Physicians' perspectives on the use of Telemedicine in Germany

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in the healthcare areas of diabetology, pediatrics, cardiology, neurology, and psychiatry

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Abstract

Title: Physicians' perspectives on the use of Telemedicine in Germany - in the healthcare areas of diabetology, pediatrics, cardiology, neurology, and psychiatry

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Telemedicine is nowadays an instrument to enhance the conventional patient-to-doctor relationship. It can appear in many variations ranging from Covid-19 boosted video consultations to device-related monitoring of patient data by the means of telemedicine.

Thus, this master thesis aims to show how different physicians apply telemedicine, the advantages, disadvantages, and challenges of telemedicine in 2021 and how Covid-19 has influenced the use of telemedicine in Germany. The scope of this study is limited to the areas of diabetes, pediatrics & diabetes, cardiology, neurology, and psychiatry & psychology.

Therefore, the results of five in-depth interviews with telemedicine experts in combination with an extensive literature review show that telemedicine can compensate partially the supply shortage of skilled specialized doctors in hospitals and practices. This compensation of skilled specialized doctors can be achieved by transferring the skill set from doctors to nurses to free up time for the doctors. Also, it has been found that one of the main application areas for telemedicine are online video consultation services with a prior personal data exchange.

Additionally, it can be verified that Covid-19 has had a positive effect on the acceptance of telemedicine in Germany, but no effect on the numbers of treated patients. Telemedicine cannot replace the personal face-to-face contact with doctors. However, it can help to increase the medical service in rural areas with limited specialists.

Keywords: Telemedicine; telemedicine use; advantages and disadvantages of telemedicine; challenges of telemedicine; Covid-19.

Resumo

Título: As perspectivas dos médicos sobre a utilização da Telemedicina na Alemanha – na área da saúde áreas de diabetologia, pediatria, cardiologia, neurologia, e psiquiatria

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A telemedicina hoje em dia e um instrumento para suportar a relação convencional entre pacientes e médicos. A aplicação pode variar desde consultações de vídeo em relação a covid-19 até a monitorização de dados de doentes pela telemedicina.

Portanto a tese de mestrado presente visa mostrar diferentes possibilidades, como médicos aplicam a telemedicina, as suas vantagens, desvantagens e enfim desafios da telemedicina em 2021 tanto como a influença de Covid-19 a utilização da telemedicina na Alemanha. O âmbito deste estudo se limita às áreas da diabetes, pediatria e diabetes, cardiologia, neurologia, psiquiatria e psicologia.

Os resultados de cinco entrevistas aprofundadas com especialistas em telemedicina em combinação com uma extensa revisão bibliográfica mostram que a telemedicina pode compensar parcialmente a escassez de oferta de médicos especializados em hospitais e consultórios. Uma das conclusões deste trabalho é que a compensação dos médicos especializados qualificados pode ser conseguida através da transferência do conjunto de competências de médicos para enfermeiros, para libertar tempo para os médicos.

Adicionalmente pode ser verificado que Covid-19 tem efeito positivo sobre a aceitação da telemedicina na Alemanha porem não afeita o número de pacientes tratados. Pode ser concluído que a telemedicina não é capaz de substituir contacto pessoal com médicos. Apesar disso e um jeito para aumentar o serviço medico em áreas rurais com limitações de especialistas.

Palavras-chave: Telemedicina; Uso de telemedicina; Vantagens telemedicina; desvantagens telemedicina; desafios telemedicina; Covid-19.

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List of Abbreviations

AOK	General Local Health Insurance
BC	Before Christ
COVID-19	Coronavirus Disease 19
DiGa	Digital Health Applications
DRG	Diagnosis Related Groups
ECG	Electrocardiogram
EBM	Uniform valuation standard for the billing for doctors
GBA	Joint Federal Committee (for Doctors, Dentists, Psychotherapists, Hospitals and Health insurance companies)
HbA1c	Haemoglobin A1c
ICD	Implantable Cardioverter Defibrillator
IT	Information Technology
RQ	Research Question
Rt-PA	Recombinant tissue Plasminogen Activator
TMC	Telemedicine Center
WHO	World Health Organization

1. Introduction

1.1. Introduction to telemedicine

Since ancient Egyptian times (3000 – 300 BC), doctors have tried to help us humans live a healthy and long life without pains and complaints. Access to healthcare was limited, healthcare knowledge was not widely accessible, and doctor-patient communication was limited. Healthcare communication between patients and doctors changed from Papyrus writing to modern audio and video communication and has improved over time due to various factors (Ogrinc, 2012). Telemedicine is one of those factors and will center this master thesis (Barbosa et al., 2021).

Telemedicine describes the remote doctor-patient communication for areas like disease diagnosis and disease monitoring. One of the main benefits of telemedicine is the increased availability of treatment in low infrastructure areas. For instance, in a rural area, where there are fewer specialized doctors and the distance to one doctor is farther away than in urban areas, telemedicine can help make treatment therapies available to all populations and reduce location constraints. Furthermore, in a country in Germany that can be considered one of the best healthcare systems globally (Daw, 2019), it is still true that there are fewer doctors than are needed (Hergert, 2016). Doctors assume that telemedicine can close the gap of a supply shortage of skilled doctors and help to improve the treatment availability in Germany (Kadir, 2020).

Another field of application is the care of chronicle health conditions like diabetes, internal medicine, or high blood pressure that can help to improve the quality of care for patients (Bundesärztekammer, 2018). Additionally, an advantage of telemedicine is the higher therapy compliance of patients taken care of through telemedicine. Furthermore, the communication between colleagues can be improved by tele consultations like Telepathology, Teleradiology or Teleneurology (Bundesärztekammer, 2018).

First versions of Telemedicine occurred in 1905 with the “long-distance transfer of electrocardiograms” of Dutch physician Willem Einthoven (Ryu, 2010). Telemedicine evolved over time through the invention of the radio, television, and the internet. Now modern telemedicine includes three goals on the European level according to the European Commission (European Commission, 2012):

1. Improvement of the health of patients through the provision of healthcare information through digital healthcare services
2. Improvement of the quality and accessibility of healthcare through digital healthcare services
3. Incorporating the opinions of healthcare experts and patients will lead to an efficient, convenient, and implementable digital healthcare service.

As stated above, telemedicine is not an entirely new treatment area, but the author assumes that the Covid-19 pandemic accelerated the speed of adaption to the usage of telemedicine. Moreover, if it is a long-term healthcare service which areas are best suited for the usage of telemedicine?

1.2. Problem Statement

The goal of this study is to analyze which treatment areas for doctors are relevant for the use of telemedicine in Germany, what advantages and disadvantages occur, what challenges in the implementation of telemedicine are to overcome and how telemedicine will be used after Covid-19. The scope of this study is limited to the areas of Diabetes, Pediatrics & Diabetes, Cardiology, Neurology, and Psychiatry & Psychology.

1.3. Research Questions

To answer the problem statement, the author created four Research Questions with in total of nine corresponding Hypotheses based on the literature review in Chapter 2. The Research Questions and Hypotheses of this master thesis are the following:

RQ1: How are different physicians using telemedicine in Germany?

H1: Telemedicine is able to compensate the supply shortage of skilled specialized doctors in hospitals and practices in Germany partially.

RQ2: What are advantages and disadvantages for doctors and patients regarding the usage of telemedicine in Germany?

H2: Telemedicine reduces monetary spendings for diagnoses and patients' treatment.

H3: Telemedicine improves the efficiency of patient treatment.

H4: Telemedicine leads to a higher patient satisfaction.

H5: Telemedicine leads to a higher doctor satisfaction.

RQ3: What are challenges in the implementation of telemedicine in Germany?

H6: Lacking IT structure can be a hurdle to implement telemedicine in Germany.

H7: Monetary remuneration of offered telemedicine services prevents doctors from using telemedicine.

RQ4: Did Covid-19 influence the use of telemedicine in Germany?

H8: Covid-19 has a positive influence on the number of treated patients.

H9: Covid-19 has a positive influence on the acceptance of telemedicine.

2. Literature review

2.1. Definition of Telemedicine

More than a hundred different definitions of telemedicine since 1970 have been defined by different peer-reviewed journals (Sood et al., 2007). However, the most used definition of telemedicine leads back to the year of 1998, where the World Health Organization describes telemedicine in the following way (World Health Organization, 1998):

> *"The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment, and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities."*

2.2. Differentiation to telehealth, e-health, and telematic

Unfortunately, there is no clear distinction between telehealth, e-health, and telemedicine in the literature; they often are used as synonyms. Sood et al. (2007) came after intensive research of the literature to the conclusion that telemedicine is one part of telehealth: *"Telemedicine being a subset of telehealth, uses communications networks for delivery of healthcare services and medical education from one geographical location to another, primarily to address challenges like uneven distribution and shortage of infrastructural and human resource"* (Sood et al., 2007).

Telemedicine, per se, focuses more on the interaction between the different participants in the healthcare system (Sood et al., 2007). In contrast, the Federal Ministry of Healthcare (2008) describes e-health in the following way: "Under e-health, one summarizes applications of

systems of information technology (IT) systems for processing health data" (Federal Ministry of Healthcare, 2021).

The commonly found expression Telematic in the literature is a combination of "telecommunication" and "informatic." Telematics connects various IT systems and enables to exchange of information from different data sources in a closed network. Only registered users (persons or institutions) with an electronic healthcare badge will access these data. Application areas of Telematic include, but are not limited to, the communication in healthcare sectors, digital patient files, and electronic prescriptions (Gullà, 2015)

2.3. Telemedicine – application areas

Besides the different definitions and differentiations of telemedicine, telehealth, e-health, and telematic, a broad range of application areas of telemedicine can be found. These broad telemedicine application areas make it easy for physicians, patients, and service providers to communicate with each other and exchange relevant information at a distance. In **Table 1**, one can see a listing of application areas according to the uses in the field of prevention, diagnosis, therapy, rehabilitation, and nursing care (Wilhelm F. Schräder & Rainer Beckers, 2009).

Telemedicine Application areas	**Prevention**	**Diagnosis**	**Therapy**	**Rehabilitation**	**Nursing care**
Telemonitoring	X	X		X	X
Teleconsultation		X	X		
Teleconference	X	X	X	X	X
Teletherapy			X		
Telesurgery			X		
Teletraining				X	X

***Table 1**: Application areas of telemedicine (cf. Wilhelm F. Schräder & Rainer Beckers, 2009)*

In the following, the author describes the different definitions of the application areas of telemedicine based on **Table 1**: Application areas of telemedicine (cf. Wilhelm F. Schräder & Rainer Beckers, 2009)**Table 1:**

Telemonitoring or home monitoring has already been proven to be cost-effective for prevention. Telemonitoring aims to record and transmit patients' vital parameters from home to the physician´s office, especially chronically ill patients. Telemonitoring thus enables remote diagnosis of patients (Marx G et al., 2020).

With Teleconsultations, a second assessment can be easily integrated by involving universities or specialized medical centers experts (Marx G et al., 2020).
In Teleconferences, examination data or therapy regimes could be evaluated simultaneously by experts sitting in different locations and geographically in different regions (Marx G et al., 2020).
Teletherapy means mobile treatment without the physical presence of the physician. The principle is replaced primarily by Video conferencing technology. Teletherapy usually requires an additional device on the patient's side (Marx G et al., 2020).
Telesurgery uses robotic technology and wireless infrastructure to allow surgeons to operate on distantly located patients (Marx G et al., 2020).
Teletraining within rehabilitation programs can support patients who do not live near clinics (Marx G et al., 2020).

2.4. Telemedicine use in Germany with the focus on physicians

In the following chapters, 2.4.1 to 2.4.4, the author describes how different physicians apply telemedicine projects in Germany in the areas of Diabetology, Pediatrics & Diabetology, Cardiology, Neurology, and Psychiatry & Psychology.

2.4.1. Diabetology and Pediatrics

Diabetology

More than 8 million patients are treated for Diabetes Mellitus in Germany, commonly known as diabetes (Kellerer et al., 2020). The disease is a fast-growing disease. Each year 600,000 new patients are treated for the first time against Diabetes. 95% of patients have Type-2 Diabetes.

Prof. Dr. Martin, one of the interview partners for this master thesis, has become a renowned national and international expert in diabetology and telemedicine in Germany (Martin, 2021).
Prof. Dr. Martin has developed and established a system of treating diabetes centrally in Germany in the clinic sector (Martin, 2021). In this system, all patients from all specialist wards with the secondary diagnosis of diabetes are centrally registered, examined, and treated. This concept is based on a previous study from Kerstin Kempf, Johannes Kruse, and Stephan Martin from 2012. In this study, Kerstin et al. found out that incorporating a short-term, motivational, and cost-effective intervention into the baseline treatment for patients with Type 2 diabetes had positive long-term effects on weight and quality of life of patients, and if applied daily, also on

HbA1c levels (Kempf et al., 2012). HbA1c is the main output parameter and tool to monitor long-term glucose levels in diabetic patients (Nasir et al., 2010).

Prof. Dr. Martin's system includes diabetes managers who gather medical data about the medical history of patients and their current therapy and who examine the patients (Martin, 2021). Also, blood glucose levels are measured on the wards, and then all this data is transferred to the hospital information system. Based on this data, specialized diabetologists hold a telemedical consultation with concrete therapy recommendations for the respective ward physician. This recommendation also includes an insulin adjustment plan. This whole process is stored in a data system called "TeDia".

Another program that Prof. Dr. Martin developed is "TeLiPro", a telemedical system for the family doctor. It includes telemedical support, structured self-monitoring of glucose levels, diet change, and motivational coaching(Martin, 2021). The combination of telemedicine and personal coaching led, like the TeDia program, to reduce risk factors for circulatory heart diseases, such as cholesterol or blood pressure.

Pediatrics & Diabetology:

Diabetology in Pediatrics is mainly related to Type 1 diabetic treatment since most young diabetic patients have type 1 diabetes. In 2019, around 31,000 children and adolescents were treated for Type 1 diabetes (Sahai & Khurshid, 1993).

In the field of diabetology in pediatrics, Ms. Dr. Simon von Sengbusch is one of the experts regarding telemedicine and an interview partner for an expert interview. She conducted with her colleagues a clinical trial study called "VIDIKI" that examined the benefits of telemedicine in children with Type 1 diabetes. The study included 240 children aged 1-16 with Type 1 diabetes from three specialized diabetes outpatient clinics in the state of Schleswig-Holstein (Frielitz et al., 2020). The program consists of monthly video consultation and patients' regular care and requires the participants to upload their Continuous Glucose Monitoring and pump data every month via a software solution. Based on this data, the diabetologist writes a treatment plan for insulin and sends it back to the patient via an encrypted email. The results of the study were positive. The HbA1c, which measures the glucose level and is the critical output parameter, could be reduced by 0.5 %.

2.4.2. Cardiology

Every year, more than 1.7 million inpatients in Germany are treated for heart diseases (coronary heart disease, valvular heart disease, cardiac arrhythmias, cardiac insufficiency, congenital heart defects) in hospitals (Deutsche Herzstiftung e.V., 2020). With over 330,000 deaths in 2019, cardiovascular diseases accounted for 35 % of all deaths and can be considered the number one cause of death in Germany (Deutsche Herzstiftung e.V., 2020; F. Köhler et al., 2019).

One of the goals of telemedicine is to reduce the return of inpatients after a coronary disease. Unexpected ICD (Implantable Cardioverter Defibrillator) failures can be a reason for the return of such an inpatient. An ICD is a battery-powered device placed under the skin that keeps track of your heart rate. Nielsen et al. found out that Telemedicine can help via home monitoring of ICD to reduce follow-up workload (Nielsen et al., 2008). Also, Telemedicine overcomes geographical distances between patients and doctors and is used for patients with pacemakers or ICDs (Schwab et al., 2009).

Another important metric is the number of hospital days spent per inpatient in Cardiology. This topic can be addressed by the biggest in Germany conducted telemedicine study, called "TIMHF2", which is ongoing and includes 1,538 patients with chronic heart failures. First results from the ongoing "TIMHF2" study from Prof. Dr. Friedrich Köhler at the "Charité – Universitätsmedizin Berlin showed that a combination of Telemedical Centers with 24hours/7days - service and patients equipped with telemedical devices can (Koehler et al., 2018; F. Köhler et al., 2019; Winkler et al., 2021):

1. Reduce days lost due to unplanned cardiovascular hospitalizations and all-cause death from 24.2 days to 17.8 days.
2. Reduce total mortality from 11 days to 8 days.
3. Reduce unplanned hospitalization days due to heart failure from 5.6 days to 3.8 days and days lost due to unplanned heart failure hospitalization.

The "TIMHF2" study showed that telemedicine could positively influence patients' morbidity and mortality (F. Köhler et al., 2019). Additionally, Köhler et al. also mention that telemedicine

does not necessarily replay the doctor-patient contact but rather complements the medical treatment (F. Köhler et al., 2019). Telemedicine is also seen as an effective means of overcoming regional differences in the management of heart failures. The critical element of this kind of care is a well-structured telemedicine center with 24 hours and 7days service. Köhler et al. reinforce that the participation of patients in such a care concept depends on the doctor addressing this kind of care to the patients. This remote patient management" (RPM) concept includes telemonitoring, training, and therapy. In **Table 2**, the remote patient management concept is explained (F. Köhler et al., 2019):

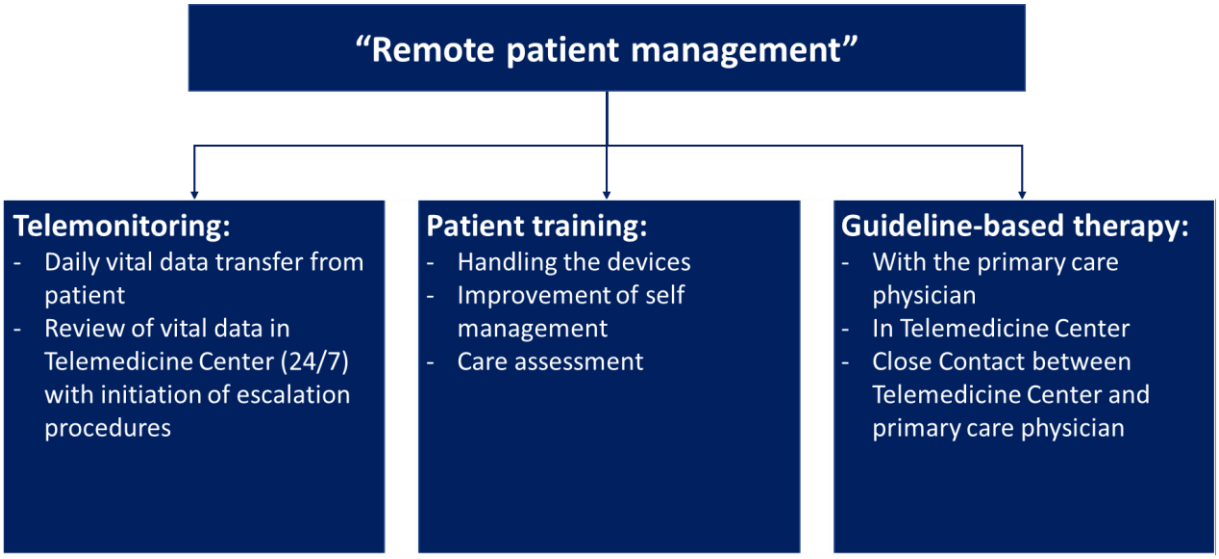

***Table 2**: Remote patient management system* (cf. F. Köhler et al., 2019)

2.4.3. Neurology

Neurology telemedicine, often described as Tele-Neurology, is applied mainly in stroke medicine. Multiple other treatment areas like headache, dementia and epilepsy exist, but stroke is currently the predominant use case in Germany (Klingner et al., 2021).
With 260,000 strokes occurring in Germany every year and 63,000 deaths annually, the disease stroke is the third largest cause of death (Heuschmann et al., 2010; Völkel et al., 2017).

In Germany, so-called "stroke networks" improve acute stroke treatment and provide fast access to treatment possibilities in mainly rural regions (Barlinn et al., 2021). Germany has 22 telemedical stroke networks and 225 cooperating hospitals that contribute to the treatment of acute stroke care of up to 48 million people. Telemedicine stroke centers treated 10 % of all stroke patients with over 38,000 Tele-Councils in 2018. Tele-Councils include the treatment of

stroke patients in hospitals without a neurological department with the help of telemedical communication between local doctors and neurologists that are not located in the hospital. Findings for the neurologist are based on different parameters such as laboratory results, vital signs, ECG findings, and radiological images.

Only every fifth hospital has a neurological department, according to the “Statistisches Bundesamt” (Klingner et al., 2021). More rural regions have smaller hospitals with fewer neurological departments, so telemedicine provides full-time advice from neurologists (Guzik & Switzer, 2020).
Especially in stroke treatment, the speed of treatment is essential. Patients with an ischemic stroke need an immediate thrombolytic treatment through the needle injection with the substance rt-PA (recombinant tissue-type plasminogen activator). The target time of the injection, stated as the door-to-needle time, is currently less than 60 minutes for patients with an ischemic stroke (Jauch et al., 2013). Moreover, for every 15-minute reduction of this time, there is a 5 % lower chance of in-hospital mortality (Jauch et al., 2013). With the mean of telemedicine, the door-to-needle time for the patient can be effectively reduced (Xian et al., 2014).

Because of a reduced door-to-needle time and other factors on the health of the stroke patient, the Tele-Stroke unit can “significantly reduce the risk of permanent disability” from stroke (Völkel et al., 2017). Germans largest tele-neurological network “TEMPIS” quantified that in their clinics' stroke patients have a 10% smaller probability of having a severe disability, of living in a nursing home, or to decease(Völkel et al., 2017).

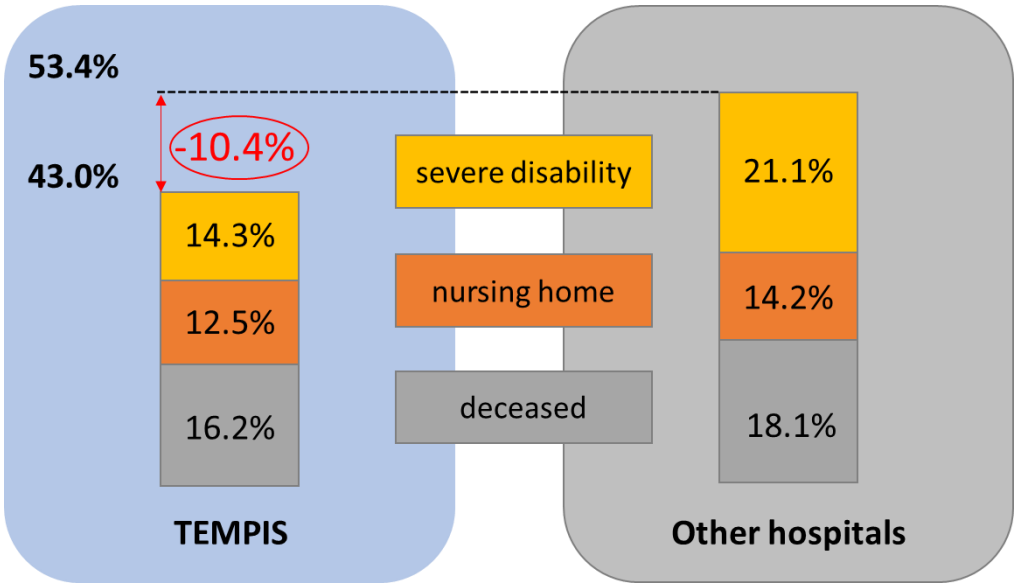

***Table 3**: Probability to have a severe disability / to get in a nursing home / to get deceased – Comparison between TEMPIS and other hospitals* (cf. Völkel et al., 2017, TEMPIS)

Although the number of stroke units has increased in recent years, comprehensive care cannot be guaranteed throughout Germany (Charité – Universitätsmedizin Berlin, 2021; Gosseaume et al., 2007; Seenan et al., 2007). In Tele-Stroke Units, regional hospitals are linked to supraregional stroke units via telemedicine. This enables regional hospitals to establish fast and specialized stroke treatment even without maintaining a neurology department (Charité – Universitätsmedizin Berlin, 2021).

The outlook of Tele-Stroke units includes the integration of other acute-neurological diseases. These diseases are at the moment and expected to be treated in the future in "Neuro-Acute-Units" (Charité – Universitätsmedizin Berlin, 2021).

2.4.4. Psychiatry & Psychology

Jacobi et al. analyzed those psychiatric diseases have in Germany a lifetime prevalence of 43 % (Jacobi et al., 2004; van den Berg et al., 2021). This means that nearly every second person will suffer over their lifetime from a psychiatric disease. Treatment of psychiatric diseases occurs in Germany in inpatient clinics, day-care clinics, outpatient psychiatrists, psychologists, and psychiatric outpatient clinics (van den Berg et al., 2021).

Structural differences in the number of doctors per patient vary widely in Germany in psychiatry & psychology. The doctor density ranges from 2,577 in cities to 23,106 in rural regions like

Vorpommern (Bundesausschuss, 2016; Schulz et al., 2008; van den Berg et al., 2021). Telemedical solutions can help to improve regional patient care. Van den Berg et al. analyzed four factors that need to be considered:

1. **Rural regions** often cannot guarantee appropriate care close to the patient's home after leaving an inpatient hospital or a day-care clinic. Many times, patients must suffer from **long waiting times**.
2. Psychotherapeutic treatments, regular help with daily structuring, and **fast** available supportive **therapy sessions are unavailable** for many patients.
3. Patients with **severe psychiatric illnesses are often difficult to reach** with therapy services. Thus, the trip to the clinic and the waiting in a waiting room can be so problematic that patients will not take advantage of the therapy services.
4. Medical consultations can hardly achieve the **urgent need for reliable medication** taking at intervals of several months.

The Institute for Community Medicine and the Department of Psychiatry and Psychotherapy of the University Medical Center Greifswald executed a project where they treated 123 patients with frequent phone contacts and message contacts after their partly inpatient clinic stay. After a partly inpatient treatment, treated patients had the following psychiatric diseases: depression, anxiety disorder, adjustment disorder, or somatoform disorder.

The results of this randomized controlled study showed that with the help of a continuous care concept of telemedicine, patients' symptoms like fear and depression could be improved significantly (van den Berg & Friedrich Wilhelm Schwartz, 2017). Since 2017 and since the positive outcomes of this study, the telemedicine concept has become part of regular care in the low doctor infrastructure area of Vorpommern in Germany (Steinke, 2017).

The lack of psychiatric departments in hospitals also increases the need for psychiatric Tele-Councils, as shown in the project "PSYCHKOM" in Bavaria, where a Tele-psychiatric consultation was established between a specialist clinic for psychiatry and two acute-care hospitals without psychiatric departments (Meyrer et al., 2011). Dr. med. Heruth, a specialist for psychotherapy and medical psychotherapist in Grimma, claims that an existing trustful relationship is an essential requirement for a video consultation. (Heruth, 2020).

Due to Covid--19, video consultations boomed in Germany, especially in psychiatry. Köhler et al. claim that video or phone consultations are limited because patients' behavior, their smell, their ability to interact in the room, and their vegetative psych expressions cannot be interpreted as accurately as in personal consultations (S. Köhler & Meier, 2021).

2.5. Chances & Challenges of telemedicine in Germany

Chapter 2.4 gives a literature overview of the chances and challenges of telemedicine in Germany to find out what advantages and disadvantages occur in telemedicine and what challenges in the implementation of telemedicine are to overcome.

2.5.1. Chances for telemedicine

The demographic development in Germany shows that the people are getting older, the demand for healthcare services is growing, and the healthcare budgets of the health insurers are decreasing. Especially on the country site, there is a lack of General Practitioners and specialists. This leads to medical supply gaps in Germany. There is a need for telemedicine.
In **Table 4,** there is a general overview of the chances for applying telemedicine:

Chances for telemedicine		**Sources**
Medical benefits	A meta-analysis of 98 review papers in 2020 concludes that 83% of the studies with telemedicine are at least as effective as traditional medicine. The umbrella review shows that telemedicine interventions can enhance glycaemic control in diabetic patients, reduce mortality and hospitalization in patients with chronic heart failure, help patients to improve their physical activity and their sensation of pain.	(Eze et al., 2020)
	The remote form of medical care can significantly enhance healthcare by offering medical services independent of time and space. The benefits of improving care for telemedicine are widely evidence-based.	(Secer & von Bandemer, 2019)

	One significant advantage for telemedicine is to get a second opinion to find the correct treatment pattern at short notice as well as to get an expert opinion, even from more distant regions. Telemedicine avoids waiting times, travel times, and examination times.	(Kalb, 2018)
	According to analyses by Bertelsmann Stiftung, telemedical remote can help to overcome the lack of specialists, especially in rural areas, as it makes it easier to overcome the distance between doctor and patient.	(Thiel & Deimel, 2020)
	Telemedicine helps to improve medical treatment in country-site areas by treating high-risk patients more effectively. Telemonitoring often leads to the favorable situation that a patient can be discharged from the hospital earlier, which leads to higher patient satisfaction and lower costs. The remote monitoring of patients offers additional advantages. Early intervention is possible ideally before the patient notices any symptoms, which could prevent a severe heart attack.	(McKinsey & Company, 2020)
	One of the more extensive observational studies in a predominantly elderly patient population shows that most patients had an improved quality of health perception, better disease understanding, and high satisfaction rates with telemedicine.	(Cardozo & Steinberg, 2010)
Patient convenience improvement	One significant advantage of remote treatment is the time and money-saving aspect for patients and physicians compared to face-to-face doctor visits, and that contacts are available more quickly. This leads to more patient convenience. Meta-analysis shows that patients appreciate the benefits of video consultations, regardless of their specific medical conditions.	(Eze et al., 2020)

Financial benefits	In a study published by McKinsey in 2018, the broad introduction of telemedicine in Germany is calculated with estimated potential savings of a total of EUR 4.4 billion: • 60% could be saved in outpatient specialist care. • 25% could be saved in outpatient care by primary care physicians • 15% could be saved by secure and user-friendly digital message exchange between doctor and patient.	(McKinsey & Company, 2020)
Control options for health insurers	The treatment data from Telemedical Apps provided by health insurances would offer new control possibilities for health insurers, especially in the light of selective and collective-contract regulations.	(Meißner, 2021)

***Table 4**: Chances of Telemedicine*

2..2. Challenges for telemedicine

Besides the significant advantages of telemedicine in Germany, there are still a lot of hurdles and challenges (**Table 5**) to overcome.

