

# Unlocking the Potential of Digital Health Technologies: The Role of Health Insurance Companies in Shaping the Digital Healthcare Ecosystem

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**Keywords:** Digital Health, Digital Health Technologies, DHTs, Non-Communicable Diseases, Chronic Diseases, Health Insurance Companies, Startups, Health Equity, Gender-Specific Design.

**Abstract:** This position paper explores the transformative potential of digital health technologies (DHTs) in addressing non-communicable chronic diseases (NCDs) and raises the question of which role health insurance companies play in shaping a healthcare landscape to embrace DHTs. Drawing from a semi-structured interview with two experts from the second-largest health insurer in Germany and supported by public industry reports, newspaper articles, and legal texts, this paper discusses three key dimensions: First, this paper challenges the metaphor of DHTs as “digital pills”, emphasizing that the success of digital medicine in addressing NCDs depends on active patient engagement, long-term intervention adherence, and actual lifestyle changes in peoples’ everyday lives, echoing challenges of analog, traditional medicine. Second, we delve into the promises of DHTs in improving individual healthcare access and health equity through gender-specific, bias-free design. Lastly, the paper elaborates on how health insurance companies operate in their roles as non-profit-oriented (a) co-developers, (b) investors, and (c) catalysts of DHT innovations on a societal scale. In conclusion, this paper sheds light on some of the critical dynamics of shaping digital health ecosystems and health insurance’s profound impact in paving the way for DHTs.


## 1 INTRODUCTION


Non-communicable, chronic diseases (NCDs) such as heart disease, stroke, cancer, diabetes, and chronic lung disease, account for 74% of all deaths worldwide. This “epidemic of NCDs” poses devastating health consequences and challenges for individuals, families, and communities, and increasingly threatens to strain healthcare systems to their limits (World Health Organization, 2023a).

Chronic diseases tend to be, by nature, of long duration and are often the result of a combination of genetic (e.g., gender), physiological (e.g., hormonal changes across the lifespan), and environmental (e.g., air pollution) factors. Equally significant though are *behavioral* lifestyle choices such as physical inactivity, unhealthy diets, alcohol consumption, or smoking (World Health Organization, 2023b).

As the world grapples with the mounting challenges of addressing chronic diseases, the role of digital health technologies (DHTs) has never been more critical and a pressing question emerges: How can digital health technologies (DHTs) be integrated into patient journeys and healthcare landscapes and what role do health insurance companies play in paving the way for their implementation and adoption?

According to the definitions of the Digital Therapeutics Alliance, DHTs encompass “the full spectrum of digital health products that are available to patients, caregivers, clinicians, and health systems” (Digital Therapeutics Alliance, 2023a). They may serve specific purposes across the entire patient journey from wellness offerings, diagnosis, and symptom monitoring, to Digital Therapeutics (DTx), which are “health software intended to treat or alleviate a disease, dis-

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order, condition, or injury by generating and delivering a medical intervention that has a demonstrable positive therapeutic impact on a patient's health" (Digital Therapeutics Alliance, 2023b).

DHTs, thus, constitute a compelling medium to address the increasingly complex and multifaceted challenges posed by NCD, for several reasons:

**(1) DHTs Empower Patients, Providing Personalized And Precise Care:** DHTs are well suited to empower individuals with resources for behavior change, such as physical activity programs, dietary trackers, or smoking cessation programs. However, every person and patient is unique, and so are their lifestyles, capabilities, and needs.

DHTs have the potential to be tailored to the individual, delivering just-in-time, adaptive interventions (JITAs) (Kowatsch & Fleisch, 2021). The concept of JITAs, "delivering the right intervention to the right patient at the right time", is engrained in the goals of traditional precision medicine which tailors drug and treatment options to an individual's specific biomolecular and genetic markers.

Yet, DHTs can go beyond snapshots of clinical, biomedical, and genetic data. They can encompass *behavioral* and *environmental* factors that play a pivotal role in the development, but also in the treatment, management, and, ultimately, treatment success of NCDs (World Health Organization, 2023b). Specifically, the availability of individual behavioral and environmental real-world data collected via increasingly powerful sensing technology integrated into smartphones and wearables that individuals carry with them in their everyday lives provides researchers and healthcare providers with unprecedented opportunities to monitor the dynamics of an individual's internal state and context in real-time. This, in turn, allows for precise and personalized support that is flexible in terms of both time and location (Nahum-Shani et al., 2018), empowering patients to take their care in their own hands anywhere and anytime.

