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Digital health applications – a digital solution for the health of the future?

Miriam Ines Füßer [a,*], Thomas Ostermann [b], Jan Ehlers [b] and Gregor Hohenberg [a]
[a] *Hamm-Lippstadt University of Applied Sciences, Hamm, Germany*
E-mails: miriamfuesser@aol.de, gregor.hohenberg@hshl.de
[b] *Witten-Herdecke University, Witten, Germany*
E-mails: Thomas.Ostermann@uni-wh.de, Jan.Ehlers@uni-wh.de

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Abstract. The smartphone is the epitome of technical innovation in recent decades. It is part of everyday life for many people – why not use it to promote health with evidence-based applications? Germany is the first country in the world to include evidence-based digital health applications in the service portfolio of its health insurance companies. There is a lack of resources in various medical specialities. Digital health applications can be a solution to support people and promote sustainable medical care. The benefits are obvious, but the utilisation rates are low. However, it can provide access to better healthcare for a large part of the population that is otherwise not considered in the debate. Some European countries have recognised the potential, but it remains to be seen how this digital solution will set up itself in the future. This Perspective Article is intended as a stimulus to integrate digital health applications into the debates on digitally enhanced healthcare, as the social impact is crucial. It therefore addresses the question of whether digital health applications can be a solution for the future.

Keywords: Digital health applications, mHealth, smartphone, society, accessibility, future

1. Introduction

Digitalisation has been omnipresent for several decades – be it in retail, vehicle manufacturing, transport and logistics or healthcare. Digital innovations characterise the economic landscape. Probably the most significant technical innovation of recent decades is the smartphone. While it was initially used primarily as a means of communication, today it is an all-rounder in everyday life. Communication has been joined by interaction. This can also be observed statistically [1,88,89]. It is therefore only natural that digitalisation and the smartphone are also finding their way into the healthcare sector.

Digitalisation in the healthcare sector in Germany is rather moderate compared to other European countries, such as Estonia [90]. However, with the presentation of the Federal Ministry of Health's digitalisation strategy in March 2023, digitalisation in the healthcare sector in Germany is to be driven forward rapidly [21]. An important part of this is the smartphone. Health-related digital applications are intended to support and promote healthcare. Most people used a health-related application for the first time during the coronavirus pandemic when they used the Corona-Warn-App (CWA) or the digital vaccination certificate [21]. However, digital health applications (DiGA) have been

*Corresponding author. E-mail: miriamfuesser@aol.de.

available to the German healthcare market since October 2020. Digital health applications are app- and/or web-based, prescription-only medical devices of a low-risk class [16]. They must fulfil a medical purpose and provide positive proof of care to be approved and made available via the DiGA directory. The review is carried out by the Federal Institute for Drugs and Medical Devices [8]. Although digital health applications have many advantages, the utilisation rates are rather low, even though there is a lack of resources in many areas that digital health applications could compensate for [68]. This is where the variable of acceptance and willingness to use comes in – both on the part of service providers and the population.

This Perspective Article therefore deals with the question of whether digital health applications can be a digital solution for the healthcare of the future. The smartphone and mHealth (mobile health) as well as digital health applications are analysed in detail. The advantages and disadvantages as well as the social aspect are then focussed on using the example of the integration of digital health applications.

2. The smartphone and mHealth

In 2023, over 4.6 billion people worldwide used a smartphone – and the forecast is rising [87]. The number of smartphone users in Germany has also risen significantly in recent years. The proportion of smartphone users in Germany is between 88% and 93%, depending on the survey. All age groups are represented [27,56].

