehealth and the technological challenges identified in the healthcare sector. These findings will be critically reviewed and related to the provision of video consultations.

- What are the general technological challenges encountered by implementing and adopting telehealth?
- What are the technological challenges in implementing and adopting video consultations?
- What are technological considerations or difficulties in implementing health IT and infrastructure?

Therefore, the following key terms are used with the additional parameters as described in Appendix I.

- Video consultations
- Telehealth
- Health information technology (HIT)

2.2 Implementation

The main source that is conducted for finding relevant scientific literature is Google scholar. Besides the use of Google Scholar, the snowball method is used for finding relevant literature in the reference list of the selected literature. Appendix I includes the search parameters and includes the sources, search terms and filters applied to the search queries. Chapter 2.3 presents the results of the theoretical framework including a schematic conclusion. Chapter 2.4 introduces and explains the objectives for follow-up research.

Articles are selected by scanning the first three result pages on availability of the additional search terms by scanning the abstract and conclusion. These additional search terms include the terms; Technology, (IT) infrastructure, Covid-19 and implementation. The additional search terms are described In Appendix I. The subset of these articles as displayed in table 1 is critically reviewed in their contribution to answering the sub questions formulated in chapter 2.2. Eventually the most informative articles are selected for further analysis. Further analysis includes the reading of the article and searches for relevant theory from the organizations or healthcare professional perspective and therefore filters out the patient perspective. The queries in table 2.1 are used in Google Scholar advanced search in combination with the aforementioned additional search terms.

Table 2.1
Literature applied to theoretical framework

Search term	Source	Filter	Hits	Relevant
Video consultations AND IT infrastructure	Google Scholar	=>2017	2.080	2
Video consultation AND technology	Google Scholar	=>2017	16.600	4

Telehealth	Google Scholar	=>2017	27.600	2
Telehealth AND video consultations	Google Scholar	=>2017	2.350	2
Health information technology AND video consultations	Google Scholar	=>2017	2.070	2
Total				12

2.3 Results and conclusions

Health IT and infrastructure

Literature describes a variety of technological challenges related to providing telehealth and video consultations. Greenhalgh et al. (2020) mentions that video consultations are often attempted using video conferencing platforms. This could potentially lead to infringements in the local information governance policies when for example requiring software downloads. The use of video conferencing platforms which are not specifically designed for video consultations could challenge the organization to align video consultations with existing workflows.

Greenhalgh et al. (2020) mentions the problem of probable insufficient bandwidth for scaling video consultations. Car, Koh, Foong, and Wang (2020) mentions that all digital communication with patient must be compliant with the organizations and countries regulations and legislations on telehealth and data protection. More on the topic of legislation and regulations is introduced later in this study under the topic of security. Jiménez-Rodríguez et al. (2020) identified difficulties in implementing video consultations. The study mentions that the introduction of video consultations is underestimated and more difficult than assumed. This study show that Healthcare professionals encounter several challenges like the following:

- Establishing a connection;
- Starting a video consultation;
- Latency;
- Disruption of conversational flow;
- Breakdowns of video consultation platforms.

In conclusion the results of this study are analyzed by use of a thematic analysis, there are 4 themes defined and sorted in several categories. The comprehensive list of themes and categories Is depicted in figure 2.1. Theme three describes difficulties in the implementation of video consultations, next to technological difficulties the lack of skills and the refusal to use video consultations by healthcare professionals and patients are described.

Figure 2.1

Perceptions about video consultation implementation; derived from " Increase in Video Consultations During the COVID-19 Pandemic: Healthcare Professionals' Perceptions about Their Implementation and Adequate Management" (Jiménez-Rodríguez et al., 2020).

Healthcare Professionals' Perceptions about Video Consultations' Implementation	Theme 1.	Theme 2.	Theme 3.	Theme 4.
	Benefits of Video Consultations	Negative Aspects	Difficulties in the Implementation of Video Consultations	Skills Needed to Hold a Video Consultation and Training is Needed
Categories	Benefits of video consultations for both healthcare professionals and patients Benefits for the health system Benefits of video consultations compared to phone calls	Negative aspects inherent to new technologies Risk of perceived distancing from professional	Technological difficulties Lack of technical skills among professionals and patients Refusal to use video consultations by healthcare professionals and patients	Technological skill Nontechnical and social-emotional skills Adaptation of technical skills

Theme four categorizes on the skills needed to hold a video consultation. Technological skills and the adaptation of technical skills are other relevant aspects for this study.

Greenhalgh et al. (2019) studied the broader concept of information infrastructure in a healthcare context. In conclusion this study suggest that health IT infrastructure could constraint digital innovation. The study lists topics of advice which innovators should take into consideration when introducing new technology in health services and systems. The study of (Greenhalgh et al., 2019) lists the following considerations:

- Expects bugs and breakdowns;
- Provide basic dependability over advanced functionality;
- Take a systematic and relational view of technology instead of viewing technology as an isolated tool or function;
- Be aware that technologically supported work is embedded in organizational routines;
- Innovate incrementally, taking account of technological and socio-cultural legacies;
- Consider standards, where they come from and what priorities and interests they represent;
- Seek to create room for standards to be adapted to changing local conditions.

Security

Tuckson et al. (2017) states that when software and devices become interoperable it results in more integrated data and patients will interact more with the data. These trends will lead to complexity in safeguarding privacy and security. Additionally Tuckson et al. (2017) states that guidelines for telehealth security and privacy are currently not standardized in the United States. Several medical specialty societies have suggested safeguards to enhance security. It also says that a regulatory framework enforced by a single federal entity will be required to maintain patient and provider trust and consequently consummate the full benefits of telehealth. Jiménez-Rodríguez et al. (2020) mentions that previous studies raised concerns that health information exchange could create new risks regarding safety, privacy, quality and confidentiality. Health care professionals should trained to improve their technological skills to minimize those risks (Jiménez-Rodríguez et al., 2020).