**(2) DHTs Can Improve Healthcare Access And Equity:** In contrast to health professionals' limited financial and personnel resources and time (Hutton & Gunn, 2007), DHTs are available on everyone's smartphone anytime and everywhere. This universal accessibility may democratize access to healthcare information and support, reducing geographical and economic barriers, and overcoming stigmas or social taboos, for instance, related to gender-specific or cultural health issues, that often hinder equitable access to quality healthcare services (Brewer et al., 2020).

**(3) DHTs are Scalable and May Contribute To Cost-Efficiency In Healthcare:** Scalability, in the context of DHTs, implies the ability to adapt, expand, and serve a growing number of patients or users efficiently and effectively (Mekniran & Kowatsch, 2023), e.g., through remote monitoring, automation, and standardization processes, and by empowering patients to make informed decisions about their well-being and health (Jiang, Ming, & You, 2019). By reducing the burden of extensive in-person care, DHTs may contribute to cost savings for both healthcare systems and patients (Borges do Nascimento et al., 2023; Gentili et al., 2022). Shifting from reactive to preventive care could not only improve patient outcomes (Aerts & Bogdan-Martin, 2021) but also reduce the financial burden associated with managing advanced and severely manifested conditions (Jiang et al., 2019).

However, despite the promising developments of more and more powerful, evidence-based DHTs, there currently is a lack of understanding of how DHTs can be integrated into healthcare systems and services (Carrilho, Videira, Campos, Midão, & Costa, 2023) and of health insurance companies' roles in this process (Iqbal & Biller-Andorno, 2022).

In 2019, even before the COVID-19 pandemic further fueled digitalization in all areas of our lives, including healthcare, Germany was the first country to introduce "digital health apps on prescription" a concept, commonly referred to as DiGA (short for German: "Digitale Gesundheitsanwendung", English: "digital health application"). The Digital Care Act further catalyzed innovation and the widespread development and use of DHTs. Yet, the seamless incorporation of these technologies into Germany's healthcare system continues to encounter substantial obstacles.

This paper aims to provide valuable insights that can inform strategic decision-making in the digital health and health insurance sectors. It offers a nuanced perspective for stakeholders invested in the evolving dynamics of healthcare delivery, guiding healthcare professionals, policymakers, and researchers to navigate and contribute to the transformative journey of healthcare in the digital age.

## 2 METHODOLOGY

This position paper captures insights and visions of two distinguished voices in the field, Marek Ryzdzewski (interview partner 1, short MR) and Jeremias Pappert (interview partner 2, short JP), as they discuss the present state, challenges, and prospects of

DHTs and the role of health insurance companies to enable and facilitate the integration of DHTs in healthcare systems.

MR is the Chief Digital Officer (CDO) at BARMER, and JP is a Consultant to the CDO. BARMER, headquartered in Berlin, is the second largest health insurance provider in Germany with approximately 8.7 million insured members.

After providing their informed consent, RB conducted one semi-structured group expert interview with MR and JP via Zoom that lasted approximately 45 minutes. The interview guide was structured along the following, overarching themes (cf. Appendix): *DHT Implementation and Effectiveness, DHT Objectives and Outcomes, DHT Quality Assessments and Learning, DHT Ecosystems and Business Models, and Future Challenges and Trends.*

RB transcribed (8 DIN-A4 pages, single-spaced, 12pt font size) and translated the audio recording from German to English. MN coded the interview thematically and inductively distilled three main, central points, collecting further information from the literature and public sources (e.g., industry reports, newspaper articles, legal texts) to triangulate and further substantiate the interview data. MN and RB discussed and refined these propositions, before MN drafted the first version of the manuscript synthesizing and discussing the themes. All authors reviewed and refined the final version of the draft before submission.

Please note that the interview partners participated in these interviews in their personal capacities. Their statements do not necessarily represent the official stance of BARMER, but reflect their personal viewpoints and opinions.

