

Telehealth in German nursing homes: Incentives, challenges and requirements for providers to adopt telehealth solutions

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ABSTRACT

Title: Telehealth in German nursing homes: Incentives, challenges and requirements for providers to adopt telehealth solutions

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The German healthcare system is facing significant challenges including demographic changes and medical staff shortages. Telehealth holds the potential to address these issues, enabling access to high-quality healthcare. This study investigates the current status of telehealth solutions in German nursing homes, contrasting incentives for adoption with potential barriers, and evaluating the requirements of various stakeholder groups for the future success of such solutions. The methodology included the use of semi-structured interviews with nursing home environment representatives.

The results indicate that while nursing homes recognize the benefits of telehealth, including improved quality of care and reduced hospital transfers, barriers like non-reimbursable costs, lack of IT infrastructure, and regulatory uncertainty persist. Attractive solutions require simple implementation, transparent reimbursement schemes, and seamless interoperability with other healthcare information systems.

To drive adoption, policymakers must provide financial incentives and update regulations, while technology providers should engage closely with nursing homes to develop tailored solutions. Policymakers, technology providers, and nursing homes must work together in a multilateral approach to develop practical solutions that address the specific challenges and workflows of German nursing homes. This study contributes to a nuanced understanding of stakeholder perspectives on telehealth in German nursing homes and recommends policy reforms and cooperative development of practical solutions to realize the potential benefits of telehealth.

Keywords: Computers, Telehealth, Nursing Home, Healthcare system, Implementation

JEL Classification: I110 Analysis of Health Care Markets; I180 Health: Government Policy; Regulation; Public Health; O330 Technological Change: Choices and Consequences; Diffusion Processes

SUMÁRIO

Título: A telessaúde nos lares de idosos alemães: Incentivos, desafios e requisitos para os prestadores adotarem soluções de telessaúde

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O sistema de saúde alemão enfrenta desafios significativos, incluindo alterações demográficas e escassez de pessoal médico. A telessaúde pode mitigar estes desafios, permitindo o acesso a cuidados de saúde de elevada qualidade. Este estudo investiga a situação atual das soluções de telessaúde nos lares de idosos alemães, olhando para os incentivos, barreiras e requisitos para a adoção destas soluções. A metodologia incluiu a realização de entrevistas semi-estruturadas com diferentes representantes de lares de idosos.

Embora os entrevistados reconheçam os benefícios da telessaúde persistem barreiras como os custos não reembolsáveis, a falta de infra-estruturas e a incerteza regulamentar. Exige-se uma implementação simples, esquemas de reembolso transparentes e interoperabilidade com outros sistemas de informação da saúde.

Para impulsionar a adoção, incentivos financeiros e atualização da regulamentação são importantes, assim como a co-criação de soluções entre fornecedores de tecnologia e os lares de idosos. Todos os envolvidos devem trabalhar em conjunto numa abordagem multilateral para desenvolver soluções práticas que respondam aos desafios e fluxos de trabalho específicos dos lares de idosos alemães. Este estudo contribui para uma compreensão matizada das perspectivas das partes interessadas sobre a telessaúde e recomenda políticas adequadas e o desenvolvimento cooperativo das soluções para concretizar os potenciais benefícios da telessaúde.

Palavras-chave: Cuidados de saúde, Tecnologia, Tele-saúde, Lar de idosos

Classificação JEL: I110 Análise dos Mercados de Cuidados de Saúde; I180 Saúde: Política Governamental; Regulação; Saúde Pública; O330 Mudança Tecnológica: Escolhas e Consequências; Processos de Difusão

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LIST OF ABBREVIATIONS

BÄK	Bundesärztekammer (Federal Medical Association)
BMG	Bundesministerium für Gesundheit (Federal Ministry of Health)
DoI	Diffusion of Innovation
DSF	Dynamic Sustainability Framework
G-BA	Gemeinsamer Bundesausschuss (Joint Federal Committee)
GDP	Gross Domestic Product
GKV	Gesetzliche Krankenversicherung (Statutory Health Insurance)
GP	General Practitioner
PKV	Private Krankenversicherung (Private Health Insurance)
RE-AIM	Reach, Effectiveness, Adoption, Implementation, Maintenance
RPM	Remote Patient Monitoring
SGB	Sozialgesetzbuch (Social Security Code)
TAM	Technology Acceptance Model
TSIM	Telehealth Service Implementation Model
UTAUT	Unified Theory of Acceptance and Use of Technology
WHO	World Health Organization

1. Introduction

The German healthcare system is facing mounting pressures due to demographic changes and increasing prevalence of chronic diseases. One key factor contributing to the country's increasingly challenging healthcare environment is its aging population, with over 22% of the country's population aged 65 and above in 2022 (Statista, 2023). Yet, it is not only the population becoming older that poses a problem, but rather a similarly strong increase of people in need of geriatric care, often with multimorbid disease patterns (Bohnet-Joschko & Stahl, 2019). Adding to this growing issue for people in need of care is a structural lack of physicians, particularly concerning general practitioners (GPs) and specialist doctors in more rural areas of Germany, which contributes to the risk of limited access to adequate medical care (Kleina et al., 2017). Growing demand for professional elderly care, coupled with a growing shortage of physicians as well as caregivers and subsequently decreasing quality of care for the individual patient: In combination, these factors pose a particularly challenging environment for providers of nursing care (Ohligs et al., 2020), and a diverse mix of potential solutions will be necessary to combat this brewing storm (Valk-Draad & Bohnet-Joschko, 2023).

The digital landscape is evolving rapidly with transformational effects on many industries. The healthcare sector is no exception. Broadly defined as the delivery of healthcare services by using telecommunication devices and technologies remotely, telehealth promises to further transform how healthcare is delivered (Dávalos et al., 2009). This potential becomes a particularly crucial factor in healthcare systems which are facing an increasing number of challenges, such as the German health system which this study focuses on. Emerging as part of a potential solution could be the deployment of innovative telehealth solutions in German nursing homes (May et al., 2021). The use of telemedicine in nursing homes has gained significant attention in recent years, particularly in the context of the COVID-19 pandemic (Ford II et al., 2022). The aim of this study to investigate the current status of telehealth solutions in Germany and to contrast incentives to adopt these solutions with potential barriers, as well as to evaluate the requirements of various stakeholder groups for the future success of such solutions.

1.1. Research questions

The thesis addresses the following research questions:

RQ1: What is the current level of utilization of telehealth solutions in German nursing homes?

What is the *status quo* in German nursing homes concerning the use of telehealth solutions? It discusses whether telehealth has already been implemented into the daily operations of nursing homes and whether the deployment of such solutions is already on the technological roadmap.

RQ2: What are economic as well as operational incentives and barriers for German nursing homes to invest in and deploy telehealth solutions?

Exploring possible incentives for nursing home providers to deploy telehealth solutions in their facilities. Both medical/operational and economic incentives will be examined and put into the context of the German care market and its intricacies pertaining to a structural lack of physicians and caregivers, especially in rural areas, and the growing geriatric population. Further, exploring potential barriers will provide valuable insights into current limitations for widespread telehealth adoption.

RQ3: What are characteristics which make telehealth solutions attractive for German nursing home providers?

The third and final research question will assess the specific needs of German nursing home providers towards an ideal telehealth solution and identify gaps from currently available applications. Based on past, current, and future challenges, as well as on possible prior experiences with telehealth solutions, this research question aims to provide insights into the actual needs of the care sector which may provide fruitful information for technology providers and policymakers alike.

1.2. Structure

Having introduced the topic, aim, relevance, and background of the study in chapter 1, chapter 2 reviews literature on telehealth and its applications, the German healthcare system with a

focus on nursing homes, and telehealth adoption incentives and barriers. Chapter 3 outlines the research methodology, detailing data collection and analysis approaches. Chapter 4 presents the interview results structured around the outlined research questions. Key insights relevant to the study objectives are emphasized. Chapter 5 contrasts the findings with existing literature, analyzing similarities and differences. Explanations for overlaps and discrepancies are provided and implications discussed. Finally, the second part of chapter 5 concludes by highlighting main takeaways, implications, limitations, and future research avenues in telehealth for German nursing homes.

2. Background

2.1. Telehealth

2.1.1. Definitions of telehealth

The term telehealth, often inaccurately used synonymously with telemedicine, can be defined as the “delivery of healthcare and sharing of medical knowledge” over a physical distance between the provider of healthcare and the patient, utilizing telecommunication systems (Thrall and Boland, 1998). There is no clear demarcation between digital health, telehealth eHealth and telemedicine in many publications; they are often used interchangeably when they in fact should not be (Bashshur et al., 2011). The term telemedicine is used in a narrower fashion and focuses on the delivery of clinical care and the interaction between the different actors in the healthcare system (Sood et al., 2007). Telehealth, on the other hand, encompasses a wider range of health-related activities beyond direct patient care, including education, research, and administration, and aims to improve health outcomes through enhanced access to information, services, and expertise. Telemedicine can therefore be defined as a subset of telemedicine (Sood et al., 2007). The term telematics, which is also often referred to in telehealth-related literature, is a combination of "telecommunications" and "informatics." Telematics connects different IT systems and enables the exchange of information from different data sources in a closed network, for instance among two or more physicians (Leyck Dieken, 2021, p.364).

In the context of Germany, the Federal Ministry of Health (Bundesministerium für Gesundheit, BMG) describes eHealth, which can be used synonymously to digital health and presents an umbrella term for both telehealth and telemedicine as follows: "eHealth is the application of information technology (IT) systems to process health data" (BMG, 2023a). To illustrate the complexity of the terminology, there are even discrepancies between what the World Health Organization (WHO) and the German Federal Medical Association (Bundesärztekammer, BÄK) label as telemedicine. The BÄK considers telemedicine as a collective term for medical care concepts that enable medical services in the areas of diagnostics, therapy, rehabilitation, and decision-making advice across physical distances or time delays, using information and communication technologies (Beckers and Marx, 2021, pp. 5-6). In contrast, the World Health Organization (WHO) already in 1998 looked at telemedicine as a form of care that encompasses

all healthcare professionals and uses information and communication technologies to exchange valid information for diagnosis, treatment, prevention, research, evaluation, and continuing education (WHO, 1998). In this context, the distance between healthcare providers and patients plays a critical role. A compromise between these two definitions could describe telemedicine as care supported by information and communication technologies, making the principle of presence in service delivery dispensable and allowing for location-independent care design (Ilin et al., 2019).

This study will subsequently focus on telehealth due to its broader application areas and use cases. To clarify the relationships between the definitions, Figure 1 provides an overview of the above terminology.

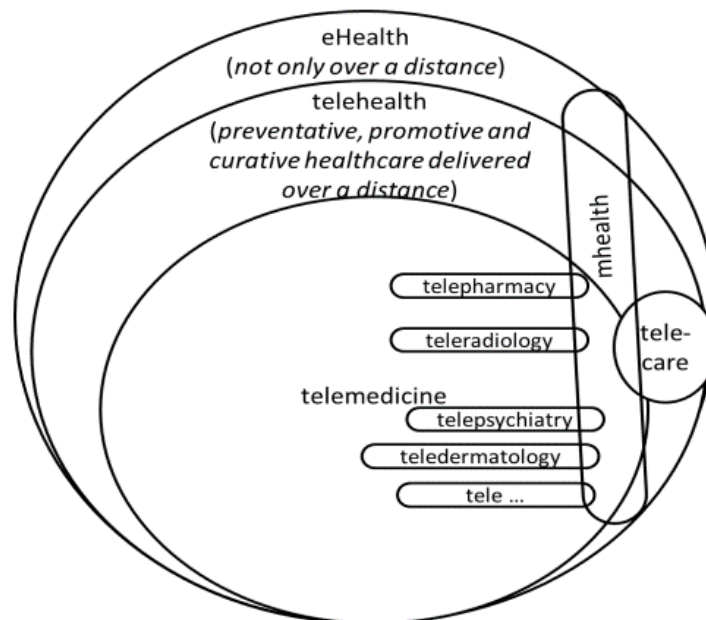


Figure 1: eHealth, telehealth, telemedicine and subsets (van Dyk, 2014)

2.1.2. History of telehealth

Before the emergence of telehealth applications, the delivery of healthcare in the form of diagnostics and therapy was bound to the physician and the patient being in the exact physical location, enabling the physician to perform a physical examination of the patient, establishing a personal relationship with the patient, and using the appropriate medical devices (Iida & Nishigori, 2016). On the other hand, telemedicine transcends these basic principles of

traditional healthcare delivery even etymologically, as the term can literally be translated from its Greek origin into “treatment from afar” or “remote treatment.” Telehealth applications can therefore be defined as using telecommunications technology, which enables the physician to provide healthcare to a patient who is not physically present, thereby overcoming the traditional principle of presence in the physician-patient relationship (Beckers and Marx, 2021, p.4).

When examining the broader context of delivering medical care over a physical distance between the provider and the patient, the first technological advancements can be traced back to as early as 1897, when a diagnosis was carried out via telephone (Elnicki et al., 2000). There are several other instances in which, at the time, state-of-the-art technology was utilized to facilitate various forms of medical service delivery, for instance, the electrocardiogram being transmitted via telegraph in 1906 (Barold, 2003), the utilization of radio equipment to facilitate the remote communication with sailors in the 1930s, or the first attempts in the transmission of radiographic imagery via fax in the 19050s (Ryu, 2010). These examples are not exhaustive; however, they should illustrate that advancements in providing medical services have existed long before the emergence of modern-day telehealth programs.

By reviewing this selection of early technological advancements in delivering medical care, it becomes clear that medical scholars were eager to adopt emerging technologies for medical purposes throughout the past century. However, due to a set of limiting factors such as high equipment cost and relatively low quality of transmission, widespread adoption of telehealth applications remained low well into the 21st century (Dávalos et al., 2009). Therefore, most telemedicine applications remained conceptually promising lighthouse projects with little applicability into mainstream medicine, primarily due to technical limitations (Cason, 2014). A rapidly evolving technological landscape (Tulu et al., 2007), including the emergence of omnipresent high-speed satellite communication, low-cost and high-performance computing, and unseen mobile capabilities have since changed the antecedents for the development of advanced telehealth solutions (Beckers and Marx, 2021, p.4).

2.1.3. Areas of telehealth application

Providing and improving access to healthcare, in addition to using medical resources in a more efficient way, are among the main goals of telehealth. These goals are achieved through a broad

range of telehealth applications, spanning the medical areas of prevention, diagnosis, therapy, rehabilitation, and nursing care (Bashshur et al., 2014). Beckers and Marx (2021, p.8) note that technological, conceptual and health economics related factors had an influence on their categorization of telehealth into three core areas of application: telecooperation, teletherapy, and telemonitoring. Citing the enablement of better healthcare choices, higher emergency service performance and reduced diagnosis time, Haleem et al. (2021) consider online patient consultations, remote patient monitoring, telehealth nursing as well as remote psychiatry rehabilitation to be the core use cases within the telehealth spectrum.