From smartphones to smart homes to smart health. The smartphone is already being used in many areas and smart solutions are a feature of everyday life. People use available applications that can be used with the smartphone to make life easier, more optimised, and more efficient. The smartphone is a constant companion for many people. It therefore makes sense to integrate the smartphone into healthcare. Especially in the healthcare sector, this means one thing for those involved: relief. In addition, resource-optimised use increases the potential economic benefits [23]. Terms such as big data, artificial intelligence and mHealth characterise and lay the foundations for smart health. mHealth is a very patient-centred approach that is interesting for research and development.

mHealth includes all medical measures, applications and procedures on mobile devices that can be used in the context of private and public healthcare. The use in the supply chain is diverse and ranges from preventive measures to follow-up care and relapse prevention [62]. This also includes the use of freely available fitness, wellness, and health services via smartphone to improve well-being and health. Health and fitness apps are trending and are becoming increasingly popular. In Germany, this is reflected in the development of users and sales, but a clear increase can also be observed in Europe and worldwide [80–83].

Most people use freely available apps for self-optimisation or to improve their general well-being and not because they have a serious illness. However, their use can become problematic if action is needed because, although these apps are subject to the mandatory data protection conditions in Europe, they have not been scientifically evaluated for medical benefits and effectiveness. This can have profound consequences for patients if they are treated incorrectly, which is why validation of these apps is mandatory. This is also essential in terms of data protection or data security.

Nevertheless, the advantages of using mHealth are clear. The smartphone as a means of communication and information creates a supporting variable for the healthcare system. Starting with more efficient practice management and clinic management. For example, recalls or important appointments can be managed flexibly via apps. This saves time, which is particularly valuable in this sector. When it comes to the specific treatment of a patient, apps can continuously record health data and help with symptom monitoring, for example. The patient and doctor can then access the data to analyse it and further plan the course of treatment. The patient's participation then not only leads to a discussion about the illness, but also increases responsibility for their own health and personal health literacy. It is therefore important to provide validated applications with scientifically based information and procedures to ensure sustainable, high-quality healthcare for all citizens. As apps are location-independent, they can also reach people in rural areas who do not have medical centres and the corresponding healthcare nearby. Other effects such as possible cost reductions or data generation for research and development should also be mentioned here [7,62].

In the world of work, lifelong learning, health communication and mental health risk assessment are of crucial importance. For example, mHealth is often discussed around mental health. mHealth can help to a certain extent. But this also applies to other disciplines of scientific research [22,67]. Apps and wearables are often used for this purpose [48]. Therefore, Germany has introduced digital health applications to the German healthcare market in

2020 to effectively use the benefits that apps and web-based applications bring. To understand what digital health applications all are about, the most important aspects are summarised below and placed in a social context using examples.

3. Digital health applications

3.1. General remarks

Digital transformation has arrived in Germany and smart solutions are becoming increasingly present in the healthcare system. With the introduction of the digitalization strategy, digital health applications have also been accessible to the German healthcare market since October 2020 [21].

Digital health applications are prescription digital medical devices in low-risk categories that are integrated into guideline-based care as part of a hybrid care process. They are available as an app or web application. Digital health applications must fulfil a medical purpose and provide positive proof of care to be approved. The testing is carried out by the Federal Institute for Drugs and Medical Devices as part of a fast-track procedure in which further requirements, such as data protection or interoperability, are also checked [8]. "The DiGA supports the detection, monitoring, treatment or alleviation of diseases or the detection, treatment, alleviation or compensation of injuries or disabilities" [8, p. 13].

Digital health applications are assigned to a disease defined according to the ICD classification, which can be both mental and physical in nature. So, patients can be treated specifically according to their illness. To receive the digital health application, the healthcare provider must make the proper diagnosis or prescribe the digital health application. The costs are covered by health insurance companies [8].

All digital health applications available on the healthcare market are stored in the DiGA directory. The DiGA directory is freely accessible. Both patients and service providers can find all relevant information there as well as the associated studies that prove the effectiveness of digital health applications [8].