Challenges for telemedicine		**Sources**
Challenges of health care system	Telemedicine still has the problem to be reimbursed due to innovation-unfriendly reimbursement system and the and strong sectoral compartmentalization. There is only limited infrastructure for telemedicine and a lack of reimbursement for telemedicine services by the health insurance companies. In addition, there is insufficient knowledge of how telemedicine can be run effectively and how the physicians and the staff should ideally communicate with the patients.	(Brauns & Loos, 2015)

Telematic & IT infrastructure	There is a lack of telematics infrastructure in Germany. Telemedicine projects are mainly isolated applications, but there is no national regulation.	(Brauns & Loos, 2015)
	The absence of payment regulations for telemedicine and coping with the billing process are additional barriers for many physicians.	(McKinsey & Company, 2020)
The regulatory framework	Continuous reviews and adjustments of the regulatory framework are necessary to push telemedicine in Germany. Up to now, there is no EBM code for the billing of remote patient monitoring.	(McKinsey & Company, 2020)
	The professional law for doctors in Germany has to be brought in harmony with the managed care concepts for telemedicine.	(Christian Dierks, 1999)
	Data protection and data security are essential for the further spread of telemedicine. In a study done by the Flensburg University of Applied Sciences in 2008, nearly 62% of the service providers and 86% of the physicians consider the risk of data violation for telemedicine as very high.	(Dr. Perlitz, 2010)
Acceptance within patients	Telemedicine solutions could lead to less personal contact between patient and doctor, affecting their relationship, especially if telemedicine is not mainly seen as an additional care system but as a replacement of face-to-face doctor's visits in practice.	(McKinsey & Company, 2020)
	Health insurance companies only reimburse telemedicine only in rare exceptional cases. The patient often has to pay for this service by himself.	(Dr. Perlitz, 2010)
	Another hurdle - especially for older people with chronic illness, is the simple usage of telemedicine applications because they have to use them alone at home regularly.	(Heng, 2009)
Acceptance within physician	Many general practitioners still recommend not to use telemedicine applications because they fear being further monitored. They also fear the additional costs associated	(Dr. Perlitz, 2010)

	with infrastructural investments and additional administrative effort. In addition, permanent access to the transmitted data requires sufficient knowledge in data security.	

Table 5: Challenges for telemedicine

3. Methodology

The author follows in this master thesis a deductive research approach based on the business research process by Blumberg, Cooper & Schindler that can be seen in **Figure** 1 **Research Process** (Boris Blumberg, Donald R. Cooper, 2020)**Figure 1** (Boris Blumberg, Donald R. Cooper, 2020). This thesis includes a literature review as well as a qualitative review that is based on five expert interviews.

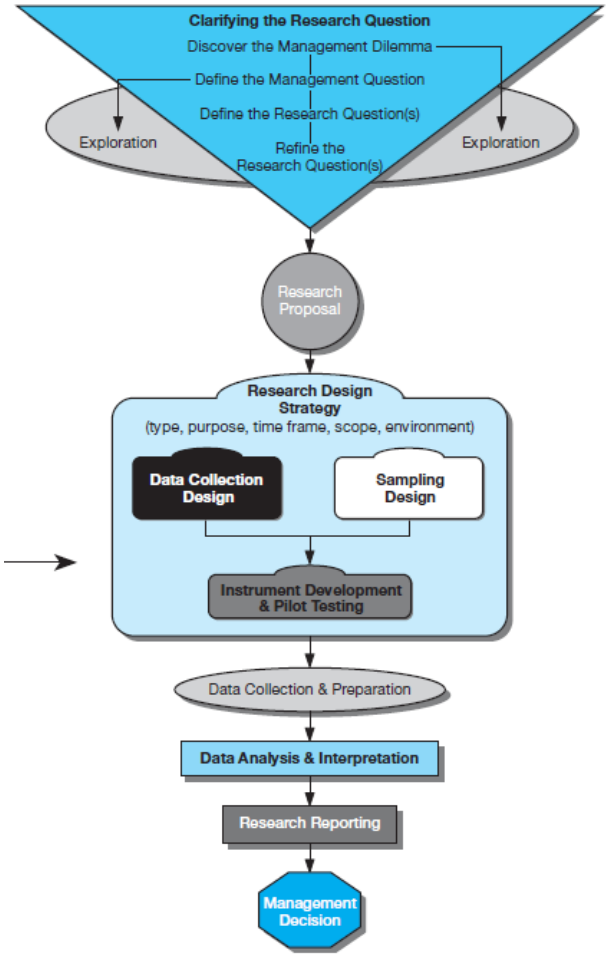

Figure 1 Research Process (Boris Blumberg, Donald R. Cooper, 2020)

3.1. Literature review

The author has conducted systematic literature on the topic of telemedicine. The first step included screening books, journal articles, reports, and certified homepages via Google Scholar and Google. Different combinations of search terms for "telemedicine" have been entered in English and German on these search platforms. In total, more than 200 relevant sources were screened. Based on their relevance to answering the research questions, for example, in RQ1, "how are different physicians using telemedicine in Germany?", the sources could be reduced to the **61 most relevant sources** for this master thesis. Based on the literature review, the hypotheses in **Chapter 1.3** have been formulated.

3.2. Qualitative review

This thesis includes a qualitative review in the form of five **in-depth expert interviews** within the healthcare sectors of **diabetes**, **pediatrics**, **cardiology**, **neurology,** and **psychiatry & psychology**. These areas have been selected because these five areas represent the majority of the top 10 common diseases areas in Germany. In **Table 6**, one can see the above-mentioned healthcare sectors in relation to their cause of death and their total patient deaths per year. One can see that the sector of Cardiology has the disease coronary heart disease with 191,913 patient deaths per year in 2018 in Germany, the highest number of patient deaths in Germany (World Health Organization, 2018).

Cause of Death	**Rank**	**Deaths per year**	**Healthcare area**	**Interview Expert**
Coronary Heart Disease	1	191,913	Cardiology	Dr. Placke
Alzheimers & Dementia	3	48,770	Psychology & Psychiatry	Prof. Dr. Grabe
Stroke	4	58,306	Neurology	Dr. Angermaier
Diabetes Mellitus	7	24,764	Diabetology	Prof. Dr. Martin

Diabetes Mellitus	7	24,764	Pediatrics & Diabetology	Dr. von Sengbusch

***Table 6**: Chosen healthcare areas for the in-depth expert interviews linked to the most common diseases* (World Health Organization, 2018)

Furthermore, the interview experts of the different healthcare areas have been selected through extensive Google research and the help of the central doctor search website tool in Germany on bundesaerztekammer.de (Bundesärztekammer, 2021). In this tool, it is possible to cluster by country and search different doctors from different fields of medicine. Sometimes you can also find the contact information (phone number, home page, address) of the respective doctor. In combination with finding the respective information on LinkedIn or on their homepages, the doctors have been contacted via mail and via telephone, but contacting via telephone was the most successful way of communication.

Unfortunately, there is no central directory of doctors that use telemedicine. Therefore, much effort was put into contacting all doctors and verifying if they use telemedicine or not. The combination with published papers of the doctors, the use of the bundesaerztekammer.de homepage, the homepages of the doctors, and LinkedIn, over 112 doctors were contacted.
Out of these 112 doctors, the above doctors were selected. In other healthcare areas like radiology, dermatology, and gynecology, no doctors have been found available for an interview. These areas and other areas also have forms of telemedicine but are not analyzed in this master thesis.

For the interviews, a questionnaire (see appendix) was created. The interview took place over zoom and lasted between 45-60 minutes per interview partner. The interview was recorded after personal consent, then transcribed in German and translated into English. Then, the interview expert had a two-week period to verify the information given on the transcript.

4. Expert Interviews and results

4.1. Selection of Interview partners

4.1.1. Telemedicine in Diabetology (Prof. Dr. med. Stephan Martin)

Prof. Dr. Martin has been selected as a participant for an expert interview about telemedicine because he is the Medical Director of the German Institute for Telemedicine and Health Promotion (DITG). He is also the Chief Physician for Diabetology and Director of the West German Diabetes and Health Center (WDGZ), which belongs to the association of catholic clinics (”Verbund Katholischer Kliniken”) with over 3,100 employees in Germany (VKKD, 2021). This is an association that supplies five clinics telemedically from an outpatient center. Additionally, Prof. Dr. Martin leads the inpatient diabetology with telemedical care *(Martin, 2)* and has been performing telemedicine for ten years *(Martin, 21).*

4.1.2. Telemedicine in Pediatrics & Diabetology (Dr. von Sengbusch)

Ms. Dr. Simone von Sengbusch has been selected as a participant for an expert interview about telemedicine because she is a specialist in Pediatrics and Diabetology. Ms. Dr. von Sengbusch is a Senior Physician for Pediatrics and Adolescent Medicine in Lübeck. There she is the Head of the Mobile Diabetes Training in Schleswig-Holstein. Also, Ms. Dr. von Sengbusch conducted the most extensive telemedicine study in children with type 1 diabetes in Germany (“VIDIKI” study) which was rewarded with a prize in the “MSD Gesundheitspreis”. Furthermore, she got rewarded with the Federal Cross of Merit in 2011 for her Mobile Diabetes Training in Schleswig-Holstein.

4.1.3. Telemedicine in Cardiology (Dr. Placke)

Mr. Dr. Jens Placke has been selected for this interview because he has been doing telemedicine in the sector of cardiology for more than ten years. He is a telemedicine expert and a specialist for internal medicine and cardiology in Rostock in Germany. He works in the joint practice for cardiology “Dr. D. Trautwein & Dr. J. Placke” which is integrated into the hospital “Klinikum Südstadt-Rostock”. Dr. Placke is doing outpatient medical care, and his practice is also a certified “Heart Failure Unit”, a certified practice for cardiac insufficiency and rhythmology. Since his first implantation of a medical peacemaker in 2003, Mr. Dr. Placke has been actively practicing telemedicine *(Placke, 1).*

4.1.4. Telemedicine in Neurology (Dr. Angermaier)

Mr. Dr. Angermaier has been selected for an expert interview because he is a specialist in Neurology at Greifswald University Hospital. Also, Mr. Dr. Angermaier is a regional coordinator and administrative site manager for Mecklenburg-Vorpommern of the ANNOTeM project (Acute Neurological Care in Northeast Germany with Telemedical Support). Furthermore, he manages the NeTKoH project (Neurological TeleCouncil with General Practitioners to strengthen specialist care in Vorpommern). Both projects are telemedical projects in the area of neurology.

4.1.5. Telemedicine in Psychiatry & Psychology (Prof. Dr. Grabe)

Prof. Dr. Grabe has been selected for this interview because he is a specialist and Director of the Clinic for Psychiatry and Psychotherapy of the University Medical Center Greifswald, where he also serves as a Professor of the University of Greifswald. He has worked in the outpatient, day clinic, and inpatient basis of the University of Greifswald and has used telemedicine since 2011.

4.2. Results

4.2.1. Research Question 1: How are different physicians using telemedicine in Germany?

Telemedicine in Diabetology (Prof. Dr. med. Stephan Martin)

The main usage area for telemedicine for Prof. Dr. Martin is in the hospital diabetology for the nurse-doctor and nurse-doctor-doctor communication. *(Martin, 3).* Also, the overall knowledge in these diabetes clinics is "too low" and the number of patients is "exploding" *(Martin, 3).* Therefore, Prof. Dr. Martin is trying to reduce this supply shortage of skilled doctors in his hospital and in Germany by creating a system with "diabetes managers" *(Martin, 3).* These diabetes managers are nurses, which work on the diabetes ward and who are trained in a systematic training program and who record the patient data in a structured interview and send the data to the doctors via telemedicine *(Martin, 3)*. The doctors then can give therapy suggestions based on these data *(Martin, 3).*

Figure 2 and **Figure 3** below describe the **two scenarios** of this **telemedicine communication**:

1.) **Figure 2**: The patient is already in another ward of the hospital, for example, in gynecology, and during the routine test for diabetology, the patient is diagnosed with diabetes *(Martin, 7)*. Then, the communication is a nurse-doctor(diabetes)-doctor(gynecologist) communication. The gynecologist makes the final overall medical treatment decision after the consultation of the diabetes specialist.

2.) **Figure 3**: The patient goes to the General Practitioner and is sent to the diabetology ward of the hospital to get their new medication adjusted. Here, the communication starts with the nurse collecting the patient data through a structured interview. The nurse sends the data to the diabetology specialist on the diabetology ward.

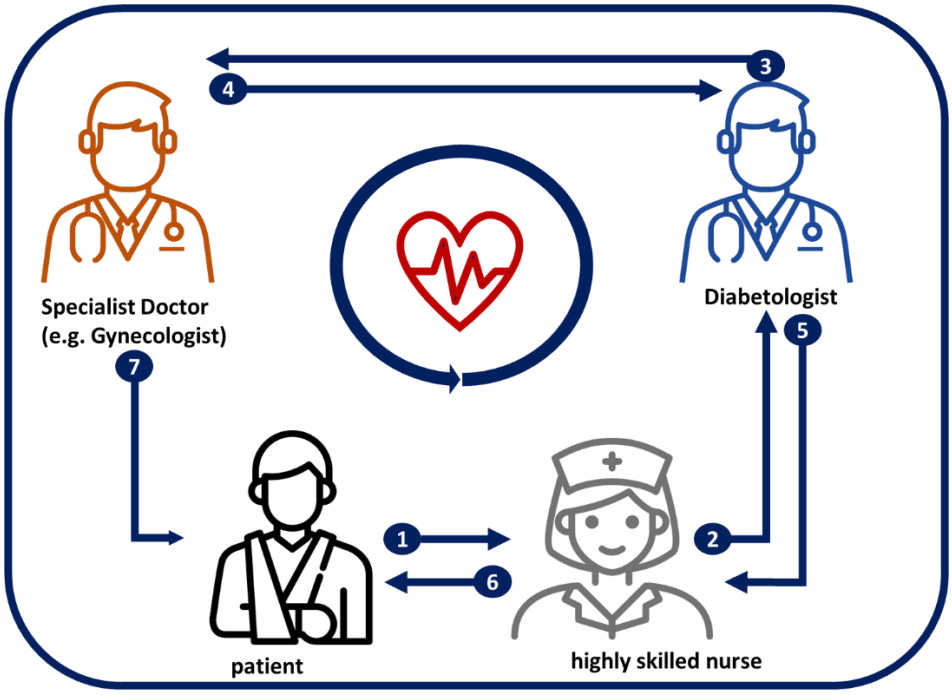

***Figure 2**: Cross-ward telemedical communication process for inpatients in a hospital (source: own creation)*

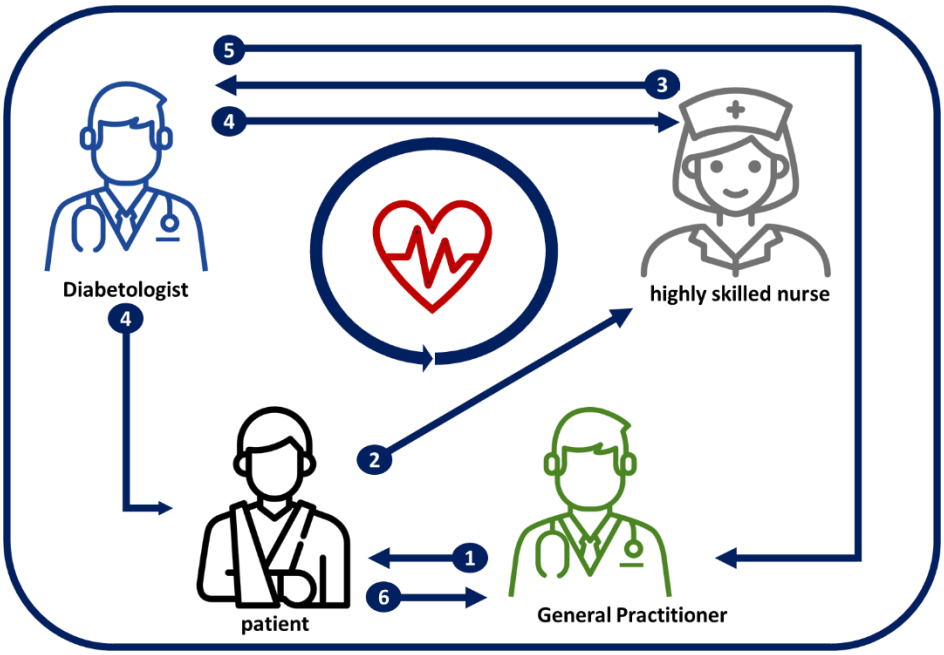

***Figure 3**: Telemedical communication process for outpatients (source: own creation)*

Telemedicine in Pediatrics & Diabetology (Dr. von Sengbusch)

According to Ms. Dr. Sengbusch, **two types of telemedicine** exist. She describes the first one as **synchronous telemedicine** via a video consultation service and the second one as **asynchronous telemedicine** via an exchange via e-mail or phone call *(Sengbusch, 3)*. Ms. Dr. von Sengbusch is mainly executing telemedicine synchronously via a 1:1 video consultation service with a "prior exchange of diabetes data" *(Sengbusch, 3)*. In her area of pediatric diabetology, telemedicine is used for data measurement, and this data is stored safely in a cloud *(Sengbusch, 4)*.

In 2016 Ms. Dr. von Sengbusch received funding from the Innovation Fund for the project "VIDIKI- VIDIKI - Virtual Diabetes Outpatient Clinic for Children and Adolescents". With this study, Ms. Dr. von Sengbusch wanted to address the problem of limited doctor appointments. She recognizes this as a significant problem since kids grow constantly and need insulin adjustment appointments every month *(Sengbusch, 4)*. Therefore, Ms. Dr. von Sengbusch suggested "shorter but more frequent" appointments in addition to the current treatment schedule. Currently, Ms. Dr. Sengbusch is negotiating to reduce traditional appointments to "one to two live contacts per year" and thinks that the rest of appointments could be replaced by digital telemedicine appointments, which would result in "more effective video consultations and more cost-savings for the patient and also resource-savings for the diabetes team" *(Sengbusch, 6)*.

Telemedicine in Cardiology (Dr. Placke)

Mr. Dr. Placke claims that telemedicine **is not just data collection but also always relies on feedback** *(Placke, 7).* He provides permanent care via telemedicine for 500 patients per year, growing by 30-50 patients per year *(Placke, 18)*. Twenty of his patients also use diagnostic tools that prevent heart failure. In his opinion, telemedicine consists out of three elements:

1. **Aggregates** like pacemakers/device-related telemedicine *(Placke, 5):*

   Mr. Dr. Placke says that this includes pacemakers, heart failure systems other systems *(Placke, 5)*. These systems send data points, which are then evaluated, and physicians draw conclusions based on that *(Placke, 5)*. Mr. Placke illustrates, for example, that if the heart rate increases, then doctors see this data and can adjust their therapy plan accordingly *(Placke, 5)*. Currently, Mr. Dr. Placke uses telemedicine for 500 patients in the area of pacemakers, aggregates, and other systems *(Placke, 5)*.

2. **Diagnostic tools** *(Placke 5-6, 24)*:

   Soft Telemedicine:

   Mr. Dr. Placke argues that soft telemedicine is a part of diagnostic tools. For instance, Mr. Dr. Placke prescribes mobile thumb ECGs that the patients can use individually at home for approximately four weeks *(Placke, 24)*. He explains that the ECG data is stored in a cloud and is accessible for doctors and patients *(Placke, 5-6)*.

   Another applicable area of diagnosis tools is for Mr. Dr. Placke the Telemedical Interventional Management in Heart Failure II (TIM-HF2) study *(Placke, 5-6)*.

   In the TIM-HF2 study, patients receive a scale or wage and measure daily data. This data is then sent to a data center. The center then gives responses like, “Everything's going well here, or here we need to make changes in medication, for example."*(Placke, 5-6)*.

   Hard Telemedicine:

   Mr. Dr. Placke uses an investigation tool for heart failure that is implanted in the pulmonary artery for patients with severe heart failure. This is part of the hard telemedicine and is used in a current study he is conducting. The tool of this study is called “CardioMEMS” and is a sensor from the company Abbott *(Placke, 5-6)*. Mr. Dr. Placke describes that the tool measures the heart pressure daily, and the doctors can adjust the medication accordingly. This prevents the patient from going to the hospital due to decompensation. Mr. Dr. Placke states that it “certainly will become part of standard care next year” *(Placke, 18-20).*

3. **Tele-Nursing** *(Placke, 6)*

Mr. Dr. Placke states that telemedicine includes Tele-Nurses are skilled nurses that can react to patient data. For instance, they can make an adjustment of medicaments when the patient's wage is changing *(Placke, 6)*. Then, based on these data changes, patients are called by Tele-Nurses, and patients can then report to the General Practitioners *(Placke, 6)*.

The communication between Tele-Nurses and patients and also the communication between doctors and patients take place via phone. Phone communication is preferred over video communication because it is easier to implement *(Placke, 12).* Patients are then called based on a traffic light system. A red light means that there will be an interaction within 24 hours, yellow light reflects an interaction within some days and green light means that no interaction is needed. The task of a well-trained nurse is that to carry out the interaction with the patient *(Placke, 12).*

Telemedicine in Neurology (Dr. Angermaier)

Mr. Dr. Angermaier states that all telemedicine projects in Germany, except the stroke area, are "third-party funded projects" and that telemedicine does not appear in the DRG system in Germany *(Angermaier, 5,9).* Therefore, telemedicine cannot be done full time and only as a side activity for doctors in Germany and for Mr. Dr. Angermaier himself *(Angermaier, 5)*.

Mr. Dr. Angermaier supervises two projects:

1. **ANNOTeM project** (Acute Neurological Care in Northeast Germany with Telemedical Support):

The first project is an inpatient project *(Angermaier, 7,18)* and has existed for 4.5 years which is based on an Innovation Fund project together with the Charité and the Emergency Hospital Berlin in the counties of Mecklenburg-Vorpommern, Brandenburg, and Saxen-Anhalt with 11 clinics *(Angermaier, 27, 45)*. The goal of this project is to "detect time-critical illnesses early" because in acute neurology, according to Mr. Dr. Angermaier, "you can prevent a lot of negative outcomes" due to the time dependency. Mr. Dr. Angermaier explains that this is the principle of "Telestroke" and that it has existed for around 15 years *(Angermaier, 11)*. Telestroke could be considered as the only financed telemedicine sector in Germany because it appears in the

DRG system *(Angermaier, 11)*. In the area of Telestroke, over 22 telemedical networks in Germany have united to the AG Telestroke *(Angermaier, 11)*. Mr. Dr. Angermaier and his colleagues made the assessment that 10-15 % of all stroke patients in Germany have been treated with telemedicine *(Angermaier, 11)*. Mr. Dr. Angermaier further explains that telemedicine in acute neurology exists because in Germany, there is a shortage of neurological clinics and that not all basic and standard care hospitals include a neurological department in Germany *(Angermaier, 11).* In those clinics without a neurological department, the local internists of the clinic are connected to a neurologist, which is available 24 hours a day for the internist and the patient *(Angermaier, 12)*. This means that the "neurologist in private practice is active on a conciliar basis *(Angermaier, 12)*.

Mr. Dr. Angermaier explains that in Germany, we have "Telestroke Units" on a local, regional and superregional level. This unit consists out of a multidisciplinary team, a so-called "black box" that looks at the patient for stroke from different doctors *(Angermaier, 18)*.
Mr. Dr. Angermaier claims that this principle of a stroke, which is in the DRG system, could also be applied to other neurological diseases (e.g., Epileptic seizures or Encephalitis meningitis) and that there lies the innovative character of the ANNOTeM project *(Angermaier 22, 24).* Currently, Dr. Angermaier and his colleagues are executing 200 to 220 councils a month with telemedicine *(Angermaier, 49).* Moreover, Mr. Dr. Angermaier and his colleagues are awaiting the approval of the GBA, the German's highest institution for medical approvals and remunerations, so that this telemedicine project could be used nationwide *(Angermaier, 98).*

2. NeTKoH project (Neurological TeleCouncil with General Practitioners to strengthen specialist care in Vorpommern):
The second project is an outpatient project with 33,000 full-time practices in the Region of Vorpommern for over four years. *(Angermaier, 7, 78).* It is a project that started a year ago and is now in the recruitment phase. It is also a project financed by the Innovation Fund *(Angermaier, 75).* Mr. Dr. Angermaier explains that this project is a more local project in the area of Vorpommern because there are structurally weak regions in Germany *(Angermaier, 75).* Also, there are supply problems of doctors in those areas with waiting times for an appointment of up to seven months, meaning that there is "no parallel examination" and the whole medical treatment with unclear symptoms is postponed by up to "two to three years" *(Angermaier, 75).* Within the university hospital of Greifswald, where Mr. Dr. Angermaier works, they are trying

to shorten this supply gap by providing standard care for a "radius of 100 to 150 kilometers" *(Angermaier, 75)*.

Like the first project, the NeTKoH project provides neurological expertise directly to the General Practitioner practice. The telemedicine Council is shorter with 15 min. in the NeTKoH project compared to 45 min. in the ANNOTeM project because Mr. Dr. Angermaier says that the General Practitioner has less time per patient. Mr. Dr. Angermaier further explains that these 15 minutes cannot "complete a neurological examination", but it can be in a first step a consultation with the possibility to get further care *(Angermaier, 77). (Angermaier, 78)*.

Overall, Mr. Dr. Angermaier describes telemedicine as all forms of communication, including audiovisual communication, but according to the definition of the German Medical Association, "a telephone call" with the patient can also be considered as telemedicine *(Angermaier, 35)*. For Mr. Dr. Angermaier, the process of telemedicine includes *(Angermaier, 39)*:

1. The phone call from internist to Neurology Specialist.
2. The Neurology Specialist recommends "appropriate imaging".
3. The Council is registered and electronically documented.
4. Audiovisual communication between neurology specialist and internist (in hospital) and patient (in hospital) happens.
5. Therapy recommendation is made by internist based on call and other indications.

Telemedicine in Psychiatry & Psychology (Prof. Dr. Grabe)

The main usage area for Mr. Prof. Dr. Grabe is the outpatient area in the psychiatric institutional department *(Grabe, 5)* in Mecklenburg-Vorpommern in Germany. Their telemedicine is used for the long-term care of patients who have already absolved a therapy and for transitional outpatient care *(Grabe, 31)*.

Here, Mr. Prof. Dr. Grabe uses telemedicine for regular care (*Grabe, 5)*. This includes, for instance, setting up activation plans (*Grabe, 5)*. This is done by making use of psychiatrically experienced and trained telemedicine nurses who then can "build on regular doctor-patient contacts" (*Grabe, 5,7)*. Here the frequency of nurse-patient contact is at least once a quarter. Prof. Dr. Grabe treats under 50 patients per quarter in this telemedicine unit, which represents

approximately 10 % of all psychiatric patients *(Grabe, 7,11)*. All those patients in this telemedicine project accept the form of therapy via telemedicine *(Grabe, 19), which* Prof. Dr. Grabe expected because a previous study from 2010 with 120 patients had a high approval rate of over 90 % *(Grabe, 19)*. The most used form of communication is via phone because video communication can sometimes be shameful for the patient or is unwanted by the patient *(Grabe, 23-25)*.

Mr. Prof. Dr. Grabe suggests not to build up a "parallel world", but rather to try to include telemedicine in the regular health care system and use telemedicine only as a supplement to regular care. *(Grabe, 51)*

Summary of all Interviews

Healthcare Areas	Telemedicine Usage
Diabetology (Prof. Dr. med. Stephan Martin)	• Main telemedicine usage is in the hospital diabetology for the nurse-doctor and nurse-doctor-doctor communication with the system "TeDia" *(Martin, 3)*. • Secondary usage in telemedical lifestyle program called "TeLiPro" *(Martin, 1)*.
Pediatrics & Diabetology (Dr. von Sengbusch)	• Main telemedicine usage is for a 1:1 online video consultation service with a "prior exchange of diabetes data" within the project "VIDIKI" *(Sengbusch, 3)*.
Cardiology (Dr. Placke)	• One telemedicine usage is in aggregates like pacemakers/device-related telemedicine and the associated Tele-Nursing based on a traffic light system *(Placke, 5-6)*. • Another telemedicine usage is in diagnostic tools for soft telemedicine (e.g., thumb ECG) and hard telemedicine (implanted sensors) *(Placke 5-6)*.
Neurology (Dr. Angermaier)	• One telemedicine usage is to detect time-critical illnesses early in acute Neurology through the "ANNOTeM" project where neurologists are connected to internists in hospital neurology *(Angermaier, 27, 45)*.

	• The "NeTKoH" project is a similar project that provides neurological expertise directly to the General Practitioner practice via telemedicine *(Angermaier, 75).*
Psychiatry & Psychology (Prof. Dr. Grabe)	• Telemedicine is used for the long-term care of patients who have already absolved a therapy and for transitional outpatient care (Grabe, 31).

***Table** 7: Telemedicine usage areas of different healthcare areas based on expert interviews*

H1: Telemedicine is able to compensate the supply shortage of skilled specialized doctors in hospitals and practices in Germany partially.