Telemonitoring, an important aspect of chronic disease management and often referred to as remote patient monitoring (RPM) (Grundmann, 2019), allows wearable devices to record health data and transmit it in real time to healthcare professionals to improve disease management and preventive care (Beckers & Marx, 2021, p.4). Other applications of telehealth include interdisciplinary teleconsultations, which facilitate the integration of expert opinions from various specialists, providing particular value in the case of multimorbid patients (Schröder et al., 2020); teleconferencing, where examination data or therapy regimens can be assessed simultaneously by experts in different locations (Cason, 2014) and teletherapy, commonly referred to as video consultations, which uses videoconferencing technology for remote treatment without the physical presence of the physician and often requires additional equipment on the patient's side (Beckers & Marx, 2021, p.4). In addition, telehealth includes telesurgery, which uses robotic technology and wireless infrastructure to allow surgeons to operate on patients remotely (Contreras et al., 2020); and teletraining, which supports healthcare professionals to participate in training and education regardless of their physical location (Feizi et al., 2021).

These diverse applications of telehealth are changing how patients interact with healthcare professionals and expanding the benefits of remote health assessments, diagnoses, interventions, and monitoring (Cason, 2014). This study mainly focuses its attention on solutions around interdisciplinary collaboration, remote patient monitoring and video consultations which may be additionally supported with connected medical devices for the real time transfer of vital parameters, as those use cases promise the highest impact in a nursing home setting (Ford II et al., 2022). As already stated in the introductory sub-chapter on the definition of telehealth, there are equal discrepancies in the nomenclature of application areas for telehealth. An overview of areas of telehealth application areas is provided in Figure 2.

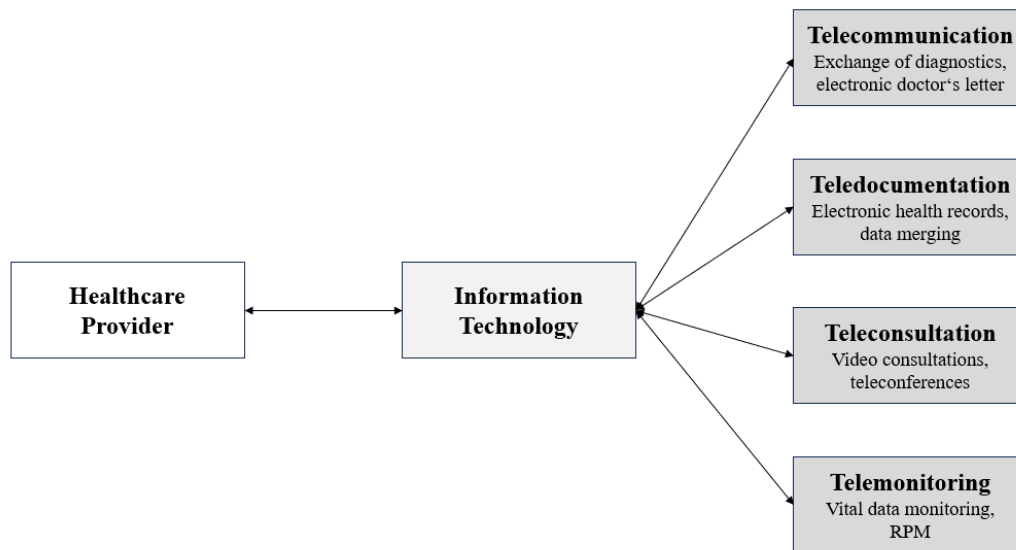


Figure 2: Telehealth application areas (adapted from Grundmann, 2019)

2.1.4. Incentives and barriers for telehealth adoption

Incentives:

There is a strong consensus in the analyzed literature that the introduction of telehealth has the potential to offer several benefits for all stakeholders along the healthcare spectrum, including patients, physicians, healthcare providers and insurances. In rural areas with physician shortages such as many remote areas in Germany (Hauck, 2014, p.1), telehealth applications can enable access to quality healthcare and address unequal distribution of healthcare workers (May et al., 2021). In addition, telemedicine can mitigate problems related to demographic changes such as ageing populations, increases in chronic diseases as well as multimorbidity patterns and physician- as well as nursing staff shortages in countries such as Germany (BMG, 2020).

As discussed previously, telehealth enables access to second opinions and expert advice from distant regions and can avoid waiting times, travel times and examination times (Haleem et al., 2021). Additionally, it can enable access to otherwise distant healthcare professionals altogether (Portnoy et al., 2020). Furthermore, patients report improved perceptions of health quality, better understanding of illness and high satisfaction with telemedicine (Cardozo & Steinberg,

2010). If implemented appropriately, time and money saved through remote treatment and increased accessibility to healthcare providers further contribute to improved patient centricity and, subsequently, higher patient satisfaction (Eze et al., 2020). Adding to this perceived increase in quality of care, Haleem et al. (2021) propose that telehealth utilization should not intend to replace traditional care delivery, but to complement it where traditional means fail.

Telehealth solutions can be used to establish better connectivity between physicians and distant patients, leading to fewer hospital readmissions and better adherence to prescription treatment plans (Eze et al., 2020). It also holds the potential to reduce the need for regular hospital visits, which can be expensive and time-consuming, especially for patients living in rural areas and nursing homes (Haleem et al., 2021). Some telehealth applications utilize video conferencing and other virtual technologies to streamline the workflow of healthcare providers, making it easier to monitor discharged patients and manage their recovery (Cason, 2014). Moreover, they allow for better follow-up visits through health apps, reducing missed appointments and optimizing patient outcomes (Haleem et al., 2021).

Improved communication between doctors through telemedicine enables the development of interdisciplinary support networks to share their skills and provide better health services (Eze et al., 2020). In terms of safety, patients with symptoms similar to those of COVID-19 can seek immediate and convenient medical advice via telemedicine without putting physicians, nurses or assistant staff into immediate risk of infections (Hagge et al., 2020). Telehealth has also proven useful in nursing homes, offering residents unprecedented access to timely and high-quality medical care while reducing unnecessary hospitalizations (Offermann-van Heek, et al., 2021; Gillespie et al., 2019).

Barriers:

Besides all the above-mentioned incentives, the implementation of telehealth encounters various limitations and barriers. One of the main challenges identified in the analyzed literature is the lack of sufficient technological infrastructure and resources, coupled with deficits in general technical literacy and acceptance among users (Kruse et al., 2020). The technical component ranges from foundational issues like broadband deployment to more sophisticated barriers like the lack of common standards for telematics infrastructure and limited to non-existent interoperability between medical systems (Leyck Dieken, 2021; Baker & Stanley,

2018). Another important aspect pertaining to the technological challenges of telehealth adoption are the security of digital networks and data protection- as well as data privacy concerns (Jäschke 2020; Martins 2020). Low security standards and fear of cybercrime, including the implied misuse of personal health data, are also concerns for all affected stakeholders, ranging from patients and physicians to healthcare providers and insurances (Sury, 2020).

Emerging only partly as a result of these security concerns are acceptance issues, originating from various stakeholder groups. Healthcare workers may feel overwhelmed with some technological advancements and the corresponding new skill set their job requires (Haleem et al., 2021), which might even lead to a fear of job loss (Pare et al., 2016). In the light of these insecurities, potential benefits of telehealth might not be immediately obvious to them, thus generating potential acceptance issues. Similarly, physicians have concerns about the diagnostic capabilities of telemedical consultations and expect them to have a detrimental impact on both the quality of medical care and the personal aspect of the doctor-patient relationship (Offermann-van Heek et al., 2021), despite strong evidence against a loss of clinical effectiveness (Eze et al., 2020). With acceptance aspects being cited as one of the most crucial success factors, the successful implementation of telehealth solutions depends on strong acceptance among all relevant stakeholders: On the one hand on the willingness of healthcare providers to offer telehealth solutions as part of their service portfolio, on the other hand on the acceptance of physicians and healthcare workers to integrate them in into the delivery of medical care, and ultimately on the patients to accept their use (Offermann-van Heek et al., 2021).

In addition to technological and acceptance-related issues, the use of telehealth applications being subject to strict legislature and rather innovation-unfriendly regulation adds another layer of complexity which may be hindering a widespread adoption (Contreras et al., 2020). Especially if not adjusted to modern telehealth use cases, the reimbursement factor has the potential to add another crucial economic barrier for both physicians and healthcare providers (Cason, 2014), as they would otherwise have to pay for both the solution itself and the medical service out of their own pocket or pass on the full cost to the patient. These relatively high costs compared to in-person, reimbursable medical service delivery can partly be attributed to the fragmented landscape of telehealth pilot projects (van Dyk, 2014). Despite their individual effectiveness, the diffusion of these innovations implies the absence of economies of scale, thus

highlighting the economic inefficiency of running many pilot-projects side by side and underlining the need to roll-out successful projects at scale (Otto et al., 2019).

A summary of the most widely recognized incentives and barriers in the analyzed literature is provided in Table 1.

Incentives	Barriers
Improved access to medical care in areas with physician shortages	Lack of technological infrastructure and resources
Improved access to specialists and second opinions	Interoperability and data protection concerns
Reduction of potentially avoidable hospitalizations	High costs of solutions and lack of reimbursement
Lower costs due to a reduction of unnecessary transfers	Change management and acceptance issues
Better chronic disease management and monitoring	Regulatory barriers and lack of clear guidelines
Potential for increased process efficiency	Concerns about cybersecurity and data privacy
Better working conditions and reduced uncertainty for nursing staff	Perceived clinical limitations of teleconsultations

Table 1: Overview of common incentives and barriers

2.2. The German healthcare system

Four main principles govern the German health system: Compulsory health insurance for everyone (can be statutory or private), contribution financing (by both statutory and private insurance members), the solidarity principle (all costs are covered by all members of the community), benefit-in-kind principle (no statutory insurance members have to make advance payment for healthcare services) and self-administration principle (the government only provides the regulatory framework for all the other players to organize themselves) (BMG, 2020, p.9f). In 2021, 88.1% of the population had statutory health insurance (GKV), 10.5 % were covered by private health insurance (PKV) and 1.5% were covered by other types of insurances (Verband der Ersatzkassen, 2023). Being among the top spenders in the EU, the general German healthcare spending has reached a volume of €390.6bn in 2018, corresponding to 11.7% of the country's GDP. While 15.4% of healthcare costs are paid out-of-pocket by households on average in the EU, this share only accounts for 12.7% in Germany, indicating stronger reliance on public healthcare spending (Blümel et al., 2022, p.4).

The German health system functions according to a decentralized and self-governing model, with the Federal Joint Committee (G-BA) being the core body in terms self-governance (Busse & Blümel, 2014). The stakeholders of the G-BA (insurances, physicians, and hospitals) decide which medical services, treatments, and medications should be offered by service providers and financed by the statutory health insurance funds, guided by the aspects of economic efficiency, appropriate care, and patient outcomes (BMG, 2020, p.19). Therefore, it also decides which types of novel services (such as telehealth applications) should be publicly reimbursed in the future (Wahner-Roedler et al., 1997).

2.2.1. Definition of nursing care

In Germany, there are different types of care, which can mainly be categorized into inpatient and outpatient care. Both forms provide support and care for people who need help in their everyday lives due to illness, disability, or age-related limitations. The different variations of care make it possible to meet the individual needs and circumstances of the person in need of care. In many cases, combinations of different types of care are also used to ensure the best possible care (Döring & Paul 2012). The classification provided in Table 2 is based on Schulz’s (2010) work and segments nursing care into inpatient care, where people in need of care are looked after in specialized, stationary facilities, and outpatient care, which is provided to persons in need of care in their own homes.

Care setting	Type of care	Description
Inpatient care	Nursing homes	Nursing homes provide long-term care for older people who are no longer able to live alone at home. Care includes medical care, social activities and assistance with everyday tasks.
Inpatient care	Short-term care	This type is limited in time and serves to temporarily accommodate and care for persons in need of care, for example during the recovery phase after a hospitalization or when family carers are temporarily unavailable.

Inpatient care	Day care	Partial inpatient care in which persons in need of care are cared for in a care facility during the day and return to their own homes in the evening.
Outpatient care	Outpatient care services (social care centers)	Professional assistance with personal hygiene, food intake, medication administration and other daily tasks. They may also provide domestic help or care services.
Outpatient care	Home care	This type of care includes medical care provided by qualified professionals (e.g., nurses) in the patient's home environment.
Outpatient care	Care by relatives	persons in need of care are cared for by their family members or friends at home. In such cases, family caregivers can take advantage of counselling and support services and apply for financial assistance such as care allowance
Outpatient care	24-hour care	A caregiver lives in the household of the person in need of care and supports him or her around the clock with everyday tasks and basic care.

Table 2: Summary of the most common types of nursing care (Schulz, 2010)

2.2.2. The German nursing home market

According to data from [pflegmarkt.com](https://www.pflegmarkt.com) (2023), a well-respected private provider of data on nursing care in Germany, in January 2023, there were 11,683 inpatient nursing homes with 918,084 available spots for elderly care in Germany. In 2022, 107 nursing homes were newly opened, while 142 were closed, indicating a temporary consolidation in facilities. About 53% of these homes belong to non-profit providers, such as Diakonie, Caritas or the German Red Cross, while municipal providers account for 4% and private, for-profit operators account for 43% (Borchert, 2023). At the same time, there are 17,122 outpatient care services in Germany, providing care to 1,810,529 patients. This care segment is mainly characterized by private, owner-operated care services without group affiliation (Borchert, 2023). In January 2023, there were 6,547 day care facilities in Germany with 106,255 spots for the care of seniors. Similar to

inpatient care homes, about 54% of day care facilities are non-profit, while municipal providers make up 4% and private providers 44% (Borchert, 2023). In addition, there are 7,545 assisted living facilities in Germany with about 379,000 units. The 17% growth of sites from 2018 to 2022 demonstrates the growing importance of this relatively new care segment (Borchert, 2023).

The ageing society in Germany implies an increase in the number of people in need of care. In December 1999, there were 2.02 million; in December 2009, 2.34 million; and in December 2019, 4.13 million people required long-term care, according to the Long-Term Care Insurance Act (SGB XI) of the social security code (Haß et al., 2023). In 2021, the number of people needing long-term care rose to 4.96 million (Destatis, 2022). Since 2017, a special effect could be observed due to the introduction of an expanded concept of the need for long-term care, which explains the above-average increase in the number of people in need of long-term care. (Destatis, 2022). This drastic spike is clearly observable in Figure 3 yet should be taken with a grain of salt due being a result of the wording change in the SGB XI.

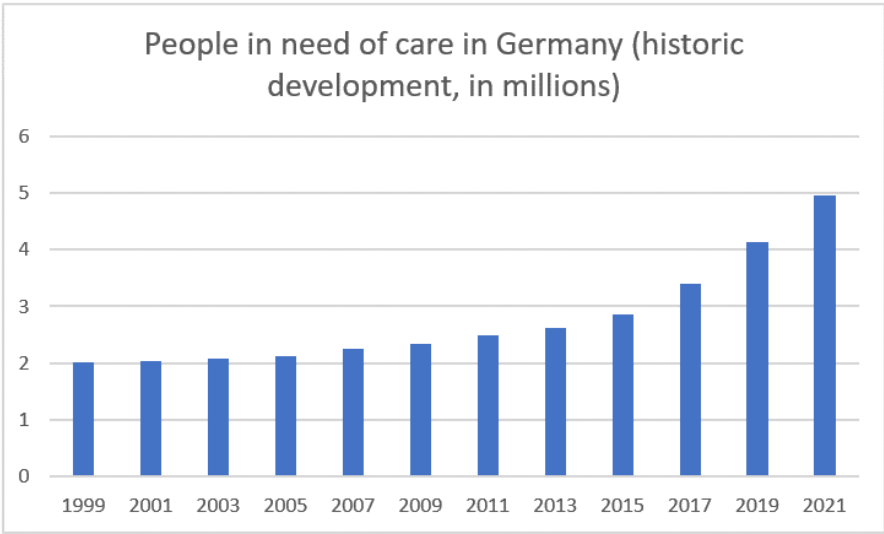


Figure 3: Historic development of people in need of care in Germany (Destatis, 2022)

According to the forecasts of the federal statistical office (Destatis, 2023) on the need for long-term care, the number of people in need of long-term care will grow from about 5.0 million at the end of 2021 to about 6.8 million in 2055, indicating a 37% increase due to the growing elderly population. Already in 2035, about 5.6 million people are likely to be affected, which corresponds to an increase of 14% (Destatis, 2023). The number of persons in need of long-

term care according to the aforementioned SGB XI is expected to be about 6.9 million in 2070 (+38%) (Destatis, 2023). A visual representation of this long-term outlook on persons in need of care can be found in Figure 4.