Video consultations

This theoretical framework focusses on technological challenges in providing video consultations. The Covid-19 pandemic lead to a growth in the use of video consultation to reduce the patient flow and limit the risk of infections(Car et al., 2020). According to Greenhalgh et al. (2020) the introduction of video consultations is a disrupting and complex change. Where some clinicians express concerns concerning technical and clinical quality, privacy, safety and accountability. These concerns could potentially form a barrier for adoption at scale. According to Car et al. (2020), video consultations provide an approximation of face to face encounters and supplement the widely used telephone consultations with a visual upgrade. There is limited and mixed evidence on the effectiveness of video consultations as a whole. Video consultations effectivity could be measured in terms of patient satisfaction, costs, safety, quality, impact and technical issues(Car et al., 2020). Randomized trials primarily focused on patient satisfaction of clinical consultations through video. The results of these trials are associated with high satisfaction among patients (Greenhalgh et al., 2020). In contrast to that, Greenhalgh et al. (2018) states that there is a growing mismatch between this level of patient satisfaction and the mostly negative experiences among the teams introducing video consultations. According to Greenhalgh et al. (2020) several organizational case studies have shown the complexity of introducing video consultations. The introduction of video consultations could be disrupting to existing processes and routines. Besides the study states that some clinicians

expressed concerns about technical and clinical quality, privacy, safety and accountability. Among other things Greenhalgh et al. (2020) mentions that experiences in the Scottish video consultation program showed that in-person support may be needed to tackle technical issues such as assessing technical readiness and the installation of hardware such as web cams and monitors. In the early stages training and guidance of both clinical and non-clinical staff on how to use video consultations effectively, could likely help the widespread adoption. Several studies make clear that introducing a new service model like video consultations is not merely a technological endeavor(Car et al., 2020; Wherton et al., 2020). The challenges of providing video consultations and the subsequent scaling of this technology are not limited to the technology of video consultations. Wherton et al. (2020) concludes that the implementation of video consultations needs to follow a socio-technical approach if video consultations are to be adopted at scale. The work process needs to be aligned with the technology. Car et al. (2020) describe a pragmatic approach on how to conduct video consultation for health care professionals and patients. This approach lists a set of considerations to prepare for a video consultation. The study suggest that the technical considerations listed are not essential for video consultations but are likely to make a difference in the quality of the consolations. The considerations relating to technological requirements are listed in table 2.2.

Conclusion

The findings of the theoretical framework are structured in the theoretical model presented in table 2.2. The theoretical framework looked at the use of video consultations from a broad perspective. It looked at health IT infrastructure, the use of video consultations in specific and the privacy and security challenges. The literature does not always define a technological potential limiting factor as a challenge. Greenhalgh et al. (2019) describes a set of considerations and Jiménez-Rodríguez et al. (2020) presents a list of difficulties. Several authors describe challenges relating to privacy and security, in relation with the use of video consultation and telehealth technology.

Table 2.2
Theoretical model

Difficulties (Jiménez-Rodríguez et al., 2020)	**Considerations (Greenhalgh et al., 2019)**	**Other challenges**
Establishing a connection.	Expects bugs and breakdowns.	Use of video conferencing software for video consultations (Greenhalgh et al., 2020)
Starting a video consultation.	Provide basic dependability over advanced functionality.	Compliance with local policy and legislation (Car et al., 2020)
Latency.	Take a systematic and relational view of technology instead of viewing technology as an isolated tool or function.	Interoperability and extended use of data (Tuckson et al., 2017)
Disruption of conversational flow.	Be aware that technologically supported work is embedded in organizational routines.	Health information exchange (Jiménez-Rodríguez et al., 2020)
Breakdowns of video consultation platforms.	Innovate incrementally, taking account of technological and socio-cultural legacies.	
	Consider standards, where they come from and what	

	priorities and interests, they represent.
	Seek to create room for standards to be adapted to changing local conditions.

The findings are categorized in descriptive themes, the suggested identified themes are derived from the theoretical model by summarizing and categorizing the findings. These themes relate strongly to the concept of non-functional requirements (NFR), which is a concept used in the field of software engineering and enterprise architecture (Ameller, Burgués, Costal, Farré, & Franch, 2018). Table 2.3 represents the themes wherein the finding as presented in table 2.2 are categorized in the following identified themes. There is a slight overlap between some of the identified themes and therefore some findings potentially could be categorized in more than one theme. In this case, the context of the study where the finding is derived from is taken into account and the findings are categorized accordingly.

Theme 1: **Reliability** of internet and network;
Theme 2: **Availability** of the application and service;
Theme 3: **Interoperability and integration**. Does it fit and support organizational routines and workflows, does it fit within the existing IT infrastructure and does it allow for information exchange
Theme 4: **Security and compliancy.** Are security measures in place to protect the privacy of the patients and the safety of data gathered and distributed.

Table 2.3
Theoretical findings categorized in identified themes

Theme 1 Reliability	**Theme 2 Availability**	**Theme 3 Interoperability and…**	**Theme 4 Security and…**
Establishing a connection.	Breakdowns of video consultation platforms.	Starting a video consultation.	Use of video conferencing software for video consultations.
Latency.	Expects bugs and breakdowns.	Provide basic dependability over advanced functionality.	Compliance with local policy and legislation.
Disruption of conversational flow.		Take a systematic and relational view of technology instead of viewing technology as an isolated tool or function.	Health information exchange.
		Innovate incrementally, taking account of technological and socio-cultural legacies.	
		Consider standards, where they come from and what priorities and interests, they represent.	

	Interoperability and extended use of data.

2.4 Objective of the follow-up research

The theoretical framework provided existing knowledge to build this study. Some of the studies did relate to the Covid-19 pandemic and accelerated implementation of video consultations. The Covid-19 pandemic is now longer among. This leads to more experience with video consultations and could provide valuable insight in the lessons learned. The subsequent part of this study will focus on finding answers to what technological challenges hospitals encounter in implementing and providing video consultations as stated in the main research question. The theoretical framework does provide a rather limited and basic understanding of challenges encountered during this process. There are a limited number of studies available on the technological challenges of the implementation and adoption of video consultations. Furthermore, the recent accelerated implementation and adoption of video consultations logically lead to more user experience and probable better understanding of the process towards providing video consultations. The theoretical framework includes studies that do research on the experiences with video consultations or look at technological challenges in a broader context, for example in health IT infrastructure or telehealth. The empirical part of this research will describe these challenges as a real life-phenomena with an explorative approach. The empirical study aims at describing what technological challenges hospitals in the Netherlands encountered during the during the implementation and adoption of video consultations amidst the Covid-19 pandemic. Being able to prepare for and manage technological challenges leads to better usability and potentially leverage the broader adoption of video consultation.