- **Valid for all expert disciplines**

For the area of **diabetology**, Prof. Dr. Martin is trying to reduce the supply shortage of skilled doctors in his hospital and in Germany by creating a system with specialized diabetes nurses who work on the diabetes ward, record the patient data in a structured interview, and sends the data to the doctors via telemedicine. The physicians then can give therapy recommendations based on these data *(Martin, 3).*

For the field of **pediatrics and diabetology**, Dr. von Sengbusch tries to overcome the major problem of adjusting the insulin dosages every month within the kids who are constantly in the growing process and who are outpatients and often living in rural areas (Sengbusch, 4). Therefore, Ms. Dr. von Sengbusch suggested "shorter but more frequent" appointments.

Dr. Placke provides permanent care in the area of **cardiology** via telemedicine for 500 patients per year (Placke 18). Telemedicine can help to recognize technical problems very quickly (e.g., in defibrillators) and help to prevent hospital admissions (Placke 8-10).

For the medical discipline neurology, Dr. Angermaier and his colleagues made the assessment that 10-15 % of all stroke patients in Germany have been treated with telemedicine (Angermaier, 11). He further explains that telemedicine in acute neurology is necessary for Germany due to the shortage of neurological clinics and that not all hospitals include a neurological department (Angermaier, 11). In those clinics without a neurological department, the local internists of the clinic are connected to a neurologist, which is available 24 hours a day for the internist and the patient (Angermaier, 12).

With the neurological TeleCouncil with General Practitioners with outpatient patients in Mecklenburg Vorpommern, Dr. Angermaier tries to overcome the supply problems of doctors in this area. (Angermaier, 7, 75,78). Patients must wait for an appointment with a neurologist for up to seven months. The university hospital of Greifswald is trying to shorten this supply gap by providing standard care for a "radius of 100 to 150 kilometers" (Angermaier, 75

In the area of **psychiatry and psychology**, Prof. Dr. Grabe is using telemedicine for the long-term care of patients who have already absolved a therapy and for transitional outpatient care in Mecklenburg-Vorpommern in Germany (Grabe, 31). Telemedicine improves the connection of structurally weak regions through the quick availability of telemedicine, which includes immediate therapeutic contact and bridging large distances (Grabe 5).

4.2.2. Research Question 2: What are advantages and disadvantages for doctors and patients regarding the usage of telemedicine in Germany?

Advantages

The following Table 8 lists the advantages of telemedicine-based on the five conducted industry expert interviews. Advantages of telemedicine include money savings, efficiency gains, improved online training, higher patients' acceptance, higher patients' satisfaction, higher doctors' satisfaction and improvement of healthcare for patients.

Advantages of Telemedicine (based on industry expert interviews)			
High Level	**Low Level (detailed information)**	**Health-care areas**	**Source**
Money savings	Telemedicine led to a reduction in hospital days with an estimated cost saving of up to 1.1 million euros per year.	Diabetology	Martin, 31
	Telemedicine improved disease prognosis.	Diabetology	Martin, 31
	Telemedicine reduced complications in treatments.	Diabetology	Martin, 31
Efficiency gain	Telemedicine improves the efficiency of the treatment through an improved structured process.	Diabetology	Martin, 31

	Time is saved with telemedicine when patients upload data instead of doctors.	Pediatrics & Diabetology	Sengbusch, 29
	Telemedicine is a good use case in areas where "the data is already being stored digitally in a cloud".	Pediatrics & Diabetology	Sengbusch, 21
	Administrative work can be reduced via telemedicine.	Neurology	Angermaier, 90
Improved online training	Telemedicine improves the utilization of training for physicians and patients.	Diabetology	Martin, 55
Higher patients' acceptance	Telemedicine has, on average, a high acceptance in Ms. Sengbusch's practice for Pediatrics, but its acceptance depends on the digital affinity of the patients.	Pediatrics & Diabetology	Sengbusch, 16
	Patients' acceptance is high, with more than 99 % in Mr. Placke's practice for Cardiology.	Cardiology	Placke, 28
	In Mr. Angermaier's hospital for Neurology, patient satisfaction with telemedicine has "always been very good".	Neurology	Angermaier, 59
Higher patients' satisfaction	Telemedicine is easier and faster. It is more affordable for patients (gasoline, parking tickets), and patients save time (travel time).	Pediatrics & Diabetology, Cardiology, Neurology, Psychology & Psychiatry	Sengbusch, 23, 26; Placke, 37; Angermaier, 43; Grabe, 5
	Telemedicine improves the connection of structurally weak regions through the quick availability of telemedicine, which includes immediate therapeutic contact and bridging large distances.	Pediatrics & Diabetology, Neurology, Psychology & Psychiatry	Sengbusch, 23, 26; Angermaier, 43; Grabe, 5
	Telemedicine reduces the shortage of medical supply by integrating more nurses into the healthcare system.	Psychology & Psychiatry, Diabetology, Pediatrics & Diabetology	Grabe, 40-41; Martin, 23; Sengbusch, 56

Higher patients' satisfaction	Telemedicine provides easier coordination of appointments.	Pediatrics & Diabetology	Sengbusch, 23
	Telemedicine reduces the waiting time for patients.	Pediatrics & Diabetology	Sengbusch, 21
	Telemedicine reduces trips to the doctor for immobile patients.	Pediatrics & Diabetology	Sengbusch, 23
	An advantage of telemedicine is the increased mobility for the patient (for instance, for the cardio messengers)	Cardiology	Placke, 36
	Telemedicine can help to recognize technical problems very quickly (e.g., in defibrillators) and help to prevent hospital admissions	Cardiology	Placke 8-10. 36
	Telemedicine can lead to fewer hospital admissions, fewer heart failures, and earlier detection of heart problems.	Cardiology	Placke, 37
	Telemedicine can have a "survival advantage" for defibrillator patients that used telemedicine, according to the "TIM-HF2" study conducted by Professor Köhler.	Cardiology	Placke, 37
	A better diagnosis is possible via telemedicine. In Neurology with Tele-Councils, the local internists get a second opinion from the neurologists via telemedicine.	Neurology	Angermai-er, 43
	Telemedicine reduces the long-term hospitalization rate of patients in Mr. Grabe's clinic for psychology and psychiatry.	Psychiatry & Psychology	Grabe, 43
Higher doctors' satisfaction	Telemedicine provides easier coordination of appointments.	Pediatrics & Diabetology	Sengbusch, 23
	Doctors benefit from using telemedicine in a home-office model in a modern working model.	Pediatrics & Diabetology	Sengbusch, 24

	Telemedicine provides "little time savings" for the doctors because patients are more punctual online.	Pediatrics & Diabetology	Sengbusch, 28-29
	Telemedicine ensures a "higher flexibility" for doctors because they depend less on other data inputs, which results in "higher-speed" for the doctors.	Pediatrics & Diabetology, Cardiology	Sengbusch, 30; Placke, 34
	Active telemedicine can reduce the number of patient meetings with doctors (e.g., in Cardiology for defibrillator patients from two to one meeting per year), resulting in less work for doctors.	Cardiology	Placke, 34

***Table 8**: Advantages of Telemedicine (based on industry expert interviews)*

Disadvantages

In Table 9**Table 9** below, one can see an overview of the disadvantages of telemedicine based on the five conducted industry expert interviews. Disadvantages of telemedicine include Accessibility, Therapy replacement, limited usage, negative influence on doctors, difficult billing system, and deterioration of healthcare for patients.

Disadvantages of Telemedicine (based on industry expert interviews)			
High Level	**Low Level (detailed information)**	**Health-care areas**	**Source**
Accessibility	Older generations (70+) do not have access to telemedicine. Ms. Sengbusch suggests that easily usable tablets are needed for older generations in order to provide telemedicine for them.	Pediatrics & Diabetology, Neurology	Sengbusch, 16; Angermai-er, 119
	Low Internet Infrastructure in rural areas reduces the accessibility to telemedicine.	Pediatrics & Diabetology	Sengbusch, 16
Therapy replacement	Telemedicine should not be used as a substitute to completely replace patient contacts. Diseases in Neurology, for	Pediatrics & Diabetology, Neurology	Sengbusch, 19,21;

	instance, cannot, according to Mr. Angermaier, be "hundred percent correctly on telemedicine all the time".		Angermaier, 90
Limited usage	Ms. Dr. von Sengbusch claims that telemedicine is not applicable in those cases when the doctor needs to examine the patient, including smell, impression with all senses, the hands, stethoscope, ultrasound, and blood sampling.	Pediatrics & Diabetology	Sengbusch, 19
	The missing existence of a digital insurance card in Germany reduces the potential of telemedicine.	Pediatrics & Diabetology	Sengbusch, 30, 32
Negative influence on doctors	Due to home office working models, physician teams "could fall apart".	Pediatrics & Diabetology	Sengbusch, 26
Difficult billing system	Diverse billing in Germany makes remuneration difficult.	Pediatrics & Diabetology	Sengbusch, 57
Missing Personal Contact	In Mr. Grabe's clinic for Psychology & Psychiatry, "direct patient contact is desired" by both the doctor and the patient. „Other ways of responding to a patient are missing in telemedicine, including nonverbal communication like facial expressions or shake hands. "	Psychology & Psychiatry	Grabe, 13-15
Deterioration of healthcare for patients	15 min. time frame is too short to give an overall diagnosis for patients at the General Practitioner, so neurologists can only "formulate a vague suspicious diagnosis."	Neurology	Angermaier, 91
	Mr. Dr. Angermaier says that "certain examination techniques" can only be done by an experienced neurologist and not be substituted by a trained internist	Neurology	Angermaier, 90

***Table 9**: Disadvantages of Telemedicine (based on industry expert interviews)*

H2: Telemedicine reduces monetary spendings for diagnoses and patients' treatment.

- **Valid for the area of diabetology and cardiology**

Hypothesis 2 is valid in the sector of **diabetology and cardiology**. Telemedicine can **reduce monetary spendings** for diagnoses and patients' treatment. This could be shown through expert interviews with Prof. Dr. Martin (diabetology), who implemented telemedicine in hospital diabetology. The **economic benefit** of this implemented system was evaluated by the University of Cologne with the Chair of Economics on the "Paragraph 21" data set. The independent external analysis showed that this new system with diabetes managers saves 0.91 hospital days per diabetes patient (Martin Röhling et al., 2019). The main reasons for this **reduction in hospital days and advantages of telemedicine**:

1. With diabetes managers, a **better disease prognosis** (Martin, 31)
2. With the diabetes managers, **complications** could have been **reduced** (Martin, 31).
3. A better-structured process of the treatment is possible (Martin, 31). The nurse gets "a higher status", helping with therapy suggestions and leading to **high efficiency** in the hospital (Martin, 31).
4. **Utilization** of training for patients and physicians gets better (Martin, 55).

Prof. Dr. Martin estimated that the reduction in hospital days could **save** up his clinic up to **1.1 million euros of costs per year** (5500 patient days per year*200 Euro patient day costs*9.9% reduction of patient days).

In the area of **cardiology,** Mr. Dr. Placke argues that the "TIM-HF2" study by Professor Köhler proved that doctors have a "survival advantage" for patients that use telemedicine, therefore, reduce patient treatment costs in the long run *(Placke, 37)*. He also refers to Professor Hindrucks and claimes that his "IN-TIME" study showed this result of a "survival advantage" also for defibrillators. *(Placke, 37)*. Mr. Dr. Placke further argues that the "TIM-HF2" study will be the basis for a GBA decision to include telemedicine for defibrillators in the EBM fee list so that patients can be treated and doctors can be reimbursed for treatment in the future *(Placke, 53)*. All in all, Mr. Dr. Placke concludes from his practical experience of more than ten years with telemedicine that telemedicine leads to **fewer hospital admissions**, **fewer heart failures,** and **earlier detection of heart problems** in the area of cardiology *(Placke, 37).*

In the other areas of **Pediatrics & Diabetology, Psychiatry & Psychology, and Neurology**, no direct reduction of monetary spendings could be observed by the experts' interview partners. However, the efficiency of patient treatment also has an indirect effect on the money savings through telemedicine, which leads to Hypothesis 3.

H3: Telemedicine improves the efficiency of patient treatment.

- **Valid for the area of diabetology and cardiology**, **pediatrics & diabetology, and neurology**

Hypothesis 3 is valid in the areas of diabetology, pediatrics & diabetology, and neurology. Telemedicine can **improve the efficiency** of patient treatment. This could be shown through an expert interview with Prof. Dr. Martin (diabetology), Dr. Sengbusch (pediatrics & diabetology), and Dr. Angermaier (Neurology). Due to the following factors, and efficiency gain in these healthcare areas could be observed by the industry experts:

1. Telemedicine improves the efficiency of the treatment through an **improved structured process** *(Martin, 31)*.
2. **Time** is **saved** with telemedicine when patients upload data instead of doctors *(Sengbusch, 29)*.
3. Telemedicine is a good use case in areas where "the **data** is already being **stored digitally** in a cloud" *(Sengbusch, 21)*.
4. **Administrative work** can be **reduced** via telemedicine *(Angermaier, 90)*.

Besides patient treatment, patient satisfaction plays a key role in all kinds of medical treatments, not only telemedicine. This leads to the answer to Hypothesis 4.

H4: Telemedicine leads to a higher patient satisfaction.

- **Valid for all expert disciplines**

Hypothesis 4 can be evaluated as valid in all areas under consideration (diabetology, pediatrics & diabetology, cardiology, neurology, and psychiatry & psychology. According to the expert interviews with Prof. Dr. Martin (diabetology), Dr. Sengbusch (pediatrics & diabetology), and Dr. Angermaier (Neurology), Telemedicine can **lead to higher patient satisfaction**. The following factors contribute to higher patient satisfaction in these healthcare areas:

1. Telemedicine is **easier** and **faster**. It is more **affordable** for patients (gasoline, parking tickets), and patients **save time** (travel time*) (Sengbusch, 23, 26; Placke, 37; Angermaier, 43; Grabe, 5).*
2. Telemedicine **improves the connection of structurally weak regions** through the quick availability of telemedicine, which includes immediate therapeutic contact and bridging large distances *(Sengbusch, 23, 26; Angermaier, 43; Grabe, 5)*.
3. Telemedicine provides **easier coordination** of appointments *(Sengbusch, 23).*
4. Telemedicine **reduces** the **waiting time** for patients *(Sengbusch, 21)*.
5. Telemedicine **reduces trips to the doctor** for immobile patients *(Sengbusch, 23)*.
6. For cardio messengers, an advantage of telemedicine is the **increased mobility** for the patient *(Placke, 36)*.
7. Telemedicine can help to recognize technical problems very quickly (e.g., in defibrillators) and help **to prevent hospital admissions** *(Placke 8-10, 36)*
8. Telemedicine can lead to **fewer hospital admissions, fewer heart failures, and earlier detection of heart problems** *(Placke, 37).*
9. Telemedicine can have a **"survival advantage"** for defibrillator patients that used telemedicine, according to the "TIM-HF2" study conducted by Professor Köhler *(Placke, 37)*.
10. A **better diagnosis is possible** via telemedicine. In Neurology with Tele-Councils, the local internists get a second opinion from the neurologists via telemedicine *(Angermaier, 43)*.
11. Telemedicine **reduces the long-term hospitalization rate** of patients in Mr. Grabe's clinic for psychology and psychiatry *(Grabe, 43)*.

One could also assume from the high number of different factors that higher patient satisfaction is really one of the key benefits and results of using telemedicine. But not only do patients gain from telemedicine, but doctors also benefit from it, which leads to Hypothesis 5.

H5: Telemedicine leads to a higher doctor satisfaction.

- ***Valid for pediatrics & diabetology and cardiology***

Hypothesis 5 can be considered valid in the healthcare areas of pediatrics & diabetology, and cardiology. Telemedicine can **lead to a higher doctor satisfaction**. This could be shown through expert interviews with Dr. Sengbusch (pediatrics & diabetology) and Dr. Placke

(Cardiology). The following factors contribute to higher doctor satisfaction in these healthcare areas:

1. Telemedicine provides **easier coordination** of appointments *(Sengbusch, 23)*.
2. Doctors benefit from using telemedicine in a **home-office** model in a modern working model *(Sengbusch, 24)*.
3. Telemedicine provides "little time savings" for doctors because **patients are more punctual online** *(Sengbusch, 28-29)*.
4. Telemedicine ensures a **"higher flexibility" for doctors** because they depend less on other data inputs, which results in **"higher-speed" for the doctors** *(Sengbusch, 30; Placke, 34)*.
5. Active telemedicine can **reduce** the **number of patient meetings** with doctors (e.g., in Cardiology for defibrillator patients from two to one meeting per year), resulting in less work for doctors *(Placke, 34)*.

4.2.3. Research Question 3: What are challenges in the implementation of telemedicine in Germany?

H6: Lacking IT structure can be a hurdle to implement telemedicine in Germany.

- **Valid for all expert disciplines**

Research Hypothesis 6 can be considered valid according to four out of five interview experts in the areas of pediatrics & diabetology, cardiology, neurology, and psychiatry & psychology. Mr. Prof. Dr. Grabe explains in his area of psychiatry & psychology that stable data networks and data protection can cause issues with the implementation of telemedicine *(Grabe, 55)*. Mr. Dr. Placke and Ms. Dr. von Sengbusch argue that low internet infrastructure in rural areas reduces the accessibility to telemedicine for doctors and patients, which also makes reading and tracking of patients' data not possible *(Sengbusch, 16; Placke, 67)*. In the area of emergency medicine, a slow internet connection can even be "life-threatening," according to Mr. Dr. Placke *(Placke, 69)*.

H7: Monetary remuneration of offered telemedicine services prevents doctors from using telemedicine.

- **Valid for all expert disciplines**

All expert interview partners verified Hypothesis 7 as valid and explained that the **monetary remuneration of telemedicine services is the key challenge for the implementation of telemedicine** in Germany *(Sengbusch, 10, 57; Angermaier, 9, 93; Placke, 67; Grabe, 59; Martin, 47)*. Dr. Angermaier argues that the billing and remuneration system (DRG system) in Germany needs to be changed because with it arises problems of billings and "that you can only do certain things if they can also be represented in terms of billing" *(Angermaier, 27)*. Overall costs, including investments costs, running costs (e.g., staff, IT, infrastructure), and additional costs (e.g., quality assurance), could be a hurdle, according to Dr. Angermaier *(Angermaier, 102).*

In addition to a difficult billing system, the "**rejection by medical professionals**" is one of the main challenges for the implementation of telemedicine in Germany. Prof. Dr. Martin reasons this "rejection by medical professionals" due to the fact that doctors are "very conservative", that prefer not to change the status quo and only execute telemedicine "when they make money out of it" *(Martin, 49)*.

When looking at current telemedicine projects, most of these projects are funded by the Innovation Funds in Germany, which is a fund issued by the government and the health insurance providers in order to improve the quality and efficiency of healthcare in Germany *(Sengbusch, 12*; Daniel Dröschel et al., 2017). According to Ms. Dr. von Sengbusch, the **challenge is to transform the project studies into long-term regular care** *(Sengbusch, 43)*. A contractual agreement between doctors, government, and health insurance providers, for instance, the "140-er Vertrag", can have a signal function for all health insurance companies and federal states to implement a telemedicine project into regular care (*Sengbusch, 43*; Vorberg & Leukel, 2021).

4.2.4. Research Question 4: Did Covid-19 influence the use of telemedicine in Germany?

H8: Covid-19 has a positive influence on the number of treated patients by telemedicine.

- ***Invalid*** *due to inconsistent assessment of the different experts:*
  - No influence: Prof Martin, Dr.Angermaier, Dr Placke
  - Positive influence: Dr. Sengbusch, Prof Dr. Grabe

Prof. Dr. Martin does not see a positive influence of Covid 19 on the number of treated diabetes patients in his hospitals due to telemedicine *(Martin, 19).* He argues that the only effect of Corona that he observed is that he "had fewer patients because the clinics were more or less closed and that they had less to do" *(Martin, 21)*.

Dr. Angermaier consents with Dr. Martins line of argumentation and claims that there was a "very clear corona effect" on the number of treated neurological patients at all, not only for telemedicine. However, the reason for this corona effect was that fewer people went to the hospital because "of the fear of not becoming infected" *(Angermaier, 53).* For instance, in the field of Neurology in the case of strokes, but also in other specialist disciplines, Dr. Angermaier predicates that patient "simply ignored symptoms" *(Angermaier, 53).* For neurology, that meant that patients with mild symptoms "did not come to the clinic at all" *(Angermaier, 53).*

In terms of usage of telemedicine in Germany, the number of cardiac patients treated by Mr. Dr. Placke using telemedicine remained constant over Corona and therefore supported the rejection of Hypothesis 8 *(Placke, 30)*. He reasons that for Cardiology, the number of treated patients due to Corona "has not changed that much". (Placke, 73). Also, the rate of increased usage of aggregates like pacemakers remained constant for patients treated by Mr. Dr. Placke using telemedicine regardless of Corona *(Placke, 5, 30).* Besides the introduction of video consultations in some healthcare areas, another side effect of Covid-19 was the improvement of handling sensitive data. Mr. Dr. Placke said Corona influenced data regulation concerns and that during Corona peak times, "data concerns were quickly excluded and deleted as non-existent" *(Placke, 72).*

Dr. Simone Sengbusch (*Sengbusch 59*) sees a boom in the number of video lessons with diabetes patients, especially kids, and therefore a positive effect on the number of patients by telemedicine. Covid-19 affected the increase of DiGa (digital health applications, reimbursable by statutory health insurance) (*Sengbusch*, 49).

Prof. Dr. Grabe also stated, "Corona has certainly promoted" the usage of telemedicine in psychiatric patients *(Grabe, 59).*) During the start of Covid-19, the health insurance providers contacted Mr. Grabe and his colleagues and justified them to carry out and bill videoconferencing. He describes the introduction of videoconferencing "as a big step forward", but also sees it critically because psychiatrists are at the moment "not allowed to do it

permanently" *(Grabe, 59)*. For the whole medical system, he states that Corona influenced the progress of digitalization and that Corona was a "total boost for the whole industry" *(Grabe, 59).*

H9: Covid-19 has a positive influence on the acceptance of telemedicine.

- **Valid for all expert disciplines**

All experts from the areas of diabetology, pediatrics & diabetology, cardiology, neurology, and psychiatry & psychology experienced Corona as a "**boost for telemedicine**" for the **acceptance and** for the **applicability of telemedicine services** *(Martin, 52; Angermaier, 121; Placke, 72; Sengbusch, 59; Grabe, 59).* In the following are the summarized individual statements regarding Covid-19:

Prof. Dr. Martin (Diabetology) states that the "use of media is different" with the "more attractive" usage of online training for patients and the continuing education of physicians (*Martin, 52).*

In the field of Neurology, Dr. Angermaier clearly concludes that the younger the patients are, the easier it is to get acceptance from them for telemedicine. (Angermaier, 119).
In general, Mr. Dr. Placke (Cardiology) and Ms. Dr. von Sengbusch describe that Corona was a "booster" in awareness of video-consultation hours for telemedicine overall and that now it should be the challenge to improve telemedicine and to develop telemedicine further *(Placke, 72; Sengbusch, 9).*

For the whole medical system, Prof. Dr. Grabe states that Corona influenced the progress of digitalization and that Corona was a "total boost for the whole industry" *(Grabe, 59*). According to Prof. Dr. Grabe, Telemedicine is a "win-win situation for everyone, it really saves resources" *(Grabe, 59)*.

5. Conclusion, limitations, and future outlook

5.1. Conclusion

Telemedicine is an omnipresent topic in the area of medicine. Eze et al. conducted a 2020 meta-analysis of 98 review papers, which showed that 83% of the studies with telemedicine have been at least as effective as traditional medicine (Eze et al., 2020). Besides the external studies, also the internal study of this master thesis that included five expert interviews from the areas of diabetology, pediatrics & diabetology, cardiology, neurology, and psychiatry & psychology, concluded that telemedicine is a useful enhancement of traditional medicine.
The objective of this master thesis was to find out how different physicians are using Telemedicine, what the advantages and disadvantages for doctors and patients are, what challenges in the implementation of telemedicine are to overcome, and to check how Covid-19 had an influence on the use of telemedicine in Germany.

This thesis proved that telemedicine could reduce the supply shortage of skilled doctors in hospitals and practices in Germany. This can be achieved via transferring the skill set from doctors to nurses to free up time for the doctors like it is done by Prof. Dr. Martin with his created system of diabetes experts. Or a shortage of skilled doctors can be overcome by using modern technologies. In the area of cardiology, modern technologies can mean device-related medicine for implantable and wearable devices that give the doctor or the skilled nurse a good monitoring and intervening system. Future potential application areas can be an improved triage system based on Artificial Intelligence that helps to improve the decision-making of the doctor.

Based on the industry expert interviews, it can be concluded that the main advantages of telemedicine include money savings, efficiency gains, higher patients' acceptance, improved online training, higher patients' satisfaction, and higher doctors' satisfaction. The main advantage of telemedicine found is the higher patients' satisfaction through telemedicine, including that telemedicine is easier, faster, more affordable, and it improves the connection of structurally weak regions through the quick availability of telemedicine. Disadvantages of telemedicine include accessibility, therapy replacement, limited usage, negative influence on doctors, difficult billing system, and deterioration of healthcare for patients, where accessibility and limited usage were the most mentioned disadvantages. This includes that older generations do not have access to telemedicine, the low internet infrastructure in rural areas reduces the accessibility to telemedicine, and telemedicine is not applicable in all fields of medicine,

especially when the doctor needs to examine the patient with all his senses and special tools. Overall, both the literature and the expert interviews found out that telemedicine should never replace traditional medicine but can be a useful additional enhancement of therapy options.

The author verified that lacking IT structures can be a hurdle to implement telemedicine in Germany. For instance, in device-related telemedicine in emergency medicine, a slow internet connection can be "life-threatening," according to interview partner Mr. Dr. Placke *(Placke, 69)*. Another verified challenge for the implementation of telemedicine is the monetary remuneration of offered telemedicine services that prevent doctors from using telemedicine. Some doctors might use telemedicine because they have the intrinsic urge to help patients with all their means and are more affine towards digital solutions, but some other doctors will not start to implement telemedicine when the remuneration with healthcare funds are difficult and provide lower remuneration compared to traditional therapy methods. A good first step is to make governmental-financed project studies through the "Innovation Funds" in Germany in all different fields of telemedicine. These projects are then a good basis for a contractual agreement between doctors, government and health insurance providers and can have a signal function for all health insurance companies and federal states to implement a telemedicine project into regular care *(Sengbusch, 43)*.

One surprising result of this master thesis was the different results to the influence of Covid-19 on the use of telemedicine in Germany. Prof. Dr. Martin, Dr. Angermaier, and Dr. Placke stated that the number of treated telemedicine patients stayed constant over Corona, whereas Dr. Sengbusch and Prof. Dr. Grabe observed a boom in the number of video lessons and for the whole medical system. However, all experts experienced Covid-19 as a "boost for telemedicine" for the acceptance and for the applicability of telemedicine services.

5.2. Limitations

The thesis is limited to the areas of diabetology, pediatrics & diabetology, cardiology, neurology, and psychiatry & psychology. The interviewed experts are mostly coming from hospitals, and the hospital view predominates in this master thesis. Furthermore, other specialist areas where telemedicine is used and has potential, like radiology, orthopedics, and oncology, are not analyzed due to the scope of this thesis. Also, the author was not able to find an interview partner in the General Practioner area, which could have been an interesting area to analyze

since General Practitioners make a lot of teleconsultations. Moreover, the thesis is limited to the physician's view and is not considering the opinions of nurses and patients.

Also, due to Covid-19, some physicians were not able to respond to an interview since they did not have the time and capacity because of their tight pandemic-related work schedule.
The author based this thesis on a literature review and a qualitative interview with five experts in the area of telemedicine. Therefore, the sample size of the results is small. Another potential future study could quantify these results through a quantitative survey in order to test the hypothesis on a broader spectrum.

5.3. Managerial implications & outlook

If a physician or the management of a hospital takes into consideration implementing telemedicine, they should be aware that this, in most cases supplemental to regular medical care. It is necessary to make one´s own benefit-risk analysis. An upfront investment in IT-infrastructure as well as in personal training of the doctors as well as for the nurses is indispensable. Administrative work can be reduced via telemedicine, and time is saved with telemedicine when patients upload data instead of doctors.
To ensure the future success of telemedicine, it is important to carefully choose the area where telemedicine applications could be used. Not every area is suitable for telemedicine for setting up the right diagnose and treatment.

Telemedicine cannot replace the personal face-to-face contact with doctors. However, it can help to increase the medical service in rural areas with limited specialists, and it can help to increase, when necessary, the frequency of contact with the patients.
In medical terms, telemedicine supports the early and better diagnostic as well as an early diagnose of a disease. It can reduce in some areas the long-term hospitalization rate. With the help of specialized and well-trained nurses also some complications, for example, within the treatment of diabetic patients could be reduced. One other positive effect is that often the utilization of training for patients and physicians gets better.

The outlook of telemedicine is positive. The healthcare system in Germany is on fire because of the need to reduce costs and maintain quantity and quality of supply for effective medical treatments. Furthermore, the lack of specialized hospitals and physicians, especially in rural

areas, and an increasing amount of people with chronic diseases are putting pressure on the German healthcare system.

Therefore, telemedicine can be a solution to stabilize the German healthcare system. Economically, telemedicine can be seen as a way of controlling costs. Telemedical services are becoming steadily more important and showing initial evidence in randomized clinical trials with regards to increasing the quality of care, reducing inpatient stays, and cutting treatment costs.

In 2021 a variety of different telemedicine projects existed in Germany. However, sustainable or even comprehensive use of telemedicine is still missing. It often happens that once a project has been completed, it is usually not possible to integrate this into regular healthcare operations. Close communication between doctors, healthcare funds, and patients is therefore needed for a successful implementation of telemedicine in regular healthcare. In the beginning, telemedicine costs money and takes time to develop, but lastly saves time and money.