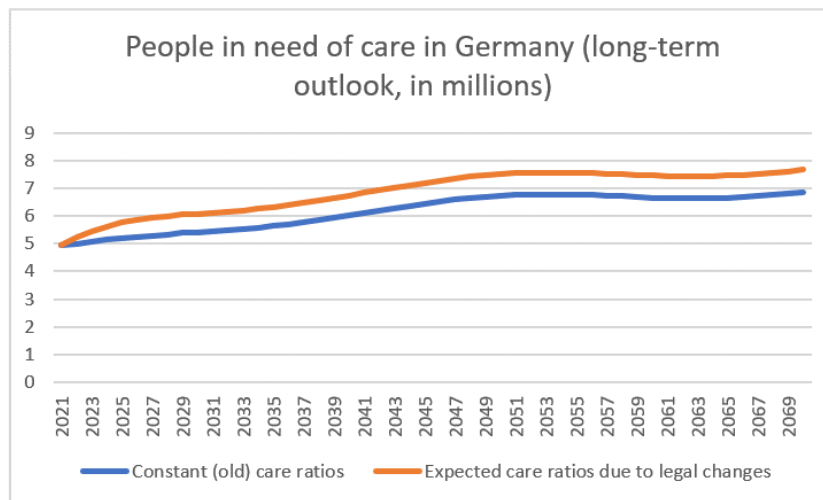


Figure 4: Long-term outlook on people in need of care in Germany (Destatis, 2023)

2.2.3. Funding and regulation

Given the ageing population in Germany, coupled with the subsequent increased need for services in the elderly care segment, the financing of the German care market marks a significant challenge for German policymakers (Schulz, 2010). Thus, the legal basis plays a crucial role in ensuring adequate financing and quality of care services (Blümel et al., 2022). As mentioned, the legal basis for the financing of the German nursing home market is the SGB XI, which introduces long-term care insurance as a compulsory insurance for all citizens (Paquet, 2020). The SGB XI defines the benefits of long-term care insurance, the criteria for the classification of need for long-term care and the associated long-term care benefits in kind and long-term care allowances (Flöer, 2018).

The financing itself is composed of three main components. The statutory long-term care insurance is the main source of funding for long-term care homes (Schulz, 2010). Depending on the classification of the need for care, people in need of care receive different benefits that can be used to cover the costs of nursing care in nursing homes. In addition to this long-term care insurance, patients in need of long-term care must pay a personal contribution to finance their stay in a nursing home (Zuchandke et al., 2012, p.215). This personal contribution varies

significantly depending on income and can be different depending on the federal state and the nursing home. In many cases, people in need of care must use their savings or even their real estate assets to finance the personal contribution (BMG, 2023b). In case the financial means of the person in need of care are not sufficient to cover the personal contribution, social assistance can be applied for in the form of assistance for care according to SGB XII, which is another book of the German social security code. This benefit is paid by the social welfare office and covers the remaining costs of the nursing home stay if all other sources of funding have been exhausted (Ochmann & Albrecht, 2020, p.223).

2.2.4. Operational challenges in German nursing homes

As already touched upon, the German nursing home sector faces a variety of challenges. Apart from administrative challenges concerning the financing of the sector or its regulatory framework, the operational level can be considered of equal importance as it concerns the direct care and support of those in need of care. One of the core challenges in the German nursing home sector is the shortage of skilled nursing staff (Bohnet-Joschko & Stahl, 2019). According to a study by the Bertelsmann Foundation (Rothgang et al., 2012, p.79), there could be a shortage of around 500,000 full-time nursing staff by 2030 in Germany. There are many reasons for this shortage, including unattractive working conditions, poor pay, high physical and psychological stress, and a low social standing for the profession (Schaller & Gernert, 2022). The situation is particularly problematic in rural areas, where it is even more difficult to recruit qualified staff (Rothgang et al., 2012, p.23). To reduce the shortage of skilled workers, various measures are considered viable, such as improving working conditions, raising salaries and strengthening education and training. In addition, the immigration of foreign nursing staff can also contribute to solving the problem (Beckers & Strotbaum, 2021, p. 270).

Adding to the problematic shortage of nursing staff, there is also a shortage of doctors, which is particularly pronounced in rural regions (Ohligs et al., 2020). As a result, medical care for nursing home residents is not always optimally guaranteed, as most facilities typically do not have a physician on site. While prevalent for both GPs and specialists, this effect is much more pronounced for specialist physicians (Kleina et al., 2017). This low availability of physicians leads to nursing staff being severely limited in assessing a patient's condition, especially in emergency situations (Cormi et al., 2021). In case no physician is on site or available to visit

the nursing home on short notice, nursing staff are frequently left with having to send the patient to the nearest hospital emergency room as their only viable option to clarify the patient's condition (Ohligs et al., 2020). While necessary in truly urgent emergency situations, this practice bears the risk of potentially avoidable hospitalizations. This leads to unnecessary cost pressure on the health insurance, unnecessary resource utilization for the hospital and emergency rescue service, and an unnecessary removal of the patient from their familiar environment (Bohnet-Joschko et al., 2021; Driessen et al., 2016). The shortage of skilled workers, the multimorbidity of the residents and the increased costs with simultaneous financing bottlenecks are major challenges that can only be overcome through joint efforts (May et al., 2021).

Another operational challenge in German nursing homes is rising multimorbidity on the patient side, i.e., the simultaneous presence of several chronic diseases. Many nursing home residents suffer from various health problems that require individual and complex care (Kleina et al., 2017). This leads to an increased burden for the nursing staff and adds an additional layer of complexity for the attending physicians (Bohnet-Joschko et al., 2021). In order to meet the challenges of multimorbidity, better interdisciplinary collaboration, both between multiple specialists and between the various medical and nursing stakeholders, may be necessary (Katz et al., 2020; Müller et al., 2018).

2.2.5. Illustrative examples of telehealth projects in nursing homes

The use of telemedicine in nursing homes has gained significant attention in recent years, particularly in the context of the COVID-19 pandemic, which has put the need for innovative solutions to ensure the continuity of care for residents into the spotlight (Ford II et al, 2022). This section reviews some selected papers that have explored the potential benefits, challenges, and future directions for the implementation of telemedicine projects in the nursing home environment. It does not aim to be a complete and exhaustive review but rather to provide some illustrative examples from which a set of insights serve to inspire the methodology and discussion of results.

2.2.5.1. Germany

The CoCare project (Farin-Glattacker et al., 2022) aimed to enhance medical care in full-time nursing homes in the German state of Baden-Württemberg, addressing deficiencies identified in studies concerning medical care within these facilities, particularly in specialized medical care. The intervention involved establishing coordinated medical care in selected nursing homes, involving teams of general practitioners, fixed visiting hours, regular specialist consultations, and extended physician availability. Key evaluation findings include improvements in process organization attributed to effective teamwork among physicians, regular meetings, and enhanced physician accessibility. Communication between physicians and nursing staff improved, and the adoption of treatment pathways became routine. In terms of outcomes, the intervention group demonstrated significantly improved teamwork between physicians and nursing staff, enhanced resident quality of life, and better overall health perceptions.

May et al. (2021), an exploratory qualitative pre-post study conducted in the rural German state of Brandenburg, found that telehealth can improve patient care, increase accessibility and continuity of medical care, and reduce the expenditure of effort by nursing staff, technical assistants, and physicians alike. The study also highlighted the importance of eliminating medical technical assistants as the de facto interface between nurses and physicians, which resulted in less loss of clinical information and faster care.

Brücken et al. (2022) present the latest study protocol for a stepped-wedge trial aiming to reduce unnecessary hospital admissions and optimize medical care for nursing home residents through an intersectoral telemedicine approach. The approach involves providing nursing homes with telemedical equipment for teleconsultations, implementing an early warning system and a digital patient record system, and having physicians available via telehealth around the clock.

2.2.5.2. International

Ford II et al. (2021), who focused on the use of telemedicine in nursing homes during and after the COVID-19 pandemic, found that all participating nursing homes in the study wished to continue telemedicine after the pandemic. Urgent assessments of resident change-in-condition

and cognitively based sub-specialty consultations were identified as the encounter types most amenable to telemedicine. The study also identified twelve work system enhancements needed to better sustain telemedicine, including improvements to equipment/IT infrastructure, scheduling, information exchange, and other telemedicine facilitators.

Katz et al. (2021) provide an overview of medical provider practice in nursing homes and organizational models of practice, highlighting that the delivery of medical care services in nursing homes is dependent on a workforce that comprises physicians, nurse practitioners, and physician assistants. The authors mention that nursing home quality is a multidimensional construct influenced by several variables, and telemedicine has the potential to impact medical provider practice and overall quality of care in nursing homes.

While not an implementation project, but in the form of a quantitative analysis, the study of Cormi et al. (2021) provides a mixed-method study exploring telemedicine activities in nursing homes collaborating with a general hospital, while also identifying crucial factors for successful telemedicine project implementation. The study found that nursing homes' telemedicine needs varied in terms of frequency and medical specialties requested, depending on whether they were located in urban or rural settings. Notably, rural nursing homes utilized general practice telemedicine sixteen times more than their urban counterparts. The authors identified three critical factors for implementing telemedicine projects in nursing homes: motivation for teleconsultations, the telemedicine service offered, and the specific organizational structure needed. To optimize the success of telemedicine initiatives, the study highlights the importance of considering these factors and adapting to the unique teleconsultation behaviors exhibited by nursing homes in different geographic settings.

2.3. Relevant management theory and innovation frameworks

To set the theoretical framework for the subsequent sense-making of results, a set of management theories and innovation/telehealth frameworks have been considered. The successful adoption and implementation of telehealth services require a comprehensive understanding of relevant management theories and innovation frameworks. Multiple change management theories have been proposed, but some are too technology-specific, while others are too generic. However, it is essential to explore other relevant theories and frameworks to

gain a comprehensive understanding of the factors influencing telehealth adoption and implementation (Rangachari et al., 2022). This section examines and compares various management theories and innovation frameworks, both general and telehealth-specific, including the Diffusion of Innovations Theory (DoI), the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), the theory of clinician acceptance, the Telehealth Service Implementation Model (TSIM), and the RE-AIM framework coupled with the Dynamic Sustainability Framework (DSF).

Change management & innovation:

The DoI theory is a well-known theory that explains how new ideas, products, or technologies spread and are adopted by individuals or groups (Lovejoy et al., 2009). It identifies different categories of adopters, such as innovators, early adopters, early majority, late majority, and laggards, and highlights the importance of communication channels, social networks, and perceived benefits in the adoption process (Rogers, 2003). In the context of telehealth, the DoI can help understand the factors that influence the adoption and diffusion of telehealth applications among different user groups, as well as the role of opinion leaders and social networks in promoting adoption (Scott & Mars, 2015).

The TAM is a widely used theory that explains users' acceptance and adoption of technology. It suggests that perceived usefulness and perceived ease of use are key determinants of users' intention to adopt a technology (Davis, 1989). In the context of telehealth, the TAM can help identify factors that influence patients' and clinicians' acceptance of telehealth applications, such as their perceived usefulness in improving health outcomes and ease of use in accessing and navigating the technology (Cheung et al., 2019).

The UTAUT proposed by Venkatesh et al. (2003) builds upon the TAM and incorporates additional factors that influence users' acceptance and use of technology (Venkatesh & Davis, 2000). It identifies four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions, which collectively determine users' behavioral intentions and actual technology usage (Venkatesh & Davis, 2000). By considering these four constructs, the UTAUT can provide a useful framework for understanding and predicting users' acceptance and use of telehealth applications. It can help identify barriers and facilitators to adoption, inform the design and implementation of telehealth systems, and guide strategies for promoting sustained use and long-term sustainability (Venkatesh et al., 2016).

Telehealth-specific models:

The theory of clinician acceptance posits that the acceptance of telehealth services by clinicians is a key factor in the successful implementation and sustainability of telehealth (Wade et al., 2014). This theory suggests that clinician acceptance can overcome various challenges, such as low demand, technology problems, nursing staff pressure, and lack of resources (Wade et al., 2014). It emphasizes the importance of addressing the concerns and needs of clinicians in order to promote the adoption and use of telehealth services (Wade et al., 2014).

Valenta et al., (2021) conducted a study on the adoption of telehealth services in an academic medical center using the TSIM. The study highlights the value of TSIM in providing a framework for developing a strategic vision for telehealth services, designing successful telehealth services, and monitoring as well as iterating for high quality and reliability (Valenta et al., 2021). The TSIM framework can guide organizations in understanding and addressing the factors influencing telehealth adoption and implementation, ultimately promoting sustained use of telehealth services in the long run (Valenta et al., 2021).

The RE-AIM framework is a comprehensive framework that focuses on the evaluation and implementation of health interventions, including telehealth (Mitchell-Gillespie et al., 2020). It stands for Reach, Effectiveness, Adoption, Implementation, and Maintenance, and provides a systematic approach to assessing the impact and sustainability of telehealth programs, while the adjacent DSF is intended to ensure continuous improvements and iterations along the implementation of the telehealth intervention (Mitchell-Gillespie et al., 2020). Together, RE-AIM and the DSF emphasize the importance of considering multiple dimensions, such as the reach of the intervention, its effectiveness in achieving desired outcomes, the adoption and implementation process, and the long-term maintenance of the intervention (Mitchell-Gillespie et al., 2020).

3. Methodology

This study employs a mixed-methods approach, drawing on both secondary data from an extensive literature review and primary data collected in the form of qualitative expert interviews. This type of data triangulation was selected to avoid any bias originating from the use of only one of these research methods and to validate, compare, and contrast the findings of each respective data source (Yu, 2009; *Clark & Creswell, 2007*).

The literature review intends to provide a better understanding of existing research in the field of telehealth, elaborate on its evolution over time, and constitute a theoretical framework for the study. It further provides ample background information on the German healthcare system as well as on the nursing home sector, and examine the country's demographics, subsequently elucidating their implications for the future of German healthcare. Furthermore, it features a taxonomy of telehealth applications and evaluates their current level of utilization, with a particular focus on (pilot) projects in German nursing homes as well as in an international context.