Digital health applications must be clearly distinguished from freely available apps or web applications. While freely available apps or web applications are made available to consumers without testing, digital health applications go through an approval process. The vulnerable health data is only available to those who the patient gives permission to view it. In Germany, health data legally belongs to the patients. Therefore, the digital health applications are strictly checked for data protection and information security. Further information on the approval process and the requirements that a digital health application must meet to be approved is explained in the following subchapter [8].

3.2. Legal basis

In Germany, the valid social law is summarized in the twelve-part Social Code (SGB). The twelve books cover relevant social policy aspects in which the applicable laws and regulations for the respective area of application are stored. The fifth Social Code (SGB V) contains all regulations relating to statutory health insurance, which also includes digital health applications [76].

With the entry into force of the E-Health Act on December 29, 2015, the first legal basis for digitalization in the healthcare system in Germany was enacted. The "Law for Secure Digital Communication and Applications in the Healthcare System (E-Health Act)" is the basis for all digital measures in the German healthcare system [22]. This is supported by further legal measures that contribute to the regulation of digital health applications. The determinants for this are the Digital Healthcare Act, which came into force on December 19, 2019, and the Digital Health Applications Ordinance, which has been in force since October 1, 2021. They regulate the entitlement to benefits for digital health applications [19,20].

All these regulations are governed by the General Data Protection Regulation (GDPR). The GDPR regulates the processing of personal data of natural persons by natural persons, companies, or organizations in the European Union. It is intended to contribute to the standardization of data protection in the European Union and regulate, among other things, the lawfulness of processing, transparency, accuracy, data minimization, integrity, and storage limitation. Digital health applications must comply with the GDPR in order to be allowed to be distributed on the market [26].

3.3. Approval procedure

Digital health applications undergo a strict authorisation procedure, the so-called DiGA fast-track procedure following Section 139e SGB. In the DiGA fast-track procedure, the requirements that a digital health application must fulfil to be included in the DiGA directory are checked along with the positive proof of provision [8].

The requirements relate to the functionality, interoperability, quality, security, data protection and data security of the digital health application. The positive healthcare effects must prove the medical benefits as well as the associated procedural and structural improvements of the digital health application.

The procedure begins with the submission of an application by the manufacturer. Manufacturers can submit their application for inclusion of their digital health application in the DiGA directory via the electronic application portal. The Institute for Drugs and Medical Devices then checks within three months whether the submitted digital health application fulfils all the requirement criteria and advises the manufacturers on the submitted digital health application.

If the digital health application fulfils all requirements and can prove positive effects on care, it will be included directly in the DiGA directory following Section 139e SGB V. In addition, the medical service is found, which provides for added payment of doctors for whom added medical services are needed as part of the treatment with the digital health application. If the digital health application fulfils the requirements but the positive effects on care are still pending, it can be provisionally included in the DiGA directory following Section 139e SGB V. This digital health application is listed as 'provisionally included' and must prove the lack of positive healthcare effects during a twelve-month trial phase – which can be extended to up to 24 months in exceptional cases – and give a plausible justification and an evaluation concept. If this is fulfilled after the trial phase, the programme will be accepted. If the required criteria are not met, the digital health application will be removed from the DiGA directory. If neither the requirements nor the positive effects on care can be proven, the digital health application will be rejected directly [8].

With the establishment of the fast-track procedure, a universal requirements profile for digital health applications was created which, together with the publicly accessible DiGA directory, creates transparency for patients and service providers.

3.4. Application

Digital health applications can be obtained directly from the patient's health insurance provider with an existing diagnosis and corresponding prescription. The recommended method of application is the blended care approach, which provides for a combination of conventional on-site therapy (face-to-face) and a digital intervention, in this case the digital health application. Direct contact between patient and healthcare provider is kept. The treatment is supported by the digital health application. Both components are harmonised within the treatment [3].