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Appendices

0. Questionnaire for Interviews

1. In which areas do you currently use telemedicine and why do you use telemedicine?
2. How do you use telemedicine in your healthcare segment?
3. How often do you use telemedicine per month/quarter?
   - 3.1. Before Covid-19 pandemic?
   - 3.2. After Covid-19 pandemic?
4. What is your patients' acceptance of telemedicine?
5. What advantages and disadvantages do you see in the use of telemedicine for yourself and your patients?
6. Is telemedicine in your area profitable?
   - 6.1. How are telemedicine projects rewarded in your health insurance?
   - 6.2. What are the costs associated with telemedicine projects?
7. How does the future of telemedicine look like?
   - 7.1. In which healthcare segments do you see the strongest potential for telemedicine?
   - 7.2. What are the challenges in implementing telemedicine?
   - 7.3. How has the use of telemedicine changed before and during Corona? How do you see the future of telemedicine in a post Covid-19 era?

I. Interview with Prof. Dr. med. Stephan Martin

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	MARCO: Thank you very much for your time, Prof. Dr. Martin. Maybe you can start by telling us something about your career, your position and your experience?
1	PROF. DR. MARTIN: I went to medical school. Then I first worked in molecular medicine at Harvard Medical School as a research fellow. I did molecular medicine there and then I went to the German Diabetes Center. I was about to transfer when I was rehabilitated. And then the boss there changed and he made me deputy director. That was Professor Scherbaum. I then co-directed the clinic there as deputy director for several years until I then changed to the Sana Clinics. I then spent four years at the Sana Clinics in an "interdisciplinary diabetology" project and I am now Chief Physician for Diabetology and Director of the West German Diabetes and Health Center (WDGZ) here in the association of of catholic clinics (”Verbund Katholischer Kliniken”). We look after a total of five clinics here telemedically from an outpatient centre. We are all part of a network. And parallel to that, there is my inpatient diabetology with telemedical care. Parallel to that, I started a whole series of outpatient telemedical projects. One of them was called “TeLiPro”. “TeLIPro” that is published and we have cared for patients nationwide. And now I am currently in the process of setting up a telemedical service for China and we have just provided telemedical care for the first patient.
2	MARCO: Wow! That's impressive and a great success. Great, thank you very much! Let's move on to the next question: **1. In what areas do you currently use telemedicine and why do you use telemedicine?**
3	PROF. DR. MARTIN: Well, my main job is hospital diabetology and we already have diabetes in at least one third of our patients who are in our hospitals. But then the person with diabetes almost does not find a role in the hospital otherwise because we do not have inpatient diabetology anymore. Nevertheless, it is so, if a patient is in the hospital. Then he has an operation, he has some complications, he has pneumonia, then the blood glucose values can be derailed. And the higher the blood sugar levels, the worse his prognosis. And to solve this problem we have, so to speak, and there are not so many diabetologists, and besides, they are expensive.

	In this respect, we have managed to train nurses with five clinics, all of which belong to one sponsor. We turned the nurses into diabetes managers. We have generated this term “diabetes manager”. And diabetes managers record the patients, then send us the data, so the doctors, telemedically. And I, together with my colleagues, then care for the patients. We then have the data available based on a structured interview and then give therapy suggestions. Some of the nurses are so fit that they naturally do this themselves. And in the end, we only give the medical competence and that they do not work freely without a medical decision. That means: why do we do that? A. The number of patients is exploding. B. The number of diabetologists is decreasing. And the knowledge in the diabetes clinics is too low there. A well-trained patient with type 1 diabetes has more knowledge than the average ward doctor or the senior doctor on diabetes. And that is the problem at the moment, why this is important in hospitals. We have now also evaluated this scientifically and the result is that with our system we can save 0.9 hospital days for people with diabetes. This has been evaluated with the University of Cologne with the Chair of Economics on the "Paragraph 21" data set. So from this side we can show that the inpatient interdisciplinary telemedicine-based diabetology pays off very, very well in the cost area.
4	MARCO: As a clinic, you naturally have a very high motivation to operate telemedicine with such a high cost-saving potential. I assume the whole thing takes place via software, or how does the communication take place?
5	PROF. DR. MARTIN: So we have a software. This has been developed separately. And in this software there are the structured questions. It records, for example, how long the patient has had diabetes, what complications he has, what medications he had before the inpatient stay. As long as the patient is able to tell us, of course. This data is then... And we record the blood sugar. The blood sugars that are measured on the wards are transferred to us by starting insulin therapy. Then the wards get an insulin sheet and we adjust that depending on the blood glucose levels. We also, of course, check to see if a patient has any complications. So what we also do is quality management. We check, for example, whether the kidney function is elevated. If it is elevated and he ison metformin (commonly used antidiabetics), then we take him off metformin. So there is a lot of things that are still going on in the background there. We look to see if someone has a urinary infection and that is why their blood sugar is elevated. In the beginning, many people were surprised about all the things we do to find out why the patient has such high blood sugar values. And many believed in diabetology that they should only take care of blood sugar, but diabetology cannot only look at signs of infection or inflammation. In this respect, we have already developed a little further. By the way, we also take care of renal insufficiency and malnutrition. So this is done in a similar way, but not to the same extent as we do with diabetes.
6	MARCO: But the focus here is on outpatient care, right?
7	PROF. DR. MARTIN: No, inpatient. So the patient comes to gynecology and has diabetes and then we automatically come there and take care of him during the inpatient stay. That's just an inpatient stay. Parallel to that, we also have an MVZ (Community health center), but that is no longer telemedicine. So our area of telemedicine is purely inpatient. We are a center that is responsible for five hospitals.
8	MARCO: Okay, very good. I am m glad you explained that again. Yeah, then you have more or less answered the second question as well. This was **2. How do you use telemedicine in your healthcare segment?** Maybe in that context it would also be interesting to know what is the main benefit for the patient through telemedicine? Is it the trip he saves to the doctor or something else? What is the main benefit from the patient's point of view?
9	PROF. DR. MARTIN: The patient is an inpatient.
10	MARCO: Right, you're right.
11	PROF. DR. MARTIN: The main benefit is that it has a better prognosis, which translates into 0.9... so we take care of 6000 patients every year. And you can do the math on that. That's almost 5500 hospital days a year. So we reduce complications. That means the patient gets better care. What is the benefit for the patient? The patient has a competent contact person for the hospital. Some of our departments, for example urology, they always do a bit of advertising. They say if you have diabetes, come to us because diabetology will take care of you. Because many patients, when they come to the clinic and have diabetes and inject insulin, are often completely shocked at how little knowledge is available there in the clinics. And at the end of the day, we can demonstrate competence, especially in comparison to competitor clinics.
12	MARCO: Wow. Of course, that is then also a significant reason for the patient to go to your clinic. Let's move on to the next question. **3. How often do you use telemedicine in the month/quarter compared to the total number of patients? (Before covid-19 pandemic and in the future after covid-19 pandemic).** Maybe you can start with how many patients you currently care for?
13	PROF. DR. MARTIN: Currently we have 180 in care. And this is a continuous care, so 12 months and also on weekends.
14	MARCO: And those 180 patients are fixed or variable?
15	PROF. DR. MARTIN: No, of course that is somewhat variable. On Mondays, of course, there are more than on Fridays. That is, what we do is, so to speak, we take care of the patients who are inpatients and have diabetes, and we take care of all of them.
16	MARCO: And of the 180 patients, how many are using the telemedicine service?
17	PROF. DR. MARTIN: All of them. So it is not the patient who uses it, it is the doctors. The doctor, so the gynecologists. So when a patient is admitted, they are immediately recorded with diabetes managers on site and reported to the doctor telemedically.
18	MARCO: 100% usage by all patients. That is great, of course, that you have already integrated that into the hospital routine like that. Did the Corona time change anything for you?

19	PROF. DR. MARTIN: No.
20	MARCO: There was no difference?
21	PROF. DR. MARTIN: No. We have been doing telemedicine for 10 years now and we set that up 10 years ago. And with Corona, we just had fewer patients because the clinics were more or less closed and we had less to do.
22	MARCO: **4. What is your patient's acceptance towards telemedicine?** Of course, when they come to you, the data is transmitted digitally by nurses and diabetes managers. Can you say something about the acceptance? How are patients responding to it?
23	PROF. DR. MARTIN: Well, they get a little information sheet and they are actually still happy that someone is still looking at the diabetes. Of course, it also depends on the patient. There are also patients who say: "I don't want a doctor. I don't want anything to be changed". Because then sometimes therapy plans really have to be changed. So if a patient has kidney weakness and is on metformin, then we have to stop metformin. And that can sometimes lead to certain conflicts with the general practitioners. We have to say that the most important acceptance is first of all with the other doctors, that means for example that we actively intervene with a gynaecologist, with a surgeon, on the ward. And that is without this doctor having instructed us beforehand. That is an agreement that we are automatically allowed to do a consult. That was the first big difficulty. Because the ward physician is actually the one who has the "say" on the ward. And that suddenly people show up and say: "Hey, you have to do another antibiotic therapy, because the patient has a urinary tract infection". That was the biggest difficulty of the implementation, that the colleagues accept this new system. It took years, but it is now well implemented. Because everyone was always worried that we would spy on something: "Strangers are coming to our ward." Even though we are from the same hospital. The second thing is patient acceptance: Most of the time that is very good except for a very few patients who may also be uhm....the General Practitioners (GPs) and that may be even worse. Some GPs say. So then there are some diabetologists who then say, "If you change over at my GP, then I won't send you any more patients".
24	Wow, that's intense. That's a tough statement, of course.
25	PROF. DR. MARTIN: Yes, mostly these are the catastrophically adjusted patients. That is, of course, the situation where we have difficulties, that is, ethical questions. So we usually communicate with the patient like this: The general practitioner has explicitly pointed out to us that we are not looking at diabetes in your case. But we would still like to point out to you that this, this and this is not right....And often we have patients who then say: "No, I will come to you again". So that is a big problem. We have now pulled it through and it is now actually after, so I have been here now for 10.5 years, so it is well accepted.
26	MARCO: That is good to hear, of course. Of course, there are always pros and cons...
27	PROF. DR. MARTIN: It is now the case that we received the North Rhine-Westphalia Health Award last year for this system.
28	MARCO: I have seen it. Yeah, you did.
29	PROF. DR. MARTIN: And now there are already inquiries from other hospitals. We belong to the association of catholic clinics ("Verbund Katholischer Kliniken"). And there are considerations that other institutions are also setting up this system and that they will be looked after by us.
30	MARCO: That is great, of course, if they lead the way and then other hospitals follow suit. The more clinics are involved, the more you can learn from each other. Yes, great. Now we have already spoken about the advantages. Maybe we could talk about the advantages and disadvantages of telemedicine in general. So as an advantage, which I think you have now said, is that the accessibility is better, that diseases can also be found better through the exchange of information data between different departments and medical areas. Maybe summarized again by you what **are the three biggest advantages and disadvantages that you see for yourself but also for the patients (question 5)?**
31	PROF. DR. MARTIN: Yes, the advantage is: firstly, we have structured treatment, secondly, we can reduce complications and thirdly, we can detect diseases such as undiagnosed diabetes. Every year we have up to 100 patients who did not have diabetes before. I honestly don't see any disadvantages. Disadvantages, of course it would be good if we could take care of every patient with a diabetologist, but we have to say goodbye to that. We have a presence on site and that is maybe again a very important thing. We do delegation. We are using telemedicine more and more to do delegation. That means the nurse gets a higher status. She may do things, but certain things she may not, and we give that. That means that the nurse even makes therapy suggestions to us and we say that we will take it. That means we have an infinitely high efficiency in our system.
32	MARCO: How does the continuing education of the nurse take place?
33	PROF. DR. MARTIN: Through an internal development program that we have developed. Because when someone comes to us, they have certain programs that they go through until they take over a ward independently.
34	MARCO: I see. So then the nurse's area of responsibility grows and then of course you can avoid the doctor shortage and ensure patient care in the long term.
35	PROF. DR. MARTIN: But! The nurse does not have medical tasks there, we do. And that is the aspect of telemedicine, that we as physicians, of course, in certain cases also go to the patients, but usually...So we cannot go to 6000 patients. It is a very structured and differentiated program. Some get the doctor, some just get the information.
36	MARCO: All right, I get it. Great. Let uss move on to question six. **6. Is telemedicine profitable in your field? 6.1 How are telemedicine projects rewarded in your health system? 6.2. what are the costs of telemedicine projects?** You mentioned the 0.9 diabetes days as a savings. Are there any other benefits that you obtain through telemedicine, for example, grants or the like?

37	PROF. DR. MARTIN: No. No, not at all.
38	MARCO: So cost savings is the main driver there for you?
39	PROF. DR. MARTIN: So we have a cost reduction of inpatient stays. We have a slight increase in revenue due to better coding, so the right coding under the DRGs (Diagnosis Related Groups). As a result, we may have a better revenue situation. That changes all the time. The more secondary diagnoses someone has, the more that increases the likelihood of jumping into another DRG. Then we have the marketing advantage in advertising that you get more patients. These are aspects that have been discussed here with the management. We are improving quality and any quality improvement is known to save costs if you do it efficiently. What are the costs? So we have 9 or 10 nurses/nurses here in the different clinics. We have senior physicians. But that pays for itself through those. Let us make an example: If you calculate 6000, or let us assume only 5500 patient days, and you say that one patient day costs 200 euros, then we are at, because the patients lie in clinics for a shorter time... And if we now assume only 200 euros, which costs a patient in the hospital, then we are already at 1.1 million euros, which we save through this. Now, of course, you can say that one day in hospital costs less, for example 100 euros. Even there, we are in a range where we can cover our costs.
40	MARCO: Okay, all right. I have another question about the 0.9 sick days. These are per diabetic patient that you have, correct?
41	PROF. DR. MARTIN: Yes, that's right. And thatis an analysis of the Section 21 data set from an outside analyzer. So we did not do that, but that is from Professor Stock. That is the former "Lauterbach" chair, who runs it. So this is one of the most renowned medical-economic chairs and it has to be said that it is also relatively well published. If you want, I can send you the publications.
42	Marco: I would love to. Absolutely, I would love to! Wow. Of course, that is insane what you are doing. I would n'ot have thought that the savings potential is so enormous. It is definitely great to have an analysis like that. Exactly. Now we were talking about costs, how do you see the further growth in Germany or the **future of telemedicine (question 7**)? Maybe the first part of this question. **Now, of course, you are primarily the expert in the field of diabetes, but do you perhaps also see potential for telemedicine in other health segments and if so, in which ones (Question 7.1)?**
43	PROF. DR. MARTIN: So basically we have different elements. I can really just talk about diabetes. Let's start with diabetes first. What is the problem with diabetology and medical association? We have, when it comes up, 18 diabetologists a year. But North Rhine has a population of 10 million people and many diabetologists are retiring. That means it will come down to a deficit, that we have no experts left. Shortage of specialists and I think that will be one of the big problems. So who will take care of the patients with diabetes then? You could say that the family doctor will have to do it, which could work very efficiently. Namely that the family doctor and we are currently training this in China. Why am I doing this in China? In Germany I would be stoned. That is why I am going to China for this. I have generated a large database and there all the data that I record... we do this very, very extensively because the patients also pay for it separately. So what we record on our ward, we also record in China and much more. So I can look into these data here and give a therapy suggestion. So I do not do anything different than what we do in the clinics. There are doctors there and they implement it. They are my ward physicians, so to speak. They then implement it and we then do it there with outpatients. How could this also work in Germany? The family doctor in the Eifel cannot be a rheumatologist, diabetologist, endocrinologist or similar. However, he can look after the patients. There we would train nurses or doctor's assistants on the spot, as we do with our diabetes managers. If there is a patient that comes in that has a rare disease or they have diabetes. Diabetes is not a rare disease. Then we would collect the data from our diabetes managers and then come to a center of excellence that then gives the primary care physician the help on how to treat that patient. So here is what we would do: We would make the general practitioner the specialist directly. But he automatically uses the specialist in the background.
44	MARCO: The specialist who ultimately makes the treatment decision?
45	PROF. DR. MARTIN: Yes. But he, the specialist, carries the decision. That means the family doctor must know enough to say: "Yes, well, this decision makes sense." Currently, patients wait six months to see a rheumatologist, and that's not possible. By that time, the disease is so advanced... And if the primary care physician records the specific lab parameters. Maybe the nurse takes the scores, the inflammation scores. When that's all done, then a rheumatologist can see a lot more patients and make a lot more decisions. Or, and this is what we are trying to do, with artificial intelligence to define algorithms that we actually make out of our heads. And that's also what I'm doing now in China as well. That we are now defining algorithms. We will also specifically evaluate these. This is not so easy with inpatients, because there are of course many influencing factors, but with outpatients it is quite possible. If this is the case, then it must be the case and this can be programmed. This means that there is then an automatic expert service in the background.
46	MARCO: Wow, great. Sounds definitely super exciting and also promising and also simplifies the process immensely through such decision trees and ultimately makes the decision easier as well. Especially if you have a good decision template when making a decision through an algorithm. Your project in China is exciting! Now you have years of experience with telemedicine. **Where do you see the biggest hurdles and challenges? (Question 7.2)**
47	PROF. DR. MARTIN: Rejection by the medical professionals.
48	MARCO: And what are the main reasons why doctors are not willing to use telemedicine?
49	PROF. DR. MARTIN: Very conservative, still thinking about some forensic things, preferably not changing anything in the status quo. A lot of the physicians in practice, the very first thing they ask is: "How much money do I make?" And if it does not make money, they demonize it.
50	MARCO: I see, I see.
51	PROF. DR. MARTIN: That means: patients have a higher acceptance.

52	MARCO: But then there are not that many doctors who do that then maybe just for ethical reasons, to bring value to the patients? Of course, many also want to have the monetary incentive. Ok, that is of course very difficult to motivate these doctors for this new form of therapy. Okay, now I have a question, which I already asked you earlier. Have you noticed in relation to Corona that the use of telemedicine has improved? So that maybe the attention to the topic has increased? Is there perhaps a higher acceptance of telemedicine in a post-Covid-19 time?
53	PROF. DR. MARTIN: Well, in any case, the use of new media is different. So for example, we do not have training anymore, we did video training. And of course that gave us an advantage because of course people did not go to the clinics. They think about it very carefully...
54	MARCO: Training now for the patient or the staff?
55	PROF. DR. MARTIN: Yes, for the patient. Yes so of course continuing education for physicians as well. Online formats are of course much more attractive, especially hybrid formats and where you can decide, "Do I go or don't I go." But now purely related to telemedicine. I think in this emergency situation it was the only chance to get in touch with the patients. Otherwise, that's certainly something to think about now moving forward. Maybe again to the biggest challenges. Something else came to my mind. There's this ongoing privacy issue. Interestingly, patients send me their findings via Whatsapp if they have my number. They do not care about that at all. So one of the biggest problems is the data protection officers. When one comes, they are always very precise. But that's my personal opinion. So utilization will get better, but not so much because of Covid, but because of the doctor shortage. Because we have a great shortage of doctors and also a shortage of experts. And of course I can take care of patients much more efficiently, now also when I use telemedicine. Covid came from the side for us at the right time for telemedicine.
56	Okay, very good. Then we are already at the end of the interview. Thank you very much for the insightful news and it was exciting to hear how you are also a pioneer for other hospitals and maybe for other areas in the future, not only in diabetology. Thank you very much for that! Have a nice day.
57	PROF. DR. MARTIN: With pleasure! I wish you the same and much success with your master's thesis.

II. Interview Transcript with Dr. Simone von Sengbusch

#	MARCO: Wonderful. Exactly. Maybe just to you, that you introduce yourself briefly, your brief background, your work experience, and your current position so we know who we're looking at.
1	MS. DR. SIMONE VON SENGBUSCH: Thank you very much, okay. My name is Dr. Simone von Sengbusch. I am a senior physician in the pediatric clinic of the University Hospital Schleswig-Holstein in Lübeck. I specialize as a specialist in pediatrics and adolescent medicine in the field of diabetology. I am a diabetologist among other qualifications I have and became your interview partner because I conducted the largest telemedicine study in children with type 1 diabetes in Germany, which I am sure you will discuss in more detail later. The study is called "VIDIKI" and took place from 2017 to 2020 and also the follow-up study 2020 directly about the lockdown to 2021 I have led and am now also in negotiations for a telemedicine contract. And so telemedicine is very important not only in my specialty. It was before the Corona pandemic and it will be after because we are a fully digitized specialty where the data is stored in clouds and that data is the basis of the consultation. From there, our specialty lends itself tremendously to telemedicine. That is my reference to the field you are writing your master thesis on.
2	MARCO: Yes, you have answered the first question, which I have already answered. In which areas do you currently use telemedicine? (**Question 1**) In diabetology and especially in pediatric diabetology. How did the whole thing come about? Or what was the background why you started to introduce telemedicine?
3	MS. DR. SIMONE VON SENGBUSCH: Let us start with the types of telemedicine. So telemedicine, to clarify this once again, can have different characteristics. One is the video consultation for advice, the other is the exchange, that is synchronous telemedicine or asynchronous telemedicine, in which we receive inquiries from patients about their attitude and give us the view in the data or somewhat delayed response. This is mostly done by email or by email and phone call or just phone call. When I talk about telemedicine and what I plan to do, what we have been testing, I am talking about synchronous video consultations. So really a "live" and "one-to-one" mobile consultation with a prior exchange of diabetes data so that patients can get upfront with what I want to discuss with them. So we use it in pediatric diabetology and why is that? People with type 1 diabetes and in my case children with type 1 diabetes that I treat have an absolute insulin deficiency that needs to be compensated for from the day of manifestation by insulin administration. This can be done by means of small pen-shaped instruments. These are called pens or insulin pumps. Insulin pumps have always been able to be read out in software, i.e. for more than 15 years. So everything that the pump does or what the patient does on his insulin pump. Of course, this has improved significantly over the years. The software solutions have become nicer, the transmission speed went faster. But since 2016, and this was the turning point in our field, small devices for continuous glucose measurement, the abbreviation is CGM for Continuous Glucose Monitoring, have become part of standard care in Germany.
4	MS. DR. SIMONE VON SENGBUSCH: That is, every person with type II diabetes, the most common form, 90 percent of all cases, but just not in pediatrics. Type 1, the most common type in pediatrics and also other forms of diabetes. Whoever has diabetes and a

	problem that cannot be controlled in any other way, for example hypoglycaemia, can get such a device. It continuously records the data in the fatty tissue, not in the blood, and thus maps all fluctuations caused by food, stress, sport or by insulin administration or even by omitted insulin administration. And if you combine this data with a pump or with insulin injections through pens, then we have a complete therapy picture, and this has only existed since 2016. And this has changed my entire field. Before 2016, the patient brought a paper diary with him, where he wrote something down five or six times a day, and they had to guess what happened in between. Now today we have a complete glucose picture, so a complete picture of what's happening in the body. That means the data is in cloud storage. They're graphically processed and they're statistically preprocessed. And this represents a change in insulin therapy for me as a doctor and for any diabetes professional.
5	MS. DR. SIMONE VON SENGBUSCH: In 2015, I visited the so-called "diabetic clinics" in the Netherlands. And there I saw that telemedicine, i.e. video consultation, but also e-mail exchange and telephone calls were already being used at that time as a supplement to contacts in the outpatient clinic, and I thought that was fantastic. In 2016, there was this decision by the Federal Joint Committee that this continuous glucose measurement would become a standard service. And exactly in that year, I submitted an application to the "Innovation Fund". At that time, the Innovation Fund was newly established by the Federal Government for the Ministry of Health in order to support innovative research projects of the future, i.e. to create a research promotion fund. And I fitted well into one of these funding areas. It was about children and adolescents. I could have also done telemedicine, but I applied for children and adolescents and received funding in the first wave for the project "VIDIKI - Virtual Diabetes Outpatient Clinic for Children and Adolescents", where exactly this was to be tested, because I knew from a preliminary study I had done that you actually need more frequent contacts. One contact per quarter is the standard. So you would have type 1 diabetes now. You are young. You are the typical person for developing type 1 diabetes. Then you would keep an appointment at a focal practice. But you are an adult, you are full-grown. But kids grow every month. That means we actually have to adjust the insulin every month. But there are not that many appointments, that many doctors.
6	MS. DR. SIMONE VON SENGBUSCH: So I just said why not use quick telemedicine contacts that are shorter but more frequent? And we chose the addition for ethical reasons in the study. We could have also said we are replacing an outpatient appointment with this. And that is what we are negotiating now because you do not need an extra contact on top of that. I believe and that in our study almost all participants saw it that way and that is also what we are negotiating now, that one to two live contacts per year are sufficient and the rest can be done with video consultation more effectively and more cost-saving for the patient, but at the same time also resource-saving for the diabetes team. And we are negotiating that right now. In this respect, this is now the big all-round blow to your **question 1 and 2**.
7	MARCO: Thank you for your answers. How often do you use telemedicine per month/quarter compared to total number of patients? (Before Covid-19 vs. after Covid-19, **Question 3**)
8	MS. DR. SIMONE VON SENGBUSCH: There was nothing. From the data protection concept to the set-up, so to the tender. Who actually offers something like that? Such a video portal which is certified and suitable for the medical sector? A secure connection using peer-to-peer encryption is required for a video consultation and commercially available programs could not be used for this purpose. There were exactly three providers at that time. One made a bid and that's who it became. And now after the Covid 19 pandemic we have launched "VIDIKI 2.0". An extension that was financed by the state of Schleswig-Holstein. And of course we all know so to speak in the pandemic, there was yes a boom in video consultations and quite rightly so. And now we use it until the contract is there. We are now in such a transitional phase of six months, the video consultation for new settings for insulin pumps and for very, very small children under two years. We just do that for free. So our specialty consists of flat rate funding. With that flat rate, you have to do everything. The child comes once a quarter and whether you still have to write ten reports or examine the child once or whether it comes three times a quarter or whether the kindergarten still has to be taught, it is all included in this one flat rate, which does not cover costs at all. That means that at the moment we do it out of love.
9	MARCO: Can you compare that numerically, how that changed in terms of their total number of patients, so how many patients were using some form of telemedicine before the Corona pandemic or before the introduction of "VIDIKI"? And afterwards, how many patients opted into the system after the introduction?
10	MS. DR. SIMONE VON SENGBUSCH: Yeah, so they do not choose, but they are fortunate that pediatric medicine offers that to you. The decision that they enroll in a portal.... Now that doesn't come until there's a contract in place for special care. So before the Covid pandemic and outside of the VDIKI study or any study at all, I would want to say, "In my specialty, in pediatric diabetology, there was no offer for a video consultation at all." But asynchronous telemedicine, that is answering emails or phone calls, that's a constant. Almost everybody uses it. Parents just write. If a child is newly ill and is three years old, the parents have questions every day and they call us every day. It is just not mapped anywhere because they would have to document a lot more. So documenting takes so much time and you don't have that. So that means asynchronous telemedicine with emails and with phone, I would say, is used by patients by at least half once a quarter. And whether it is they want prescriptions or they have a question or whatever. That was true even before the pandemic. And it is the same today after the pandemic. But the video hour, it is being happily embraced now when they offer it. Not by everyone, but by almost everyone. Whether or not they offer it has to do with whether or not they can bill for it. And that ss the crux of the matter. Without a contract and without money, an employer would have to. and pediatric diabetology takes place in clinics, the majority 95 percent of the time...adult diabetology takes place in specialty practices... There, the doctor is the boss and can decide for himself whether or not to purchase video consultations. But the compensation is downright low right now and who does it, I know from my internal medicine colleagues, they do it because they can do it from home. And they think home office is fine for one day a week. Or they do it because they're convinced it's great for patients. Or they do it because they don't want to order pregnant women into the office every day, for