3.1.Data collection

The expert interviews were conducted with a sample of 10 experts from the German nursing home sector, encompassing decision-makers at providers, an independent consultant, nursing staff as well as a nursing home director, physicians with direct responsibility for nursing home residents, and with leaders of provider-side nursing home associations who closely collaborate with member organizations, both generally and specifically on telehealth-related projects. To ensure a comprehensive analysis of both operational and medical aspects as well as economic and managerial aspects, this selection of a diverse and representative sample intends to ensure an unbiased 360-degree view on real-life practices concerning the research questions defined in chapter 1.2 (Silverman, 2011). To ensure relevance of the collected data, it was ensured that all participating healthcare professionals have substantial prior experience in the nursing home sector. The interviewees were recruited through targeted outreach via personal networks and emails directly to providers, professional associations, nursing homes on the facility level as well as general practitioners. A full list of interviewees with their respective roles is displayed in Table 3.

To ensure unbiased and comprehensive answers without predetermined perspectives, the data collection was carried out utilizing semi-structured interviews with open-ended questions (Britten, 1995). The interviews were conducted and recorded via video conferencing software due to physical distance between the author and the interviewees. The interview guide (Appendix 1) has been developed based on the three core research questions as well as related literature for subsequent data triangulation and includes open-ended questions designed to elicit as unbiased and detailed responses as possible from participants (Britten, 1995). All interviews were conducted in the interviewees' native language German, audio- and video recorded, and subsequently auto-transcribed in full utilizing the video conferencing software's language processing tool.

<i>Interview ID</i>	<i>Profession</i>	<i>Category</i>
<i>QM</i>	Lead Quality Manager	Provider
<i>PM</i>	IT Project Manager	Provider
<i>IC</i>	Telehealth Consultant	Consultant
<i>GP1</i>	General Practitioner	Physician
<i>GP2</i>	General Practitioner	Physician
<i>ND</i>	Nursing Home Director	Nursing Home
<i>SN</i>	Skilled Nurse	Nursing Home
<i>A1</i>	Chief Executive Officer	Association
<i>A2</i>	Chief Executive Officer	Association
<i>A3</i>	Regional Manager & Lawyer	Association

Table 3: List of interview participants

3.2. Data analysis

After careful review and correction of the auto-transcripts, all interviews were reviewed again and assigned thematic codes utilizing MaxQDA software. This code system (see Table 4) was originally constructed deductively, i.e., based on existing literature related to the research questions. However, to accommodate emerging topics from the interviews themselves, an inductive approach has been utilized by adding some additional codes after having conducted

the interviews (Mayring, 2000). The resulting coded interview segments were then used as the basis for the results section of this study. Anonymized and paraphrased interview summaries, with verbatim quotes highlighting specifically significant passages, were translated to English, and can be found in Appendix 2.

<i>Domain</i>	<i>Code</i>
<i>Adoption Level</i>	Asynchronous
<i>Adoption Level</i>	Medical-Device-Enabled
<i>Adoption Level</i>	Documentation
<i>Adoption Level</i>	Telecare
<i>Adoption Level</i>	Interdisciplinary Collaboration
<i>Adoption Level</i>	Synchronous
<i>Incentives</i>	Interdisciplinary Collaboration
<i>Incentives</i>	Aging Population
<i>Incentives</i>	Reduced Staff Shortages
<i>Incentives</i>	Improved Access to Care
<i>Incentives</i>	Avoidable Hospitalizations
<i>Incentives</i>	Economic Efficiency
<i>Incentives</i>	Improved Quality of Care
<i>Incentives</i>	Process Efficiency
<i>Barriers</i>	Lack of Evidence
<i>Barriers</i>	Financial
<i>Barriers</i>	Acceptance
<i>Barriers</i>	Reimbursement
<i>Barriers</i>	Processes
<i>Barriers</i>	Regulatory
<i>Barriers</i>	Staff Shortages
<i>Barriers</i>	Training
<i>Barriers</i>	Technical
<i>Barriers</i>	Lack of Evidence
<i>Future Requirements</i>	Hardware
<i>Future Requirements</i>	Software
<i>Future Requirements</i>	Acceptance

<i>Future Requirements</i>	Reimbursement
<i>Future Requirements</i>	Training
<i>Future Requirements</i>	Regulatory
<i>Future Requirements</i>	Processes

Table 4: Code system

4. Results

Results are presented and organized by research question, based on the set of questions laid out in the utilized interview guide (Appendix 1). Appendix 2 provides an in-depth overview of individual participants' results, paraphrasing responses and using direct quotes where appropriate particularly to highlight relevant passages. To provide a more detailed overview of responses, a summary table of coded segments is provided for each research question to indicate interviewees' notions towards individual codes.

RQ1 – Adoption & potential of telehealth:

Code	Providers		Consultants	Physicians		Nursing Homes		Associations			Coded Segments	% of all Segments
	QM	PM	IC	GP1	GP2	ND	SN	A1	A2	A3		
Asynchronous	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	21	165%
Medical-Device-Enabled	✗	✓	✓	✗	✓	✓	✓	✗	✗	✗	6	47%
Documentation	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	20	157%
Telecare	✓	✗	✓	✗	✗	✗	✗	✗	✓	✓	2	16%
Interdisciplinary Collaboration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	16	126%
Synchronous	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	22	173%

Figure 5: Coded results of RQ1

In exploring the current level of telehealth adoption in German nursing homes, various experiences among different stakeholder groups were identified. Nursing home staff (ND, SN) and providers (PM) have initiated pilot projects utilizing synchronous telehealth solutions with connected medical devices. These pilot projects have garnered positive feedback from both staff and patients, indicating a clear interest in telehealth solutions within nursing homes. ND proudly noted: “Where we already stand out from the market, so where we can also go into marketing as a facility - if we needed marketing here in our [rural] region - we would do it about our unique telehealth project.”. However, it is important to note that adoption in nursing homes and among major providers remained limited at this stage. QM regretted that his facilities had not adopted telehealth solutions yet, as they “would have made our lives much easier [in times of COVID-19 and beyond]”.

The consultant (IC), specializing in documentation and IT project management, had been involved in several pilot projects aimed at enhancing these aspects of telehealth. While recognizing the potential benefits, IC also acknowledged that telehealth adoption remains in its early stages for clients he had worked with. However, he echoed GP1's experiences in saying that telehealth can make nursing staff "feel valued and respected, as their documentation and

expertise are acknowledged and utilized."

Physicians (GP1, GP2), on the other hand, have shown a more diverse pattern of adoption, employing a mix of synchronous and asynchronous telehealth solutions, with a clear focus on the latter. GP1 highlighted success of asynchronous documentation system: "That's actually our secret, this improvement in secure communication, timely communication and secure information exchange and increasing multidisciplinary teamwork." In comparison to nursing home staff and providers, physicians exhibited broader adoption of telehealth technologies. GP2 more strongly emphasized the ability of digital communications to minimize interruptions during the day and enable effective and efficient care. Both noted that paper records are still prevalent in many nursing homes.

Provider-side associations (A1, A2, A3) within the nursing home sector acknowledged the potential benefits of telehealth but noted no widespread adoption in their member organizations, despite proactive interest from one of A1's member organizations: ""We have member organizations that say why can't it be done faster? In fact, there are quite a few." The aspect of improving interdisciplinary cooperation was considered important by A1 and A2. A3, on the other hand, mentioned the use of digital solutions such as video counseling for patients who are first time seekers of long-term care, especially during the COVID 19 pandemic.

RQ2 - Incentives for telehealth adoption:

Domain	Code	Providers		Consultants	Physicians		Nursing Homes		Associations			Coded Segments	% of all Segments
		QM	PM	IC	GP1	GP2	ND	SN	A1	A2	A3		
Incentives	Interdisciplinary Collaboration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	41	3,22
Incentives	Aging Population	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	5	0,39
Incentives	Reduced Staff Shortages	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	1	0,08
Incentives	Improved Access to Care	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	45	3,53
Incentives	Avoidable Hospitalizations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	26	2,04
Incentives	Economic Efficiency	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	15	1,18
Incentives	Improved Quality of Care	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	58	4,55
Incentives	Process Efficiency	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	93	7,30

Figure 6: Coded results of RQ2 (incentives)

Among providers, the potential for reduced costs and hospitalizations served as the most compelling incentive. PM pointed out that telehealth significantly reduces the time spent on the road for physicians, enabling them to allocate more time to patient care: "The main benefit lies within the economics, because we don't have to send physicians and respiratory therapists on all these trips, that saves them a lot of valuable time." QM specifically emphasized improving

access in areas with physician shortages, while PM focused on the crucial role of interdisciplinary collaboration, particularly in specialized care settings.

IC highlighted benefits encompassing data access and enhanced communication between healthcare professionals. He noted that early intervention via telehealth can minimize hospitalizations, benefiting patients and the healthcare system alike, and underscored how impactful it would be to avoid more hospitalizations: “The nursing facilities above all, because they know that this is also quite devastating for the patient psychologically or for the resident. The emergency rooms say we constantly get people who don't belong here at all.”

Physicians cited improved coordination, reduced hospitalizations, and enhanced access to care as key incentives. GP2 noted that telehealth enables less costly potentially avoidable hospitalizations due to the possibility of consulting with a physician before hospitalizing a patient. GP1 agreed on that, and particularly highlighted the improved interdisciplinary collaboration with nursing staff: “When you work like this, you also learn to appreciate, value each other differently. The nursing staff is really a great team for me to work with.”

The incentives for nursing home staff primarily revolved around improved rural access, reduced hospitalizations, better monitoring, and enhanced communication. For instance, ND emphasized that telehealth eliminates the need for residents to travel long distances for medical appointments, thereby reducing transportation challenges and discomfort, which is largely in line with the views of SN. Additionally, both expressed agreement with the potential of telehealth to reduce avoidable hospitalizations and increase the quality of care, which ND specifically underscored: “The residents who live with us do not have the opportunity, like someone who lives at home, to get in the car and go to the doctor's office.”

While associations generally acknowledged the potential benefits, they were more theoretical in their assessment of improved coordination and outcomes. A2, however, underscored the potential benefits telehealth deployment might have on the lack of physicians in rural areas: “It reduces the impact of the shortage of physicians on nursing homes, which would be very attractive for nursing homes. For example, if they don't have to spend ages trying to get appointments, don't have to spend ages negotiating with the primary care physician when he's finally going to come back to the nursing home.”

RQ2 - Barriers for telehealth adoption:

Domain	Code	Providers		Consultants	Physicians		Nursing Homes		Associations			Coded Segments	% of all Segments
		QM	PM	IC	GP1	GP2	ND	SN	A1	A2	A3		
Barriers	Lack of Evidence	✗	✗	✗	✗	✓	✗	✗	✓	✗	✓	9	0.71
Barriers	Financial	✓	✓	✗	✓	✓	✓	✗	✓	✓	✓	47	3.69
Barriers	Acceptance	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	78	6.12
Barriers	Reimbursement	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	56	4.40
Barriers	Processes	✓	✓	✓	✗	✗	✓	✗	✓	✓	✓	99	7.77
Barriers	Regulatory	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	64	5.02
Barriers	Staff Shortages	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	50	3.92
Barriers	Training	✓	✓	✓	✗	✓	✗	✓	✗	✓	✓	32	2.51
Barriers	Technical	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	91	7.14

Figure 7: Coded results of RQ2 (barriers)

The barriers to telehealth adoption largely exhibited a convergence of opinions among stakeholder groups. Process-related and interoperability issues, reimbursement uncertainties, and challenges related to stakeholder alignment were commonly acknowledged challenges. However, specific concerns varied.

Among providers, barriers included issues with reimbursement, lack of integration with existing systems, and challenges related to physician acceptance. QM noted the unresolved reimbursement topic as a significant hurdle. In terms of acceptance, both agreed on the resistance to digitalization among some staff and patients, particularly older individuals, with QM noting divergent views among caregivers. PM, on the other hand, cited regulatory concerns as a core barrier: “I think that technically and all these things that could be done, that would all work very well, it's just how it's regulated in general and also how it's accepted by all stakeholders thereafter.”

IC identified multiple barriers hindering telehealth adoption in Germany. The consultant underscored issues related to integration and alignment among stakeholders, which hinder the seamless, multilateral adoption of telehealth solutions. Training gaps for physicians and nurses, along with insufficient technological literacy, stood out as key issues. Technical challenges mentioned included connectivity, protocol standardization, and the absence of centralized solutions for data integration. Process inefficiencies, such as burdensome documentation and outdated communication methods, were considered to add further complexity.

Physicians, as a group, pointed to interoperability issues, high costs, and fragmented solutions as the primary barriers to wider adoption. GP1 emphasized the poor implementation and support from software providers. GP2 deemed the lack of adequate training for involved stakeholders

as a core barrier: “Introducing novel solutions stands and falls with the training concepts behind them. If there is no sufficient training for the ones operating the telehealth solution, there will not be sufficient acceptance from the ones on the frontline.”

Nursing home staff highlighted challenges related to technology, staff training, and privacy concerns. Both ND and SN agreed on the technical barriers to telehealth, such as inadequate network infrastructure and the need for user-friendly interfaces. ND mentioned financial strains on care facilities, primarily in the form of initial investments. Both pointed to reimbursement issues and shared concerns about the acceptance of new technologies, mentioning resistance and the perceived burden on healthcare providers. SN noted that older healthcare professionals may be less open to adopting telehealth technologies.

Association representatives expressed concerns regarding the lack of concrete, large-scale evidence supporting telehealth, reimbursement uncertainties, and difficulties engaging physicians. On top, A1 and A3 highlighted difficulties with integration and WIFI setup in older buildings as technological barriers. All association representatives agreed that process challenges exist, with A2 and A3 detailing issues like integration into existing workflows and cumbersome documentation. All groups found acceptance to be a significant barrier, highlighting resistance from physicians and caregivers, as well as varying levels of acceptance among patients and their families. Financial constraints were universally acknowledged, with each group focusing on different aspects like equipment costs, funding uncertainties, and the financial burden on care facilities and recipients. The associations group also concurred that reimbursement issues persist, especially relating to service categorization and payment for digital services, as highlighted by A2: “We then go back to the question of financing, so if I as a patient want to have something like telehealth consultations, then I must also want to pay, ideally through an increased health insurance contribution.”

RQ3 - Future Requirements for Telehealth Adoption:

Domain	Code	Providers		Consultants	Physicians		Nursing Homes		Associations			Coded Segments	% of all Segments
		QM	PM	IC	GP1	GP2	ND	SN	A1	A2	A3		
Future Requirements	Hardware	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	34	2,67
Future Requirements	Software	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	62	4,87
Future Requirements	Acceptance	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	47	3,69
Future Requirements	Reimbursement	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	23	1,81
Future Requirements	Training	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	39	3,06
Future Requirements	Regulatory	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	48	3,77
Future Requirements	Processes	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	52	4,08

Figure 8: Coded results of RQ3

There was a consensus across stakeholder groups on the importance of interoperability, training, regulatory clarity, and the need for pragmatic solutions that prioritize processes and ease of use. Despite these areas of agreement, participant groups set different priorities.

The Provider Group emphasized the need for improved infrastructure, hardware, software interfaces, as well as better regulation and reimbursement schemes. QM stressed the importance of widespread WIFI coverage and suggested the creation of dedicated treatment rooms with high-quality communication equipment, while PM emphasized the need for a simple and accessible telehealth solution for specific medical situations used directly by the patient's bed. QM and PM agreed that training and skills in using new technologies are needed. QM mentioned the possibility of a new profession of telehealth assistants. PM also stressed the importance of appropriate reimbursement for telehealth services. There was also common ground on processes and the need for adequate reimbursement, as QM highlighted: "And I hope that they will get their act together and say that now we are finally going to create the legal basis and standardize everything in telehealth, and that we will also reach reasonable agreements with the health insurance companies beforehand."