Patients can work on their health in a participatory manner and thus increase their autonomy and self-efficacy. At the same time, the relationship between patient and healthcare provider is strengthened in the long term, as more intensive collaboration takes place. It increases the flexibility of therapeutic measures and promotes symptom monitoring, which provides a better overview of the course of treatment. The blended care approach also promotes the cost-effectiveness of treatment [24,41,43]. Positive study results have demonstrated the effectiveness of the blended care approach, particularly in mental illness [31,49,94]. On the part of service providers, the blended care approach increases acceptance of digital interventions. Nevertheless, further studies are needed in this regard, especially in other specialities, as digital health applications are not yet established in standard care in Germany [34,43,44].

3.4.1. Digital health applications and auxiliary devices

Digital health applications can be extended with other devices, sensors or wearables to achieve or support the purpose of the digital health application used. The main function must nevertheless be digital and there must be a need for the added hardware used. In addition, the hardware must not be privately financed items. This includes, for example, exercise mats or smartphones that would have to be bought additionally. Standard interfaces, such as smartwatches, can still be used if they were considered in the conformity assessment and assessed as positive [8].

There are currently (as of 29 July 2024) eight digital health applications on the market in Germany where added devices are included, necessary or optional. For example, a digital health application for agoraphobia, social phobia

or panic disorder uses VR glasses, which are included in the therapy program [11]. Optional other devices are used, for example, in the treatment of vaginismus, obesity, cardiovascular diseases or sleep disorders. For example, devices for measuring body values that are connected to the digital health application via Bluetooth are used for this purpose. These include scales, blood pressure monitors, blood glucose meters, pedometers, smartwatches, fitness watches or other activity trackers [10,12–17]. Some digital health applications require added devices that are indispensable for the therapy program. One example is the glucose meter, which is an essential part of the treatment of type 2 diabetes mellitus in a specific digital health application [9].

3.5. Offerings

Since the DiGA application portal was launched in May 2020, a total of 202 applications have been submitted, of which 44 applications were listed for permanent inclusion and 158 applications for provisional inclusion for testing. Of these, a total of 57 were listed in the DiGA directory and 21 were rejected. 109 applications were withdrawn and six – including two at the request of the manufacturer – were delisted. Nine applications are currently being processed (as of 8 May 2024) [16].

The existing range of digital health applications is constantly being updated. According to the DiGA report of the National Association of Statutory Health Insurance Funds, 26 digital health applications were listed for mental illnesses, six for diseases of the musculoskeletal system, four each for diseases of the nervous system and metabolic diseases, two each for oncological diseases, diseases of the urogenital system and the ear, and one each for diseases of the cardiovascular, respiratory, and digestive systems as of 30 September 2023. Digital health applications for mental illnesses account for the largest share by indication [40].

3.6. Pros and cons

Digital health applications bring with them various argumentative advantages and disadvantages. A brief tabular summary can be found in Table 1.

3.6.1. Pros

The use of digital health applications can effectively increase the quality of healthcare [25]. They can be used at different points in the care chain – in prevention, therapy, aftercare, and relapse prevention [43]. As a complementary therapy method, digital health applications provide an easily accessible, added possibility for treating a disease, as in most cases no added purchases are needed on the part of patients or healthcare providers. This is because the interventions are accessible digitally via an app or web application. In Germany, over 80% of people – across all generations – own an internet-enabled device [57,88].

Digital healthcare applications play a significant role in closing the healthcare gap in Germany, which is particularly pronounced in rural areas away from urban centres. One example of this is the lack of available psychotherapy places [39,50]. Psychotherapists are unable to meet the increased demand and patients often only receive treatment after a long wait. A survey shows that patients are more likely to cancel treatment or even start treatment if the waiting times are too long [5]. This can have serious health consequences. Digital health applications can bridge long waiting times and be used as a complementary measure before the actual therapy begins. This is particularly important for mental illnesses, as rapid treatment can make a significant contribution to the success of the therapy [5].