### 3 HEALTH INSURANCES ROLE IN THE DHT ECOSYSTEM

#### 3.1 DHTs Are not Digital Pills

Generally, DHTs are considered to act as tools that empower individuals to take the management of their condition(s) into their own hands. Yet, the interviewees emphasized that while DHTs may provide personalized support in monitoring symptoms or preventing disease progression, they cannot be considered an independent, standalone treatment option: *“We should make a slight distinction between ‘treatment’ and ‘support during illnesses’. [...] That’s how DiGAs are designed today. They assist in monitoring certain*

*symptoms or disease progress, preventing escalations, but they don’t provide treatment themselves” (MR).*

While the interviewees highlight the enormous potential of DHTs with regard to their *“substantial impact [...] not only on health-related metrics but also on significant healthcare system-related challenges, such as a shortage of skilled professionals, financing, or governance” (JP)*, they also strongly advocate to temper expectations:

In 2019, Kowatsch et al., and in 2021, Fleisch, Franz, and Herrmann, coined the term “digital pill” for information and communication technology and software that collects real-world user data via wearable or smartphone-based sensors (e.g., behavioral- or lifestyle-related) and uses this data to predict vulnerable states, to detect receptive states, and to intervene at opportune moments. The authors emphasize that such “digital pills” could particularly benefit chronically ill patients. For instance, by alerting a caregiver or health professional when a sharp increase in body weight detected by a digital body weight balance indicates a potential worsening of heart failure (Gray, Indraratna, Lovell, & Ooi, 2022): *“For chronic diseases, especially in the case of heart failure, it’s easy to imagine using these technologies to monitor or at least accompany the course of the disease, detect any deviations more quickly, and intervene as needed, for instance, before someone has to be readmitted to the hospital” (MR).*

Yet, our interviewees strongly rejected the notion of the “digital pill” metaphor. According to them, DHTs should not be portrayed as pharmacologically-active, quick-fix remedies, that encourage patients to passively await their effects. Instead, patients, healthcare professionals, and policy makers should recognize DHTs as a fundamental element of a holistic treatment strategy that empowers them to proactively manage their conditions in their daily lives. *“You can take a painkiller, and afterward, the pain is gone, but it doesn’t cure the disease in that sense. The same goes for digital technologies. Regular use, treatment adherence, and adherence are all requirements that we also see with digital technologies. Only then can expectations be reasonably fulfilled” (JP).* The full potential of DHTs may take time to realize: *“This may change with the use of AI at some point, but at the current time, nobody can expect immediate effects from digital technology use” (JP).*

Indeed, while studies show that DHTs can enhance patient adherence to analog treatment or medication plans (Batra et al., 2017), a common challenge in analog medicine (Brown & Bussell, 2011; Kones, Rumana, & Morales-Salinas, 2019; Osterberg &

Blaschke, 2005), the effectiveness of DHTs, vice versa, is influenced by patients' engagement with the DHT and adherence to the suggested interventions in the first place (Forbes, Keleher, Venditto, & DiBiasi, 2023).

In conclusion, while DHTs may play a valuable role in offering continuous support, particularly in managing chronic NCDs or when bridging gaps between treatment steps (e.g., after or before a stationary phase in a psychiatric clinic), they require a certain "level of continuity [...] to lead to the desired outcomes" (MR). We therefore propose, that DHTs are not digital pills, but that they have the potential to complement and augment treatment approaches.

### 3.2 Gender-Specific DHTs Improve Health Access and Equity

DHTs are poised to tackle unmet needs and address prevailing biases, stigmata, and social taboos (e.g., with regard to gender- or sex-specific or mental health topics), which might help to improve access to health and health equity (Sinha & Schryer-Roy, 2018). Especially, the barrier to accessing or sharing sensitive healthcare information might notably be lower with a digital solution (Tam, Bhat, Mohindra, & Kumar, 2023; Wies, Landers, & Ienca, 2021).

For instance, the DiGA *Endo-App* caters to women and menstruators with endometriosis, "conveying evidence-based and guideline-compliant self-management techniques for chronic gynecological and pain-related conditions, as well as monitoring individual symptoms" (Endo-App, 2023). Even though endometriosis is a condition that affects approx. 10% of reproductive women globally (World Health Organization, 2023c), it is also a condition that is not fully understood, and therefore often misdiagnosed or trivialized. It often takes several years for an individual to receive a formal diagnosis of endometriosis, even though many suffer from severe pain and infertility, which can have significant impacts on individuals' quality of life (Pettersson & Berterö, 2020; Sims, Gupta, Missmer, & Aninye, 2021).