The consultant took a more technical stance and suggested that the telematics infrastructure must be further developed to meet the requirements of telehealth, and standardization plays a crucial role in the preparation of medical data. When it comes to hardware, he noted that it is important that technical support in the form of devices alone is not enough to revolutionize care. Rather, a holistic view of processes and procedures is required, according to IC. In the area of processes, he called for competencies to be brought together and interdisciplinary communication between the participants in the healthcare system to be improved but highlighted the challenges of this: "'That's the problem, because it's not just doctors who communicate with each other. If it's just doctors, then I have the telematics infrastructure, but if you add nurses, pharmacies and insurances into the mix, the infrastructure becomes much more complicated."

For the Physician Group, a secure platform for information exchange and appropriate reimbursement were cited as future requirements. Both saw the need for a platform to connect practice management systems and nursing home software for efficient information exchange. Regarding the acceptance of telehealth solutions, GP1 and GP2 saw the need to extend digitalization to residential and long-term care communities. In prioritization, there was a slight

discrepancy between GP1 and GP2. While GP1 calls for reimbursement for the additional workload like updating the asynchronous communication platform, GP2, much like QM, strongly called on policymakers: “Without the commitment from politics, any pilot project can be as good as it wants to, and it will never reach a scaled roll-out. Nursing home providers and physicians need security and commitment, before they can fully go in.”

Both participants from the nursing home group emphasized the importance of a good internet connection in nursing homes. In terms of training, both interviewees highlighted the need for training and education for staff. ND also mentioned concerns about data protection and information sharing. Both groups emphasized an intuitive and user-friendly interface.

SN mentioned the need to integrate digital communication into rescue and emergency care, while ND emphasized the ease of use of the program without technical complications and spoke of the need for an appropriate balance between data protection and smooth promotion of treatment.

The Association Group recommended comprehensive software solutions, improved hardware, and effective communication for future telehealth implementations. In terms of increasing acceptance, a general need for comprehensive explanation and education to enable positive uptake was identified. A2 emphasized the importance of a user-friendly interface that is suitable for older and less tech-savvy caregivers as well as for care recipients, while A3 mentioned the importance of interpersonal interaction. In the area of software requirements, there was common ground for holistic, interoperable software solutions. Regarding regulation, there was agreement that model projects should be integrated into regular care in case of a positive evaluation, or as A3 put it: “I believe that the goal must be to bring the various model projects into regular care. And I don't think we currently have any idea how we can do that.” In terms of hardware requirements, both A1 and A2 mentioned the potential to digitize measurements such as blood pressure or blood glucose.

5. Discussion

In this chapter, the expert interview results from chapter 4 are interpreted and compared against the literature review from chapter 2. By triangulating the responses from the ten interviewed experts from five different stakeholder groups in the nursing home sector with existing literature on telehealth in care, the aim is to arrive at a clear picture of the current situation and derive implications for a further rollout of telehealth applications in the nursing home environment.

5.1 Main findings & implications

RQ1: What is the current level of utilization of telehealth solutions in German nursing homes?

While various applications have been reported to be successfully operational in German nursing homes as part of the expert interviews, it became clear that the current level of utilization is largely limited to pilot projects. With the exception of GP1 and GP2, who are both primarily using asynchronous documentation solutions to interact with and instruct nursing staff, no other interviewees reported the use of a telehealth solution in an advanced stage, i.e., as part of regular care. These findings are in line with Otto et al. (2019), who note that the co-existence of various fragmented pilot projects, which are often severely limited in scope, can hinder widespread, scaled adoption. Highlighting the economic inefficiencies of running such pilot projects side-by-side and not harvesting potential synergies from pooling such projects, van Dyk (2014) further underscores the general notion of the interviewees that while many of the conducted pilot projects have been received generally positive, coordinated measures must be undertaken to achieve a notable boost in telehealth adoption in German nursing homes.

RQ1 – Implications:

As a result of these findings, it will be worthwhile to invest in the coordination and standardized evaluation of available pilot projects across Germany. While many projects yield good results and promote a generally positive attitude towards the potential impact of telehealth in German nursing homes, a country-wide, scaled adoption can be only be attained if these initiatives are monitored centrally and streamlined accordingly to properly leverage the generated insights for a strategic and coordinated roll-out. Therefore, managers and policymakers should explore opportunities for sharing and pooling resources as well as knowledge across fragmented pilot

projects and conduct in-depth economic and medical efficiency analyses in order to minimize costs and maximize the health economics benefits of upcoming telehealth implementations at scale.

RQ2: What are economic as well as operational incentives and barriers for German nursing homes to invest in and deploy telehealth solutions?

Incentives:

In terms of incentives for telehealth adoption in German nursing homes, there is a broad consensus among study participants that telehealth solutions show great potential to positively impact both economic and medical aspects of nursing care. While different stakeholder groups have reported a broad range of different incentives, they agreed on core aspects which can be achieved by telehealth. While the characteristics of these incentives varied to some extent due to the different backgrounds, the interviews revealed a clear acknowledgement of the potential of telehealth applications to positively impact the quality of and access to care on the operational side, while appreciating potential cost savings due to reduced travel times and costs for both patients and physicians on the economic side. In parallel with the consensus among interviewees that telehealth applications should be seen as a complement rather than a replacement for face-to face care, these results are largely in-line with the findings of Haleem et al. (2021) and Gillespie et al. (2019). Another core incentive for the interviewed nursing home stakeholders was the potential of telehealth consultations to reduce the number of potentially avoidable hospitalizations, which account for severely detrimental economic consequences for providers and similarly negative medical consequences for patients. These results are in line with Driessen et al. (2016) and Ohligs et al. (2020). In accordance with Hauck (2014, p.1), interview participants have acknowledged the much-cited lack of both GP and specialist physicians in more rural areas of Germany and highlighted the potential of telehealth solutions to address this structural problem by enabling physicians to treat more patients virtually than they could in-person in the same amount of time. It can therefore be seen as even more important to win the acceptance of the remaining physicians in those areas, due to the relevance of their acceptance as proposed in Wade et al.'s (2014) theory of clinician acceptance. One striking theme reported by interview participants is the enablement of improved interdisciplinary communication for healthcare professionals, most notably between nursing staff and physicians. In interviewee experiences, offering these low-threshold communication channels results not only in fast and well-reasoned decision-making in nursing care but also

contributes to higher perceived recognition for their work among nurses, in turn leading to lower strain on staff and higher process efficiency altogether. While interdisciplinary collaboration has primarily been mentioned in the context of physicians with different specializations communicating among each other (Eze et al., 2020; Schröder et al., 2020), the theme of improved nurse-physician communication has not been as prominent in the analyzed literature.

Barriers:

Despite these generally promising incentives, significant barriers for telehealth adoption in the nursing home ecosystem persist. The barriers reported by interviewees are characterized by various levels of complexity, starting at basic technological problems like the absence of a reliable Wi-Fi connection in many nursing homes, as reported by Baker & Stanley (2018). Transcending basic technology-related problems like the availability of a reliable internet connection, other technological issues like the secure transfer of patient data and especially the lack of interoperability between practice management software (physicians), patient records (nursing homes) and telehealth solutions (telehealth providers) stood out in the expert interviews, posing a significant threat to the widespread roll-out of telehealth solutions and adding an additional layer of complexity for all involved stakeholders. The need for smooth interoperability between systems was for instance also reported by Ford II et al. (2022) and van Dyk (2014). Yet another core barrier mentioned by interview participants across the board is that the introduction of telehealth applications, if mismanaged, can create more problems than it solves, especially if the technology does not take into account processes and workflows of nursing staff. In-line with Beckers & Strotbaum (2021, p.270) participants highlighted that technology should be derived from actual needs and processes in nursing homes, and not *vice versa*, which would put additional strain on nurses and physicians, and in turn jeopardize acceptance among healthcare staff. Lastly, regulatory barriers stood out as another key barrier for telehealth adoption. Participants called on policymakers to provide a clear legal framework for the topics of data protection and initial investment subsidies, as well as on medical decision-making bodies and health insurances to provide appropriate reimbursement schemes. While the much-cited regulatory barriers are in accordance with Contreras et al.'s (2020) research, Cason's (2014) work underscores the notion of reimbursement issues presenting a complex barrier which requires multilateral stakeholder engagement in the medical ecosystem.

RQ2 – Implications:

The results from both the literature review and the expert interviews show that virtually all stakeholders somewhat agree on a multitude of incentives which telehealth applications can bring to nursing homes. There is a certain degree of agreement on barriers to telehealth adoption too, however, interview responses have varied to a larger extent compared to incentives. Although this can partially be attributed to the different backgrounds and stakeholder perspectives, e.g., IC focusing more on the technical components, while SN emphasizes medical issues, etc., it could be inferred that stakeholders are driven by their unique agenda when confronting barriers to telehealth adoption. Therefore, interdisciplinary discourse among all involved stakeholder groups will be necessary for each of the groups to better understand the specific barriers their respective counterparts face. The fact that each stakeholder group has reported a unique weighting of barriers and intricacies calls for multilateral knowledge exchange and willingness to make concession beyond each group's own barriers, in order to ultimately achieve overarching incentives for the good of the entire German healthcare system at scale. However, if collaboration across stakeholder groups can be achieved, these incentives have the potential to alleviate some of the major challenges which the country's healthcare system faces. If the required process efficiencies and seamless integration are achieved and a similar quality of care can be demonstrated at scale and nurses are enabled to make well-informed decisions without having to physically call in a physician, telehealth holds realistic potential to emerge as a crucial tool to combat the structural lack of physicians in rural Germany.

RQ3: What are characteristics which make telehealth solutions attractive for German nursing home providers?

When asked about what they would consider an ideal telehealth solution for their specific use case along the nursing care spectrum, responses varied to some extent. This can once again partly be attributed to the various backgrounds and perspectives from the different stakeholder groups, which corresponds to the DoI theory's (Rogers, 2003) different user groups and different stages of adoption. However, most of the characteristics that would make a future telehealth solution attractive for interview participants are largely in line with existing literature, including ease of use and little need for training for both software as well as hardware which must also be easy to integrate, in line with for instance Gillespie et al. (2019). On the hardware

side, participants echoed Baker & Stanley's (2018) perspective that the integration of connected medical devices are deemed beneficial in principle, but only if their implementation and onboarding efforts are offset by efficiency gains in daily operations. Process efficiency in general emerged as a core requirement for the adoption of telehealth applications, as some participants feared that the introduction of a solution which isn't closely oriented towards actual nursing staff and physician processes would cause more problems than it would solve. This notion is in line with Beckers & Strotbaum's (2021, p.270) findings that telehealth innovations should not be interpreted as novel IT tools, but rather as holistic medical process innovations. This goes hand in hand with the need for broad acceptance among patients, nurses, and physicians, representing another crucial theme for the success of telehealth which the requirement for process efficiency can be seen as a precursor of. The latter two factors can be subsumed under perceived ease of use, while the recorded incentives from RQ2 can be subsumed under perceived usefulness. In combination, these two factors fulfil the requirements for the successful acceptance of a new technology under the TAM as proposed by Davis (1989). Corresponding to Talal et al. (2020), yet another central requirement under perceived ease of use reported by participants was the need for interoperability between existing systems like electronic health records, practice management software, and novel telehealth solutions. Since nurses are already struggling with the time-consuming burden of documentation, often paper-based or reliant on double entries for different systems, the need for standardized interfaces between smoothly interoperable systems can be considered a crucial factor, both in existing literature like Beckers & Strotbaum (2021, p.269) and in the conducted expert interviews. Lastly, the final core requirement from expert interviews were adequate reimbursement policies and clear guidelines from policymakers on the adoption and use of telehealth solutions, which conforming to the notion prevalent in previous studies like Contreras et al. (2020).

RQ3 – Implications:

As a result of the above requirements for future successful telehealth solutions in German nursing homes, telehealth providers should pay close attention to the actual needs and requirements of stakeholders in the nursing home environment and physicians, adhering to the principle of "form follows function". Instead of pushing new solutions onto the market solely for the sake of technological innovation, these applications should be oriented towards making existing workflows more efficient and incorporating continuous feedback from adopters, as recommended by Mitchell-Gillespie et al. (2020). In addition, integration with existing software

and hardware systems is crucial success factor for sustainable telehealth deployments. Interoperability emerged as an absolute core theme for telehealth solutions, and it should be addressed by both telehealth providers and policymakers. The latter are called on to provide regulatory frameworks which mandate the use of interoperable solutions, particularly in the context of documentation software and electronic patient records. Additionally, all stakeholders across the nursing home ecosystem, including health insurances, should enforce multilateral collaboration on reimbursement schemes. Appropriate reimbursement schemes should be designed to reflect both the costs incurred for participating providers and physicians, but also the added value for patients in terms of quality of and access to care. In a recent example, AOK Nordost, a German statutory health insurance provider, implemented a selective contract to reimburse physicians for the use of connected medical devices when conducting video consultations with partner nursing homes (ÄrzteZeitung, 2023). Only by working together and considering the specific needs and requirements of their respective counterparts, all stakeholder groups can ensure the successful implementation, adoption, and sustainability of telehealth solutions in German nursing homes.

5.2. Limitations, further research, and outlook

Research design limitations may influence the results of this study. Firstly, the rather small sample size of only ten interview participants may not fully represent the entire population of stakeholders in the German nursing home ecosystem. Participants of five different groups and from various geographical areas across Germany were selected to ensure a multi-perspective discourse on the topic of telehealth in geriatric care, but not all regions or states could be covered with this sample size. Additionally, the consultant group consists of only one participant, which is why his view could not be triangulated in the context of a within-group analysis. The use of semi-structured interviews with open-ended questions can be susceptible to bias in participant responses, as individual opinions, experiences, and particular topics may be over-emphasized in some interviews. In particular, project specific insights and anecdotal learnings may not be fully generalizable and therefore underscore the need for caution in interpreting the findings. Furthermore, all interviews were conducted in German and subsequently translated to English. To mitigate the loss of meaning, interviews were paraphrased and interpreted fully in German, however, a loss of nuance to some extent cannot be ruled out. Lastly, the literature review part of this study relies heavily on secondary data

from existing literature, which may not capture the most recent developments in the quickly evolving landscape in the field of telehealth appropriately.

Based on the above limitations, future research should examine a larger sample size of experts across the healthcare spectrum. By including participants from more regions across Germany as well as from more facilities, future studies can better represent the diverse perspectives of stakeholders in the German nursing home ecosystem. Furthermore, involving specialist doctors in addition to GPs could provide a more comprehensive understanding of the potential benefits and challenges of telehealth in geriatric care, especially in the context of rising multimorbidity among nursing home residents. Expanding the scope of research to include various types of nursing care facilities, such as assisted living communities and home care services, can further help identify the unique needs and opportunities for telehealth implementation in different care settings. Additionally, examining future telehealth projects which will be implemented at a larger scale can provide insights into the challenges and benefits of scaling up telehealth services in geriatric care. As such, future studies will be able to generate data from telehealth solutions integrated into regular care, which can help evaluate the effectiveness and feasibility outside of isolated pilot projects.