3 Methodology

This chapter describes the research methodology of the empirical research. It thereby describes how the empirical part of this study is conducted and what approach was used and why this was chosen. Chapter 3.1 describes the conceptual research design. Chapter 3.2 explains how the technical design phase is established. Chapter 3.3 elaborates on the data analysis approach. And chapter 3.4 reflects on validity, reliability and ethical aspects of this study.

3.1 Conceptual design

The theoretical framework lists a set of technological challenges, difficulties and considerations. The empirical part of this study does not aim to test existing theory. Therefore, the interviews are not limited to exploring the themes derived from existing literature. The interviews will explore the process towards providing video consultations and the challenging aspect and bottlenecks encountered. This study uses an explorative approach and aims at describing what technological challenges hospitals in the Netherlands encountered. A technological challenge in the context of 'providing' video consultations can of course be broader than a purely technical component. In principle, you could even count that a technological challenge in this context encompasses every challenge related to video consultations. The video consultation software in could be seen as a technological development. A challenge is defined as a technological requirement which is not implemented. Or could include issues encountered during the implantation or use towards adopting video consultations. Existing theory will not literally be tested but concepts derived from existing theory will be used to support the exploration and are interwoven in the interview structure.

In developing the research strategy the theory of Saunders et al. (2019) is applied in supporting a suitable research philosophy and describing the research methodology. An interpretive and subjective attitude is applied in designing the empirical part of this research. Concerning the subjective approach as described by Saunders et al. (2019, pp. 134-137), this research considers that a potential technological challenge or difficulty could be perceived different for every organization and person. This study uses an explorative approach to get a better understanding of these challenges encountered in providing video consultation and aims to build theory based on data. *"Theory follows data rather than vice versa, as with deduction"* (Saunders et al., 2019, p. 155). A qualitative research design will support in gathering knowledge and lead to probable alternative or additional description of challenges encountered towards providing video consultations which could contribute to the development of theory.

A single case study is developed, there will be one case study with a single unit of analysis being the case organization described in chapter 4.1. A case study is chosen to be the best fit for the research objective, exploring challenges encountered when implementing and adopting video consultation technology as a real-life phenomenon within the context of a hospital setting in the Netherlands (Saunders et al., 2019, pp. 196-199). The main focus in on the 'what' questions to describe the challenges encountered. The following questions aim to be answered with empirical evidence.

1. What technological requirement in providing video consolations did the organization consider?
2. What difficulties did the organization face when implementing the video consultation solution?
3. What factors impact the use and adoption of video consultations?

3.2 Technical design: elaboration of the method

A single case study with an exploratory nature uses a qualitative approach in gathering data. For the empirical part of this study two sets of interviews are planned. To contribute to the validity of the study the first set of semi structured interviews is conducted with strategic experts on the edge of business and IT. The first interview will focus on the design and requirements used for implementing video consultations. Therefore, an enterprise architect will be interviewed, the field of enterprise architecture is concerned with translating business requirements into technology. Between design and use there is an implementation phase and a support or administration aspect. Considering that, a project manager, and a technical support worker is either valuable in determining to what extent the chosen technology provides functionality as demanded by user groups. After the first set of interviews the interviews will be transcribed. The second set of semi structured interviews will be conducted with functional administrator(s), IT advisor(s) and at least one user who has experience with using video consultations within the organization. This second set of interviews will build on the information gathered from the strategic experts and will further be reflected upon on a tactical and operational level. This means that the requirements gathered from literature and the first set of interviews will be questioned with the main goal of understanding to what extent these are implemented. In addition to that, this set of interviews aims to gather data on potential challenges limiting the use and adoption of video consultation. All interviews make use of an interview protocol. To make sure all themes are addressed a script is developed including the interview themes being addressed. The interviews have four themes incorporated with a set of specific questions on these themes derived from the theoretical framework. The interviewees are aware that the interviews can be cancelled or ended at any time and participation is voluntary. All information is processed anonymous to guarantee the privacy of the participant. All interviewees receive an information sheet prior to the interview to introduce the topic, underlying themes and the background of the study. The interviews will be held with a digital video conferencing platform and will have a maximum duration of 60 minutes. Each interview will be recorded in agreement with the interviewee to make sure no valuable information is missed in further analysis. Recordings will be deleted after the data is transcribed and ultimately within 30 days.

3.3 Data analysis

The interview data will be **transcribed** by use of transcription software , according to Saunders et al. (2019, p. 645)this method reduces the time needed to transcribe an audio recording. The interviews recordings will be converted from mp4 to mp3. Subsequently the mp3 files will be loaded into the transcription software. This software does not work flawlessly and therefore the transcriptions are manually revisited.

The data will be analyzed by use of a **thematic analysis**. A thematic analysis is a systematic approach in analyzing qualitative data sets, such as interviews and observations. The purpose of this analysis is to discover themes or patterns across a data set. A thematic analysis can be used irrespective of the research methodology. According to Saunders et al. (2019, p. 652) a thematic analysis could be used in inductive and deductive research approach. This research aims to discover and describe the challenges encountered towards providing video consultation technology, this could be seen as theory forming and thus an inductive approach. Saunders et al. (2019, p. 652)mentions that in an inductive approach, themes will be derived from the data. In this approach themes will be defined based on the interest of the research rather than using a framework of themes based on existing theory to examine the dataset.