The health insurance company will cover the costs of obtaining the digital health application if a diagnosis and prescription are available. The app or web applications can be activated and used directly using an access code. This creates a certain anonymity for patients and overcomes the barrier of shame that many patients feel, especially in the case of mental illness.

In addition, digital health applications can be used anywhere and at any time. The time savings are mainly since they can be dynamically integrated into everyday life and no additional appointments or trips to the healthcare provider are necessary [53,58].

Another important aspect is helping patients to help themselves. Patients can work on their health in a participatory manner and are no longer helplessly at the mercy of their illness. Active participation in the design of

treatment measures promotes self-management, self-monitoring, and patient empowerment [53,58]. Active patient participation can also increase adherence to treatment, which in turn can lead to a better course of treatment [51].

Another aspect here is data generation. Active and continuous documentation on the part of the patient generates data that shows the course of treatment in more detail, to which the healthcare provider can respond appropriately and, if necessary, adapt and optimise this or other therapeutic measures (e.g. the medication plan) [47].

The combined use of traditional and modern healthcare also promotes the sustainability of treatment in line with the Sustainable Development Goals (SDGs), which were adopted by the United Nations in 2015 as part of the 2030 Agenda. As a digital measure, digital health applications contribute to the achievement of various goals, such as SDG 3 – Good Health and Well-Being – or SDG 4 – Quality Education [45,93].

There are also economic benefits. On the one hand, digital health applications generate jobs in a passive sense – for example through the establishment of start-ups or the further development of an existing portfolio in which digital health applications are central. This can be seen in the annual growth rate of the number of employees at manufacturers. There is also an increase in part-time working models among manufacturers, which increases the social impact as employees have more time for other commitments, such as care work or social engagement [64]. There is also evidence that digital health applications and e-health measures in general are more cost-effective [23,58]. The potential economic benefits should therefore not be ignored. According to estimates by McKinsey & Company, the potential benefit from the use of digital solutions in Germany alone amounts to around 42 billion euros per year compared to 2018. These digital solutions include the areas of mHealth and enabler technologies [23].

3.6.2. Cons and criticism

Although digital health interventions offer many benefits for patients, healthcare providers and the healthcare system, many available options are unknown. As a result, they are not established in routine care and the potential cannot be utilised [95]. In Germany, there are also complex bureaucratic processes and delayed digitalisation, which make it difficult to set up them in routine care. According to Thiel et al., systemic factors such as the financing system, stakeholders involved, public spending or the significance and cultural anchoring of data protection are factors in this [90].

For many service providers, the studies needed for the inclusion process of digital health applications in the DiGA directory are inadequate. They criticise the insufficient validity and reliability of the digital measures as well as the fluctuating offerings [40]. Provisionally accepted digital health applications are available on the market without being able to provide positive proof of care. They also criticise the poor information base, inadequate payment for the service provided, poor pricing and potential costs that may arise in connection with digital health applications. For them, these are not in proportion to the benefits. In addition, concerns are often expressed about data protection and data security. Service providers also criticise the possibility of receiving a digital health application directly via the health insurance company if the corresponding diagnosis exists. For them, the necessary sign from the doctor and participatory decision-making between doctor and patient are missing. They also criticise the lack of training opportunities for dealing with digital health applications – both on the part of patients and service providers [28,42,69,74,91].

4. Digital health applications and health – discussion examples

Digital health applications are a low-threshold, quickly available offer that can support existing therapeutic measures. The advantages strongly favour the use of digital mHealth technologies in healthcare, but the disadvantages lead to concerns and doubts. To put the topic in an application-oriented context, it is recommended to consider digital health applications in the context of treating various diseases.