5.3 Conclusions

This study has examined the current status, incentives, barriers, and requirements for the adoption of telehealth solutions in German nursing homes. The findings indicate that while telehealth utilization is still in its infancy in most nursing homes, there is significant potential and willingness to adopt these technologies more widely.

The expert interviews revealed that the main incentives for nursing homes to adopt telehealth are improving quality of care and access to medical expertise. Telehealth solutions like RPM, video consultations, and interdisciplinary telecooperation can help address challenges with physician shortages, reduce hospital transfers, enable better chronic disease management, and improve coordination of care. Economic incentives were less emphasized, though cost savings from avoided hospitalizations were noted.

However, multiple barriers to large-scale telehealth adoption were identified, including lack of technological infrastructure, challenges with interoperability and data protection, high costs, lack of reimbursement schemes, and change management issues. Nursing home providers desire solutions that are easy to use, integrate with existing systems, comply with data protection laws, and have demonstrable benefits for quality of care. Ongoing evaluation and evidence generation are needed.

For telehealth to reach its potential in German nursing homes, concerted efforts by technology vendors, lawmakers, physicians, and nursing home providers will be required. Technology providers must focus on developing interoperable solutions that meet the specific needs of nursing homes and can integrate with existing care processes.

Policymakers need to create regulatory frameworks that enable telehealth reimbursement and incentivize adoption while protecting patient data. With the proposed Digital-Gesetz (DigiG), one such piece of legislation has passed the German cabinet in late August 2023 and will soon be debated in parliament (BMG, 2023c). This new law aims to accelerate the digitization of the German healthcare system, including the development and expansion of telehealth services. In the context of nursing homes, this law is expected to have a significant impact on the future adoption of such solutions. By focusing on the expansion of video consultations and teleconsultations, the law will make telemedicine a fixed component of healthcare provision. On top of enabling more comprehensive and easier-to-use telehealth solutions for elderly patients and healthcare professionals, the law will also remove the current limitation on video consultations and orient medical reimbursement more towards the quality of care delivered. This change will encourage healthcare providers to offer more telehealth services, including in nursing homes, as they will be better compensated for providing high-quality telemedicine care. Furthermore, the law aims to improve interoperability and cybersecurity, which will be crucial for the successful implementation of telehealth services in nursing homes. Improved interoperability will ensure seamless communication between different healthcare providers and systems, while enhanced cybersecurity measures will protect sensitive patient data. Legal initiatives like form the basis of a positive outlook on the future of telehealth in German nursing homes.

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List of Appendices

Appendix 1: Interview guide

Appendix 2: Interview results (by participant group)

Appendix 1: Interview guide

RQ #	RQ	Topics	Core papers	IQ #	Interview questions
RQ 0	Control Questions		n/a	IQ0	Please introduce yourself (age, gender, education, professional background, current position, general relationship with technology)
RQ1	What is the current level of utilization of telehealth solutions in German nursing homes?	Current adoption rate, roll-outs; potentially Germany demographics and care market landscape	Brücken et al. (2022), Ford et al. (2022), Ohligs et al., (2020), Katz et al. (2021)	IQ1	Are you currently using any telehealth solutions in one of your facilities?
			Brücken et al. (2022), Ford et al. (2022), Ohligs et al., (2020)	IQ2	If yes, which ones and to which extent?
			Groom et al. (2021), Offermann-van Heek et al. (2021), May et al. (2021)	IQ3	How have staff received them?
			Groom et al. (2021), Offermann-van Heek et al. (2021), May et al. (2021)	IQ4	How have patients received them?
			Katz et al. (2021)	IQ5	If no, is the deployment of telehealth solutions on your roadmap, i.e., do you plan on deploying them in the future?
			Groom et al. (2021), Ford et al. (2022), May et al. (2021), Offermann-van Heek et al. (2021)	IQ6	What is your general perception of telemedicine solutions and their potential impact in nursing homes?
RQ2			Gillespie et al. (2019), Groom et al. (2021), Haleem et al. (2021), May et al. (2021), Offermann-van Heek et al. (2021), Bohnet-Joschko & Stahl (2019)	IQ7	Which are the most promising incentives for telehealth adoption on the administrative/economic side?
			Driessen et al. (2016), Ford et al. (2022), Gillespie et al. (2019), May et al. (2021)	IQ8	Which are the most promising incentives for telehealth adoption on the operational/medical side?
			Cason (2014), Haleem et al. (2021), Portnoy et al. (2020), Qi Tan et al. (2022), Otto et al. (2019), Kruse et al. (2020)	IQ9	What are general barriers/blockers to adopting telehealth solutions?
			Bohnet-Joschko & Stahl (2019), Gillespie et al. (2019), Ford et al. (2022), Kleina et al. (2017), May et al. (2021), Snoswell et al. (2021)	IQ10	If you have already implemented a telemedicine solution, what were the outcomes on the QoC as well as on your organization?
			Bohnet-Joschko & Stahl (2019), Cormi et al. (2021), May et al. (2021), Qi Tan et al. (2022), Offermann-van Heek et al. (2021)	IQ11	What role do you see nursing staff playing in the implementation of telehealth solutions?
			Cormi et al. (2021), Offermann-van Heek et al. (2021), Kruse et al. (2020)	IQ12	If there have been unsuccessful attempts to implement telehealth solutions in one of your facilities in the past, why did they fail?
RQ3	What are characteristics which make telehealth solutions an attractive investment attractive for German nursing home providers?	Characteristics, desired features & devices, necessary organizational readiness, external needs	Ohligs et al. (2020) & below for individual	IQ13	In an ideal world, what would the optimal telehealth solution for your organization look like in terms of...
			Ford et al. (2022), Haleem et al. (2021)	IQ14	Software functionality?
			Baker & Stanley (2018), Driessen et al. (2016), Contreras et al. (2020), Ford et al. (2022)	IQ15	Hardware, especially in terms of medical devices?
			Baker & Stanley (2018), Martins (2020)	IQ16	Interoperability with current systems, e.g., EHR?
			Cason (2014), Contreras et al. (2020), Ford et al. (2022), Gillespie et al. (2019), May et al. (2021), Portnoy et al. (2020)	IQ17	External factors (regulatory, reimbursement, etc.)?
			Cormi et al. (2021), Bohnet-Joschko & Stahl (2019), Ford et al. (2022), Holden et al. (2013), Qi Tan et al. (2022)	IQ18	Internal factors (training, acceptance, etc.)?

Appendix 2: Interview results (by participant group)

IQ #	Interview questions	Participant ID			
		QM		PM	
		Main Comments	Significant Quotes	Main Comments	Significant Quotes
IQ0	Please introduce yourself (age, gender, education, professional background, current position, general relationship with technology)	Male, background as a skilled nurse, further education into care management and currently leading quality assurance at a large nursing home provider		Female, background as a skilled nurse, working in intensive care and later transitioning to project management in the healthcare industry	
IQ1	Are you currently using any telehealth solutions in one of your facilities?	No particular use of telehealth technology in managed facilities		Yes	
IQ2	If yes, which ones and to which extent?	n/a	"Telemedicine per se unfortunately not, which we rather regret. We think it can be very good, and just in the context of the Corona pandemic, telehealth would have made our lives much easier. Especially with visiting the residents' GP visits or the GP visiting the residents at the facilities."	A synchronous, medical-device-enabled telehealth solution Lack of acceptance, particularly older individuals who may not be technologically proficient Device functionality not optimal	"The solution is being used regularly to conduct virtual consultations, ideally once a week with the respiratory therapists or physicians."
IQ3	How have staff received them?	n/a		Generally well due to better access to care	
IQ4	How have patients received them?	n/a		Further deployment is on the roadmap	
IQ5	If no, is the deployment of telehealth solutions on your roadmap, i.e., do you plan on deploying them in the future?	Yes, they acknowledge the potential, would like to deploy telehealth			
IQ6	What is your general perception of telemedicine solutions and their potential impact in nursing homes?	Positive perception, but significant groundwork needs to be done first		Positive general perception, but significant gaps must be addressed before scaling	
IQ7	Which are the most promising incentives for telehealth adoption on the administrative/economic side?	Improved access to care, particularly in areas with physician shortages	"However, these would of course be synergy effects that would be very nice, but we must of course also first be clarified legally thanks to how one can, so to speak, digitization and care of the resident in the context of vital signs, etc. in the end then also do everything from a single source?"	Significantly reduced time spent on the road for physicians, leading to more time for patients Cost savings from reduced travel and hospitalizations Better availability of physicians and respiratory therapists	"Exactly, so the main benefit lies within the economics, because we don't have to send physicians and respiratory therapists on all these trips, that saves them a lot of valuable time. The same goes for avoidable hospital admission, because without our telehealth solution, many nurses would send patients straight to the hospital in uncertain situations."
IQ8	Which are the most promising incentives for telehealth adoption on the operational/medical side?	Combating lack of skilled nursing staff & physicians Quick access to transparent health data Interdisciplinary collaboration	"I always have to operate our own internal system and on the other hand also enter things into the other portals and that is actually seen as the biggest deficit. That there are no reasonable interfaces."	Significantly reduced potentially avoidable hospitalizations The alternative would simply be fewer in-person visits - which is not in the interest of patients Increased perceived diagnostics safety for nurses	"So for me it's primarily the regulatory issues, so I think that technically and all these things that could be done, that would all work very well, it's just how it's regulated in general and also how it's accepted by all stakeholders thereafter."
IQ9	What are general barriers/blockers to adopting telehealth solutions?	Interoperability issues with existing systems resulting in inefficient processes Unclear allocation of responsibilities between stakeholders Acceptance issues, primarily among physicians Unresolved reimbursement topic	"At the moment, they are experiencing that everyone is looking at how their area of responsibility is and we are rather on the way that it is as narrow as possible, because the number of specialists is not available, of course, you concentrate more and more on your core business."	Acceptance issues among less tech-savvy staff Barely designed processes amplify acceptance issues across stakeholders Lack of participating physicians Lack of cost coverage from health insurances	
IQ10	If you have already implemented a telemedicine solution, what were the outcomes on the QoC as well as on your organization?	n/a		Positive impact on QoC due to higher physician coverage for each patient Perceived reduction in personal physician contact for some patients	
IQ11	What role do you see nursing staff playing in the implementation of telehealth solutions?	Crucial role, but need for training concepts and clear delimitation of responsibilities		Frontline staff play a key role in the implementation of telehealth solutions Acceptance, understanding and appropriate training are required for nursing staff Nurses can act as a mediator between patients' fears and new technology	
IQ12	If there have been unsuccessful attempts to implement telehealth solutions in one of your facilities in the past, why did they fail?	n/a		Not particularly unsuccessful, but some of the integrated medical devices are not in use due to increased complexity	
IQ13	In an ideal world, what would the optimal telehealth solution for your organization look like in terms of...	A room fully dedicated for telehealth, in which patients can be brought into in the comfort of their own bed, including all necessary devices and communication equipment		Continuous availability of health data (both in-person and online) Seamless integration of care documentation	
IQ14	Software functionality?	Easy to use with little need for training Voice and video transmission from patient to physician High security standards, shouldn't be the responsibility of individual stakeholders like a GP	"And I hope that they will get their act together and say that now we are finally going to make the basis in the Teleinformation Act and everything in tele-digitized medicine uniform, and that we will also reach reasonable agreements with the health insurance companies beforehand. It is still the hope, after all years in the health service."	Availability of vitals to ensure time-efficient and well-prepared visitations Data visualizations for quick physician interpretations	
IQ15	Hardware, especially in terms of medical devices?	If well integrated and easy to use, "plug and play" medical devices would be beneficial Suitable IT infrastructure		A multi-functional device, unifying many devices into one, would be a great asset in the future. Standardized interfaces to existing systems are crucial for telehealth success	"Like heart rate, you also have other health data and in overall it has now been established that we actually have a tablet with which we use for video conferences, but all this data, which should actually be sent to the physician. The vital signs via devices are currently not used at all."
IQ16	Interoperability with current systems, e.g., EHR?	Top priority	"And I'd like to see more round tables where we can say where we need to work together more. I think that's also a big problem here in Germany, that everyone sees themselves too much alone in the systems and is becoming more and more entrenched there alone, instead of saying for the sake of the patient we all have to optimize things together and pull together."		
IQ17	External factors (regulatory, reimbursement, etc.)?	Financial support must be provided for initial investments due to tight margins at providers Reimbursement important for sustainable use Regulatory frameworks on compulsory use of new technology		Need for federal regulation on telehealth to avoid uncertainty and slow innovation climate Bureaucracy is blocking faster technology adoption	
IQ18	Internal factors (training, acceptance, etc.)?	Clear allocation of authorization rights and competencies Patience with nursing staff Patients still require human interaction, acceptance is crucial		Need for better training and internal communication for nursing staff	

IQ #	Interview questions	Consultant IC	Significant Quotes
		Main Comments	
IQ0	Please introduce yourself (age, gender, education, professional background, current position, general relationship with technology)	Male, technical education, started with the development of software applications for medical device technology and energy systems. This led to the exploration of telemedicine and the establishment of a telemedicine network as an external consultant.	
IQ1	Are you currently using any telehealth solutions in one of your facilities?	Working with a couple of facilities and providers on pilot project implementation	"Digitization poses different problems than telehealth. Because they are still a big step behind. They have to document, of course, and they find this documentation a tremendous burden."
IQ2	If yes, which ones and to which extent?	Primarily documentation- and interdisciplinary collaboration oriented	"There was once a telehealth project where we directly addressed the collaboration between physicians and nursing staff, where this was also to be supported technically."
IQ3	How have staff received them?	Too early to tell	
IQ4	How have patients received them?	Too early to tell	
IQ5	If no, is the deployment of telehealth solutions on your roadmap, i.e., do you plan on deploying them in the future?	Many of the collaborating providers have telehealth on their roadmap and acknowledge potential	
IQ6	What is your general perception of telemedicine solutions and their potential impact in nursing homes?	Positive general perception, however, with many primarily technical questions still to be addressed	
IQ7	Which are the most promising incentives for telehealth adoption on the administrative/economic side?	Elimination of predominant paper-based documentation and processes Better collaboration and communication with pharmacies Cost efficiencies due to potentially streamlined processes	"Unfortunately, this [avoidable hospitalizations] is the standard, and that's not nice, everyone knows that. The nursing facilities above all, because they know that this is also quite devastating for the patient psychologically or for the resident. The emergency rooms say we constantly get people who don't belong here at all."
IQ8	Which are the most promising incentives for telehealth adoption on the operational/medical side?	Increased interdisciplinary communication, especially between nursing staff and attending physicians Enablement of early intervention and problem detection, leading to fewer hospital admissions and better patient outcomes Potential of centralized and easily accessible patient information	
IQ9	What are general barriers/blockers to adopting telehealth solutions?	Challenges of sharing medical data between different healthcare professionals Electronic patient files are not deeply integrated, and there is a lack of trust and cooperation between different healthcare stakeholders Technical setup, i.e., connectivity and protocols Limited wide-scale evidence due to prevalence of pilot projects Acceptance issues, particularly among physicians Training and technological proficiency, particularly among nursing staff	
IQ10	If you have already implemented a telemedicine solution, what were the outcomes on the QoC as well as on your organization?	n/a	
IQ11	What role do you see nursing staff playing in the implementation of telehealth solutions?	In addition to physicians, nursing staff buy-in is crucial Telehealth can make healthcare professionals feel valued and respected, as their documentation and expertise are acknowledged and utilized	
IQ12	If there have been unsuccessful attempts to implement telehealth solutions in one of your facilities in the past, why did they fail?	n/a	
IQ13	In an ideal world, what would the optimal telehealth solution for your organization look like in terms of...		
IQ14	Software functionality?	Emphasizes the importance of secure communication channels and the need for a centralized patient index Sharing medical data between different healthcare professionals AI and machine learning capabilities as state of the art technologies to be considered	"That's the problem, because it's not just doctors who communicate with each other. If it's just doctors, then I have the telematics infrastructure, but if you add nurses, pharmacies and insurances into the mix, the infrastructure becomes much more complicated."
IQ15	Hardware, especially in terms of medical devices?	Telehealth devices at the intersection of remote patient monitoring and synchronous remote diagnostics Ultrasound technology as an area of telehealth application	
IQ16	Interoperability with current systems, e.g., EHR?	Crucial need for interoperability and standardization	
IQ17	External factors (regulatory, reimbursement, etc.)?	Call for technological questions around standardization, interoperability, and infrastructure to be addressed by regulators Clear responsibilities need to be assigned to stakeholders	
IQ18	Internal factors (training, acceptance, etc.)?	Need for training and support for healthcare professionals, especially those who may be less technologically proficient Telehealth assistants could emerge as a new profession with dedicated education Success stories and sustained evidence are critical for clinical buy-in, which is in turn critical for scaled telehealth adoption	