	example, and so on. But in our field. I'm employed in a clinic, which means my employer has to decide. He thinks it is good, but he thinks it is good above all when there is remuneration for it.
11	MARCO: Sure, that makes sense. If it is compensated, that is more interesting for the employer.
12	MS. DR. SIMONE VON SENGBUSCH: During the pandemic it was relatively easy, of course, because there were special regulations for almost everything. The patient could not come to the clinic, he could not hand in his insurance card. There were really great ad hoc and also generous regulations for the clinics. Otherwise, we could not have continued to exist. But. That is over now. Now we need a contract, and we are working on it. So, I cannot give you any concrete figures. I can only say that before the pandemic, outside of studies, there were no video consultations. Ours is the absolute exception, but it is a study. But then asynchronous telemedicine with emails and phone calls extremely common. Ask diabetes counselors. So, they check their hour-long answering machine first thing in the morning about what they need to do now. If you count that, a lot. And I would say every patient, every other patient once a quarter, has some question for the diabetes team. But it is a rough estimate and that is the same today as it was then. But telemedicine? There is a lot of requests for that. Our patients, they know it, they're glomming onto it and they're anxious to get started. Now... But they can't start until we have a contract, because then the service is also reimbursed and without reimbursement, except in the context of a study, I can't offer it, unfortunately.
13	MARCO: Compensation makes sense, of course.
14	MS. DR. SIMONE VON SENGBUSCH: You get a very small technology surcharge. You have to have treated a not insignificant amount of patients first in order for you to reimburse that as a video portal, which you have to use. You do have to use a certified, there are many, many now. That's a good thing. But at the end of the day, my service has to be paid for, because at the end of the day, at the very least, I'm going to have to eventually redeem what I would redeem down in the outpatient clinic. And that is also one of the hurdles.
15	MARCO: Yes, what is your patients' acceptance of telemedicine? **(Question 4)**
16	MS. DR. SIMONE VON SENGBUSCH: For the most part. Not a hundred percent, but for the most part, extremely high. So, it depends a little bit on digital affinity. So, there are still parents who either have reservations about any modern technology, so they're very afraid, even though we use encrypted email and a peer-to-peer encrypted doctor video portal, so those are very few, so a small group. And a slightly larger group says they feel technically overwhelmed by it. For example, they don't have a laptop or a computer at home, they just have a tablet PC. With this you can do telemedicine, but of course I say a bit limited. So, you would need like it a keyboard to it, so that you can type well also a password somewhere and we notice it just also the new insulin pumps have all apps, also the new insulin pens, there they must then with a NFC sensor or low energy Bluetooth data into an app transfer. You have to sign up for the app, just like you sign up for a big internet store. And we have to help families with that. They don't know your email address, or you know the email address, but forgot your password or displaced yourself on your email address. And that's not meant to sound disrespectful at all. Please that in no way, but I am just looking closely at where the error is or where the problem is. And those who are more dismissive of telemedicine are very unsure of how to use modern technology. They may have a smartphone, but they really only use it to make phone calls and only gradually discover extra functions that seem completely mundane to everyone else. But those who can do that... I say, those who use their smartphone for more than just making phone calls, who also know how to look something up in the browser, on Google for example, they also have no problems using telemedicine.
17	MS. DR. SIMONE VON SENGBUSCH: But the truth is, part of our population doesn't have regular internet access at home because they cannot afford it. It is a very small group, but they do exist. And if you live in a rural area, you have fiber to the edge of the village. But there is nothing in the village because there is no provider to distribute fibre to every single house. That is also the truth. That means that you need at least a 20 Mbit - or better 50 Mbit - line for the Internet, i.e. for video consultation, which is encrypted. That is actually nothing great. But even in Hamburg there are areas, residential areas, where you do not have 20-Mbit. Believe it or not. And where they cannot upgrade either, because that is not possible in the house, because there is no connection there. So, we have to find possibilities via mobile WLAN or the mobile phone network. So, it is not quite easy, but as far as acceptance is concerned, it's generally very high.
18	MARCO: What advantages and disadvantages do you see in the use of telemedicine for yourself and your patients? **(Question 5)**
19	MS. DR. SIMONE VON SENGBUSCH: What advantages and disadvantages do I see? You can never completely lose patient contact. That is important. So, telemedicine, of course, does not work if they have to examine a patient, if I have to draw blood, or if I can only assess a disease if I examine the patient. This includes smell, impression with all senses, the hands, stethoscope, ultrasound, blood sampling. Of course, this is not possible with telemedicine. Today there are all kinds of gadgets for smartphones that allow you to put on a stethoscope and hold it to your chest. That is certainly great if you live in Australia and you really do not have a doctor a thousand miles away, then I think that is all great. But in Germany I would say "nice to have", but not really necessary.
20	MARCO: You do need to go to the doctor, absolutely.
21	MS. DR. SIMONE VON SENGBUSCH: Yes, for physical examination... And also, if you do telemedicine...We had to enroll every patient in our study and it will be like that later on, personally. Because, you know, I have to get a sense of my patient. I need to get a feeling for the family and you cannot do that via video. You actually have to sit across from a live person. That means that telemedicine, even in my field, will never completely replace contact. But in this field, where the data is already stored digitally in a cloud, a large part of the contact can actually be replaced, if families want that. The disadvantage is that insecure patients, patients who absolutely need my personal, my fluidity, that I'm there, that I'm sitting across from them, that they perceive me as a doctor and as a human being...They need that for their safety, so that you can manage this disease. And that's okay. These are people who rightfully say, "Telemedicine is not mine. I don't feel safe in that medium. " But by that you don't mean technology at all, you mean

	person to person. Face-to-face contact is a different matter. Something is being transmitted, something is having an effect. With all due love, you can express a lot of empathy, even via video. But maybe that only works when you're sitting face-to-face." And I accept that. From there, I think even in my field, never 100%, but maybe 70% of all families will say, "That is a great solution from a certain point when you feel safe in therapy." And 30% will always say, "We do not want to, we do not have the technical capabilities. It is beyond us technically. Or I consciously want to see the doctor and also take fewer contacts in my head."
22	MARCO: So you are saying in principle that it should be offered as an additional option, but would not be used exclusively as an alternative? Because of course many, as I said, because there are many hurdles in the use of telemedicine, because of course not all patients are open to telemedicine.
23	MS. DR. SIMONE VON SENGBUSCH: You have to take a good look at it, but also not every professional field is suitable for it. But if you imagine, for example, people in retirement homes. If they're sick and they have to see three different specialists three times a week and organize that for people who live at home or in a retirement home. Because they have to be accompanied, they can hardly get to the taxi on their own. How much easier it is if you have nursing staff with a very good mobile camera and a very good device and can at least check: "Does the patient really have to come or can't the wound control also be done by district nurses or mobile nursing staff, such as Veras, who are specially trained and are in contact with a doctor and thus represent a kind of intermediate station. But also with the aim of avoiding trips to the doctor for people who are not very mobile, who are very ill or where this is simply an organizational task from rural regions. I believe that every specialist area should take a look at whether telemedicine offers added value for our patients and for us as a specialist area. If so, how could this be achieved without endangering the patient? And of course, and this is always the point, can it be billed? And then we also have a bit more time for the patients who then have to come.
24	MS. DR. SIMONE VON SENGBUSCH: So, in our outpatient clinic, hopefully with the introduction of regular telemedicine for the patients who actually need an hour, we will take an hour. But we do not have an hour per patient, but the ones that need an hour, we will have an hour. So, the downside. There is more to come. Other advantages that you haven't even asked about yet are the following. Working models are changing. Telemedicine also in the clinic as in the practice means that they do not necessarily, not necessarily have to work in the clinic or practice. The patient is sitting at home, so am I at the moment. Why shouldn't I do telemedicine from here? I am sitting here all by myself. No one comes in. It is correct under data protection law if I use the right portal and if I take my service laptop, it is all encrypted as well. This means that we also have to think about who is allowed to work in the home office. You have to take the experience of Covid and say. Many had to and did not want to. But there were also many who said. For me it is a great idea. I would like to work in a home office one day a week, or maybe two if it is professionally feasible. That in turn would mean that people would not necessarily be able to live close to their workplace, but a little more cheaper, a little further away, because they would not have to travel to the clinic, practice or to their employer every day.
25	MS. DR. SIMONE VON SENGBUSCH: But that also means that we have to set up home office workplaces and make sure that negotiating teams do not fall apart. In my specialty, that means. We have several diabetes consultants and one team. The one with you says, "Telemedicine is great, it's a great fit. I can take better care of my child. I am happy to do it in the evenings voluntarily. I do not even want more money for it. But I want the chance to do it." Same for me. I work after clinics anyway and at the same time I can offer telemedicine great from home. I would do it on a weekend morning, for example. Other colleagues say, "That does not fit my concept at all because I am clinical. I am visible on the ward. That does not work so well." That means we have to see for whom this is something and how we can keep a team together as a whole so that it doesn't fall apart, because that was a bit of a disadvantage in the Covid pandemic. People didn't see each other at all anymore, except virtually. That works, but it is no fun and it does not create a team spirit. But I think that is a very, very important socio-political point, that we simply look now, where telemedicine works, the question also arises: Why should only the patient benefit from the fact that he can stay at home? Why should he not be offered telemedicine at a high rate and very effectively by the staff also from home? Why not by me as a doctor? One must examine it. Do I miss then in the hospital in any place? That must not be the case.
26	MS. DR. SIMONE VON SENGBUSCH: But could you not create such working models where you also work at home one day? That is also part of it. I see an advantage in that. But you can't let the team fall apart. That would be a disadvantage. The employer must always have the feeling that he can check whether I have really worked. But you can do that with us because we document it as well as possible. And with that, I think you have a huge opportunity. Because why are we losing people in the clinics today? We have such a shortage of nursing staff. Why? Because they have to drive. Because they have to find a parking space, pay for a parking space. Because they now have to pay endless gas costs. And they don't have the income to just cushion that. And they just have the time loss of driving an hour to and from work twice. How much more convenient is telemedicine? Not just for the patient. He clearly says he saves on travel costs. But why cannot the person who does it also save on travel costs? That is really important to me. Or do I see a huge advantage to this?
27	MARCO: Yes, exciting in any case. Perhaps again from the clinic's point of view, the potential time savings that are possible through telemedicine. If you now compare a normal consultation with a digital consultation. How long is a normal consultation when it takes place physically? In comparison, when it takes place online, can you compare that somehow?
28	MS. DR. SIMONE VON SENGBUSCH: Yes, it is actually little time savings, but it is there. It is quite interesting. So, one consultation hour with us in the outpatient clinic and that's different in every clinic in Germany, though. We calculate with half an hour per patient, whereby you have to prepare the data. That is no longer possible in this half hour. You have to rework the data. You will probably have to wait another day for the lab results. You have to write the letter, print it out, sign it, pass it on, often write an expert opinion, then there is nothing in it. That means you have a consultation hour that lasts four hours, you have eight, maybe emergency patients, nine patients, scheduled per doctor. Then one of them does not show up, one is stuck in traffic, one is late, the

	staff has already left. So let us say you basically have four hours, eight patients, and you have to make up another two to two and a half hours. Then at some point during the day, because that cannot be done that evening itself… Especially if you are also waiting on lab values. And you are dependent on staff who read out the insulin pumps, who read out these CGM systems, that they have all that in stock. Then they write the prescriptions, then they measure.... blood pressure, length, weight and so on. That means there is another person, they have work too, they are counting. Now we have telemedicine. Telemedicine can be done in 10, 15 or 20 minutes. It depends on how many questions the patients have.
29	MS. DR. SIMONE VON SENGBUSCH: If you, as we do in our study, the evaluated data, which are online and which the patients have to upload themselves, this part is now omitted for us. If you look at it, an appointment like that is totally fast. Especially if you take modern technology, if it is parents of smaller children. They often have many questions still in kindergarten and so on and also need expert opinions. That means on average... We had about 20 to 30 minutes over seven doctors, not only me, but all doctors together in the first six months. But they get faster the more often they do it. And the patients are on time. They're on time. They're not in the outpatient clinic. And it's not their fault. They're looking for a parking space or stuck in traffic. The fact that they're late has nothing to do with poor planning, it's unplannable things. With telemedicine, you can plan, you can be there on time, otherwise you can't get in the room. And that means I save time when patients are prepared, when they've looked at the data and they have a good metabolic situation. I don't save time when I have a lot of other things to discuss and also have to write a report. Unfortunately, I also have to document a lot online, and I have to make sure that the prescriptions are filled, which now also take time, so ultimately there is the same need for time.
30	MS. DR. SIMONE VON SENGBUSCH: But my flexibility is much higher because I don't depend on anybody. I get everything done. The only thing we still need is the prescriptions. I have to go to another place for that. You have to say here prescriptions have to be written for patient X and there you still have to send a referral. So, in the end this is still plus minus zero, but it can gain speed, especially in the practice, maybe not in our clinic, but in the practice where they have a prescription hotline anyway, where everything is organized much more effectively than it can be in a huge university clinic. By the way, this also shows a disadvantage of telemedicine. At the moment it is unfortunately still the case that patients, whether they like it or not, have to swipe their insurance card once a quarter in the practice or clinic. And in our clinic, they still need a referral. You can also send it by post. They do not exist electronically yet. It would be nice, but it will come someday and of course it makes the whole thing absurd. If you are cared for telemedicine, but you have to swipe your insurance card once so that you can get prescriptions. That has to change. So, for chronically ill people who always need the same thing: Insulin, insulin pump, catheter, blood sugar, test strips, etc... For these people, the whole thing must, in my view, also work without an insurance card, or somehow electronically, however.
31	MARCO: Like with a credit card, for example, that there's an extra code or an extra password to protect the card, for example?
32	MS. DR. SIMONE VON SENGBUSCH: Yes, wonderful, I would be there. So why not. So instead, we as physicians, have this new electronic health professional card. But actually, you're absolutely right. Would we need maybe a new electronic health card so that you can request prescriptions without having to scan them in person. As a chronically ill person, you need prescriptions, that's a standard and that's somehow unfortunately not solved. The idea that we can send our prescriptions directly to pharmacies, that is a nice idea, but the step before that, nothing has happened yet. Yes, that's where I see a real disadvantage at the moment. It can't be that I have more organizational effort to keep the patient out of the clinic, to take his card, to give it to someone who then prints prescriptions. There has to be another way.
33	MARCO: Maybe before we get to the next question? Um, you mentioned your study, your two studies that you did. Maybe you could briefly present those, what the results are. I'm sure that would be interesting to know.
34	MS. DR. SIMONE VON SENGBUSCH: Okay. "VIDIKI - the virtual diabetes outpatient clinic for children and adolescents" was a quasi-randomized controlled trial. Six months was the controlled group, from 2017 to 2020 ,led by the University Hospital Schleswig-Holstein - Campus Kiel (UKSH) in Lübeck. Included were 240 children and adolescents, one to 16 years, from the state of Schleswig-Holstein and Hamburg. The study hospitals were Kiel University Hospital, Lübeck University Hospital and Kiel Municipal Hospital. The University Hospital Lübeck formed the starter group, the intervention group. This means that after inclusion in the study, the children received telemedicine three times a month in addition to one live contact per quarter at their own diabetes outpatient clinic. The waiting control group consisted of the children who were randomised to Kiel and the municipal UKSH Kiel and this was done according to postcode, therefore quasi-randomised. These children simply waited six months and then also received monthly telemedicine as a supplement. All the children received telemedicine for 12 months, so one year, and then they could voluntarily, if they wanted, until the end of the study. That was December 2019, continue to receive telemedicine. In this third trial ending, which was called "Telemedicine on Demand," we also piloted care in tandem. That is, the diabetes consultants conducted the consultations under the supervision of the diabetologist, who himself conducted the video consultation in the first two study phases, i.e. as a delegation of medical services. The results are as follows: They are published in "Pediatric Diabetes and Diabetic Medicine" and in many other journals. First of all, at the outset, we published the study design because that's very comprehensive. We had a qualitative, quantitative and health economic evaluation.
35	MS. DR. SIMONE VON SENGBUSCH: That is a lot of work, you even publish the design of a study. We published the data protection concept to a large extent because there was nothing comparable at all and we thought that others should have a blueprint for it. We then published the results. First, on the quantitative data. The main outcome parameter was metabolic position. The value for this is called HBA1C. This is a long-term glucose value that shows how the metabolic situation was in the last eight to twelve weeks. The HB1C did not change significantly in the first six months between the intervention group and the control group. That's disappointing at first. But that was because, and we couldn't have anticipated this at the time, we had enormous technical problems in the first three months. Telemedicine was completely new. Our firewall blocked the video transmission. It was exactly the same

	problem with patients. And if you use the consultation appointment not for consultation but for trouble shooting, then it just doesn't work. Unfortunately. But then we saw that if you look at the entire cohort or if you do a subgroup analysis of which children entered from the beginning with an inadequate metabolic position that is an HBA1C above 7.5, or a good metabolic position, that there was a clinically relevant and significant drop in this parameter after 12 months and after 15 months. Very impressive.
36	MS. DR. SIMONE VON SENGBUSCH: But we did a real-life study. I could have designed the study differently. I could have said that I would only take children with a suboptimal metabolic situation, but not the very bad ones, because they are difficult to motivate, but only those in the middle of the field. That would have given us the best chance of achieving a significant improvement in six months. But we did not do that, because that is what I decided. Innovation Fund studies should be transferable one-to-one into reality. But that also means we take them all, the super good and the super bad and the ones in the middle. The super good ones cannot improve. That means, unfortunately, they dilute their study collective a bit in terms of values. The super bad ones can also be quite poorly motivated. That is, they do not get better, but they got much better and we did not know it before. We also allowed every form of therapy: Insulin pump, pens, and every sensor. That's real life. But if you want to test for significance, I should have designed it differently. I still wanted significant results, of course. It's harder with real life, but the study time was limited to three years. It wouldn't have fit any other way. So, what else did we accomplish? The secondary medical outcome parameters were family burden. There was a significant reduction in "Burden", that is what it is called, particularly in mothers, a terrific success. Then there was a significant improvement in parent satisfaction. And all of this in this six month controlled study period and no impact on quality of life, as well as no significant impact on self-efficacy. Quality of life well, three year old kids...what are they supposed to feel in their quality of life? More or less. The quality of life is formed by whether they can or cannot go to kindergarten and whether the family is in a harmonious mood. But in this respect, it is not so bad. We are glad that the quality of life of young people did not deteriorate because they saw their doctor only once a month. There were positive trends, but it was not significant. So qualitative study. We interviewed 30 families when they entered the study about their expectations of telemedicine and interviewed them again one year later about their actual experiences. And they found out the same as all active doctors and diabetes advisors in the VIDIKI study, who had done it themselves. We also interviewed them in a second study plus seven referring children's diabetologists. And they all found out: "The flexibility in scheduling appointments as well as the possibility to have more frequent contact and the improvement of the metabolism, which is connected with it, is a huge advantage." They all said it is a very personal, very flexible medium, which they like. They have, and we found that quite great, both the doctors have seen it and the diabetes advisors, but especially the parents have said it, that they feel more confident to adjust insulin themselves because they have understood in the way we have done telemedicine, why we derive change in therapy from these curves, which we do discuss with the patients.
37	MS. DR. SIMONE VON SENGBUSCH: We look at the statistics, we explain them, we look at the daily curves, and we say, "This is the insulin plan. We see the following trend. That is why we are adjusting that there." And you have that in writing beforehand. And then again in conversation, that it's something that often doesn't work out as well in the outpatient clinic in terms of speed. That was a real win. The health economic evaluation is currently being published. I can only say that there is a small cost difference in favour of the intervention group. For the very, very first time in Germany, we have collected real costs for children with diabetes over a period of six months. And you can't interpolate them over a year. We simply looked at inpatient costs, outpatient costs, costs for insulin and glucagon and for aids and looked at how they developed and compared the whole thing with a sub-population that already had a sensor six months before the start of the study as a comparison group. And I can't tell you all the results there because they're being published right now. But I can tell you that that gave a small cost benefit, but not significantly in favor of the intervention group and that there was a movement away from inpatient care to assistive devices. But that just has something to do with the fact that there was a boom in assistive devices between 2017 and 2018, and more modern insulin pumps and more modern sensors. These cost money and that is reflected in the price.
38	MS. DR. SIMONE VON SENGBUSCH: Unfortunately, we had a dynamic in the collection of costs that we could not have foreseen. The "VIDIKI 2.0" study followed directly on from the "VIDIKI 1" study. So we had three months of evaluation time. That was from January to March 2020. And then the Care Guarantee Fund of the State of Schleswig-Holstein continued to finance the VIDIKI 2.0 study, basically a continuation study, and now four clinics, including the Itzehoe Clinic, have carried out telemedicine themselves in the sense of a cohort study, i.e. not a comparative study with a comparison group. We have newly included children under eight who were newly diagnosed with diabetes and have again a qualitative and a quantitative evaluation. The results are being published now, so I can't say anything about that yet. This study ended in April 2021 and since then we have been in negotiations, which we hope to conclude this year, to get telemedicine into standard care via the "140er-Vertrag". The Federal Joint Committee (GBA) has evaluated the VIDIKI study, the first the Innovation Fund study. It is all online. You can look at everything I'm about to tell you by just typing into Google, "VIDIKI and Innovation Fund." Then click on reports and then you will see the outcome report and the evaluation report. So almost everything is in there, including the publications.
39	MARCO: Super.Thanks for the tip!
40	MS. DR. SIMONE VON SENGBUSCH: You can refer to it in your master thesis. You can also see online how we have described all the models very precisely, also in terms of costs. What does telemedicine actually cost? The GBA has said that our project, i.e. telemedicine, is not yet standard care in pediatric diabetology, but that it cannot be recommended directly for standard care either, because we have broken the first parameter. The HB1C value. That's why I went into it in such detail. But you see so many positive

	aspects in this study. We have now evaluated very comprehensively, so we have been recommended to the subcommittee "Disease Management Programme Type 1". I don't have any feedback yet on how long that will take. That is being worked on right now. It could take a very long time. It may take years. We may be returned to some other committee. But the health insurance companies, and the parents see that this is going to do something. The latest insulin pumps, which are now on the market in 2021, transfer their data to clouds via an app at one o'clock in the morning, and for the most part already control the insulin autonomously in patients. In the next few years, more and more pumps of this type will come on the market. And they need a doctor who also covers a technical aspect, namely to look at which small screws I can still turn so that it really works well, motivate the patient and ensure that the technology also works well on the body? In other countries, not outside Europe, it has to be said quite clearly, there are already software solutions that even make suggestions to me as a doctor about what can be changed, because they run over the data with artificial intelligence.
41	MS. DR. SIMONE VON SENGBUSCH: This is the same software that I am looking at today with my human intelligence. I'm very glad that the health insurance companies are looking so far ahead and saying, "Yes, so for such a clinical picture, the appropriate form of counseling must also be found, and for that we must now make a new model." The problem is Pediatric diabetology in Germany is underfunded. That is, no matter what they earn, it is not enough to finance the multi-professional team of diabetologists, diabetes counselor, psychologist, social worker, nutritionist (ecotrophologist or diet assistant). How are you going to fund five specialist groups if you are in an outpatient clinic that is small with 50 to 100 patients? You cannot fund that at all. Even we can barely do that, and we have almost 400 patients. It is not feasible. Our specialty is an outpatient area that is somewhat back-financed by inpatient treatment, which is actually not a good thing. We do not want to see patients as inpatients at all, except for educational purposes. That is just the way it is! Speech medicine does not always pay well. In our specialty, unfortunately, it does not. That means we need to find a new funding formula and now is an opportunity. The "140er- Vertrag" is not a permanent solution, but it would be a very, very great start and I am very happy if this works out at the end of the year and would be super grateful to all the insurance companies and our negotiators if they can manage this together.
42	MARCO: So this "140er-Vertrag" is basically the agreement between the health insurance companies and you?
43	MS. DR. SIMONE VON SENGBUSCH: First of all, it is an agreement between our consortium partner, the AOK Nordwest, and the University Hospital Schleswig-Holstein (UKSH). But such agreements are usually structured in such a way that you can join. You can join as a diabetologist, pediatric diabetologist in a practice or clinic in a certain catchment area, which is defined in this contract. And you can join as a health insurance fund and say: "I want my patients to also offer". Then you join as a fund and take over this contract. This means that this contract would then have a kind of signal function and I would almost like to guarantee that other federal states would say: "We would also like to have this. And then it forms a basis, if other federal states want it, for other federal states as well.
44	MARCO: I see, Wow! You are a big pioneer on this field. It is really great what you are doing for telemedicine and the multitude of studies you are conducting. It is really remarkable how you are mastering all of this and basically offering real pioneering work for the whole of Germany.
45	MS. DR. SIMONE VON SENGBUSCH: That is how I felt it. If you were to ask me, I would say that the introduction of video consultation as part of our study in 2017 was a little bit like they had to move Mount Everest on foot ahead. And why was that? Because everything was new. It just did not exist in medicine and neither did our workstations or the settings in our computer. There just wasn't anything set up for telemedicine and to have accomplished that really fills me with great pride. We have just been awarded. The VIDIKI project won the second main prize in the "MSD Gesundheitspreis". I think it is great that we have been honored in this way. And even if I would have liked the GBA decision to be different, we were judged fairly. I could have designed the study differently, but the SHI funds see our results in a way that they can be directly transferred. That means what we measured. Telemedicine takes time, but then it is effective. It will be possible to transfer that to standard care and that has its value. And in this respect, I must also say that this is a very, very well-run project. I am sure that in retrospect I would do some things differently. But I am also happy that I managed it with the whole team, because they win, always only as a team.
46	MARCO: Let us move on to the next question. Is telemedicine profitable in your field? Can you say something about that? Maybe also about the research, the studies? In the run-up, was there anything about the health care system rewarded **(question 6.1)?** And what costs are caused by telemedicine projects **(question 6.2**)?
47	MS. DR. SIMONE VON SENGBUSCH: Let us start with question 6.2. In our VIDIKI Innovation Fund study, we have been funded with 1.7 million euros. That covered everything, personnel, and material costs. This means that no extra costs were incurred by the clinics, and certainly not by the patients. So, from the encryption software for e-mails to the personnel costs, everything was included. So how are telemedicine projects in the private practice sector financed? Well, you can have a look at the KBV.de (Kassenärztliche Bundesvereinigung) website. There you will find all the figures for physicians in private practice. I do not treat as an established doctor but treat within the framework of the university outpatient flat rate. But would you be a pediatric diabetologist in private practice or a psychologist, psychiatrist, family doctor and would you like to offer any kind of consultation hours? Then you will find there the number with the corresponding points and which you can then convert back into euros. And you will see: "No, it is not properly remunerated." It is often still seen as a kind of light version, whereas the insurance company with which we negotiate and all those who were in our project have already recognized that the video consultation, as we offer it, is... And there is only one comparable construct to this: that is telemedicine for children and adults who wear a pacemaker or an implanted defibrillator. Their data is also transferred to cloud software. The cardiologist or pediatric cardiologist looks at the data and talks to the patient, usually on the phone. This type of telemedicine, there was already a remuneration amount for it before and we also oriented ourselves to that, because we said: "We do much more. We evaluate the data ourselves, we talk to the patient by video. I also write the expert reports.

	We also do psychosocial counselling and coaching because technology on the body is not everything. " Unfortunately, you also have to wear it. It is not implanted, but they always have needles stuck in their body, several at a time. That is, what is completely different, if what is built in for the next ten years. To that extent I think pediatric cardiology and adult cardiology I think had it adequately really well rewarded at the time, but that is an isolated example. As I understand it, the psychologists also, and I thought that was a good thing, especially in the Corona pandemic, offered telemedicine. It is a great thing to be able to pick up people seeking psychological help via a video consultation at a low threshold. Yes, I also believe that I have heard, I do not want to guarantee it, that this is quite well remunerated. But for us, that just does not exist yet. We are just negotiating that as the very first thing. And I think "telemedicine is not ambulance light." You can quote me on that, but telemedicine as we do it in our specialty, where it's not just about me telling him, "The lab results are great, they're fine, the wound looks better. Yeah, looks much better. Bye."... Two minutes of contact, that's different... But our contacts take just as long as in the outpatient clinic. I have to write the same reports, I have to document everything. I have to take care of the prescriptions and I have to evaluate something beforehand, but I create a much better effect than in the outpatient clinic. That is why it is important for us from the very beginning that this kind of care has to be completely recalculated. And we are only doing that right now because we're in the middle of negotiations, I can't tell you anything about that.
48	MARCO: Exciting, definitely. Now we have touched on other areas of healthcare as well. How do you see the future of telemedicine in not only your field, but also in other fields from your professional point of view? Where do you see the strongest potential? **(Question 7.1)**
49	MS. DR. SIMONE VON SENGBUSCH: Basically, I am not sure yet whether the "DiGa" (digital health applications, reimbursable by statutory health insurance) will bring so much. I think they will prove it now that they are on the market, whether they are accepted by any target group and how well. I am just very curious and very open-minded about that. But the electronic referral, the electronic doctor's letter, the electronic prescription, the electronic sick note and the use of the insurance card in a secure, encrypted way for a certain part of our society. I do not want to exclude all the elderly either, there are also people who are very tech-savvy. But for those who have some basic technical knowledge, I think that would be great. And if there was a unified portal for an electronic patient record, where the doctor slides the referral in, and I can take it out of there electronically and go somewhere else. That is really easy. That would be great. I see a huge potential there, too, because that is an administrative, time-consuming effort where you still have “24 needle printers” that have to press something through. That has to be different today.
50	MARCO: Yes, that would not only save time, but also increase physician and patient satisfaction.
51	MS. DR. SIMONE VON SENGBUSCH: Yes, and how much more practical is that? Imagine that you are now under time pressure because you somehow still have a doctor's appointment. You actually only have that because you have to pick up prescriptions and the office closes at 12. How stupid? It should be possible to do this electronically somehow with this prescription with the electronic signature via my new health professional card, for example? In which health service? I see a great benefit in all subjects where data is available in digital form. That is above all our field of expertise. But I really do not have an overview of all subjects, perhaps also cardiology. I know that there are studies, many studies on emergency medicine, which benefit greatly from telemedicine. Of course, the more rural you live or on islands. Those are profiteers because they just don't have a person that can come directly to them. I would like to see that...take it on.... It does not happen no matter who I tell...Everyone says, "Great idea, but no one does it. " We would need a tablet for seniors with a keyboard where you just have a big button, one says telemedicine primary care doctor and the other says telemedicine specialty doctor. So that seniors can easily manage to turn the whole thing on and off. Even with fingers that suffer from arthritis. Even with eyes that cannot see well anymore, that need bigger letters. A tablet PC, opens up very, very easily to older people. And why couldn't people who live so far away be offered something like this? I would also like our health care system to be open to such liaison projects. There are already many such projects in neurology, i.e. a smaller clinic that has no neurologists at all but has stroke patients who can be connected to a large stroke unit at night. That's a great idea. There has to be one for radiologists, too. Or we could close down all the small hospitals. But of course, that has to be financed. That means that if specialized care is better for patients, then these specialized centers must also be reimbursed if they provide telemedicine for smaller centers. Prof. Martin already told this years ago in the Diabetology, that was still before the sensor supply.
52	MARCO: You are right. I have already had an interview with Prof. Martin.
53	MS. DR. SIMONE VON SENGBUSCH: Yes, wonderful. Prof. Martin who not only looked after his clinic, but also other clinics, with a kind of visiting service. Great thing. So, I think the innovation fund is great because it gives room for studies that test something like that, and I see a strong potential there. All subjects where people need to be studied. They need to continue to do that. But there's more, of course. I'm at all...I do not have any experience with surgery, but of course I've heard about the new surgical robots, the ones where you can sit somewhere else and assist in surgeries. I just do not get how big the potential is.
54	MS. DR. SIMONE VON SENGBUSCH: I think that every primary care physician should offer a window of three hours, so to speak, for video calls where they have to see something. I think that wound care, diabetes is also coming back in a big way, offers a great area because with good cameras they can really see a lot as well. And if they have skilled staff, which also describes the smell, they have a real benefit. I think that seniors in particular, geriatrics, could really benefit from offering some assistance to the elderly or finally developing modern technology that works well for the elderly. I could imagine that psychosomatics and psychotherapy, i.e. outpatient at least individual contacts could be considered, then people with infections with a high risk of infection, who actually only come to a doctor for a laboratory consultation. They can avoid the way into the practice or clinic ambulance if they do it by video consultation. These people can also take blood pressure at home, especially adults. They can take their temperature; they can take their saturation and frankly telemedicine.... They can also do lab tests at home, for example, HB1C levels. Those have been measured by our patients themselves at home. In addition to that, there are more and more ways that patients can test from a drop of