4.1. Digital health applications in the supply chain

Digital health applications can be used to improve healthcare. As the statistics have already shown, the need for help is great – both in Germany and in a European comparison. Acceptance and willingness to use it on the part of

Table 1
Overview of the advantages, disadvantages, and criticisms of digital health applications. The disadvantages and criticism are summarized in this table

Advantages	Disadvantages/criticism
More efficient healthcare	Insufficient information base
Anonymity	Confusing range of measures
Contribution to closing the supply gap	Complex information flood
Low thresholds offer	Bureaucratic hurdles
Location independent	Delayed digitalization
Time saving	Insufficient reliability and validity of the studies
Cost efficiency	Fluctuating offer
Wide range of applications	Lack of training
Active participation	Lack of acceptance
Self-help and empowerment	Lack of willingness to use
Data generation	
Potential economic benefits	
Sustainability	

service providers and patients is essential to set up a new therapeutic measure in routine care. To show how simple and effective digital health applications can be used, it is advisable to look at some fictional examples.

Scenario 1 – Depression: Max is a 34-year-old businessperson in a medium-sized company. He is the father of a three-year-old daughter, a single parent and works 40 hours a week. Max feels overwhelmed and emotionally exhausted. He is not feeling well mentally and seeks help from a family doctor. He recommends that he consult a psychologist. After the first consultation with the psychologist, Max is suffering from depressive episodes due to his high workload and family obligations. Since the waiting time for psychotherapy is around 20 weeks [50], the psychotherapist would like to use a digital health application before the actual therapy begins. On the one hand, to document symptoms, and on the other hand, so that Max can learn to deal with the episodes and increase his self-efficacy. The advantage here is that Max can flexibly integrate the digital health application into his everyday life and is not tied to added appointments or locations.

Key facts: 2019, around 84 million people in the European Union suffered from mental health problems. That's around one in six people. However, there are significant differences between Member States [33]. The health insurance company's analyses show that diagnoses of mental illnesses are increasing and have significant socioeconomic consequences [2,41,42,85]. Affected people have an increased risk of health problems and are often subject to stigmatization processes. Social participation and social contacts are decreasing. There are also financial consequences and economic costs [66,84]. Other economic consequences include a lack of workers, reduced work efficiency and productivity. Companies experience an indirect increase in costs due to the failure [5,96]. The health system is under economic strain [6].

Scenario 2 – Sleep disorders: Paula is a 20-year-old student who likes to meet friends in her free time and is socially involved in her community's youth organization. She is also a caring relative. Her father is ill and needs 24-hour care. Although an outpatient care service comes along, the support is inadequate, but the family's financial resources are not sufficient for further help. Paula spends almost 20 hours a week [29] caring for her father. She often finds it difficult to balance caring for her father with education, friends, and commitment. She has a lot of responsibility and thinks about how she can please everyone. The result: she suffers from circles of thoughts in the evening as well as difficulty falling asleep and staying asleep. This reduces her productivity and performance in everyday life. She seeks help from her doctor, who prescribes a digital health application for her sleep problems. He would like to forego drug treatment for the time being. Paula learns relaxation techniques to bypass her sleep-preventing thoughts and improve her sleep hygiene. She is happy that she is sleeping better after just a brief time and feels strengthened.

Key facts: Sleep disorders are becoming more common in the population. The prevalence of insomnia varies from 5.8 to 34.8% in Europe. On average, 24.8% suffer from nighttime insomnia symptoms and 10.1% suffer from chronic sleep disorders [3]. With persistent insomnia, the risk of cardiovascular diseases, for example, increases, as

various meta-analyses [46,78] and prospective studies [59,77] show. The risk of other diseases such as depression, rheumatoid arthritis or osteoporosis also increases [77]. The quality of life decreases and the general state of health declines [60]. In addition to the health consequences, there are economic burdens. The European healthcare system is under strain [71]. There are high costs [44]. The individual himself is limited in his ability to work, perform and be productive. People who work shifts are particularly badly affected [38,61,73].