The first step in the process of the thematic analysis is **Coding** the data sets. Coding is used to categorize the data into themes and involves labeling the units of data with a unique descriptive code. In this case the transcribed interview data is analyzed in a three-step approach. The first steps search for technological requirements set by the organization. The second step looks for difficulties the organization encountered when implementing the video consultation solution. The third step will search for factors limiting the use and adoption of video consultations. This type of analysis supports in answering the sub questions. The analysis will define **themes** after scanning the interview data, these themes will be refined during the analysis and are used to code units of data. Maguire and Delahunt (2017) did an extensive study on the concept of thematic analysis and state that:

> A theme may be initially generated inductively from the raw data or generated deductively from theory and prior research(Boyatzis, 1998).With an inductive approach, the themes identified are strongly linked to the data themselves and may bear little relation to the specific questions that were asked of the participants. Inductive analysis is a process of coding the data without trying to fit it into a preexisting coding frame or the researcher's analytic preconceptions. In this sense, this form of thematic analysis is data-driven(Braun & Clarke, 2006).In contrast, deductive analysis is driven by the researchers' theoretical or analytic interest and may provide a more detailed analysis of some aspect of the data but tends to produce a less rich description of the overall data(Braun & Clarke, 2006).

This rather high abstraction level of coding will suit the exploratory nature of this study. Besides it will lead to answering the sub questions. The sub questions start with focus on the design phase and the requirements for video consultations. The second sub question focusses om the actual implementation process of the video consultation solution. The last question will focus on the use and adoption of video consultations. This set of sub questions will contribute in answering the main research question. Technological requirements that are not being implemented, took great effort and determination, or potentially limit the adoption and provision of video consultations will be labeled as challenging. Besides other issues encountered during the design, implementations and use and adoption will be labeled as a challenging.

3.4 Reflection on validity, reliability and ethical aspects

This study aims to present reliable and valid results and takes ethics into account, this is done by addressing and integrating these concepts as described as follows.

Ethics

This study values the privacy of the participating interviewees, an interview is developed to secure aspect relating to privacy. Taking part in these interviews is anonymous other than mentioning the position of the interviewee. The interviewee is aware that in some unique positions this could lead back to their identity and could be considered a privacy infringement. The interview protocol includes

Reliability

Reliability refers to the replication and consistency of a study. Researchers should be able to replicate this research design and achieve similar findings(Saunders et al., 2019, pp. 213-218). This study included reliability by design. The interviews will be conducted with two groups of participants, first a group of strategic experts will share high level information and potentially identify new themes which will be included in the second set of interviews with users and administrators on a tactical and operational level. The use of an interview protocol with an interview

script supports a uniform interview structure and makes it possible to compare the interview responses.

Validity

This study has an exploratory nature and therefore does not measure specific phenomena. The qualitative research design includes a set of measures to contribute to the validity of the interviews. The interview invitation included a description on the background and goal of this study. Besides the interviewees were informed that the interviews are audio recorded and will be anonymously transcribed. The interviewer has sufficient technical knowledge to understand the video consultation technology and the components involved. This study uses different perspectives by interviewing participants in different roles and organizational layers. This use of different perspectives allows to reflect strategic findings upon tactical and operational experiences.

Previous measures described how the validity of this study is assessed and which techniques are used to contribute to the validity of this research. This leaves unanswered if the findings of this study can be generalized to other (academic) hospital. This study makes use of a single case study with a subjectivist approach, expecting that the findings of this study are strongly related to the interpretation of the participants. This assumptions in combination with using a single organization could impact the external validity and thus generalization of this study results. The case organization is representative to other academic hospitals in the Netherlands, nevertheless rules and regulations in other countries and organizational standards and choice of technology could lead to different challenges towards providing video consultations.

4 Results

This chapter presents the main findings of the empirical part of this study. Chapter 4.1 gives a brief description of the case organization and explains why this is a suitable case organization. Chapter 4.2 reflects on the interviews and any deviations to the methodology. Chapter 4.3 answers the three formulated questioned being answered by the interview results.

4.1 Case organization

The case organization selected for this case study is an academic hospital located in the Netherlands. The case organization is familiar with the concept of video communication in general for online lecturing MDTM's and video consultations for a few medical specialties. Furthermore, it has been working with teleconsulting and video consultations for many years. The COVID-19 pandemic had a huge influence on the demand for several types of video communication. This study specifically focusses on one type of video communication; the video consultation appointments between patients and clinicians. The increased need for video consolations forced the hospital to rethink their infrastructure and processes related to video consultations. There was a clear assignment driven by the pandemic which was to implement and integrated form of video consultation as soon as possible. This was necessary to be able to continue to provide consultations while limiting physical contact to minimize the risk of spreading the COVID-19 virus. This forced the hospital to select a suitable video consultation application and professionalize the video consultation infrastructure in a rapid pace. The pandemic strongly motivated the organization to professionalize their video consultation services.