	blood from their finger as well. You just have to be incredibly innovative to say, "I'll try that." I refer, for example, to the study "KULT-SH", which is running in Kiel, and which is investigating video consultation hours for oncological children.
55	MARCO: What challenges do you see here in implementing telemedicine? (**Question 7.2)**
56	MS. DR. SIMONE VON SENGBUSCH: Challenges, yes. You need money for studies. That's what the Innovation Fund is great for, though. So, if you apply and you get through. You need an employer who says, "I think that's great." And you need the staff to do the studies. Telemedicine, studies as well as telemedicine as a service needs people to do you. And if you don't have nurses if you do nott have... After all, we have nurses who qualify to be specialists. It's going to be the specialist nurse, it's going to be the diabetes consultant, but if you don't have them anymore, then you cannot provide telemedicine. We actually have a very different problem. We have great technology now that works, but we don't have the people to do it anymore because simply staffing clinics costs money no matter what the service is. That is actually where I see the bigger problem right now. In that respect, how do I see telemedicine? I see a chance, if you are lucky like me, that I have led a study with a great team, which has delivered great results, has been funded by the state and health insurance companies that say: "We see the benefit, they have convinced us. "We are now negotiating a contract so that we can get started. Whether this will work in the long term, how long this contract will last or whether other contract reforms will have to be developed, I cannot tell you. Because there is still one problem. That is the diversity of service. Adult diabetology, to wrap this up, takes place in practices, with the primary care physician, and for type 1 patients, it takes place in the diabetic specialty practice. Those who are very ill are also treated there with type 2. Children's diabetology, on the other hand, mainly takes place at children's hospitals.
57	MS. DR. SIMONE VON SENGBUSCH: That is where the appropriate specialist sits because the specialty is not at all profitable in the practice. But there's personal authorization, there's medical care centers, or they're practice owners, or they have a university outpatient flat rate like we do. That means that a single billing code is only of use to one, but never to all, because billing is so diverse in Germany. So, there are simply very different options. And in order to get a service into the area, you have to look exactly who is the provider and what kind of contract would actually provide the financing basis, so to speak? But I think that in my field, in diabetology, most diabetologists are now open and say yes, this is something for children, this is something for adolescents, because they need more frequent contacts. It is something after diabetes manifestation, whether it is an adult with type 1 diabetes or a child. It is something for pregnant women, no matter what diabetes they have, because they need to come frequently. But if they are coming more and more frequently, they are heavily pregnant, it is a crazy burden. And it could be something great for people with type 1 or type 2 diabetes who have open wounds on their foot or leg, where you at least have wound checks done in between by specialist staff on site, so nurses or a district nurse or a diabetes consultant or whoever. Um wound consultants, without the diabetologist himself having to go back there or you have to transport the multi morbid and low mobility patient to the office. I think these are the areas of application for telemedicine in 2021 in my specialty.
58	Great. Thank you. Then maybe on the last question, on **question 7.3**, is the use of telemedicine changing before and during Corona? Well, we have actually answered that more or less already. There was very little before and now, of course, there has been an extreme boom. How do you see the topic of telemedicine in the area in a time now after Corona?
59	MS. DR. SIMONE VON SENGBUSCH: Yes, because of the positive experience that many people have had with video lessons. Kids had video school, that worked more or less well at one time. But at least they got to see how it works in the first place. And many adults had to work from home. First of all, we saw that it works and many people who until then had said "Oh, that is not mine, so it's a lot of work" had to deal with the pandemic, whether they wanted to or not. And then you just get out of your comfort zone and realize. Actually, not impractical. And then when you do a video consultation and realize that it works, then you have cached people. Then they say to me now, "I did not think it would be that great, but it works great. " From there, if they have an innovative therapist in front of them, no matter what specialty, I see a huge opportunity in telemedicine. If you make an effort to be empathetic, look at the camera, follow a few ground rules and if your specialty is amenable to it and not all of them I said yes, will find it great. But I think especially younger people who are in the workforce, parents of kids, for whom just an outpatient appointment at a specialty outpatient clinic is a whole lost afternoon and we still have to take two hours off from their employer.... For them it is a huge relief and these patients, but they will determine what comes in the market.
60	MS. DR. SIMONE VON SENGBUSCH: Because doctors who already offer their appointments online today, that is easy. That is becoming the standard. If they do not offer that, then you just have to employ staff to manage your appointments. But cannot that be done electronically? I think it can be done electronically in many ways and that is changing something in our society. Yes, and we all have to become open to technology, in every medical specialty that works with patients, you have to get out of your comfort zone a little bit, where you don't think technology is so great, because there is no electrocardiogram machine today that does not also feed the data into a hospital information system, for example, or say, "I did an exam, you have to do it today." If you work in my field today, you have to enjoy technology. It was different 20 years ago. Then they had to feel a lot of joy in live consulting above everything and that is when other skills were more in demand. These skills are still important today. But now part of the job and part of the training has to be technology. In this respect I see a positive future for telemedicine if it is supported, both financially and structurally. If Internet access is ensured throughout Germany to such an extent that even in rural regions it is at least reasonably coherent. And yes, and if there are a few innovative pioneers in each specialist area, of which I am one.
61	MARCO: Yes, then many, many thanks for the exciting insights. We are now at the end of our interview. It is unbelievable what you have already achieved in the field of telemedicine in the last few years. Thank you very much.
62	MS. DR. SIMONE VON SENGBUSCH: With pleasure. It was a pleasure to meet you. Good luck with your master's thesis.

III. Interview with Dr. Jens Placke

#	Hello, Dr. Placke. Thank you very much for taking the time today. First of all, I would like to ask you to introduce yourself briefly, i.e. tell me about your background, your professional experience and what your current position?
1	MR. DR. JENS PLACKE: Yes, so Jens Placke. I am 53 years old and have been in private practice since 2002. Until 2002 I was employed at the university in Rostock, and before that I did my residency in internal medicine and then my residency in cardiology. With the settlement, it went then nevertheless still further, and in the meantime we received additional qualification for the cardiac insufficiency. This is from the German Society of Cardiology, an additional certification and then also the additional certification for rhythmology, which is the active cardinal implants, so everything where current flows through and we install from pacemakers to defibrillators (defis) ... The certification and recently also the psychocardiological basic care. We work in a branch here that is also focused on heart failure. We have been a certified "Hearth Failure Unit" of the German Society of Cardiology since 2017. You have to maintain certain standards, call certain standard operating procedures (SOPs) your own and, of course, perform guideline-compliant medicine on patients. This does not mean that the others do not do this, but we are particularly committed to providing special care for heart failure, i.e. patients with cardiac insufficiency. And then we have a cooperation in this context with some hospitals, among others also in the German Heart Center in Berlin. And we also work here in the hospital. The practice is within a hospital. We implant here, so I implant here pacemakers, defis, CRT systems.... Joa, and we implanted the first medical pacemaker here in the practice in 2003. Since then, telemedicine has been our special focus.
2	MARCO: Quick question. That is, in the hospital you are co-located, you care mainly outpatients or also inpatients?
3	MR. DR. JENS PLACKE: All outpatient medical care. Outpatients only. We would love to open something like a day clinic here. But that is politically not possible. And these are the short distances. So, if a patient has to be treated as an inpatient, we can accommodate him relatively quickly. So, there are many, many advantages.
4	MARCO: I understand. There is the patient transfer easier. Yes, thank you very much for the introduction. Then I would also start right into the questions if it is okay with you? Sure, right then to the first question. In what areas are you currently using telemedicine and what is the background? Why do you use telemedicine in general? (Question 1)
5	MR. DR. JENS PLACKE: You have to divide telemedicine in cardiology a little bit. So, on the one hand there is telemedicine, which is determined by aggregates, so pacemakers, so device-related telemedicine, which are pacemakers, heart failure systems and so on. They send data, so to speak, and we evaluate the data and then we draw conclusions. For example, if the nightly heart rate increases, then we know that something is wrong. Or if we see arrhythmias. That is this device-related telemedicine that we have been doing since 2003 and increasingly so. We currently have about 500 patients in telemedicine care for pacemakers, aggregates and so forth. Then there is another area that has been growing and growing. For example, we give diagnostic tools to the patient, for example, a thumb ECG that the patient can then put on at home or wherever they are and derive an ECG. And that is then stored in our computer via a cloud, so to speak. And we can then give the patient a diagnostic tool in this way, so to speak. Of course, you can also do it with the Apple Watch, but there I have, then I have to go the roundabout way that it first has to be sent back here and so on.... But ultimately, it is the same principle. So diagnostic tools. And we are also currently participating, for example, in a study that is investigating tools for heart failure telemedically. It is already working. This is a sensor that we implant in the pulmonary artery, a so-called "CardioMEMS" sensor from the company Abbott. And in patients with severe heart failure, this tool is used. We measure every day. So, the patient measures his pulmonary pressure every day and then we know based on the development of these pressure curves whether the patient is overloaded with fluid and whether we need to change something in the medication, with the goal that we manage the patient so that he does not have to go to the hospital because of decompensation.
6	MR. DR. JENS PLACKE: And then there is so completely. Yes, so in the future... And we have been involved in that as well. That was in the Telemedical Interventional Management in Heart Failure II (TIM-HF2) study. There the patient gets a sensor, an ECG device, a scale and he implements all these things every day, so to speak. He measures every day and sends the data to a center and the center can then respond and say: "Everything's going well here or here we need to make changes in medication for example." That is one technical area and the other area, that is about tele-nursing. So that means we also coach a lot of patients where we say: "So here, your weight has gone up or we have arrhythmias. We need to do this and this and this now." So, one example, if we see that the patient has atrial fibrillation and they don't have any anticoagulant medications in their medication list yet, for example, that's extremely important. And then we also implement that immediately, call the patients, they should then report to the GP and so on. So that is kind of this important momentum for telemedicine. There always has to be an action. If you do telemedicine to collect data, then maybe that's fancy and usually nice, but it does not do anything for the patient. So, telemedicine also always means that there has to be feedback. This tele-coaching/tele-nursing is extremely important to provide.
7	MARCO: And now I imagine...Um, patient XY uses a pacemaker, for example. Let us say this pacemaker. I do not know now the technical characteristics, whether that automatically sends the data or there is an add-on device that is then connected to it and the data is then transmitted to it maybe via a secure cloud probably. Um, what? What follows on from that?
8	MR. DR. JENS PLACKE: Yes, exactly. So that is exactly as you reported. A data transmission of a pacemaker, of course, only works if the pacemaker can do it. So, he must have the technical requirements. In any case, it needs either a so-called cardio messenger or a mobile phone that can do this. So also, the first pacemakers where you can query the data with the mobile phone and send it to us. Of course, this is all secured via standard connections which are 99.99% secure, there are never 100, so they are very

	secure. And the data only gets into our computer, so it is all secure and fine from a data protection point of view. And if we now see, for example, that there is a rhythm disturbance in the patient, which makes our action necessary... Then we make immediate contact. This is not an emergency system, but it is a system where the patient, either automatically or semi-automatically...You can set this up so that the data comes in every night...You can set that up so that the data only comes when the patient is actively polling...That is where the systems differ a little bit, depending on what pacemaker I have, what system I have. And with this data I get an ECG, so to speak. I also get certain trends. So if, for example, the frequency goes higher and higher, then you can see that wonderfully in the curves or patient activity is also displayed. If it goes down, for example, then we know that something is wrong. Then you have to call and ask: "What's going on? How are you doing? Are you having any problems?" And then, of course, the technical sides...So all patients who are with us in telemedicine, of course, are also at an advantage in that we recognize technical problems very quickly, for example, rare, but just repeatedly occurring probe defects in defibrillators. And these can lead to a shock being triggered without it being necessary. And then these inappropriate shocks. And since we have been actively using telemedicine, we have virtually banished all approved shocks to the past. So that pretty much does not happen anymore with our patients.
9	MARCO: I take it these shocks are life threatening then too, if they happen?
10	MR. DR. JENS PLACKE: They can cause you a lot of trouble. But first of all, they are just not necessary. And you can see technical artifacts in the probe early on, for example. If you see them, then we can immediately call the patient, call in, switch off the shock function, replace the probe or have it replaced, repair the whole thing, and then it is done. And it would be much worse if the patient gets a shock, who is not infected at all, maybe is affected by it and then comes to the hospital with emergency conditions. That is always bad with emergency. Elective is always better...
11	MARCO: I have one more question. So, the data then comes to you and they look at the data and see whether it is now a technical problem, whether it is now somehow another problem where you have to adjust the therapy plan. Does the discussion then also take place digitally or does it then follow-on site by telephone? Um, maybe you can give us some insight into that.
12	MR. DR. JENS PLACKE: Usually by telephone. After all, we have many employees with us who deal primarily with this issue. If now, for example. That is always quite well solved software technically. There is when everything is green in telemedicine, then it is like a traffic light system, then not much data assessment is carried out. If now, for example, a yellow alarm occurs, that must be looked at. For red alarms, we react within 24 hours and correct the whole constellation. This is often done by our employees, who are all trained in telemedicine and are very good at it. Usually, we actually do that over the phone. Video consultation hours are, let us say, theoretically possible, but the telephone call is easier to implement. That is just the way it is.
13	MARCO: Yeah, that is actually where we more or less already touched on question 2. And do you have anything to add to that? How do you use telemedicine? (QUESTION 2.)
14	MR. DR. JENS PLACKE: Um, nope, that was actually exactly what I just elaborated on.
15	MARCO: Maybe on the number of patients that you have, let us say, that use telemedicine. Can you give me some insight into how current… how many patients in general are using telemedicine compared to all patients? How many patients do you have in total per quarter and or per month? (Question 3)
16	MR. DR. JENS PLACKE: Well, we have about 500 patients in permanent care. And the trend is upward. There are between, so between 30 and 50 patients more every year.
17	MARCO: And such a care, it lasts on average how long?
18	MR. DR. JENS PLACKE: With pacemakers, for example...Well, when a patient gets a CRT system now, for example. That is a complex three-chamber pacemaker. He automatically gets telemedicine from us. So, all patients who get one also get telemedicine. And that's where they are. That's it. They are constantly looked after and they always send a data record every quarter. That is usually always the case. There are some patients where we have a data set every night and these are device-based patients, which are about 500 patients. Then we have like 20 patients that have sensors. That is getting more and more as well. These "CardioMEMS" patients, that is within the scope of the study. We will have to see how that develops, but it will certainly become part of standard care next year, and then there will be more of them.
19	MARCO: What is the name of the study they are doing again?
20	MR. DR. JENS PLACKE: The "Passport Study". It was initialized by the GBA.
21	MARCO: Thank you.
22	MR. DR. JENS PLACKE: And then, of course, there is this, let us say, "soft telemedicine," that we provide patients with a thumb ECG like that, sometimes for 4 weeks. That's a fluctuating number. Yeah, that is five to 10 a quarter where we do that sort of thing.
23	MARCO: So those 500 patients, they have sort of had them in their care for years?
24	MR. DR. JENS PLACKE: Yes, exactly. And there are more and more every year and depending on the data load, it has to be said that this is also a work that is well manageable, because not all patients have problems, but sometimes there is a week where there is no alarm at all or where nothing has to be examined. But there are always days when there is more to do as far as telemedicine is concerned.
25	MARCO: They are also patients who do not want that, for example, who do not get medical care?
26	MR. DR. JENS PLACKE: Yes, but you can actually count them on one hand.
27	MARCO: The number is very small?
28	MR. DR. JENS PLACKE: Yes, it is very low, it is not less than one percent. These are then patients who then usually have such a reason, so even though it is not really...It is a burden on the electricity bill, I do not know...Or I do not really want to have so much technology at home...And interestingly enough, I have never heard that any patient feels too monitored by it. That hass been

	interesting to me. So, on the contrary, the common statement that we hear like that is: "That is totally good. It lets me know that everything is okay and it makes me feel a lot safer." So this is the leading opinion of patients so far and I have not heard so far that anyone feels like they are being watched.
29	MARCO: In terms of Corona, has anything changed for you? Compared to people using telemedicine more or using it less? Or has it remained constant? (Question 3)
30	MR. DR. JENS PLACKE: That has remained constant. And these rates of increase so from 20 to 50 patients a year, so it is remained that way regardless of Corona. It has not increased, it has not decreased. But that probably has to do with the fact that we were already practicing telemedicine before Corona.
31	MARCO: And that yes since 2003 is of course a long time there. Yeah, great. Yeah, great thank you. Um, good. Accordingly, we have already answered question 4 actually, like it is the uptake probably very high if 99 percent of telemedicine use?
32	MR. DR. JENS PLACKE: Yes, absolutely. Very high.
33	MARCO: Um, but then perhaps to question 5. What advantages and disadvantages do you personally see for yourself, but also for the patient within the scope of the application of telemedicine? (Question 5)
34	MR. DR. JENS PLACKE: Again, there are these two areas: technical and medical. Technically, it is simply that we have significantly more safety. To make it concrete. Otherwise, we have the circumstance with the defibrillator patients that we usually have to look at them twice a year, i.e. as a presence presentation. With active telemedicine we can reduce this to once a year. So, it means less work for us. We do have more data work, but it does not have to be managed by doctors.
35	MARCO: So, it is less expensive for you then?
36	MR. DR. JENS PLACKE: Yes, exactly. So, for workflow, it is less work for us with higher security. And that is a decisive advantage that we see for us personally. And that is also the advantage for the patients, because they say: "Oh, man, I do not have to go to the doctor that often. And even if I go to Timbuktu now, for example, and I take my Cardio Messenger with me, I know my doctor is kind of relatively close." Namely, only from a transmission away. These are all already advantages of mobility that resonate and that is indeed an advantage. Medically, there are considerably many advantages to start with patients. Rhythm disorders are detected early, deteriorations in health are detected early, we prevent hospital admissions. Hospital is not a good place, so it is always a dangerous place. So health-wise and medically the patient has only advantages from telemedicine and we also have medical advantages from it. We have more work with the patient, of course, but ultimately, again, less work there because patients, of course, can bring complications and can bring exacerbations of disease. But if I save a patient from decompensation, then I am happy to spend this work. Because if he is prone to decompensation and he has been back in the hospital, the patient always comes back to us worse than he was before. That's the problem when a heart failure gets acutely worse. And it never gets back to what it was.
37	MR. DR. JENS PLACKE: And so, we can really take good care of patients in heart failure for a long time with more effort, but with the medical result that again it is less effort, it is less work, it involves less complication. That is an advantage that has been demonstrated in various studies, so "TIM-HF2" for example by Professor Köhler. Which has been proven that we actually have a survival advantage for these patients. And while we are on the subject of study data, so Professor Hindricks in his "IN-TIME" study has also demonstrated that for the defibrillators. So, these are survival benefits. There have been many studies on telemedicine that showed no advantages or were neutral. But these were all studies that had a shortcoming that these two studies did not have. You always have to respond to a telemedicine finding. You must have SOPs. Yes, if I have atrial fibrillation, I have to call the patient. If I see artifacts, then I have to check the defibrillator. If I see patient activity dropping, then I have to respond to that. So that is the bottom line with telemedicine. And if that is adhered to, then it is certainly a lot more work at first. Not necessarily medical, but there are staff there, so the tele-nurses, they count that. But the bottom line is that it saves time for the doctor, and also for the patient, because he does not have to come here as often. And we have a clear medical benefit, fewer hospital admissions, less heart failure and yes, early detection of problems.
38	MARCO: Which is, of course, a cost saving accordingly. For the health insurance companies, for example?
39	MR. DR. JENS PLACKE: Yes, we see that, but unfortunately the health insurance company does not see that.
40	MARCO: That is the billing, of course. An ongoing battle between the insurance companies and the medical profession. Yeah, yeah, thank you. Ahem. Then we come to question 6. How do you see the profitability of telemedicine? First, is this telemedicine project or the telemedicine that you use supported or rewarded in any way by the health care system? Is there any funding from the health insurance or funding pots from the federal government? (Question 6)
41	MR. DR. JENS PLACKE: Yes, well, we have been actively practicing telemedicine since 2003. But at that time, as I said, it was all in the double digits for the first five to eight years. The health insurance companies didn't even know that such a thing existed. So that wasn't reimbursed either. We have since 2016 or 2017... I do not know exactly, but I think it is around that time.... I believe that since 2017 there has been an EBM code for telemedicine, i.e. for the query of a telemedicine-capable pacemaker system or aggregate.
42	MARCO: Excuse me, what is an EBM number?
43	MR. DR. JENS PLACKE: Well, EBM number means that it is my fee list, so to speak, that is the uniform assessment scale. The system in Germany is a bit strange. So, we have the area of the GKV, the statutory health insurance, and the statutory health insurances have... So, the central associations have negotiated a so-called uniform assessment scale together with the National Association of Statutory Health Insurance Physicians.
44	MARCO: Okay, I get it.

45	MR. DR. JENS PLACKE: And it says in there what can be billed and what is not in there cannot be billed yet. And until 2017, the term telemedicine did not exist in the EBM. Okay, well, it just was not true. And that was more or less a hobby, which always led to some colleagues saying: "Well, what Mr. Placke is doing is a bit.... Does he have too much time?"
46	MARCO: HAHAHA. Of course that is very nasty....
47	MR. DR. JENS PLACKE : Yes, but it is necessary. We have always seen and recognized the advantage. And now it is so that we always have to justify ourselves to the Association of Statutory Health Insurance Physicians, why we have so much telemedicine...
48	MARCO: It is a big, big war. Let us put it this way...
49	MR. DR. JENS PLACKE: Well, it has been remunerated since 2017, but it does not cover the costs. It has to be said that of course the cardio messenger also costs money, there is a wireless internet connection and so on. So far, this has always been done in such a way that we have implanted this with the price of the device at the same time, so to speak, and we have noticed it.
50	MARCO: So, there is still a user fee for the data transfer?
51	MR. DR. JENS PLACKE: Well, currently it is the case that it is paid for once and then it is done. It is not that expensive anymore, such a SIM card. And now it is partly so that the health insurance companies... There are health insurance companies that are very generous and we get through it well. But there are also health insurance companies that say: "No, pacemaker care is already expensive enough. So there is nothing more." We are always sorry about that, but at the end of the day there is also a telemedical supply right for the patient and we always insist that the patients also demand this from the health insurance companies.
52	MARCO: What exactly does that involve?
53	MR. DR. JENS PLACKE: Yes, so if I implant a unit that has the capability of telemedicine, then the patient can say, according to the understanding of the “Sozialgesetzbuch” (German Social Law Book), then I want that, too. That is the leverage against the health insurers and ultimately that is but...A lot of it is a matter of interpretation by the health insurers. It is very, very difficult and we will have to wait and see what the current situation is. So, there is a GBA decision from December last year, you can call it up on the GBA page. There it is about telemedicine for heart failure. Unfortunately, and this should start from 1.10.2021 ... And that is a reimbursement of telemedicine centers, primary treating physicians and medical technology. That means that patients with heart failure will have a right to telemedicine care in the future, with ECG, with scales, with all this equipment, that it is again based on the "TIMHF2" study. That is the background for this GBA decision. So, the patient has a right to be treated in this way and he needs a primary treating physician, which is us, for example. A telemedical center, we could also do that and then they also have the right to get this technology and that is in the resolution and there are also the implementation provisions already in it. But currently there is no sum, no EBM number and the negotiations between health insurance companies and professional associations, which is currently ongoing. But there is no result yet. Therefore, the start date of 01.10.2021 was postponed for the time being to 01.01.2022 currently. In principle, however, this only affects patients with cardiac insufficiency. And there are criteria for that. This does not apply to patients who have a defibrillator, for example. There are already EBM figures for that. So, this is another extension of the remuneration of telemedicine. But at the moment we do not know how much money will come out of it, who has to do what or what has to be considered in the whole story. The negotiations are going on right now.
54	MARCO: Is it usually the case that the patient then gets this device for free, for example, or does he have to make a co-payment?
55	MR. DR. JENS PLACKE: Yes, yes. So, at best it might be reimbursed like a device, treated like a device, and then it depends on whether the patient still has to pay a co-pay or is co-pay-exempt. If he has to pay a co-payment, then I think it is 10 Euros per device or something like that. But the indication for it is basically made by the primary treating physician, the cardiologist, and he says: "Okay, this is a patient who can go in there and then it will be applied for and then it should be possible."
56	MARCO: Maybe just to summarize on the costs...What are the cost drivers that you see with telemedicine versus not using telemedicine?
	MR. DR. JENS PLACKE: Well, telemedical care is always expensive due to hardware and software. So, there are the cardio messengers, for example. There are differences between the individual companies. So, on average I think it is always about 1,500 euros. And then of course you have the working time of the tele-nurses, who have to deal with the data...
57	MARCO: So, 1,500 euros for you to use the system at your place.
58	MR. DR. JENS PLACKE: No, the health insurance company has to pay for that then.
59	MARCO: Okay, so that gets billed to the insurance company and you get reimbursed?
60	MR. DR. JENS PLACKE: Exactly. So, we prescribe that and the health insurance finances that. But as I said, it is only since 2017/2018 that this has increased more and more... So, the health insurance company AOK is relatively exemplary, but many other health insurance companies unfortunately refuse. And there, where the patients refuse, there you try to get that then somehow with rented devices. But in principle it should be so that it is prescribed and the patients have then quasi also no additional costs, except the little electricity, which they must supply. In practice, of course, we have to have certain things in place, like a nice, fast internet connection. We currently have about two and a half employees who deal with telemedicine. That is per day maybe a working time of, so if it is all fast and all green and there are few alarms, then that is maybe half an hour maximum. But if there are many alarms and there is a lot of telephoning to do, then and also in connection with medical consultations, then it can sometimes be an hour or an hour and a half.
61	MARCO: How much does an employee earn on average? Then I could already calculate the cost savings, I say...
62	MR. DR. JENS PLACKE: I can actually tell you that quite precisely. We are at 16 to 17 euros per hour for our employees.
63	MARCO:Great. Thank you. Perfect. Of course, it really depends on how this will continue in the future with the various health insurance companies, whether the health insurance companies will continue to reward and finance it. If the money is there, of course,

	then it can be implemented sooner. This will of course be more likely to be rewarded and perhaps other practices that have not yet jumped on the bandwagon will follow suit. Exactly, then let us proceed. Let us move on to question 7: How do you see the future of telemedicine? Now we have heard a lot about cardiology, but do you see strong potential for telemedicine in other health care segments and why exactly in these segments, just as your personal view out of the box.
64	MR. DR. JENS PLACKE: So, telemedicine definitely has a huge future, especially if you then imagine that you couple the whole thing with artificial intelligence. Um, so even this assessment of the data that comes in some form yes, by artificial intelligence or by. So not right now. I am not talking about deep learning. So Deep Machine Learning is not there I believe. The algorithms must always be clearly recognizable, why the AI decides so and not otherwise.
65	MARCO: So clear decision trees that basically simplify the decision for them.
66	MR. DR. JENS PLACKE: Exactly, exactly. That will certainly come. So, along the lines of: "We, we have now what do I know like 50 patients in telemedicine, for example, with the diabetologist, I think that is a very big area where that is going to come." That is where all the blood sugar curves have come in now. After thorough consideration by artificial intelligence structures, we actually only had to look at two patients. And if I can rely on that algorithm, I have reduced the workload from 50 patients with blood glucose curves to two. So that is a huge opportunity that we have there if it is used wisely. So, I see especially just the diabetologists, so whenever something is measured, the pulmonologists theoretically as well, because they could collect, for example, peak flow meta-data every day. But the professional association of pulmonologists has spoken out against this. They would still like to see the patient live. That is fine, each specialty group can decide that for itself. Cardiology is extremely important. We have talked about it a lot. Radiology is also extremely important. If, for example, we exchange X-ray images better, in general for diagnostic things, radiology, but also in dermatology or in other specialties, if findings are exchanged via telemedical structures, that is always helpful for the patient. But everywhere where the patient can collect data, blood sugar, cardiology we already have...peak flow meter or whatever...Then you can assume that a telemedical application is possible. Whenever the doctor asks: "Please show me the things you have. Then this would be theoretically possible by telemedicine. But today it is not because we can no longer read any data formats, but rather because, for example, in a small village there is bad Internet.
67	MR. DR. JENS PLACKE: But I think there are a lot of possibilities where this will play a big role in the future. Always, even if the patients become more immobile. There are some areas that cannot be cared for by telemedicine. But even in pediatrics, there have already been projects. Especially if you look at Stanford, they have done a lot in this area. For example, they were able to establish such diagnostic rooms. I was once a witness at a congress how this was presented. Then the mother comes with the child in a diagnostic room and then telemedicine is transmitted and at the end at the other end just sits the pediatrician at Stanford University, because just in the area where the mother of the child is just currently no pediatric consultation. And then they talk and there is a good camera, there is also a blood pressure monitor and everything like that. So, there can be a basal anamnesis and also finally not only video consultation, but also really measured values can be transmitted. For example, you can also do this in dermatology, where you can say that if this is a good camera, then you will get a good diagnosis. So, from my point of view there are many, many possibilities to develop telemedicine. First of all, the will has to be there. I think the medical will is there, but unfortunately the political will is not always there and it costs money to develop things. But at the end of the day, I am firmly convinced that it saves time and therefore also money.
68	MARCO: Maybe let us go back to the challenges. So, you probably see politics as one?
69	MR. DR. JENS PLACKE: The politics and also the infrastructure as well. So as long as we still have areas where "the bits and bytes fall from the sky one by one", then telemedicine is not worthwhile especially for example in the emergency area. Emergency medicine is also a big area, if we equip emergency doctors with an ECG and the emergency doctor would like to know from the cardiologist: "Has it always looked like this or do I have to worry about the ECG and then it fails because he cannot send the ECG because there is no Internet, then that is a bit stupid." So this structure, so political requirements, structural requirements and...And that is quite important to me. Now a bit of the Medical Council is coming through again. So, I am the committee chairman for digitalization in the medical association in Mecklenburg-Vorpommern. Um, the training. So, this has to start early in the studies. If we only start in the specialist area or even later, when the doctor is already finished and actually has other things to do... If we only then start with telemedicine in training, then we will not win so many friends. If we start with telemedicine in the study...Theoretically there should be a chair for telemedicine. If we don't manage to integrate it into the training, then it will be harder and harder to win.
70	MR. DR. JENS PLACKE: It is easier to position this from the outset in the training. Because then the resident does not come to the hospital and marvel at all the things that are possible, but the patient's assistant asks: "Where is the telemedicine workstation here?" And woe betide the hospital that does not yet have a telemedicine workstation. Yes, so with a new entry there is also pressure. But I think that is the training of young doctors...We always complain that the young people, so this old problem as before, before and the youth of today...Yes, but we also have to do things to make it better. And part of that is that we start early to take what is routine for us and for me right into education. I see students all the time. We do a bit of training here. We always have students on training courses and when they come here and see what is going on in telemedicine, their eyes always open wide. And then they always ask themselves: "My goodness, I do not even know that this exists. And where does that come from? And how is that done?" And all that kind of stuff. And that is a shame.
71	MARCO: Yes, I think so. The "aha" effect should have been there earlier somehow. Earlier in college, definitely. And that is what people know about being passed on. Yes, thank you. Then we come to the last question, we already touched on it a bit earlier. You have now said that you did not have any major deviations before and during Corona. Maybe still related to Corona how do you see the future of telemedicine now successively post-Covid-19 time?