Scenario 3 – Joint problems: Frank is a 69-year-old pensioner who has done heavy physical work throughout his working life. He only has a small pension, is compulsorily insured and therefore cannot afford private medical treatment that could permanently improve his condition. Frank suffers from chronic knee problems and back pain, which severely limit his quality of life – both physically and socially. Since the pain and immobility significantly restrict his everyday life, he no longer goes out often and is lonely. Frank goes to the family doctor with his complaints and asks for help. He recommends a digital health application that explains step-by-step exercises that can permanently alleviate his symptoms. He no longer feels helpless against the disease and is actively working to alleviate his symptoms. After a few weeks he can take part in life again because his physical symptoms have improved. Frank is once again a part of society who can enjoy his retirement.

Key facts: Joint problems are among the most common physical limitations in Europe and worldwide. In Europe, around one in five adults suffers from chronic pain. The prevalence varies across European countries. Back pain, joint pain and neck pain are among the most common causes of pain in Europe in 2010 [7]. 53% of those affected have visited a doctor at least once within a year. Around 8% at least 20 times [35]. The impact that joint problems have on everyday life is great. Many of those affected are limited in their abilities. For example, they can no longer take care of their household properly, social activities are reduced, and their independence is limited. Many also suffer from sleep problems [7,35]. The economic impact is high. The limited resilience leads to lost work, increased absenteeism, and lower productivity. The costs of social care, (informal) care and the health system in general are increasing [35].

Scenario 4 – Cardiovascular diseases: Christian is a 51-year-old long-distance truck driver who drives many international routes in Europe and likes to end his work with home cooking. Due to his lifestyle and predisposition, he suffers from hypertension. He knows that he is a future risk patient. His father (82) has already had a heart attack and his mother (79) suffers from heart failure. Christian is worried that, like his parents, he might develop further problems as he gets older, so he seeks help from his doctor. Since he wants to continue pursuing his passion as a truck driver, his doctor prescribes him a digital health application to help him make his lifestyle healthier. With the prescription, he can flexibly download the app and use it wherever he is. He consults with his doctor about his development in regular video consultations. After a few months, he integrated a balanced diet and exercise sessions into his everyday working life. He was able to lower his blood pressure. Excited by the results, he recommended the digital health applications to his parents, who were also able to use the digital intervention despite their advanced age thanks to external aid and the user-friendliness of the applications.

Key facts: Cardiovascular diseases are the most common cause of death in Europe and worldwide [63,72]. In 2020, over 60 million Europeans – almost 13.5% – suffered from cardiovascular disease [32,35]. Over 10,000 people in Europe die from it every day [92]. Risk factors such as an unbalanced diet, smoking, physical inactivity, or alcohol consumption increase the prevalence of cardiovascular diseases, but also other diseases such as diabetes mellitus or hypertension [35]. The economic costs are high. They can be divided into costs for the health system, productivity losses and informal care [35].

4.2. Digital health applications further thought out

The examples from Chapter 4.1 reflect the reality of life for many people – not only in Germany, but also internationally. Mental illnesses, diseases of the musculoskeletal system and cardiovascular diseases are increasingly occurring in Western society. But other illnesses such as diabetes, cancer or digestive disorders can no longer be dismissed and are among the diseases of civilization in Western society [75,79,86]. Access to better health (digital) resources, a well-structured and developed health system and the active participation of patients promote long-term health care. This is also urgently needed because society is getting older and the need for the necessary health care and care cannot be met now. Increasingly resources – especially personnel – are required [52,68]. Digital health applications can play a part in filling this need. Helping people to help themselves is essential in view of possible