IQ #	Interview questions	Physicians			
		GP 1		GP2	
		Main Comments	Significant Quotes	Main Comments	Significant Quotes
IQ0	Please introduce yourself (age, gender, education, professional background, current position, general relationship with technology)	Female, background as medical technical assistant, studied medicine later in life and has since worked as a physician in a hospital and up until today as a primary care physician in an urban environment with her own practice Fully covering a nursing home on top of her own practice		Female, background as a primary care physician, partly covering a nursing home in a rural environment	
IQ1	Are you currently using any telehealth solutions in one of your facilities?	Yes		Yes	
IQ2	If yes, which ones and to which extent?	Primarily asynchronous solutions in the form of patient files/documentation to communicate with nurses Occasional use of a synchronous video consultation solution	"What we are doing is an absolute success model, and none of us would want to do without it. But the success really lies in the fact that we were the ones who needed digitization, that we got it off the ground, and that we geared it to our needs. We have tailored the digital possibilities to our needs and not the other way around, as often happens."	Primarily synchronous telehealth solutions in the form of video consultations, but without connected medical devices Partly usage of an asynchronous digital documentation system in the nursing home context Good reception from nursing home staff, as documentation gives them clear instructions, boosts interdisciplinary communication and reduces uncertainty Mixed, but generally positive reception from patients, especially in terms of	"Simple solutions already go a long way. Yes, certainly there is a use-case for sophisticated telehealth solutions with a multitude of connected devices, but what we're doing in terms of simplified and remotely accessible documentation can already impact quality of care quite strongly."
IQ3	How have staff received them?	Very well, nursing staff feel valued Lower levels of burnout and churn reported in the participating facility			
IQ4	How have patients received them?	Very well, increased satisfaction due to higher frequency of physician input			
IQ5	If no, is the deployment of telehealth solutions on your roadmap, i.e., do you plan on deploying them in the future?	Further rollout is a goal		For now only existing use	
IQ6	What is your general perception of telemedicine solutions and their potential impact in nursing homes?	Very positive general perception, telehealth can become transformative tool in care		Very good experiences so far with the potential to add value in the wider nursing home environment	
IQ7	Which are the most promising incentives for telehealth adoption on the administrative/economic side?	Strongly improved process efficiency for nursing staff Improved coordination of patient care and tasks due to significantly better information exchange and collaboration across healthcare stakeholders		Decision-making pressure is taken off nursing staff due to easier access to support from primary care physician Less costly potentially avoidable hospitalizations due to the possibility to touch base with a physician before sending a patient to the hospital Emergency having access to a physician Higher frequency is seen as an asset by all involved stakeholders, but particularly patients Especially in rural areas, physician shortages are already a major issue and can be combated by telehealth, particularly by eliminating long distances	"Nurses often have no other choice than sending patients off to the nearest emergency room in cases of uncertainty on how to proceed with them. If they can clarify the issue with a physician remotely, this is a game changer for all stakeholders."
IQ8	Which are the most promising incentives for telehealth adoption on the operational/medical side?	Increases quality of care due to continuous coordination between nurses and physicians, resulting in fewer unclear situations and potentially avoidable hospitalizations	"That's actually our secret, this improvement in secure communication, timely communication and secure information exchange and increasing multidisciplinary teamwork. When you work like this, you also learn to appreciate, value each other differently. The nursing staff is really a great team for me to work with."		
IQ9	What are general barriers/blockers to adopting telehealth solutions?	Technology acceptance is an issue, especially due to an overwhelming amount of fragmented solutions without interoperability and underlying processes as well as lack of awareness of available technologies Poor implementation and support from software providers High initial costs associated with technology investments for physicians	"The doctors are not allowed to enter data, some have a digital file and a paper file in parallel. Then the doctor has to enter everything in the paper file and the nurse transfers it to the digital file. So you can't believe all that, yes, but that's still relatively common, yes."	The lack of large-scale projects leads to the prevalent hesitation towards widespread adoption, which is a vicious circle in itself Despite positive experiences, acceptance can still be an issue Some projects struggle with low staff acceptance due to inadequate training The impact on the quality of care has been very positive, both for GP-practice patients and for nursing home patients Most people value having the possibility to consult with a physician more highly than they see technical or process difficulties as an issue	"Introducing novel solutions stands and falls with the training concepts behind them. If there is no sufficient training for the ones operating the telehealth solution, there will not be sufficient acceptance from the ones on the frontline."
IQ10	If you have already implemented a telemedicine solution, what were the outcomes on the QoC as well as on your organization?	Reduction in hospitalizations led to significantly faster recovery for many patients Better QoC also due to reduced stress levels and increased recognition for nursing staff			
IQ11	What role do you see nursing staff playing in the implementation of telehealth solutions?	Crucial role, as their processes and workflows (alongside those of the physicians) should be the core of telehealth applications Nurses' knowledge of their patients should not be underestimated for a physician's assessment of conditions		They play a very central role, as they are the ones interacting with patients on the frontline There is a need to empower nursing staff with medical assistance to take weight off their shoulders in decision-making	
IQ12	If there have been unsuccessful attempts to implement telehealth solutions in one of your facilities in the past, why did they fail?	Not in this particular facility, but there have been reports from other GPs about telehealth not being feasible/viable due to a lack of interoperability with existing systems and high costs associated with compatibility		n/a	
IQ13	In an ideal world, what would the optimal telehealth solution for your organization look like in terms of...	Most importantly, telehealth technology must be driven by processes and demand from healthcare stakeholders, not the other way around Need for nursing homes and care facilities to transition from paper-based records to digital systems		Ideally, there would be a one-stop-shop for everything - software and connected hardware - with different telehealth providers ensuring smooth interoperability Standardized interfaces for practice management systems to smoothly interoperate with care management systems in nursing homes User friendly and self-explanatory navigation through the software to boost user acceptance	"Without the commitment from politics, any pilot project can be as good as it wants to, and it will never reach a scaled roll-out. Nursing home providers and physicians need security and commitment, before they can fully go in."
IQ14	Software functionality?	Need for customizable, yet interoperable IT systems Software should be designed to simplify daily tasks and support healthcare professionals in their work Implementation support from software providers is crucial, especially for non tech-savvy physicians			
IQ15	Hardware, especially in terms of medical devices?	n/a	"So that everyone is happy to continue on this journey and to give the people who have to be cared for the necessary quality of care in the medical field and also the quality of life they deserve. That only works with a good standard of care and something has to happen here in our country in any case."	Connected medical devices are generally a positive development in terms of diagnostics and monitoring, but their ease of use is a priority Enable fast and secure transfers and interoperability between different file management and practice systems, to ensure better availability of patient information and empower interdisciplinary collaboration	
IQ16	Interoperability with current systems, e.g., EHR?	Interoperability between GP practice software and nursing home patient files is a crucial success factor	"Yes, that's exactly how it is - this fragmented landscape, which must finally come to an end. A standard is needed, a reasonable standard in all practice management software systems and nursing home software systems that is oriented to the care requirements and the processes that are to be supported digitally on site."		"Trying to make a nursing home's patient file management software work together with a hardly compatible practice management software of the facility's primary care physician can be a nightmare. Interoperability can be very powerful in overcoming barriers."
IQ17	External factors (regulatory, reimbursement, etc.)?	Need for affordable digital solutions for physicians The government should provide incentives for the adoption of digital solutions, including financial support for the implementation of user-friendly and effective software.	"So far, the policymakers have not succeeded. But so far we really are at the bottom of the league, second to last in the whole international comparison."	Calls on regulators for physicians to be compensated fairly for their efforts around telehealth adoption and for telehealth services Standardized interfaces should become part of federal regulations to be taken seriously by software providers	
IQ18	Internal factors (training, acceptance, etc.)?	To boost acceptance among nurses, physicians, and patients, telehealth solutions should not come as a burden that requires effort to be invested, but as something that makes their daily life easier.		Comprehensive training concepts are necessary to overcome fears among nursing staff and physicians alike, in turning ensuring the necessary acceptance Clear definition of responsibilities among all relevant stakeholders	

IQ#	Interview questions	Nursing Homes			
		ND		SN	
		Main Comments	Significant Quotes	Main Comments	Significant Quotes
IQ0	Please introduce yourself (age, gender, education, professional background, current position, general relationship with technology)	Male, background in nursing sciences, worked at a private nursing home provider after his studies and has been leading a rural nursing home as facility director since 2015		Female, background as a skilled nurse with over 30 years of experience and over 20 years as a training for nurses in education, working at a rural nursing home	
IQ1	Are you currently using any telehealth solutions in one of your facilities?	Yes	"Where we already stand out from the market, so where we can also go into marketing as a facility - if we need marketing here in our [rural] region - we would do it about our unique telehealth project. And we just go along with it because we are simply interested in the technology."	Yes	"So I would always advocate that we try it [new telehealth solution] out ourselves. We have received it from a large insurance company as a trial project and maybe you we can convince them of it, because is really a fine thing and for the quality of care of the residents it is wonderful."
IQ2	If yes, which ones and to which extent?	Pilot project involving a synchronous, medical-device-enabled telehealth solution		Pilot project involving a synchronous, medical-device-enabled telehealth solution	
IQ3	How have staff received them?	Very well, they appreciate having the possibility to consult with a physician despite the rural location of the nursing home		Very well, they appreciate having the possibility to consult with a physician despite the rural location of the nursing home	
IQ4	How have patients received them?	Very well, they enjoy interacting with their physicians more frequently, even if it's just over a video consultation		Very well, they enjoy interacting with their physicians more frequently, even if it's just over a video consultation	
IQ5	If no, is the deployment of telehealth solutions on your roadmap, i.e., do you plan on deploying them in the future?	A rollout beyond the pilot project is on the roadmap		Very well, they enjoy interacting with their physicians more frequently, even if it's just over a video consultation	
IQ6	What is your general perception of telemedicine solutions and their potential impact in nursing homes?	Very promising, sees the nursing home environment as a valuable area of application for telehealth advancements Highlights the positive impact it has had on communication and access to primary care. The project has provided valuable insights and opportunities for further integration of telehealth services.		environment, large impact especially in rural regions However, digitization in general is not perceived as advanced in nursing homes as it is in other sectors of the healthcare system	
IQ7	Which are the most promising incentives for telehealth adoption on the administrative/economic side?	The aging population and decreasing workforce in rural areas create a need for innovative solutions Eliminates the need for residents to travel long distances for medical appointments, reducing transportation challenges and discomfort Potential to reduce healthcare costs by avoiding unnecessary hospital admissions and reducing the need for transportation, resulting in cost reductions for providers and insurances	"For us in inpatient care, the issue is a bit more precarious, which has now become a bit clear to me in the context of this project. The residents who live with us do not have the opportunity, like someone who lives at home, to get in the car and go to the doctor's office, have a cold or whatever, but they are dependent on either the communication being taken over by the nursing staff or on the nursing staff being able to communicate with them."	Not that many insights into the administrative or economic aspects as a frontline nurse Telehealth allows for immediate communication and consultation with healthcare professionals, particularly in emergency situations Enables healthcare providers to assess skin conditions and provide timely medical orders Can be beneficial for managing chronic conditions such as cardiovascular diseases and COPD if vital signs are monitored Enables healthcare providers to listen to lung sounds using a stethoscope remotely	
IQ8	Which are the most promising incentives for telehealth adoption on the operational/medical side?	Enables quick assessment and management of conditions such as wounds and skin irritations Reduction of hospitalizations which are usually very stressful and sometimes dangerous for patients Enables closer monitoring of residents' health conditions, early detection of changes, and prompt intervention, leading to improved quality of care Provides a new communication channel between residents and their primary care physicians, especially for those who cannot easily travel to a clinic		Older healthcare professionals may be less open to adopting telehealth technologies Issues with audio quality and internet connectivity can pose challenges during telehealth consultations Telehealth offers convenience and timely medical support, particularly in emergency situations and for ongoing management of chronic illnesses Saves patients unnecessary trips to the hospital, which can have a severely bad impact on their overall wellbeing, especially if they suffer from dementia Implementation in larger healthcare facilities with multiple departments and staff members can be challenging due to the need for coordination and agreement among various stakeholders Some healthcare professionals may view telehealth as an additional burden or may be resistant to change	"So for me, it's not an additional burden. I find it rather a relief for both sides for the resident, and also for us [nursing staff]."
IQ9	What are general barriers/blockers to adopting telehealth solutions?	Legal challenges related to state licensure and practice laws, credentialing, liability concerns, telehealth service reimbursement, and costs of telehealth infrastructure Cybersecurity fears and concerns about the standard of care contribute to acceptance issues Technical issues and the need for improved network connectivity Impersonal interactions, limited ability to perform hands-on assessments			
IQ10	If you have already implemented a telemedicine solution, what were the outcomes on the QoC as well as on your organization?	Telehealth offers a more convenient and less disruptive healthcare experience for residents, particularly those with cognitive impairments or anxiety related to hospital visits Saves time for both nursing home staff and primary care physicians by allowing for quicker assessments, consultations, and decision-making			
IQ11	What role do you see nursing staff playing in the implementation of telehealth solutions?	A very important role, as they act as the binding component between patients, physicians, and technology. Nursing staff acceptance is a critical factor for telehealth success and sustained use in nursing homes		Speaking from experience, a crucial role, as they need to operate new telehealth technologies while maintaining their already demanding workday routine Being the first point of contact for patients, they also have the responsibility of mitigating potential fears and concerns regarding the use of technology in nursing care	
IQ12	If there have been unsuccessful attempts to implement telehealth solutions in one of your facilities in the past, why did they fail?	n/a		n/a	
IQ13	In an ideal world, what would the optimal telehealth solution for your organization look like in terms of...	Should facilitate collaboration and communication among different healthcare professionals, including specialists and primary care physicians Acceptance and engagement of healthcare professionals, including physicians and nurses, are key factors for the sustainable implementation of telehealth services Patients should have control over their own health information and be able to selectively share it with healthcare providers		Our telehealth solution should be expanded to include as many specialists as possible, such as neurologists, who can provide valuable insights and assessments for specific conditions like dementia Telehealth should prioritize the quality of care and patient satisfaction, ensuring that telehealth services meet the needs and preferences of patients	
IQ14	Software functionality?	Ensuring data privacy and security is important for patient trust and acceptance of telehealth, featuring clear protocols and secure servers should be in place to protect patient information Should have intuitive and user-friendly interfaces to minimize technical difficulties and maximize ease of use		Ensuring the privacy and security of patient information during telehealth consultations is essential	
IQ15	Hardware, especially in terms of medical devices?	Integration of common medical devices is beneficial	"And reasonable training concepts, those will be much needed."	Reliable internet connection and strong network coverage form a crucial basis for telehealth implementation Connected medical devices should have ease of use at the core of their design, e.g., constantly having to charge devices or connectivity issues can be a burden Telehealth should be integrated into existing healthcare systems and workflows to ensure smooth implementation and adoption	"I still remember how we were converted here 20 or 25 years ago, we started with handwritten documentation, oh God, then we were told to start with a PC. Oh dear, what is a PC? Well, we are not the younger ones. We're the older ones here, and we had to get used to it first, and so it goes step by step."
IQ16	Interoperability with current systems, e.g., EHR?	Interoperability with patient management software to avoid multiple entry of the same datasets	"I genuinely hope that future, the participation from GPs will increase strongly, and even more so from specialists."		
IQ17	External factors (regulatory, reimbursement, etc.)?	Individual agreements between healthcare providers, health insurance companies, and care facilities to ensure the availability of telehealth services The number of physicians who are open to use telehealth must increase Telehealth interventions should be supported by evidence from rigorous research studies to ensure their effectiveness and impact on patient outcomes		Healthcare providers should be supportive and interested in the implementation of telehealth, as demonstrated by their participation in training sessions and willingness to collaborate Reimbursement for the use of telehealth should be regarded as a multilateral topic and discussed between all relevant healthcare stakeholders	
IQ18	Internal factors (training, acceptance, etc.)?	Physicians who have strong connections with their patients are more open to adopting telehealth to provide better care Acceptance and engagement of clinicians, including nursing home staff and primary care physicians, are crucial for the successful implementation and sustainability of telehealth services Feedback and communication with the telehealth provider to foster continuous improvement		The acceptance and readiness of healthcare professionals to embrace telehealth are crucial for successful implementation Adequate training and support are necessary to ensure staff members are comfortable and proficient in using telehealth technologies Patients may require education and support to understand and use telehealth effectively	