4.2 Interviews

The interviews took place by use of a video communication platform and where audio recorded. There was a total of six interviews, starting with interviewing an enterprise architect to get a broader perspective on all the elements, roles and departments involved. Subsequently the identified departments and roles were interviewed by executing a set of semi structured interviews. The four themes derived from the theoretical framework as depicted in table 2.3 were included in the interviews as being potential challenges. Although not every participant could contribute to all themes due to a diversification of knowledge among departments. For clarity those themes are the following: Reliability of internet and network; Availability of the application and service; Interoperability and integration and Security and compliancy. Six people are interviewed, all having different roles. The interviews topics were not limited to aforementioned themes, and aimed at discovering the implementation process and challenges encountered towards adoption. The interviews tried to gather as much data as possible relating to the implementation and adoption process and its challenges. First an enterprise architect was interviewed to discuss the initial design and gain better understanding of the implementation project. After that an administrator of the video consultation software was interviewed. Subsequently to gather more information towards the end user perspective, an IT advisor was interviewed. The role of the IT advisor is to connect with the medical department and support in their use of IT. Next to that the project manager guiding the implementation was interviewed. Eventually a security officer was interviewed. The last interview took place with a medical specialist to gather more insight in the actual end user perspective. During the interviews it became clear that the technical challenges were rather limited according to the interviewees. Although it became clear that there were several other factors causing a rather limited use of video consultations within the organization. Therefore, the interview structure shifted more towards finding general difficulties encountered during the implementation and use of the new video consultation software. The initial plan aimed to interview mainly technical roles. Although the first two interviews pointed out that the technical challenges were limited. Nevertheless, the adoption of video consultations was not satisfactory. Therefore, it made sense to include at least one of the end users in the interviews to gather data on what other factors limits the use of video consultations. Due to time constraints and limited availability of end users, which are mainly medical specialist. Only one of the end users has been interviewed. In line with the initial research design, the interviews are all literally transcribed. The interviews were recorded with audio and video, these recordings were converted to audio only (.mp3). These audio files were loaded into transcription software. Unfortunately, the interviews took place in Dutch and the transcription software made use of a preview version of the Dutch language. Meaning that all recordings had to be revisited and the transcriptions had to be manually corrected. During the interviews and further analysis, it became clear that there was a certain process leading to providing video consolations. The thematic analysis derived the themes from the interview data by identifying recurring themes mentioned by the interviewees. The following analysis describes how the themes are defined. The bold words formed the basis of the thematic analysis coding framework and identified themes. During the interviews and analysis of the gathered data it became clear that the **technical implementation** was successful on the basis of the initial **design**, but the **use and adoption** lagged behind despite the fulfilment of certain **requirements**. During the **implementation**, there are therefore various **challenges** and **difficulties** in providing video consultations, some related to **Covid-19.** Other difficulties were encountered, such as in the adjustment in the **working processes** and **technical infrastructure** as a result of choosing new technology. Results of empirical sub questions

The coded data is consolidated in one codebook containing all the relevant data to answer the sub questions. The codebook makes use of highlights in specific colours defining the themes. The

codebook separates each interview with a horizontal line within each theme including the interviewees' role. The codebook is included in appendix II.

4.2.1 Results sub question 1

What technological requirement in providing video consolations did the organization consider?

Concerning the pre pandemic situation, the organization was using a video conferencing tool for video consultations. This video conferencing tool did not integrate with the electronic health record and created extra overhead in administration and did not comply with authorization standards. The enterprise architect was responsible in consolidating the technological design in an advisory design document. The first and non-arguable requirement the organization had was that it must integrate with Epic, which is the electronic health record (EHR) platform the organization is using. The organization has a general principle which says that the patient context is sacred. For the video consultation software this meant it was required that the patient authenticated via the patient portal and the medical specialist entered the consultation from the EHR from the record of the patient. Thus, there had to be a hard link between the patient context and the actual video consultation. This was facilitated by integrating the chosen video consultation within Epic, in this case the patient could login and authenticate via MyChart which is the patient portal of Epic and the medical specialist would enter the consultation from the patients records in Hyperspace. Hyperspace is the user interface which the medical professionals and administration use to enter the EHR. Besides the organization did not want to ask patients to install any software nor to create any third-party accounts. Besides a decent internet connection should be available to have a video consultation, Zaurus provides a connectivity check to test the connection. There are no specific requirements defined concerning the themes derived from the theoretical framework. The organization has a processing agreement with Zaurus which is a requirement derived from the GDPR. The application provides end2end encryption and complies with the following standards; NEN 7510, ISO27001, ISO 27701 and ISO 9001. In conclusion it could be said that the organization did not set a clear list of requirements in order for the application to be in line with existing standards and policies. The routine like approach in relation with picking an application based on a benchmark with a similar hospital seemed to have worked for the implementation.

4.2.2 Results sub question 2

What difficulties did the organization face when implementing the video consultation solution?

The accelerated implementation of video consultation was driven by an ending licensing agreement of the current platform and accelerated by the Covid pandemic. The current platform was rather expensive and licensing should therefore be ended. The pandemic forced the organization to act quick and choose a suitable and proven solution for video consultations. The crisis control team enabled the organization to act quickly, as stated by one of the project leaders *"That's why at some point last year during the COVID period it was said, well, this is just taking way too long, so something else has to come"*. The organization implemented Zaurus like a one size fits all video communication platform, soon it was discovered that this would not work for every type of video communication. Zaurus is a platform as a service (PAAS) solution running in two European datacenters and therefore being a high available (HA) solution. This study focusses on video consultations between care provider and patient. Although it became clear that for example multi-disciplinary video consultations (MDTMs) among medical specialist come with different requirements. The implementation has been mainly technical and took around two weeks. Therefore, several aspects like when a video consultation is actually a suitable alternative has not been taken into account. The integration with the regular working processes did not get the

attention needed. Medical specialist and patient representatives were not part of the implementation process, which caused certain things to be overlooked. The organization was challenged with finding the hardware needed like webcams and headset. Mainly due to the pandemic and high demand, most products were sold out or sold at a premium. This was also a motivation to choose the current video consultation solution, Zaurus works on a mobile device and the majority of medical specialists own a smart phone. The organization assumed that video consultations could be done with a smart phone, this was not the case. The organization did not set clear guidelines on when a video consultation is suitable and what the expectations are. The input from IT advisors was mainly put aside due to the time pressure in implementing the new video consultation platform. This led to several issues along the way and might had a strong impact on the eventual adoption. One of the IT-advisors states that "…It's technically implemented, but functionally it is not implemented now…". Looking back one of the medical specialists mentions that they probably would not have chosen Zaurus. The organization encountered some difficulties during the implantation process, some of these challenges or difficulties mentioned are:

- Problems related to closed firewall ports
- Video or sound didn't work on the patient or hospital side.
- The patient is just as big in the screen as the doctor, this could be confronting, especially for psychiatric patients. These patients should not be confronted with themselves.
- The previous video consultation application didn't integrate with the EHR which is a requirement.
- There is no possibility to invite patients for group sessions, these appointment types are not available in the EHR. This means that only one patient could speak with one doctor per consultation. There is a workaround although this compromises the patient context, this means others have to be invited by a meeting link. Being not sure if the recipient is the actual patient.
- The EHR only works from the virtual desktop when working from home, the virtual desktop solution does not allow for video consultations. This means one of the apps developed for the EHR had to be used. Consequence of this is that a mobile device has to be used to open these app.
- Some false positive error came up when starting a video consultation, stating the patient was not in the virtual waiting room, while the patient was actually there.
- The organization has a shortage of office space, meaning offices are not private. Making it difficult to held video consultations without disturbing coworkers.
- Some difficulties with switching between video communication caused the configuration of microphone and camera to break, resulting in no video or sound.
- Appointment orders with video consultations for different departments were missing.