future developments. If people learn to work participatively on their health – not just with digital interventions, but in general – this can have a major social impact. People are advocating more participation in their health decision-making, and this can be a big advantage for digital interventions. What is important here is the acceptance and willingness to use digital interventions. Even if people want more say in their medical decisions, it is still up to health care providers to provide options. Therefore, service providers are central to the implementation of digital health applications and digital interventions in general. If people learn to use digital health applications (and other digital interventions) now and use them effectively for their health, they will be able to do so even when they are older. Digital health applications are not tied to age. Let's take Paula from the discussion example. She is now 20 years old and is learning to deal with her sleep problems sustainably. The good experiences she has with the digital health application shape her attitude towards digital interventions and if in 30 years she suffers from hypertension like Christian or from joint problems like Frank, she will know that she can rely on a quickly available, simple resource, without having to accept long waiting times. Of course, one can and should assume that patients only have good experiences with digital health applications and other digital interventions, but in this case, it is important to enter the discourse to address concerns, fears and concerns. At the same time, extensive information transparency must be the basis. People can be sceptical, and they should also question treatment methods if there is reason to do so. The issue of data protection is particularly important because health data is vulnerable. Therefore, digital health applications go through the fast-track process by having to meet requirements and positive proof of care. Valuable information is accessible to everyone via the DiGA directory. Everyone can find out about this – or not?

In this context, another aspect that digital health applications bring with them should be mentioned: accessibility. Not only in terms of the information base, but also in terms of use. There are different population groups that can be divided based on objective characteristics. For this purpose, the socioeconomic status should be highlighted. In the examples mentioned, different social environments are the basis for proving the low threshold and general availability of digital health applications. People who are socially and financially better off also tend to have better access to health care. This is also reflected in people's life expectancy and health status. Studies show that well-off people live longer and healthier lives than people who are socioeconomically disadvantaged. Factors such as job and the associated workload are important here, but also educational opportunities, which are often determined by socioeconomic status [4,24,30,54,97]. Digital health applications are covered by health insurance companies if there is a diagnosis or a prescription. This measure enables disadvantaged population groups to take part in better health care. It should also be remembered here that 100% will not be achieved because hurdles such as homelessness or access to the Internet stand in the way, but the inclusive approach should be brought to the fore here.

The international comparison shows that Germany is lagging other countries when it comes to digitalization [90]. But with the introduction of the digitalization strategy and the digital health applications measure included there, Germany is a pioneer when it comes to evidence-based app and web applications in health care. And the potential was recognized. The European Union wants to improve health care in the EU with e-Health [36]. Digital health applications are ideal here because digital health applications are subject to the standards and specifications of the European Union. This applies, for example, regarding data protection, since manufacturers must adhere to the European standards of the GDPR during production and the studies that are intended to prove the positive supply effect are usually carried out according to international standards [8]. Various member states see potential and are examining whether the implementation of digital health applications is also a possibility for them. However, they also emphasize hurdles [55]. Some countries have laid the groundwork to set up digital health applications in their healthcare systems. These include, for example, France, Austria, and Belgium. With the Social Security Financing Act 2023 (LFSS), France has created a law to make prescription health apps available to health insurance companies. In a trial year that is like the German fast-track procedure, digital applications can be reimbursed one year before they are finally included in routine care [37,70]. Austria establishes digital healthcare within the framework of the Digital Austria Act (DAA) and Belgium regulates the approval of digital healthcare applications via the mHealth pyramid [18,65]. In the future, however, it will be transnational digital networks that shape the healthcare system. Even if the design of health systems is the responsibility of national states, the European space must offer a secure platform for citizens' health data to generate development, progress, and improve (digital) health for everyone.

5. Conclusion

The smartphone has long been part of many people's health plans. It is now important to set up validated procedures and applications on the market that can be proven to have a positive effect on care and sustainably support the healthcare system. The approach of digital health applications based on the German model is one way to efficiently improve health care. Patient participation is particularly important. Given the aging population and lack of resources, digital solutions are inevitable and desirable. Furthermore, digital health applications focus on the social aspect of accessibility to health resources. Digital health applications have the potential to become a permanent digital solution approach of the future. Therefore, further cross-national, society-related studies should be pursued. It remains to be seen how digital health applications will establish themselves on the international market and the potential has already been recognized in some European countries.

Conflict of interest

None to report.

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