72	MR. DR. JENS PLACKE: I think yes, Covid-19 was actually just a training of viruses and how they can annoy us. There will always be situations like this as well, and there will always be pandemic problems as well. I believe that is indisputable. That is why what we have now learned in the Coruna period should not simply be put to one side again. If we are of the opinion that we no longer need it, but on the contrary, it should continue to be cultivated and developed further, in particular video consultation hours, and in particular to really understand telemedicine as an opportunity from a pandemic point of view to avoid doctors, patients and contacts in general. I think that is very, very important. From my point of view, and we have experienced this in many areas, Corona has been such a booster. Even data protection concerns were quickly excluded and deleted as non-existent. And we should actually take that on board and say: "Okay, we are in a position to operate good telemedicine. And we should develop that further, because the next...So, after the pandemic is before the pandemic."
73	MR. DR. JENS PLACKE: And if we go in there secured, that is certainly enough. From my point of view, it does not concern all areas of telemedicine, because it has not changed that much in our case. But just what the video consultation or also new areas, pediatrics, dermatology, emergency medicine, and and and, are extremely important things. Just imagine that in the future they will have a pandemic mobile that automatically tests the patient with a dry test, i.e. with a dry laboratory. And then we know in advance whether the patient has a viral infection or not and can provide him with targeted emergency medical care and say: "Okay, you are going to go there and there." Now it is like, they come to the hospital with whatever they find that may or may not have virus and the hospital has to have an extreme amount on hand to clean up the situation. And if we can say telemedically beforehand with the patient and then really also determine, "Yes, this looks like this, this looks like this. Please take the patient straight there, because he's going to ETS anyway, or or or..." So there are a lot of possibilities, I think.
74	Yeah, great. Yeah, wow. Yeah um, thank you so much for your opinion. It is super exciting. I think especially that you have been using this for so long as well. Since 2003 also shows that you are one of the leading experts in telemedicine in Germany related to cardiology. Thank you very much for your time.
75	MR. DR. JENS PLACKE: Thank you very much as well and good luck. And yes, telemedicine is always close to our hearts and mine, because it is a topic that has to be brought forward and everything that serves this purpose is always worth every effort.
76	MARCO: Thank you! Thank you very much and see you soon.

IV. Interview Transcript with Dr. med. Anselm Angermaier

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#	MARCO: Hello Mr. Angermaier, thank you very much for your time today. Maybe you can introduce yourself briefly: What is your background? What is your current professional position?
1	MR. DR. ANGERMAIER: Well, I am a specialist in neurology for some years. I studied in Greifswald, I also did my training as a neurologist here and originally come from the stroke area, so to speak. I have done a lot of research and I am active in various projects in the field of neurological telemedicine. I just see here that Zoom says function outpatient or inpatient?
2	MARCO: Now that was exactly the question: outpatient and inpatient, because acute neurological is then only outpatient or is both also used?
3	MR. DR. ANGERMAIER: So, acute neurological is inpatient That the question so long is now the function do you mean function in terms of telemedicine or function in terms of my neurological activity?
4	MARCO: So, in terms of telemedicine?
5	MR. DR. ANGERMAIER: The thing is, that is all. That is of course all...So all the telemedicine stuff that is going on in Germany right now is all third-party funded projects. There is no, except for one special case...We can discuss that in a moment...It is not, so to speak, except for this special case, mapped in the normal DRG system? That means you cannot do it full-time, you can only do it part-time. Either you have a third-party funding, where you finance yourself or you do it on the side and have other activities, such clinical activities, and I am a mix of both.
6	MARCO: Okay, so you can do both inpatient and outpatient quasi?
7	MR. DR. ANGERMAIER: That anyway with respect to my clinical activities, but also with respect to the outpatient telemedicine activities. There is a second project that we are doing. A big project that is in the outpatient area. The project "ANNOTeM" is inpatient and the second project is called "NeTkoH" and that is in the outpatient area.
8	MARCO: Then let us get straight to the questions. In which areas do you currently use telemedicine and why do you use telemedicine? What is the background? (Question 1)

9	MR. DR. ANGERMAIER: Well, as I said, telemedicine in Germany, except in the stroke area, is actually only used in research projects so far or partly in consultation hours, whereby there is always a problem of financing, because it is not reflected in the DRG system. I personally do telemedicine in two areas. One is the ANNOTeM network, which deals with acute neurology. And in the second area, which has been in preparation for a year and is now in the recruitment phase in October, so to speak neurological telemedicine at the family doctor. Would you like to hear a little bit about the projects?
10	MARCO: I would love to, I would love to, yes. Maybe you can explain how that works, how it works?
11	MR. DR. ANGERMAIER: So, let us start with ANNOTeM. So, let us put it this way, acute neurologic medicine is stroke-heavy, if you will, but not just stroke...But that's what it is all about, first of all Detecting time-critical illnesses early, detecting and treating them early, because neurological illnesses in the acute setting, it is like, "If you can detect them early and treat them early, you can prevent a lot of negative outcome, because they are just time-dependent." And that is also the principle of "telestroke," which is the telemedicine treatment of stroke. The principle has been around for 15 years and that is the big exception. Because that is mapped in the DRG system. That means in Germany, and we have united last year so to speak again to the AG Telestroke. There are 22 telemedical networks in Germany that are involved in stroke treatment, not exclusively, but also. We have made an assessment. We can say that about 10-15% of all stroke patients in Germany are treated via telemedicine. The principle is that they do not arrive at a neurological clinic, because there are not so many neurological clinics in Germany that they can provide comprehensive stroke treatment, so that acute strokes..... Um, which of course need neurologists per se, but also come to internal medicine clinics or basic and standard care hospitals, where there is no neurological department.
12	MR. DR. ANGERMAIER: And they still need to be taken care of, and that is where neurological telemedicine comes in, which can capture the patient via audio-visual contact. And that works very well because neurological disease, especially examination, is based primarily on inspection and communication. I think surgeons, for example, telemedicine would be nixed because the surgeon has to touch the patient. He has to palpate. That is not possible with telemedicine, at least not now. And that is why we can use internists, imaging - everything is available in the hospitals, of course - and that is why we can treat acute strokes relatively well with the internists who are there. And that even goes so far... They all have a neurologist attached to them, who looks after them within 24 hours, so that they can be left on site and can also do the further treatment on site, so that they don't have to go to the big centre, always of course under neurological supervision. In practice, this means that the neurologist in private practice is active on a conciliar basis. And that means. He goes there and gets paid for looking at the patient on a case-by-case basis.
13	MARCO: So, the resident neurologist is part of this stroke unit?
14	MR. DR. ANGERMAIER: In terms of billing, yes, so to speak. But that is not a future, that is not a structure, but a...So at ANNOTeM that is a so-called neuro-acute unit? ANNOTeM is a special case, I'll tell you more about that in a moment. And for a few years now there has been the term, the certification criterion, of the "Telestroke Unit" from the German Stroke Society. You can be certified for this, which is the lowest level, so to speak. Then there is the stroke unit, the regional stroke unit and the supraregional stroke unit. But that is not a must.
15	MARCO: Now let me ask you a stupid question: What is the main task of this stroke unit?
16	MR. DR. ANGERMAIER: Stroke unit means, so to speak, specialist unit for stroke. It is so that one has determined...Also let us say, however, that there is not so long. It has been around for 15-20 years, and it has been established that... Stroke patients used to lie on the normal ward between all the other patients and when stroke patients deteriorate, they quietly deteriorate and if you don't look regularly, it can happen that the arm or the leg gets worse or the patient actually has swallowing disorders or you get pneumonia as a result of the swallowing disorder because things get into the oesophagus. That is, it is all very bad.
17	MARCO: So, an interdisciplinary team, so to speak...
18	MR. DR. ANGERMAIER: That's right. You have that on every ward, of course. But the key thing is, "They are all trained there specifically for stroke, and it is sort of a black box." And that black box has a tremendous effect, for every stroke. That is why they say that every patient should be located in a stroke unit, so to speak, if possible. And you can transfer that, however, also to the internal medicine clinic, and you can apply these principles there as well. And that works relatively well. That means according to this concept, this Telestroke concept, you can also treat stroke in non-neurological clinics. As I said, Telestroke has been around for 15 years and ANNOTeM has been around for four and a half years. That was in the original project of the Charité with us and the Unfallkrankenhaus Berlin.It is an innovation fund project. The Innovation Fund is a... Do you know it?
19	MARCO: Yeah, I know.
20	MR. DR. ANGERMAIER: There you can also read that it is also listed on the website. So, it comes from the Charité. We participate there as one of the three tele-consil centers, so to speak.

21	MARCO: How much funding did you get then, if you do nott mind me asking?
22	MR. DR. ANGERMAIER: Several million euros. The funding phase is over now. We have now entered a phase where we are continuing the network on a pay-as-you-go basis. The principle here was that we said, "Yes, it's established for stroke and it's also in the DRG system, but there are other time-critical neurological diseases where the principle applies just as much, but which have been completely under the radar so far, such as epileptic seizures, certain brain inflammations, certain paraplegic syndromes." And the exact same thing applies there. And then we transformed those principles and just applied them to that principle. And then we built up a network with eleven clinics in Mecklenburg-Western Pomerania, Brandenburg, Saxony-Anhalt and we evaluated this scientifically, both in terms of outcome parameters and in terms of the economic aspects. And the results are there now, they are good. The results have been submitted to the GBA. And we are now hoping, so to speak, for the pronunciation of the recommendation. That means that the innovative thing about ANNOTeM is that we were able to show that it also works with other neurological diseases. And it also makes sense from a health economic point of view.
23	MARCO: So, what are the other major diseases or with those where they have found that it brings a high success? Can you say that already?
24	MR. DR. ANGERMAIER: Yes. Epileptic seizures, so status epilepticus is an epileptic seizure that is there permanently and doesn't go away. Encephalitis meningitis, so inflammation of the brain or meningitis and cross-sectional. And also disorders of consciousness.
25	MARCO: Impressive. Wow.
26	MR. DR. ANGERMAIER: Thank you. That is why we are expecting referrals again and the funding expired last year in February and since then we've been doing it on a pay- as-you-go basis, which means the individual network clinics pay our expenses, which means we do not make a profit, we are just sort of application-oriented for them to keep this service going. So, of course we have personnel costs, ongoing technology costs and try to maintain that, so to speak. The problem with these innovation fund projects is that it's such a design flaw... And that is that no one could imagine that at some point something would come out of it that could be put into practice. That's my impression, so to speak...And then it came about now and then you had to think about how to design the process. There is such an approach of a process, but so completely I think, because the first projects have now recommendations...And so this process is not quite clear yet, how that will go. But we hope that at some point it will be included in standard care, that is, in the DRG system. But the basic problem is that I already said at the beginning that it is actually not possible in principle in the DRG system to bill for a service if you do not have the patient with you.
27	MR. DR. ANGERMAIER: That means that something has to change in the DRG system. That means, and unfortunately that is always the problem in the health care system, that you can only do certain things if they can also be represented in terms of billing. Otherwise, it is always at the project level and cannot become permanent at the normal level, so to speak. So that was ANNOTeM and the other one is NeTkoH. And ANNOTeM is such a supra-regional story, we do it in Mecklenburg-Western Pomerania, Brandenburg and Saxony-Anhalt. And maybe one more thing about that, which I forgot to say: "The patients who of course need a neurological clinic are now also transferred there and we do that too." That means we take care of the entire patient management of transfer from one clinic to another. The internists don't have to do that and that takes a lot of the work off the internists because it's much easier when the neurologist communicates with the neurologist about a certain patient and explains to him why he has to go to his clinic than when the internist has to do it.
28	MARCO: I have not quite understood one hundred percent the principle of where the telemedicine medical field is going now.
29	MR. DR. ANGERMAIER: Everything, so to speak, is done by telemedicine....
30	MARCO: So is that how the communication is done via video or how exactly?...
31	MR. DR. ANGERMAIER: Yes, exactly. Just like we're doing here now.
32	MARCO: Okay, all right.
33	MR. DR. ANGERMAIER: Well, everything I have described now is telemedicine, so to speak. So, telemedicine is of course not only audiovisual communication, it is so to speak much more in the medical field. So, if you see the patient there telemedically, so to speak. It starts with the internist calling the patient and introducing him to ANNOTeM. This is not only the pure audiovisual communication, this is a component.
34	MARCO: Maybe you can explain it with an example. For example, we have a stroke patient now. He is now in the hospital. And how is the process related to telemedicine?
35	MR. DR. ANGERMAIER: Well, first of all, he calls. If you also want to be very strict, also according to the definition of the German Medical Association, a telephone call and to contact the patient is also telemedicine. And the electronic patient file is also telemedicine.

36	MARCO: So sure, that is obviously where do you start and then where do you stop in terms of the definition of telemedicine.
37	MR. DR. ANGERMAIER: That is why, that is clear. .....Telemedicine is a matter of definition.
38	MARCO: So how would you describe it?
39	MR. DR. ANGERMAIER: Well, it starts with a phone call. The patient is there, he is called. We have such and such patient here. Yes, then we recommend appropriate imaging, then the council is registered, that's also already in the electronic council request documentation system. Then the patient is seen by us, audiovisually. Then, a certain therapy recommendation is made and this is written into the documentation system, so to speak, and then it is completed, is archived or spat out of the printer there as well and then the appropriate things are implemented. And, the whole process, that is telemedicine.
40	MARCO: Thanks, again, good to understand.
41	MR. DR. ANGERMAIER: Yes. It goes beyond that because even if that is sort of completed, if the patient has to be transferred because the internal medicine clinic cannot provide the care in this particular case because the necessary measures are beyond the equipment of the internal medicine clinics, we also take care of the transfer. That is, it also goes one step further to the admission to the next clinic. By the way, it is now also possible to send CT or MRI images electronically.
42	MARCO: Do you use that with all your patients, so these telemedical modes of transmission or does the patient basically have a choice to decide? For example, in the psychological field, where you have talk therapy now, it might be something else where you need a consent form. But what about in your field? Do you use this telemedical offer for all your patients or only for a certain number of patients?
43	MR. DR. ANGERMAIER: These are the patients who come to these internal medicine clinics. ANNOTeM was ultimately developed for structurally weak regions where they do not have a neurological clinic. This means that a patient who would actually have an indication to go to a neurological clinic, but the neurological clinic is three hours away, will of course go to the next hospital. And that's why it's a medical, a so-called council... And the patient can of course refuse, but this is all acute medicine, that is, he will not refuse, or he is in a state in which he is not at all legally competent. That means he doesn't matter anyway. It means he has to. So that is legally a medical service...Getting a second opinion, ultimately from the experts...And he doesn't have to consent to that, the patient. What you mean, that is so to speak in the outpatient area so to speak...There we have certain interviews or treatment measures. That is there something else. And there is also our second project NeTkoH. There it runs differently.
44	Um, maybe you can... I don't know if you know the numbers. But if we take all the clinics that you're connected to now let's say with the ANNOTeM network, how many clinics is that in total?
45	MR. DR. ANGERMAIER: Eleven
46	MARCO: Eleven, okay. Do you know how many patients that have in total or on average?
47	MR. DR. ANGERMAIER: Do you mean regular patients, or do you want to know how many councils we do?
48	MARCO: How many councils. I think that would make the most sense.
49	MR. DR. ANGERMAIER: Well, I can tell you that we do an average of about 200 to 220 councils a month.
50	MARCO: Maybe as a question for me. A council means per patient or is it a summary of different patients. So, one council means one patient?
51	MR. DR. ANGERMAIER: One council per patient.
52	MARCO: Okay. Did anything change for you before or after Corona, in terms of that number? (Question 3)
53	MR. DR. ANGERMAIER: On the number, yes. That is also very clear and there is also a very clear corona effect. We were able to prove that scientifically. It was simply the case that fewer people went to hospital because they were afraid of getting infected. And this fear of getting infected was so pronounced that, for example, in the case of strokes, but it was also the case in other clinics, i.e. also in other specialist disciplines, certain symptoms were simply ignored because the fear of being infected by Corona hovered over everything. And especially in the area of strokes it was the case that patients with mild symptoms did not come to the clinic at all and did not call the ambulance service. And then the stroke severity shifted, so to speak. That means that only severe patients with severe symptoms came to the clinic and those with mild symptoms stayed at home. That is why during the Corona period our number of councils decreased. For the reason or also we do not only see strokes, we also see many other patients in ANNOTeM. But the ratio of strokes, we have seen that very closely, has been in terms of more severe. And basically the number of

	conciles has gone down.
54	MARCO: That is, the councils used to be more than 200 or less, or it's those 200 now....
55	MR. DR. ANGERMAIER: Now. So now it is not high after all. Now, yes, it is a normal condition ultimately. Corona means so to speak in the phase of lockdown and first and second wave. So now this third, fourth wave, these waves now you can't call it corona anymore. This is a permanent state. By the way, you will also see this in other areas. In the hospitals, normality is now slowly returning. Everyone is getting on better with the situation, so to speak, and patient numbers are also returning to normal.
56	MARCO: Yes, in any case, I have already noticed in the other interviews. Um. Yeah good. The next question, how is the acceptance of your patients accordingly, since there is no consent of course? (Question 4) Um, I am assuming or that is basically emergency care, right?
57	MR. DR. ANGERMAIER: You are exactly right.
58	MARCO: Accordingly, the patient does not have to tune in, does he?
59	MR. DR. ANGERMAIER: So, if the question of what is meant by acceptance, well, acceptance can also mean that you can see satisfied with the phone. So, I do not have to mean it is just the take-up. So, the satisfaction was always very good. This is no self-praise, but the patients are grateful, because they know that they live in a rural region and that they get an expert from a centre. Um, they are actually always very grateful.
60	MARCO: And maybe again as a question. That is, if you are now connected, then you have in principle with the patient and with another responsible doctor, then do this interview together or how does that work then?
61	MR. DR. ANGERMAIER: It is not called an interview.
62	MARCO: I mean the medical history, of course.
63	MR. DR. ANGERMAIER: Medical history, that is right.
64	MARCO: Yes, exactly. That is, then there are somehow video cameras on site in the clinics, special rooms where the patients then come in?
65	MR. DR. ANGERMAIER: All of it and both of it. So, there is a system here. We have a mobile system on wheels with a screen and a camera on top where they can see me and I can see them. The camera is remotely controllable and you can just log into this system and enter things.
66	MARCO: Okay, so that means the camera and the rack will be retracted then?
67	MR. DR. ANGERMAIER: Well...
68	MR. DR. ANGERMAIER: Well, usually there is a special room, a video room, and then the patient comes in.
69	MR. DR. ANGERMAIER: Yes, exactly. And that's where the device is.
70	MARCO: All right, I see.
71	MARCO: All right. Yeah, super interesting.
75	MARCO: Let's move on to question 4: What advantages and disadvantages do you see in the use of telemedicine? On the one hand for yourself, but also on the other hand for the patients? For example, you have already mentioned the rural connection, where without telemedicine in principle no care would be possible. Are there other advantages and disadvantages that you see?
73	MR. DR. ANGERMAIER: So, benefits are clear, very clear.... Now for me... Maybe I should mention this other project again?
74	MARCO: Yeah, I'd love to. The NeTkoH project?
75	MR. DR. ANGERMAIER: Yes, exactly. That has just started now. That's also an innovation fund project. So, you can find that through the JCC. A little more info on that. But that has just started. So, I cannot give you too many details yet. We have just started with the patient recruitment this month. That's where the principle is different. We see in the outpatient area and that is more regional, so to speak around Vorpommern here, because we have structurally weak regions here. We also have a supply problem in the outpatient area with neurologists. That means you wait up to seven months for an outpatient appointment with a neurologist. So, when the family doctor says it is a European problem, it does not have to be true, but, if he says... then the patient has to wait up to seven months until the neurologist can tell him that it is not a neurological problem and then the patient comes back and before that there is no parallel examination, but everything is postponed. That means that they run around as outpatients with some unclear symptoms for two to three years. And there are various reasons why this is the case here, regionally, but this is a very difficult situation. And this culminates, among other things, in the fact that the general practitioners no longer know how to help themselves

	and come here to us in Greifswald, here at the maximum... Well, we are here from the university medicine, but also maximum care providers and also make basic and standard care here for a radius of 100 to 150 kilometres.
76	MARCO: Wow, big area!
77	MR. DR. ANGERMAIER: That is different here than in the West and that means they refer us to the emergency room and that doesn't work, of course, because that's not an emergency. And there are very clear criteria in Germany as to who can be admitted to the hospital and when and who cannot. And if someone has had the same symptoms on one side of the body for months, it must of course be clarified on an outpatient basis. That is a very real problem. And that is why we have now created a project, which is also supported by the Innovation Fund, where we bring this neurological expertise directly into the GP practice, also in the telemedical setting, also audiovisually and also with the device, where we can then, so to speak, if the GP thinks that there is a neurological problem, call us and we switch on and give a recommendation directly. In the GP setting it is so that they do not have as much time as now with ANNTeM for example in the acute area, because there a council so with everything around it takes 45 minutes to an hour. The German general practitioner sees about a hundred patients a day... That means he has six to eight minutes per patient. Of course, you cannot do much with that. So, we made a deal with the family doctors, they give us a total of 15 minutes for the council. We can't do a complete neurological examination in that setting. It does not work. But we see it more as a consultation, so to speak, with regard to further care. Is it really a neurological problem? Can it stay with the GP? Does it need to see a specialist? As said latency (waiting time) is 7 months or does it even need to go to the clinic?
78	MR. DR. ANGERMAIER: But sometimes something slips through the GP's fingers and he thinks it is nothing. And at the same time it is an acute problem which has to be solved with the clinic now, so for example with the stroke symptoms and especially if you have to be referred to the specialist, you can already initiate a little bit of diagnostics in the meantime, because the diagnostics go much faster than the specialist appointment. And with that, the patient can already have a diagnostic workup with the neurologist, so to speak, and then he can already have a diagnosis in this context. In any case, time is saved and there is no longer the rat race at the end with diagnostics and new appointments, which may take forever again. So that means process optimisation in the end, and we also think that this will lead to savings. And we also think that these referrals to us will reduce the emergency room. That means less burden on the inpatient structures and also unnecessary referrals to the neurologist, where appointments for others are then taken away. And ultimately we hope to be able to keep more patients with the family doctor. When we think that this is not a neurological problem at all. Basically, it is a process optimization, so there are savings in many areas and increased patient satisfaction ultimately and ultimately also faster diagnosis and faster treatment and also better quality of life. And that's what we're trying to achieve now with 33,000 full-time practices here in the region for over four years.
79	MARCO: That means that the general practitioner offers an additional consultation hour for this in principle?
80	MR. DR. ANGERMAIER: No.
81	MARCO: Or how does that work? Or you have a permanent service then?
82	MR. DR. ANGERMAIER: Yes, exactly.
83	MARCO: So, you could say you have a kind of call center, expert call center? Let's put it this way.
84	MR. DR. ANGERMAIER: So ANNOTeM is also nothing different in principle. With ANNOteM it is like this: There are three centers that do it, they do not do it in parallel yet, but there is always only one doctor who is responsible for the center. And it is the same with NeTkoH. We do it as a regional project, but then there is a neurologist who is "on call", so to speak. And that is in principle also a consultation hour and they also have an MFA who then coordinates it and then is directly switched to the doctor's office when the patient is there so to speak in the presentation and then so to speak the opinion is given to it, because the family doctor does not have the time to call him in again. He can't manage that at all.
85	MACO: I see...
86	MR. DR. ANGERMAIER: That is, it's a little bit of a different setting and ... But we think that it allows us to reach more patients, so to speak. Especially in the outpatient setting, it is pretty important. That's also the view of the Innovation Fund and, by the way, also the AOK, because we also need a health insurance company that participates and provides the data.
87	MARCO: The two projects are also with the AOK. Yes, exactly.
88	MR. DR. ANGERMAIER: There are three other health insurance companies involved in ANNOTeM. With NeTkoH, we could only get the AOK. That has something to do with the application process. Ultimately, it would have been better if we had had a few other health insurance companies, because that now has a bit of an influence on patient recruitment,
89	MARCO: I see. So, the benefits to patients are obvious to me. What are the benefits for you now? Is it more work than if you were working now regularly without telemedicine?
90	MR. DR. ANGERMAIER: Well, the question is, where do you see it? So that always begs the question, from what perspective do you see it? So, there are disadvantages, of course, because telemedicine is not a substitute for the neurologist on site. So that's what

	we see right now in ANNOTeM, that we can't diagnose all things one hundred percent. It doesn't work because we're not there. In the end, we do have to do some things that they cannot do over the channel, so in the area of neuruology certain examination techniques for example...The internist on site cannot do those because he is not a neurologist? We train them, of course, we do, but in the end it's still an internist. That is why it is so important that a neurologist looks at it within 24 hours. But still, because it is time critical, sometimes you have to make decisions about what it is and what it's not. Also, does the patient stay in the hospital or not. And in some individual cases, they cannot do that through this channel, which means it is not an equivalent substitute for the doctor on site. Whether that is an advantage or a disadvantage has to be seen. For the time being, the timely, local care certainly outweighs the disadvantages. That's the big advantage, and the disadvantage is that sometimes you might overlook certain things.
91	MR. DR. ANGERMAIER: You have to look very carefully and if necessary transfer the patient to a neurological clinic. And in general it is like that. So, for the patient…Do the advantages actually outweigh the disadvantages and for the physician it is. Is it so that depending on how the setting is so, so if they so to speak so . Council service so of course they do a lot less administrative work than if they have patients for themselves in the clinic. There they have all the bureaucratic build up which is insane. But that is of course a different area, a different, different relationship, because the patient is of course then in the internist clinic with a urologist and then, if he comes times ran and him in the ambulatory area is, it offers actually only that more net lies, it is actually only advantages, because the two so said. Our project in these 15 minutes they can not diagnose at all. They cannot do that at all. They can formulate so a vague suspicious diagnosis. But that doesn't play such a role in the outpatient area. But that is not enough. It is time-critical. Then it's more a matter of finding an answer at some point and treating the patient. Of course then nevertheless some form, then in the long term time-critical, because of course each diagnosis would have and then those to filter out the critical things and to bring possibly nevertheless faster into the hospital. But so, for the individual patient himself I see there hardly disadvantages.
92	MARCO: It is good, but it is definitely good to know that it actually has a lot of benefits for the patient.
93	MR. DR. ANGERMAIER: And if you will, so that is the. ..... And that is all more location-based telemedicine, so to speak, so there is telemedicine in the hospital and telemedicine in the doctor's office. You can take it even further. That's what we're doing right now, but for various special consultations for certain diseases here at the university medicine, headaches, movement disorders, the like, they have to come here for every appointment. So, we are still involved in a headache consult. You do not have to be. You just talk to the patient once you have seen them. You just talk to them and ask how they're doing. And that's when you fit the patient in. And especially with the new telematics infrastructure coming in. I think that sooner or later we, the patients, will not have to come here anymore, but we will be able to do it via audio-visual communication. The disadvantage and the problem here is again the billing.
94	MARCO: The settlement is not yet recognized.Of course, the point is to get the recognition and that is, of course, just as one-to-one settlement.
95	MR. DR. ANGERMAIER: That is what the DRG system shows because it's outpatient. But still, it's not as well represented, so that's....
96	MARCO: But that is where these studies usually help, right?
97	MR. DR. ANGERMAIER: Yes, it is. That is the first step. But so in that area it is, it is more about how do you set it up? And if they are doing office hours, that does not matter what access it is. That is simply a matter of determination by the GBA also how that is equally remunerated and whether it does not matter whether they sit opposite each other or how we are now connected here via a computer. It's just a different channel and the content is the same.
98	MR. DR. ANGERMAIER: Yes, it is individual, so it is not nationwide. That is why ANNOTeM has such a central role, because it is the first project that has such a central structure, where the three big German health insurance companies are in it, namely AOK, Barmer and Techniker. And when it gets the general recommendation from the GBA, the highest German body, then it is, so to speak, through. Then you can do it everywhere in Germany according to the principle. And that's why there is also a bit of hope from our Telestroke community. ANNOTeM is of course more, but it is of course also organized in the Telestroke community, because so far it is like this, these individual, these 22 Telestroke networks, they have different financing structures. The best financing structure is "Tempis" in Bavaria, but they always do their own thing. The health insurance companies said: "Yes, that is so good. The Bavarian health insurance companies... "That is so good, we will finance it." But it is a regional thing, it is done via additional fees. That is, it is not in the DRG system. The individual hospitals charge the patient and because it was a medical case, we get a little additional payment and this additional payment is paid to the bank centers and with that they finance, so to speak, maintenance costs, personnel costs and similar costs. We have also proposed this. You have to propose a few things in the GBA what we want to have in the future. And yes, there are different opinions about it... The German Hospital Association has also brought something, it is not yet so clear whether this works nationwide. There are various legal concerns and so on, but in Bavaria it works strangely enough. The Bavarians just do it and then there are other networks where the state helps a little bit, supports, so to speak, because the state wants that of course the regional care runs, but then they all get by a little bit. But there is no nationwide financing structure.
99	MARCO: What are the main cost drivers of telemedicine projects?