4.2.3 Results sub question 3

What factors impact the use and adoption of video consultations?

The number of video consultations within the organization is limited, very limited as literally being stated by the interviewees. After the implementation people started using the software enthusiastically, although soon they found out that the current setup was not workable. The doctors stopped using it and that is the situation to this day. There were not many patients either who have said to be wanting a video consultation as a substitute to a face2face encounter. The patients need the right infrastructure and a certain level of digital literacy to participate in video consultations. Besides there weren't many doctors convinced that video consultation was suitable for their patients. There were no major incidents in for example the availability of the software. Nonetheless the adoption is far behind what was expected, even though no targets were explicitly defined. Steering on targets set by the board of directors and benchmarking with other hospitals could support the adoption rate according to one of the medical specialists: "So when we had technical things ready, the number of video consultations is minimal, say very limited" according to a functional administrator, IT advisor, architect and medical specialist. People who started enthusiastically after two, three days had something like; but this is not workable and actually stopped doing it again. That is the situation to this day. The organization realized something had to change to increase the use and adoption of video consultations. Therefore, a core team is formed and developed an adoption plan which explains what it wants to achieve the coming three years. This adoption plan aims to get the users involved, both internally and externally. Besides the organization set a clear target, saying that 30% of the remote consultations should be done with video consultations, and that 30% of the overall consultations should be remote consultations. The adoption plan aims to explain the benefits to the doctors and supports in optimizing workflows and provide hands on support. The adoption plan is not approved yet by the board of directors. As mentioned before, the patients need to have a MyChart account so it could enter the patient portal to start a video consultation. The majority of the patients did not have an account and could not make use of video consultations at that point. Therefore, a group started to approach patients to supply accounts for the patient portal. One of the project managers mentioned that at points where the pandemic slows down, the patients are more inclined to have a face2face encounter. The doctors need direct hands-on support in case issues are emerging. At the start this was not available and the IT service desk was not prepared in supporting and fixing the issues without interfering the video consultations. Doctors should be motivated to start adopting video consultations, it is important to explain the advantages it could have like workflow optimization, less crowded waiting rooms and accessibility. One of the medical specialists stated: "I think we should also try to enthuse the caregivers that doing a distance consultation in your entire work process, so video or a call. That it does help to finish an outpatient clinic shift at least partly faster".

5 Discussion, conclusions and recommendations

Chapter 5.1 reflects on the results of this study and relates the empirical finding to existing studies. Chapter 5.2 concludes this study and answers the main research question, chapter 5.3 describes the recommendation for practice explaining the contribution to video consultation implementations in a hospital setting. The final chapter in this study recommends on directions for further research and reflects on the limitations of this study.

5.1 Discussion – reflection

Before the pandemic struck, the case organization made use of a video conferencing tool for video consultations. This tool did not integrate with the EHR, which was a sacred architecture principle within the organization. Besides the costs of licensing for the video conferencing platform were too substantial. Existing literature mentions that the use of video conferencing software for video consultations is a risk. Greenhalgh et al. (2020) write that: *"However, video consultations are often attempted using platforms designed for video conferencing. As well as being poorly aligned with clinic workflows and routines, they may require software downloads that breach local information governance policies".* It was clear that the video conferencing software did not align with current workflows. This study showed that implementing and providing a video consultation service entails more than buying a software solution and implementing it based on a set of technical requirements. This is in line with what was discovered by previous studies stating that the implantation of video consultations is not merely a technical exercise (Car et al., 2020; Wherton et al., 2020). The accelerated implementation forced by the pressing Covid pandemic and the need for an integrated video consultations platform, has caused it to be a primarily technical endeavor. One could question that the implementation could be defined successful. Additionally, it should be made clear beforehand what is considered a successful implementation and if implementing new video consultation technology is the actual end goal. According to Car et al. (2020) video consultations effectivity could be measured in terms of patient satisfaction, costs, safety, quality, impact and technical issues. These terms were not explicitly mentioned as criteria defining success, it could at least be said that the impact of video consultation without it being adopted is rather limited. The empirical data gathered clearly defines that the implementation on itself was not the end goal of the case organization. The end goal was for the organization to adopt an integrated solution for video consultations as a substitute for other types of remote consultations. And to increase the level of remote consultations as a substitute for face2face encounters. It became clear that new technology on itself does not resolve a business problem. The business problem during the pandemic for the majority of industries but even more so in healthcare was business continuity by providing the same level of healthcare with taking into account the measures and recommendation from the government. This was the biggest motivation for the case organization to provide an integrated video consultation solution and is in line with findings from a previous study of Car et al. (2020). The government advised to limit the amount of travel and visits in general. COVID-19 played a substantial role in the accelerated implementation and potential limited perspective on the eventual problem to be dealt with. The interview data defines three distinct phases, namely the design phase, the implementation phase and the use and adoption phase. All of these phases had to deal with its own challenges although it becomes clear that the third phase was the most challenging.