Q#	Interview questions	Associations						
		A1	A2	A3	A4	A5	A6	
		Main Comments	Significant Quotes	Main Comments	Significant Quotes	Main Comments	Significant Quotes	
Q0	Please introduce yourself (age, gender, education, professional background, current position, general relationship with technology)	Male, background as a lawyer, currently leading the eastern branch (covering 4 German states) of a provider-side association, representing both private and non-profit care provider interests and advising them on various topics including innovation		Male, background as a certified social pedagogic, with extensive experience as a nursing home director, now Germany-wide CEO of a care provider side association, representing non-profit provider interests and advising them on various topics including innovation		Male, background in political science and in association administration, currently Germany-wide CEO of a care provider association, representing non-profit provider interests and advising them on various topics including innovation		
Q1	Are you currently using any telehealth solutions in one of your facilities?	Not generalizable for all association members, but generally no widespread, particularly for direct treatment or interventions		No widespread adoption among member organizations as of yet		No widespread adoption among member organizations, but monitoring of pilot projects across Germany		
Q2	If yes, which ones and to which extent?	Telehealth has been utilized in some institutions for consultations and advice, particularly in the form of video consultations, during the COVID-19 pandemic when in-person visits were limited	"As far as telecare or telemedicine is concerned, that is of course a bit difficult to judge now, has already said so we do not have any member organizations now where we can say that telemedicine is directly applied in the form of any treatments or similar."	Two member providers have agreed to start pilot projects Scattered use of synchronous video consultations here and there	"We have two institutions that have agreed to start a corresponding project with us, because we want to find out in practice, parallel to the developments that exist at the federal level, how telemedicine applications can be made functional."	There are various pilot/model projects across the country that focus on specific aspects of telehealth, but they are often limited in scope and application	"So of course we have numerous model projects across the country. These concern all possible areas of care, but also all possible subject areas, but are then often also very strongly restricted in scope."	
Q3	How have staff received them?	Some member organizations have specifically asked for faster adoption and showed great interest in telehealth technology	"We have member organizations that say what can't it be done faster? In fact, there are quite a few."	n/a	Positive feedback for video consultations as they provided access to care for nursing home residents during Covid-19	There are mixed reactions on the patient side, ranging from very positive experiences to patient-perceived barriers to telehealth, such as lack of interest or access to technology		
Q4	How have patients received them?	Patients have reported mixed, yet generally positive experiences with telehealth, including improved well-being and time savings from reduced travel		Yes, pilot projects are on the roadmap with further rollouts planned in case they are successful		Yes, further pilot projects are on the roadmap, and if they are successful, further rollouts are planned		
Q5	If no, is the deployment of telehealth solutions on your roadmap, i.e., do you plan on deploying them in the future?	Sometimes, patients themselves are less concerned than family members		The technology has the potential to have a large impact on increased accessibility of high quality care for nursing home residents		In theory and in small-scale pilots, the potential for positive impact has been demonstrated - addressing patient barriers, ensuring ease of implementation, and highlighting the advantages of telehealth are important for increasing adoption and utilization		
Q6	What is your general perception of telemedicine solutions and their potential impact in nursing homes?	Telehealth is expected to continue and potentially be implemented on a long-term basis, depending on the success and feedback received during each project's pilot phase						
Q7	Which are the most promising incentives for telehealth adoption on the administrative/economic side?	Telehealth can simplify administrative tasks, such as documentation and billing, by integrating patient data into software systems Facilitation of communication and collaboration between healthcare providers, allowing for timely consultations and reducing the need for physical transfers of patient information Potential to reduce healthcare costs, particularly by avoiding unnecessary hospitalizations and emergency department visits	"We know from our members that telehealth is not very well accepted. There is also a very wide range, so there was talk of from complete rejection to very good acceptance. We actually have companies that are still very, very analog."	Telehealth has the potential to reduce healthcare costs by minimizing travel expenses and unnecessary hospital visits Simplified administrative tasks, such as documentation and billing, leading to increased efficiency, reduced strain on nursing staff and reduced administrative burden Receiving care in the comfort of their own bed or room promotes patient-centered care and improving patient satisfaction Governments have a strong incentive to promote telehealth as a means to improve healthcare efficiency and outcomes, especially regarding drastic hospital shortages in parts of Germany	"Especially for people with dementia, this is an important argument, to be able to stay in their familiar surroundings and perhaps be accompanied by familiar people."	Telehealth has the potential to save financial resources by reducing the need for in-person visits and hospital admissions, which tend to be accompanied by nursing staff Potential to reduce the negative impact of physician shortages on the care nursing home patients receive, particularly in rural areas	"To take up the example of combating the shortage of rural physicians, I would not call it an advantage, but rather the fact that it reduces the impact of the shortage of physicians on nursing homes, which would be very attractive for nursing homes. For example, if they don't have to spend ages trying to get appointments, don't have to spend ages negotiating with the primary care physician when he's finally going to come back to the nursing home."	
Q8	Which are the most promising incentives for telehealth adoption on the operational/medical side?	Telehealth offers a faster and more convenient way to access a high quality delivery of healthcare services, reducing the need for travel and allowing for immediate access to medical records Enables patients in remote areas to access specialized care without the need for long-distance travel, reducing hospitalization rates and unnecessary referrals	"But that's what I also say, if I had the relief, then I can achieve the relief the quickest and the easiest actually in the area of administration."	Telehealth can help overcome barriers to accessing healthcare, particularly for patients in rural areas or with limited mobility and lead to higher frequency of receiving care, resulting in improved health outcomes for patients	"But I do believe that you can save personnel, because you can simply save travel time and for one travel time I can already deal with another patient."	Increased patient satisfaction due to simplified access to appropriate care Reduced disruptions from the setting patients are used to, leading to stress reduction, particularly for patients with dementia who would otherwise perceive trips to the hospital as highly burdensome Potential to improve healthcare access, reduce healthcare disparities, and enhance patient outcomes	"Yes, so I think that is a very central incentive to make life easier. Yes, and of course, on the one hand in terms of nursing processes, but on the other hand definitely also for the patients. It has the potential to contribute to a much calmer life, particularly for patients with dementia."	
Q9	What are general barriers/blockers to adopting telehealth solutions?	Fully embraced digital technologies - administrative processes, such as obtaining signatures and sending documents, are still largely paper-based and time-consuming The lack of interoperability between different systems and platforms hinders the seamless exchange of information and data Complex regulations and outdated reimbursement contracts make it difficult to implement and integrate telehealth solutions effectively Infrastructure required for telehealth, such as reliable internet	"Yes, from the point of view of the health insurers, it should be that they say, we would like to have this by yesterday. Of course, it's much cheaper for the insurer. The day in the hospital costs them enormously."	Existence of multiple telehealth platforms and systems that are not compatible with each other creates challenges in integrating them well We get a general consensus as of yet, but video consultations had a positive impact on the frequency and quality of care for nursing home patients Healthcare providers may be resistant to adopting telehealth due to concerns about the impact on their workflow, patient-provider relationships, the quality of care, and inadequate training Cost of purchasing and maintaining telehealth equipment and services is considered burdensome, particularly for smaller nursing home providers Complex regulations and licensing requirements across different jurisdictions can create barriers to the widespread adoption, adding to inadequate reimbursement rates for new technologies Inadequate internet connectivity, lack of Wi-Fi infrastructure, and outdated facilities can hinder the implementation	"Non-existent Wi-Fi, because the buildings are simply not Wi-Fi-capable, so many facilities are stuck in old walls, where they try to bring in Wi-Fi. This is technically all solvable, but with such high costs, because then countless cables must be pulled."	Many model projects are highly specific and limited in their scope, often focusing on individual facilities or specific areas of healthcare and lacking insights for general adoption The issue of financing telehealth initiatives is seen as a significant challenge Wi-Fi-capable, so many facilities are stuck in old walls, where they try to bring in Wi-Fi. This is technically all solvable, but with such high costs, because then countless cables must be pulled."	"We are then back to the question of financing, so if I as a patient want to have something like telehealth consultations, then I must also want to pay, either through an increased health insurance contribution or through an increased care insurance contribution and there I am back to the health insurance. This is a health and not a care service."	"We are then back to the question of financing, so if I as a patient want to have something like telehealth consultations, then I must also want to pay, either through an increased health insurance contribution or through an increased care insurance contribution and there I am back to the health insurance. This is a health and not a care service."
Q10	If you have already implemented a telemedicine solution, what were the outcomes on the QoC as well as on your organization?	Member organizations have reported that telehealth has the potential to reduce healthcare costs, particularly by avoiding unnecessary hospitalizations and emergency department visits				A number of already completed model projects have demonstrated clear benefits and have been well-received by healthcare providers who attribute positive effects on the quality of and access to care for nursing home residents Telehealth initiatives should always prioritize improving the quality of care and the well-being of staff and patients alike, there is no use of simply pushing technology just because it is available	"The nursing facilities are all under a lot of pressure, and some of them are at the limits of what can be done. And then it's always difficult to say, 'I'm going to do another project here, and I don't really know beforehand what will actually come out of it.'"	
Q11	What role do you see nursing staff playing in the implementation of telehealth solutions?	They play a crucial role, however, large parts of the nursing staff are already overwhelmed with various tasks and responsibilities, making it challenging to adopt and implement telehealth Resistance to change and a lack of understanding or awareness of the benefits of telehealth contribute to its limited adoption				Considering the acceptance and appropriate training of nursing staff is crucial for the successful implementation and sustainability of telehealth projects		
Q12	If there have been unsuccessful attempts to implement telehealth solutions in one of your facilities in the past, why did they fail?	The lack of sufficient funding and financial support for telehealth initiatives and infrastructure development has posed a significant barrier for a number of member organizations				n/a		
Q13	In an ideal world, what would the optimal telehealth solution for your organization look like in terms of...	Anything that has a positive impact on the quality of care, but doesn't require more input/resources than positive outcomes						
Q14	Software functionality?	n/a						
Q15	Hardware, especially in terms of medical devices?	Connected medical devices like digital blood pressure valves or remote patient monitoring technology can be a great asset in telecare, robotics and IoT devices have the potential to transform how nursing home residents live	"Inevitably it approaches. There is the obligation, at the moment as of 1.1.24 to be connected to the telemedical infrastructure."	A mobile cart which can be used both in inpatient and outpatient settings, featuring all common medical devices and video conferencing equipment, would make a solid basis for telehealth projects	"One idea that has been bounced around a lot is introducing the new profession of a telemedical assistant. This person would have to be restricted to one facility though, to keep a certain level of trust."	Need for user-friendly interfaces that address the concerns and fears of both healthcare providers and patients, particularly older individuals	"I believe that the goal must be to bring the various model projects into regular care. And I don't think we currently have any idea how we can do that."	
Q16	Interoperability with current systems, e.g., EHR?	Seamless integration and interoperability with existing systems are seen as a crucial success factor for widespread telehealth adoption Standardization will be key for inter-stakeholder collaboration (e.g. between providers, physicians, and insurers, etc.)	"What could be digitized, course, would be, for example, to say, I don't know, to measure blood pressure, blood sugar, etc. These are things that could certainly also be done digitally."	Development of comprehensive electronic patient records that can be accessed by all healthcare providers involved in a patient's care is essential for seamless telehealth services	"If we can then manage to integrate AI-technologies as well, maybe we can automate the documentation process."	Standardization and interoperability are crucial long-term success factors Ideally, there would be one solution with a standardized interface for all telehealth application areas	"In that case, the facilities have to focus on what, from their point of view, is the easiest to implement, and B generates the greatest benefit from their point of view."	
Q17	External factors (regulatory, reimbursement, etc.)?	A collaborative and partnership approach to telehealth implementation, involving all stakeholders including insurers and policymakers, can help overcome barriers and facilitate adoption		Modernized reimbursement policies and regulations on telehealth use must urgently be considered by policymakers Collaboration between all relevant stakeholders, i.e., researchers, practitioners, policymakers, etc., can help identify challenges and develop solutions for telehealth implementation	"I think there will have to be a balance between how much telehealth and how much in-person medicine, I would say"	Call for innovative solutions and policies from the government to promote the adoption and utilization of telehealth		
Q18	Internal factors (training, acceptance, etc.)?	Healthcare professionals, particularly those in nursing and caregiving roles, need to be trained and educated adequately on the use of telehealth technologies and their benefits Having dedicated resources, both in terms of technology and personnel, is essential for supporting telehealth work and overcoming barriers to acceptance Demonstrating early successes and positive outcomes of telehealth can encourage staff acceptance and facilitate increased adoption				The current schedule and range of activities is already more than challenging for nursing staff - dedicated time and resources are needed to deploy training measures		