100	MR. DR. ANGERMAIER: Staff.
101	MARCO: Personnel, mhh ok. What other cost drivers do you see? For example, the purchase of video equipment...
102	MR. DR. ANGERMAIER: So, technology, definitely. Investment costs is clear, but you also cannott underestimate the running costs. We need, of course, behind the technology system...There you also need a provider who will take care of problems very promptly. And that just depends on what your setting is, so to speak. Let uss say with the family practice it's not so bad now. So, for the patient it is not going to work. He has his problem. For months he is very annoying for the household, but there is nothing bad happening. Now in the acute area, where there is then but around acute stroke, prompt treatment, it is then very difficult. But that also means that you need someone who can take care of you immediately. And of course, this has to be rewarded financially and these are also costs that you then have. But the main cost driver is, of course, the provision of medical care and certain other things. So, of course, I can also mention that in the telemedicine networks you not only have telemedicine, that is, doctor-patient or doctor-doctor contact, but you also have a little bit around it. They have to maintain a few things for the stroke area only, so that the DRG requirements are met. So you have to do quality assurance, you have to do quality management, you have to train the people on site and that also causes costs, travel costs, personnel costs, things like that.
103	MARCO: Interesting in any case, which of course then also for a rat tail of costs, that also entails, but of course is also good, because in the end of course it has the patient's welfare in mind.
104	MR. DR. ANGERMAIER: I wanted to mention that for a moment, sorry. So it is not enough to just put a box down. There's somebody sitting on the other side to talk to each other. You also have to be on the ground and see how things are going on the ground and on a regular basis.
105	MARCO: Yes, of course, quality control is also important. Yeah, definitely. Now we have talked about your health sector. Where do you see the strongest potential for telemedicine in general with different health segments or also summarized for you again: Where do you see the strongest potential? And in addition to that, the strongest potential in the entire healthcare sector?
106	MR. DR. ANGERMAIER: Do you mean health segments?
107	MARCO: Exactly so in different areas, whether it is cardiology, radiology is...?
108	MR. DR. ANGERMAIER: Uh, oh, you mean in what disciplines now, right?
109	Yeah.
110	MR. DR. ANGERMAIER: Oh, so in principle everywhere. There is no longer any area where this digitalization is not taking hold. The question is then strongest potentials.... That's difficult to say, because of course I don't have a complete overview of the other disciplines. They are always in their own field...
111	MARCO: But in their own area. Maybe you can have a better overview of where there is more potential?
112	MR. DR. ANGERMAIER: So, in neurology. So, I can first say or the other way around...I can tell you where there is no potential and that is in surgery. Because the question also here, how you define telemedicine, yes. For me, telemedicine is mainly doctor-doctor, doctor-patient contact and with patients, so to speak. If you define telemedicine as a digital robot that helps you operate, it helps, then of course surgery is in there again. It is a question of definition. If you define it in a general way, then everywhere. And if you define telemedicine as doctor-doctor and doctor-patient contact, then surgery is clearly out, because they need direct patient contact on site. But especially in the non-surgical subjects it is meanwhile, especially in radiology, it is absolutely standard. So, with radiologists, let us take the example of the USA. All the Indians, who are also based in India, do radiology for the USA. And there is also the time delay. That means they get the results very quickly. But in Germany it is also like that, by the way also in ANNOTeM, that there are many radiologists on site in the clinics who are responsible. But that does not mean that the radiologists have to sit there on site. They can sit anywhere. For example, the Unfallkrankenhaus Berlin has a huge tele-radiology and supplies at least 50 percent of our network clinics in Brandenburg. So, in the field of radiology, it does not matter where the images are viewed and the images can all be transmitted electronically.
113	MR. DR. ANGERMAIER: Not an issue at all. So, in an analogy, that is standard. And when they talk about clinical application--then also cardiology. There I just say event recorder, so so USB stick implantation into the skin, you can read that remotely. Hundreds of miles away. No problem. And as I said in neurology. All these outpatient consultations, because in neurology they see and have to talk above all. They can do all that with it and also in the area of follow ups. So, if you think in terms of apps, there is also a lot of potential still. Then of course you need someone to look at that app. So, it is like this, when you discharge someone with an acute stroke from the hospital. Then the patient goes to rehab and then he is left to his own devices or to the family doctor. But the family doctor has to do many other things and that means an individual care, stroke specific, does not exist. That means individual also, we call it secondary prophylaxis.... longer term So, again further advice. How does it look? After a year, the blood pressure is well adjusted, is this and this and this..... There is no such thing. And that of course is the ability in these apps to generate that data. And you have to give, of course, on the one hand,

	somebody to look at it. And the jobs have to be created again. You can't do that at a clinic, so easily. But the neurologist in private practice can't do it either. That means that there is already enormous potential.
114	MARCO: But that has not yet been implemented, with help. So, there are such apps can also use as a patient.
115	MR. DR. ANGERMAIER: Well, there are startups. Have also been in contact with a few that want to do that. So for example now area of stroke, which was secondary prophylaxis, because that is also a problem that they are sort of left to their own devices and in other areas I know so similar development. The cool thing about these apps is that they are scalable. Everybody has a smartphone...They make some simple algorithm there, then they have to type something in there and then you can easily generate the data. This goes even further, for example that you can network certain, if you like, certain medical devices, be it a blood pressure monitor or pulse monitor or something like that.
116	MARCO: Great, very interesting. What challenges do you see there? Maybe in implementing telemedicine as well? What are the biggest hurdles?
117	MR. DR. ANGERMAIER: Settlement, acceptance? Um. So, acceptance...
118	MARCO: Acceptance by the patient or acceptance by the medical profession?
119	MR. DR. ANGERMAIER: Um, both. So, the younger, the easier. And um. So let us say so we are a transitional 70+. I see that also in ANNOTeM, there it is difficult, people do not like to talk to the "man from the TV". But that will still take a few years, then that will be gone, because then also the older people are now so to speak with smartphone affinity and the like. But that is still a problem of implementation at the moment. That means that some, some simply cannot communicate well. That is indeed a problem with ANNOTeM, but you always have to build up a triangular relationship with the internist. The internist then has to translate into "quotation marks", so to speak, because the patient then also just looks at the internist and asks where does the voice come from? Such things are it and so data protection aspect. That is of course also always a thing. It is all very complicated, but here... So, there are all ways and means, but that is extremely costly to make that so to speak now data protection regulation compliant. That costs money.
120	MARCO: Yes, I think so. Obviously, that is a lot of work. Um, yes, well, then we come to the last question: How has the use of telemedicine changed before and during Corona? And now also related to a time maybe after Corona: How do you see the telemedicine looking forward?
121	MR. DR. ANGERMAIER: Well, you can say that Corona was such a boost for telemedicine. Basically, for the acceptance and for the application, so acceptance in the population or also in the working world, there has been a lot more video communication than before and that will remain so. There is so to speak also his business area, so to speak times a third or a perhaps to the half of all business trips will fall away. No one will be doing that anymore. Or in the area of the health system, as far as training is concerned... Congresses will probably only run hybrid. It's also maybe a negative development again. That is too much on-line is, must it nevertheless times again somewhere to drive and the whole time... One sits yes already the whole time before the PC and now then again in the congress, again before the PC sits... At some point it' i enough.
122	MARCO: The human contact is then of course there sometimes also nice.
123	MR. DR. ANGERMAIER: And therefore, we already notice that the telemedicine application, that is, the demand for it is also increasing the projects that are running in this regard and the future regarding telemedicine is rosy. Of course, with the advantages and disadvantages... You always have to look, related to each question, what you want to achieve with the thought: "There is no doctor on site now."
124	MARCO: Yes, very nice. Then we would also be at the end of our interview. Thank you very much for your time, Dr. Angermaier.
125	MR. DR. ANGERMAIER: It was a pleasure to meet you. Goodbye.

V. Interview transcript with Prof. Dr. med. Hans Jörgen Grabe

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#	MARCO: Hello Prof. Dr. Grabe. Thank you very much for your time today. I would like you to briefly introduce yourself, i.e. your career, your professional experience, your current position.
1	MR. PROF. DR. GRABE: My name is Hans Grabe. I am 55 years old and a specialist in psychiatry and psychotherapy. I am the director of the clinic at the University of Greifswald and work on an outpatient, day clinic and inpatient basis and I am pleased to be your interview partner on the subject of telemedicine.
2	MARCO: Then I would also jump right into the questions, if that iss okay with you.
3	MR. PROF. DR. GRABE: Yes, absolutely.
4	MR. PROF. DR. GRABE: Perfect. Then to the first question, in what areas are you currently using telemedicine and what is the background of why you are using telemedicine this area? (Question 1)
5	MR. PROF. DR. GRABE: Well, we have been using telemedicine here in care for 10 years now, in the outpatient department, that is, the psychiatric institutional outpatient department. And we do that for many reasons. On the one hand, Mecklenburg-

	Vorpommern is a large area and there are patients who have a very long way to travel and who at some point can really no longer afford to come, at least not in high frequency. And it is of course then also a high consumption of personnel resources, if one always comes here to the specialist physicians or psychological psychotherapists in a high-frequency, which sometimes makes totally sense. That is quite clear. Especially, if one goes in principle rather in the direction of a quite concrete psychotherapeutic question. But for many patients who come to our outpatient clinic, it is also about regular care. It is about bonding, it is about daily feedback from "every days problems" for example. It is about setting up or implementing activation plans with the patients via telemedicine. It is about actually implementing measures that have been developed by doctors or psychotherapists in telemedical care. Something like exposure or something like that. So that means that in telemedicine, as you have already heard a little bit, we actually use telemedicine nurses who essentially then do this with the patients, so not academics, but nurses, but who build on regular doctor-patient contacts, which then take place at least once a quarter.
6	MARCO: That means these nurses get advanced training and then they are trained to become the telemedicine experts. Is that right?
7	MR. PROF. DR. GRABE: That is one way to think of it. So, the nurses have been psychiatrically experienced. We trained them and they have been with us for many years now. And they have a lot of experience in the management of mentally ill people and also in the implementation of the therapeutically developed concepts. So that is going quite well. Of course, there are not hundreds of patients in this outpatient telemedicine program. That is just under 50 per quarter.
8	MARCO: And compared to how many patients? How many patients do you have per quarter on average? (Question 3)
9	MR. PROF. DR. GRABE: I cannot tell you that at all, it is a couple hundred. So, I… I really do not know.
10	MARCO: Can you say roughly that it is maybe 10 percent, 20 percent? So a rough estimate...?
11	MR. PROF. DR. GRABE: Yeah, maybe 10 percent.
12	MR. PROF. DR. GRABE: Okay. Um, and in the other, so in the other 90% or 80%, whatever how many there are, why is not telemedicine used there?
13	MR. PROF. DR. GRABE: Well, these are patients who come to the regular doctor once a week or once a month via the psychotherapist contact, and one has to say that this everyday accompaniment is not so necessary. Of course, we now have Corona and that is the second topic. We have also implemented therapist contacts by telephone and telemedicine via Corona when there were contact blocks and so on. But that is something that really has to be said. That is something that is actually reluctantly done. So that is definitely only the second best option. If you want to keep a one-hour therapist contact over telemed or over the phone.... Neither the therapists nor the patients want that. That can happen from time to time, that maybe every third or fourth appointment is done via telemedicine, but... Our experience is that the direct patient contact is desired by both sides. You can react to other signals, you get other signals at all, which you can't receive on the screen at all. You have other ways of responding to a patient, even non-verbally. And we had the possibility, we completely equipped ourselves. We now had various laptops here with a complete online program... At the moment when presence was possible again, that went down massively. You have to say that. There is the use in the psychotherapeutic context, which is then not so welcome and we have in principle also first conversations. Also if now someone has presented itself emergency-like in Corona times, also at that time, we have said, we want to do that only in presence. In exceptional cases, when there was no other way, we also did it via Zoom. But look, you have to be able to judge so many categories. You have to be able to discuss so many subtle things with the patient. That is limited at some point on the screen.
14	MARCO: But does not it, does not it maybe take away the hurdle of a patient coming to you? If he is coming through telemedicine, so now as a first contact conversation because maybe he is afraid to go to the doctor? Or is it kind of or how do you see that? Do you see there the personal contact rather more sensible, because as I said you can evaluate more facial expressions and gestures and keep the overall view?
15	MR. PROF. DR. GRABE: So, let us say with the masks, of course, it was or of course, it is also totally silly. It is really important because sometimes you actually do not understand the patient emotionally. You only hear the spoken word, but you do not understand the emotional accompanying tone. So even if we are professionals, if we see the eyes, if we perceive and assess the undertone in the voice. There are always cases where we can only guess a little without facial expressions. That's difficult. And that is the gold standard, it has to be said. And even "shake hands", greeting with a handshake, is important because they sense how he's squeezing, is he sweaty, is he shaky, is he obviously nervous? And anyway...Those are things like that, that then either fits the overall picture or contrasts the overall picture. So, you make an overall impression out of many, many puzzles, which then also becomes therapy-guiding. What you said about the inhibition threshold dropping...That is of course conceivable. It is clearly conceivable. But the question again is how realistic is that really? So, if someone really notices that he has a mental problem, that he is in some kind of mental distress, then... Then of course the decisive step is to really confide in someone and to develop trust. So, talking to a screen is not really what this is about....
16	Yeah, that's right.
17	MR. PROF. DR. GRABE: Yes, I mean, whether you watch the whole movie and turn off the sound and just talk to the screen or not. So, this personal component is also part of the therapy effect.
18	MARCO: Let us move on to the next question and patient acceptance of telemedicine. So those who use it, of course they accept it, but what is the acceptance of their patients in general towards telemedicine. Could you comment on that? (Question 4)
19	MR. PROF. DR. GRABE: Well, we do not have all patients in telemedicine or in projects now. But the ones that are in, of course, they accept it. That iss sort of this, this circular conclusion. On the other hand, I have to say that there are very few who reject it in the first step. Especially when it comes to the continuation of treatment via telemedicine after inpatient treatment, very many agree. Okay, back then in the study that we also conducted in 2010, it has to be said that we asked virtually everyone. And the approval

	rate back then was over 90 percent. Now, of course, we only ask those patients who we think it makes sense. So, of course we select. This is not a truly representative survey, but we are addressing patients who we know need continuous support after inpatient or day-care treatment, and they don't have it. Without telemedicine they wouldn't have it, because we can't offer them appointments, we can't offer them such high frequency in the outpatient clinic with the therapist...And also otherwise in the established area there are no possibilities to map that. Not in the frequency, not so fast, maybe in six to nine months, but then only in the context of a psychotherapy. So, the patients we approach, we assume that they will benefit from it. And that is what we sell to them, so that they benefit from it. And usually they say: "Yes, great, I'll do it." Whereas this form of telemedicine is actually done by telephone.
20	MARCO: About the study you mentioned. That was done in 2010. Can you maybe briefly cover what the result of the study was, what you found out?
21	MR. PROF. DR. GRABE: Yes, these were patients of the day clinic, whom we offered quasi consecutively, that is, to all of them after the end of the day-clinical treatment to come into a telemedical, six-month follow-up observation. At that time we really did intervention versus "treatment as usual", so basically nothing from our side. And that was very interesting to see. We had about 120 patients, that there was a further improvement of symptoms. That has to be said... Actually, we would have assumed in the best case that the symptom reduction would be maintained by the day clinic treatment. But there was even a further reduction in symptoms in the intervention lead group. This is not dramatic, but it has shown that there are obviously really tangible therapy effects over six months, because in the opposite case without therapy it is often the case that patients deteriorate again.
22	MARCO : Wow, great. Interesting. Of course, also a great success for telemedicine. What advantages and disadvantages do you see in the use of telemedicine? Once for yourself, but also for the patient. (Question 5)
23	MR. PROF. DR. GRABE: Well, the advantages are, of course, the quick availability. So, you can immediately establish the therapeutic contact, you can bridge large distances in the federal state, you can also sometimes on vacation, so if the patient would be on vacation or somewhere else, you can also perform telemedicine well. Many are simply not able to come to Greifswald so often, as I already said for financial reasons, in order to really get into contact "face-to-face". And many people do not need intensive psychotherapy, which has already taken place, which has already run its course, which has already expired, but it is more a matter of life support over a longer period of time. And of course telemedicine can deliver and offer that excellently...That is really good. Of course, it only works according to the concept if there is no highly paid therapist at the other end of the line, but a nurse who is simply much cheaper. But that is enough. And of course there is also the backup possibility to be present very quickly for emergencies or crises, to order the patient in very quickly and to care for him on site. That is also something that we can make excellent use of. We do a lot of it by phone and not by video, because well, video... That is a discussion in itself. Of course you see the other person, but you also have to present yourself as a patient. That means you have to put on make-up somehow, to get dressed. You show the other...
24	MARCO: Maybe also shame partly from patients?
25	MR. PROF. DR. GRABE: You say it. Shame, the apartment, the background, then children run through the picture and the children, I do not know, are maybe not dressed or I do not know...So, of course, you give glimpses into your own four walls, which are sometimes actually shameful or unwanted. That's why it is good to have a phone. It also works outside the home. The disadvantage is, of course, that you only get a narrow spectrum of the patient, which is why the real psychotherapists do not really like it as a permanent measure. And I think the patients do not like it in the sense of a real psychotherapy either. It has a different character, how we use telemedicine. Nevertheless, you can of course also do psychotherapy via Zoom, for example, or other methods. That is also possible, of course. But it. Yes, I think you do not get some things. And that is the problem. I could imagine that you only reach a certain clientele of patients and that means that you are of course highly selective and the ones you reach, you wouldn't know what it would be like if you saw them face-to-face. That is difficult
26	MARCO: Can you say there is a certain group that are certain characteristics on the people that use telemedicine with them and for example it is partly younger people or can you kind of make a statement there?
27	MR. PROF. DR. GRABE: Well, no.
28	MARCO: So it's all over the place?
29	MR. PROF. DR. GRABE: Yes, in Corona it was across the board, because there we have now, so to speak, for some, that is, in a few months we have made it a little bit area-wide. There we went almost completely to video consultation. But otherwise in the routine operation it is rather the chronic ill patients where we have to say: "Even an intensive psychotherapy of 20, 30, 40 hours does not help substantially anymore, because they already have all that. That does not work. They now need another form of care and that is where it is extremely good." Or there are really patients who were briefly inpatients/partial inpatients, where we say that there is a high chance of recovery, which we then secure a bit more with such telemedical measures. The last group is not very large, but of course it also exists.
30	MARCO: So you are saying basically for long-term care of patients who have already done therapies and for transitional outpatient care. Those are so the two areas of use?
31	MR. PROF. DR. GRABE: Exactly. Exactly, you can say that.
32	MARCO: Exactly, all right. Um, what about the profitability of telemedicine? Is a telemedicine project, whether it takes place by telephone, video or in any other form, honoured or subsidised by the health insurance companies or the health system in general? (Question 6)
33	MR. PROF. DR. GRABE: Um, well, in the meantime, this requirement for remote treatment has been dropped, so to speak. So that was a big problem for a long time because the insurance companies simply did not accept that you could also hold a kind of video

	consultation, so to speak. So, they simply thought: "No, that is not medical treatment. So therefore, forget it." That does not exist anymore and...to what extent doctors in other specialties can now also cancel that high frequency, I cannot say off the top of my head right now. So, there are natural limits, of course. Sometimes you really have to physically examine the patient. In dermatology you can of course also exchange pictures, that is also possible, but that is it then...There are just certain limits. Of course, there are limits. Otherwise, of course, you can use it. In our case we do it via the psychiatric outpatient department and there you have to say that we simply charge these nurse services as we provide them, whether it is "face-to-face" or telemedicine, we simply do it that way and I say that the insurance companies accept it.
34	MARCO: Does it make a difference for the nurse in terms of time, whether she basically does it on site or online? Is there a time saving or does it take longer?
35	MR. PROF. DR. GRABE: No, it does not make any difference. So the range of the conversations is between 10 minutes and 60 minutes and that just varies from patient to patient. This Psychiatric Institute Outpatient Clinic, that would even allow us to have outreach help. The nurse could get in the car and drive there. But I mean, you can imagine, that's an immense cost.
36	MARCO: Yeah, that does not make any sense.
37	MR. PROF. DR. GRABE: 60 kilometers there and 60 kilometers back and the time and a patient seen, that is already in economical terms speaking for telemedicine unbeatable there. That is sheer madness.
38	MARCO: What are the costs of the telemedicine project and how do you use it? (Question 6)
39	MR. PROF. DR. GRABE: Well, we do not incur any costs, so we just incur revenue from the nurses' service numbers. But that is also really limited income. You have to say that the times are calculated on a minute basis, so to speak.... Um yes, I do not know... Half an hour of nurse service costs, I would have to check, maybe no idea 15 euros or something or 20 euros.
40	MARCO: I see. But it does of course reduce the shortage of subject matter experts like you for example. So, you are of course highly educated and there are of course not so many, it is of course also a long way to get there and accordingly it helps of course to supply the broad masses better.
41	MR. PROF. DR. GRABE: It is exactly as you say. Yes, so obviously we have to think carefully about who gets it? So it is not for everybody. Definitely not. But if we associate it well, I think it is extremely efficient. And we also have patients, some of them in years of care, who simply accept it well. And we can already say that they used to be in partial inpatient treatment more often than today.
42	MARCO: So that saves costs then, too. That is right.
43	MR. PROF. DR. GRABE: We have collected the data in detail, but we have not evaluated it yet. But I would even say, in part, it leads to a halving of the long-term hospitalization rates. So that's just a gut estimate, because the concept is more coherent, the patients are not idling or free-running for months, but are in telemedicine on a weekly basis, so to speak. And then they have once a year, they do day clinic again, but then that is all focused, that is all planned. It is all embedded with pre and post treatment. That's already...I think that's already really efficient.
44	MARCO: But you would definitely say that in principle the telemedicine project reduces the duration of inpatient treatment and therefore also saves costs for the health care system?
45	MR. PROF. DR. GRABE: We actually have to evaluate the data again. So, for the time being it is just a gut feeling on my part. But there are patients who used to come several times a year and now they only come every one or two years and they are not so sick anymore. So that probably has an extremely positive effect on some of them, I really have to say.
46	MARCO: Great, that is a very positive side effect, of course, for you and the patient. Interesting. Um, how do you see that in other health care segments? To question 7.1 where do you see the potential now, outside your world? Um, in which other areas, now looking out and into the future? Where do you see even greater potential for telemedicine in other areas?
47	MR. PROF. DR. GRABE: Um, well, maybe my imagination is a little bit limited, but what I can already see, for example, in radiology, is that there are CT and MRI devices in many places where there is no radiologist at night and then these findings are transmitted to a center at night and then they are evaluated centrally, so to speak, and played back. So, this is already a very practicable measure, which really helps to ensure emergency care in smaller hospitals. Then we also have a Neuro-Council here at the university, also a Stroke Council, which means that one goes to the patient with the tablet and then also carries out the corresponding examinations. And the neurologist at the other end of the line is sitting in the university and can then, to a certain extent, make an assessment of the whole case somewhere in the country. So, these are applications that are completely good. Of course, it is important that there are experienced people at the other end of the line. So, I would be a bit afraid if there were real telemedicine centers, like call centers.
48	MARCO: Call centers. Of course, that can lower the quality of care.
49	MR. PROF. DR. GRABE: Mhh yes, so at least one has to fear that. These could be then such small profit centers. Everybody sits there and has to carry out so and so many conversations and so and so many interventions per day. I cannott imagine that a doctor, even if he is experienced, only does telemedicine for years or decades, that cannot be like that, he has to have a practice, he has to have the patients, he has to have the experience, he has to learn. And if he then does 10 or 20 percent of his consultation hours telemedically, it is somehow not the problem. But if they then just sit all day and then maybe work from home and so on. So, I would be a bit afraid of that. Because I think that destroys the doctor-patient relationship, that destroys the whole cooperation, that does not really build up trust. And the clinical pictures are partly very complex and you have to say very, very early: "Ok, then go to the outpatient doctor or whatever".
50	MARCO: So, would you say in principle telemedicine always only as a supplement, but never really 100 percent as a replacement of a medical service?

51	MR. PROF. DR. GRABE: Well, that would be, that would actually be my plea that you say that you always embed the medical service in the context of regular health care and do not build it up in such a form of a parallel world. Because in this parallel world, let's face it, there is a lot of money at stake. And if it is somehow worthwhile, if some people who have a lot of money, who want to invest a lot, who somehow notice that this is a business, that you can make money with it, then money is pumped in and then something is created that somehow works and then you have a lobby group. And this lobby group, it influences politics. And the politicians say, well, if you are so important, if you are doing such a great job and if you have such great proof of effectiveness, then we will do it that way. Yes, Lord, it is no witchcraft to get it right. And I would be a bit careful... Yes, because, in other words: "How high must the hurdle be for the patient to come to the doctor at all? So, at some point the telemedicine doctor has to give him permission for that?" So, what kind of style can this take in a medical market that really has very limited resources? And so, I actually think the German system, that we make it person-related, is still totally good. I think that is also what I would expect from medicine. And that is also what I teach our students here, that interaction is the goal and success of every treatment.
52	MARCO: What challenges do you see in the implementation of telemedicine replaced? (Question 7.2) You have been doing this for over ten years....
53	MR. PROF. DR. GRABE: It is, of course, the technical requirements that have to be met. So, telephone works quite well. Yes, the data network. I mean, the data network should be so good that it really delivers reliable data in every corner of the republic, that is, also delivers good image data. We are on the way there, but of course we are still a long way from where we want to be. And there should also be good models for the entire data infrastructure, in terms of patient safety, so that everyone doesn't have to think for themselves: "Well, how can I guarantee the patient's data protection? But that is simply such a...
54	MARCO: A secure system with peer-to-peer connections.
55	MR. PROF. DR. GRABE: Yes, that there is such a medical IT world where every doctor can log in. You are in that thing and you can basically reach patients through that system or other clinics. Um yeah, that you just do not, you do not always have to worry about that from zero to a hundred. Yes, that....but okay, I think there are a lot of smart people working on this, who are digging through the paragraph jungle in Germany and trying to generate technical possibilities. I think the Germans are, how shall I say it, sometimes a bit handicapped by their perfectionism.
56	MARCO: Right, that American culture maybe a little bit different, for example, that you are just more likely to try things out.
57	MR. PROF. DR. GRABE: Yes, that is right. So, privacy is given such a big space in some places because then they are placed in places where they are deciding yes and no. And that cannot be the case at all. It cannot be that way. A state data protection officer must not have such a right of veto, so to speak. Data protection was originally intended to protect big tech companies. And it's so absurd that on the one hand everyone is on Facebook, WhatsApp, Google and elsewhere... And then the doctors and scientists really have to walk over broken glass and through the Siberian cold to somehow be able to do a project because of data protection. You cannot imagine some of that. There are things that no longer take place at all, because data protection is no longer manageable. And that is absurd. These are stylistic blossoms that do not promote progress.
58	MARCO: Alright, then we come to the last question and that is about the use of telemedicine before and during Corona (question 7.3). Did that change anything for you and how do you see the future of telemedicine in a post-Corona era?
59	MR. PROF. DR. GRABE: Well, Corona has certainly promoted that and also the health insurance companies have then actually also written to us that the therapy type it can be carried out and billed via videoconferencing system, there even the insurance companies have made a big step forward, which this vote, that is fortunately not forever...So that is now also again not so that we are allowed to do that permanently. That was only then under the lockdown conditions, but I think then we need much more freedom. The doctor really has to be able to decide what is the adequate option and that is then left to the doctor and he then bills it the way he thinks it is right. And if the, yes, for example, established doctor does that, which of course in brackets also "must manage economically", but behind which is not a large profit company, then I would say that it is his responsibility that it is covered by the Hippocratic oath, that he does it the way he thinks is best for his patients. Yes, I think that is totally fine. We have made a lot of progress in the direction of digitalization, of course, through Corona, and that is given the whole industry a total boost. And of course, there will be less of it without the lockdown, but some developments can't be reversed and that's also really good in part, when useless, stupid patient presentations, which are associated with a lot of waiting times, a lot of effort, when you can then process them within 5 minutes telemedically. That is a win-win situation for everyone, it really saves resources.
60	MARCO: Yes, then we are already at the end of the interview, unless you want to say anything else that comes to your mind about telemedicine that's important to you. Otherwise, um, yes, thank you very much for your time.
61	MR. PROF. DR. GRABE: With pleasure. One more addition, then, where we talked about this data set of this ongoing telemedicine treatment. We do have it. And it is really very interesting. So, if you want to do a scientific paper sometime, it would be really interesting to compare these patients, also on the basis of the health insurance data with other patients. So how often are they in treatment? What other treatments have they received? And do they actually differ from the reference sample of similar patients in their cost and utilization behavior? These are things that could be found out. So, we have all, all patients of course then always logged. They are constantly in the system, they can be easily identified. That would be a story. So just for the future.
62	MARCO: Yeah, that is great. That is directly already something for the end of my master's thesis, the outlook. What are some more future research areas and that is perfect.... Absolutely, you have already helped me tremendously there. Absolutely.
63	MR. PROF. DR. GRABE: All right. Good.
64	MARCO: Thank you very much, have a nice day and see you soon. Thank you.
65	MR. PROF. DR. GRABE: Yes, no problem. Bye-bye. Good luck and bye.