The design phase was mainly executed by enterprise architecture with a strong technical focus. The design phase includes a set of technical requirements, integration in the current infrastructure and alignment between business and IT. The theoretical framework of this study concluded with a set of themes. These themes summarized findings from several studies describing challenges and difficulties encountered by implementing and providing video consultations. This study has an explorative and subjective approach, meaning that the themes were incorporated in the empirical part of this study, although were not literally being tested or limited to those themes. The themes relate strongly to the concept of Nonfunctional requirements (NFR), as written by Chung et al. (2003) this is a concept mainly derived from software development although recently either used in enterprise architecture(EA). Not all of the themes were recognized as being explicitly mentioned as requirements or challenges. The organization did not actually buy the software but selected and bought an application which was hosted in the cloud as a platform as a service (PAAS) solution. This

could be the reason why several of these themes were not included in the enterprise architecture design for video communication. The first interview related strongly to the design phase and technical requirements and challenges in implementing those. It became clear that there was not a clearly defined set of detailed requirements, although there were several principles of which some were so to say 'sacred' according to an enterprise architect. The most prevalent principle was that video consultations should only be started within the patient's context. Meaning that the video consultation solution needed to integrate with the electronic health record (EHR) and the patient portal. This principle was not denoted a challenge due to the chosen software solution offering integration with the EHR and thus patient portal. This relates to integration and interoperability which is one of the themes derived from the theoretical framework. The biggest challenge in the design phase would have been aligning business needs with IT. Due to the time pressure driven by the pressing COVID-19 pandemic there was almost no time to involve the potential users according to every interviewee except the project manager. The organization needed a safe and proven solution and therefore had chosen for an application that was recently implemented by another hospital and the positive experiences they had with it. **The implementation phase** which was rather quick due to pressure and support from the crisis control team (CCT). The implementation took around two weeks and was mainly driven by project management. The implantation phase included the facilitation of technical infrastructure and hardware. The latter was a challenge due to the worldwide high demand resulting in shortages and unavailability or rather premium priced webcams and headset. **The third phase**, concerned with use and adoption was initially not taken into account by the organization although it defines the end goal. The organization realized that offering a piece of software in itself was not going to lead to many doctors using it and wouldn't realize organization wide adoption. Once the design and implementation phase were executed it showed quickly in the usage statistics that something was not as expected as being mentioned by all interviewees. This triggered the organization to get a better involvement of both users within the hospital as well as patients participating in video consultation. This led to the formation of a core team with users and IT advisors including a member of the board of directors. This core team defined a set of success factors related to adoption. This includes more than merely providing a functioning software application. In the use and adoption phase It was discovered that the level of support was an important aspect. Doctors should have support in case of issues related to video consultations on speed dial. There was immediate action on this pressing issue by creating an extra option in the selection menu of the service desk. Unfortunately, it showed that doctors whom have encountered issues before and were not able to get suitable support abandoned the use of video consultations to this day.

5.2 Conclusions

This study described the challenges in the process towards providing video consultations in a hospital environment. The questioned as described in chapter 5.1 are answered and lead to the following sub conclusions.

What technological requirement in providing video consolations did the organization consider?

The organization did not set out a specific set of technological requirements in the initial design as delivered by the enterprise architect. There are several principles which the organization did adhere to, the main principle was the required integration with the EHR for both clinician and patient. Another important requirement was that the patient should not have to install additional software or create third party accounts. The organization selected a PAAS solution which by design has the

highest privacy and security standards. Picking an application based on a benchmark seems to have worked for the success of the implementation.

What difficulties did the organization face when implementing the video consultation solution?

The organization mainly focused on the technical implementation process which was rather quick and did not encounter many issues. The main issue the organization encountered was the limited amount of support provided to the users during the implementation and as hands on support. Other issues were encountered due to not having the right hardware and workplace available. Besides the organization expected that video consultation would work by using mobile devices, this was not the case from the users perspective which led to bad experiences. Resulting in many users abandoning video consultations which is the case to this day.

What factors impact the use and adoption of video consultations?

There are several factors influencing the use and eventual adoption of vide consultation. The main factor is the expectation that implementing a new video consultation application is mainly a technical endeavor. Involving the right stakeholders including the actual users is important. Knowing the requirements of the users and developing new working processes could positively impact the use and adoption. Stating the advantages and using and communicating and promoting possible benefits of video consultations by doctors to other doctors could leverage on the benefits of video consultations. The lack of having guidelines on when to substitute an encounter with a video consultation and the limited involvements of higher management and the board of directors did not help the adoption of video consultations. Setting a certain target on the percentage of video consultations based on a benchmark with other hospitals could incentivize doctors to make use of this technology.

The three sub conclusions contribute in answering the main research question which as formulated in chapter 1.4 is stated as follows:

“What are the challenges in implementing video consultation technology amidst the COVID-19 pandemic in a hospital environment.”

The provision of video consultation as an encounter type from hospitals to provide care to its patients entails more than providing a software application. The provision of video consultations starts with the design phase which should include the user’s perspective with clearly defined expectations and a high level of integration with existing working processes. The biggest challenge relating to implementing video consultation is actually implementing it in a way that the technology could effectively be used and lead to an acceptable level of adoption. The Covid pandemic puts extra pressure on implementing video consultations resulting in a narrow scope and eventual unsatisfactory level of adoption. Medical specialist should have hands on side-by-side support when setting up video consultations in case of (technical) issues arising. Organizations should set clear goals and expectations on the effectivity of video consultations and define what appointment types are suitable for being substituted by video consultations. Having a standardized fully equipped workplace with the right hardware in a quiet and private environment is a basic requirement which has been challenging due to crowded offices and hardware scarcity. Stating the potential benefits of video consultation such as workflow optimization, accessibility and less crowded waiting rooms should get more attention in general. This could help doctors and patients to leverage on this type of consultation even when not in a pandemic situation.

5.3 Recommendations for practice

This study could support organizations in implementing video consultations. The study shows that in order to effectively implement video consultations a hospital has to embrace more than just a technological perspective. The implantation comes with several challenges which could be pre-defined and managed when these are known beforehand. Video consultations have to be integrated in the working processes and targets have to be set to effectively steer on the number of video consultations. The eventual goal is not the mere implementation of the video consolation technology, this study helps to see the road towards providing video consultations and its challenges along the way as a whole. Meaning that it is not merely technical driven, nor should it be fully patient or users defined. It should be an iterative process including all stakeholders to build towards an effective solution potentially substituting other forms of remote care and even face2face encounters. In order to do this, doctors have to determine which appointment types are suitable for video consultations and what potential benefits video consultations could have for improving working processes.

5.4 Recommendations for further research

The first interview pointed out that having a pure technical focus might have had a strong impact on the limited adoption rate. The theoretical framework looked at video consultations from a technological perspective and searching for challenges and difficulties encountered towards providing video consultations. The empirical part of this research mainly focused on interviewing technical roles and only one end user in the form of a medical specialist. During the analysis of the data gathered it became clear that there were several phases leading towards providing a video consultation solution. One of the biggest challenges seemed to involve the actual users and their needs in order to drive a successful adoption. This research did not include the full user perspective and therefore further research on the alignment between business needs and IT would give better insight in potential other factors limiting the eventual effective adoption of video consultations. Further research could test if the findings do limit the adoption of video consultation and to what extents. Furthermore, it will be valuable to describe how these technological difficulties could be brought to the attention of organizations and provide insight on how these challenges can be overcome. This study fits into the broader context of rapidly integrating, providing, scaling and adopting new technology. This requires a flexibility in the organization and business and IT needs need to be aligned. The concepts of enterprise architecture could play an important role in getting a better understanding in successfully implementing video consultations.

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Appendices

Appendix I

Search terms and selection of scientific articles

Search term	Inlcusion criterea	Articles selected	Description and relevance
Video consultations AND IT infrastructure	Technology, Covid 19, Implementation	Bokolo, A. J. (2020). Exploring the adoption of telemedicine and virtual software for care of outpatients during and after COVID-19 pandemic. *Irish Journal of Medical Science (1971-)*, 1-10.	Article studies the adoption of telemedicine and virtual software during and after the Covid-19 pandemic. The article provides both the patients and organizational perspective. The article provides several factors impacting the adoption of these platforms from both the technological and organizational perspective.
	Technology, Covid 19, Implementation	Grüttner, P. (2021). Opening the Door for Digital Transformation in Hospitals: IT Expert's Point of View. *Digitalization in Healthcare*, 29.	Article about general concepts relating to digital transformation in hospitals.
Video consultation AND technology	Technology, Covid-19	Greenhalgh, T., Wherton, J., Shaw, S., & Morrison, C. (2020). Video consultations for covid-19. *BMJ, 368*, m998. doi:10.1136/bmj.m998	Key article describing the implications of scaling and implementing video consultations in response to Covid-19.
	Technology, Covid-19, Implementation	Jiménez-Rodríguez, D., Santillán García, A., Montoro Robles, J., Rodríguez Salvador, M. d. M., Muñóz Ronda, F. J., & Arrogante, O. (2020). Increase in video consultations during the COVID-19 pandemic: healthcare professionals' perceptions about their implementation and adequate management. International journal of environmental research and public health, 17(14), 5112.	Article describing implementing video consultations in response to Covid-19. This article does research on the healthcare professionals perception on the implementation of video consultations. The article describes four themes; Benefits of video consultations, negative aspects, difficulties associated with the implementation and the need for training.
	Snowball	Flodgren, G., Rachas, A., Farmer, A. J., Inzitari, M., & Shepperd, S. (2015). Interactive telemedicine: effects on professional	Article defining telemedicine and the use of video consultations.

		practice and health care outcomes. *Cochrane Database of Systematic Reviews*(9).	
	Technology, Covid-19	Wherton, J., Shaw, S., Papoutsi, C., Seuren, L., & Wherton, J., Shaw, S., Papoutsi, C., Seuren, L., & Greenhalgh, T. (2020). Guidance on the introduction and use of video consultations during COVID-19: important lessons from qualitative research. *BMJ Leader*, leader-2020.	Article about adopting video consultations at scale. This article defines three focus areas, IT infrastructure, organizational routines and workflows and interactional work of a video consultation.
Telehealth	Technology	Tuckson, R. V., Edmunds, M., & Hodgkins, M. L. (2017). Telehealth. *New England Journal of Medicine, 377*(16), 1585-1592. doi:10.1056/NEJMsr1503323	First hit of the search term and provides an overview, key aspects and definition of telehealth including key priorities for telehealth research.
	Technology	Hall, J. L., & McGraw, D. (2014). For telehealth to succeed, privacy and security risks must be identified and addressed. Health Affairs, 33(2), 216-221.	Article about privacy and security risk related to telehealth. This article focusses on network enabled telehealth devices. Meaning that where a device collects information to the patient and transmits the data to the health provider.
Telehealth AND video consultations	Technology, Covid-19	Vandekerckhove, P., Vandekerckhove, Y., Tavernier, R., De Jaegher, K., & de Mul, M. (2020). Leveraging user experience to improve video consultations in a cardiology practice during the COVID-19 pandemic: initial insights. *Journal of medical Internet research, 22*(6), e19771.	Article describing the experience of the use of video consultations during the pandemic. This study was done in The Netherlands in a cardiology practice and provides insight into challenges from both the healthcare professional and the patient.
	Technology IT infrastructure	Car, J., Koh, G. C.-H., Foong, P. S., & Wang, C. J. (2020). Video consultations in primary and specialist care during the covid-19 pandemic and beyond. *BMJ, 371*, m3945. doi:10.1136/bmj.m3945	Article describing considerations for using video consultations for both the organization/healthcare professional and the patient.
Health information technology AND video consultations	Technology, IT infrastructure	Greenhalgh, T., Wherton, J., Shaw, S., Papoutsi, C., Vijayaraghavan, S., &	The objective of this article is to define what health information infrastructure is and how it supports technological innovation. The empirical

		Stones, R. (2019). Infrastructure revisited: an ethnographic case study of how health information infrastructure shapes and constrains technological innovation. *Journal of medical Internet research, 21*(12), e16093.	objective relates strongly to the main research question of this study. The objective was to examine the challenges of implementing and scaling up video consultation services.
	Technology, Covid-19	Kayser, M. Z., Valtin, C., Greer, M., Karow, B., Fuge, J., & Gottlieb, J. (2020). Video Consultation During the COVID-19 Pandemic: A Single Center's Experience with Lung Transplant Recipients. *Telemedicine and e-Health*.	Article about video consultation experiences during the COVID-19 pandemic. Mainly looks at the patient perspective but includes valuable finding from an organization perspective

Appendix II

Codebook and identified themes

Not included in publication

Appendix III

Interview protocol

Not included in publication