Similarly, the DiGA *Kranus Edera App* offers men digital support for the treatment of erectile dysfunctions and their causes (Wiemer, Bartelheimer, Raschke, & Miller, 2022). Due to the social stigma and feelings of embarrassment commonly associated with erectile dysfunction, approximately a fraction of those affected seek assistance from a urologist (Budberg, Bucher, & Hornung, 2005; Fisher et al., 2004). "Men facing such challenges are more willing to use a digital solution than to overcome the taboo and visit a urologist or a psychotherapist" (JP).

To achieve this, developing bias-free algorithms, that are able to consider each individual's unique genetic, biomedical, environmental, and behavioral profile, is central to the effectiveness of DHTs and to ensure equitable healthcare (Knight et al., 2021). "Anything related to biases or stereotypes that providers may not be aware of can probably be better compensated or mitigated if the underlying algorithms are bias-free. That's the real challenge because these algorithms are crafted by humans" (JP).

The development of bias-free algorithms though is not only an ethical imperative in healthcare, as it directly impacts the effectiveness of DHTs and, hence, patient well-being: As DHTs continue to evolve, addressing algorithmic bias is paramount to harness their full potential in improving healthcare outcomes for all individuals, regardless of their background or demographic characteristics (Panch, Mattie, & Atun, 2019).

### 3.3 Health Insurances: Co-Creators, Investors, and Catalysts – but not Developers of DHTs

Amid a significant transformation in the global healthcare ecosystem, health insurance companies find themselves at the nexus of innovation, tasked with reshaping the landscape of healthcare delivery. However, in the intricate realm of healthcare, especially when considering the integration of DHTs, it becomes evident that this sector operates outside the conventional boundaries of other markets, or, as JP put it: "The healthcare sector doesn't work like a typical market" (JP).

Indeed, the approach of statutory health insurer companies in Germany differs significantly from the for-profit focus that characterizes traditional markets: "We can't think in terms of revenue streams" (JP). Statutory health insurance ("Gesetzliche Krankenversicherung, GKV) functions in accordance with the solidarity principle (Federal Ministry of Health, 2023). Therefore, the primary concern of statutory health insurance companies revolves around optimizing the care and well-being of each insured, a mission intrinsic to their role. Additionally, they also "bear a certain responsibility [to influence cost management in certain areas] on a systematic level" (JP).

In this vein, DHTs are embraced as a potent catalyst enabling health insurance companies to effectively and simultaneously juggle the dual roles of enhancing individual patient care and optimizing healthcare costs on a broader societal scale.

According to our interview partner, there are several ways for health insurance companies to do so: (a)



as co-developers of DHTs together with startups or established players, (b) as financial investors in digital health funds, and/or (c) as catalysts and role models inspiring other stakeholders in the market:

(a) *Co-development* of DHTs is particularly interesting for health insurance companies, as it allows them to leverage external expertise and resources from startups or established players. However, while health insurance companies may excel in ideation and strategic healthcare management, they may not possess the speed, flexibility, and dynamism inherent in startups. *“A health insurance fund has certain core competencies, what it does exceptionally well, and startups, with their size, structure, and flexibility, have other advantages that are better suited for such development projects [...] Therefore, we try to bring together the best of both worlds by contributing our expertise while leaving the development in the hands of our cooperative partners” (JP).*

(b) Since the introduction of the “Digital Care Act” in 2019 (German: Digitale-Versorgung-Gesetz, DVG), statutory health insurance companies are allowed to *invest* up to two percent of their financial reserves in digital health innovations (Hoffmann, 2022), for instance, to indirectly (e.g., through venture capital funds) or directly finance startups (§68a, Abs. 1-4, SGB V). This opened up new opportunities for health insurance companies to support DHT innovation and developments indirectly as *investors*.

Engaging in (high-risk) investments, for instance, through Venture Capital, however, is typically not within the nature of statutory health insurance. Hence, despite this new law, except for BARMER, health insurances have been quite reserved in their actions to this day (Brainwave Hub, 2023).

Some of the reasons for this can be attributed to the financial situation of the statutory health insurance fund in Germany: The potential investment volume has significantly decreased in recent years due to reduced reserves, partly resulting from additional costs due to the COVID-19 pandemic (Greß & Jesberger, 2021). Yet, other reasons include the fundamental mandate of statutory health insurance funds, which is not profit-oriented (Busse, Blümel, Knieps, & Bärnighausen, 2017), and the risk of potentially losing members' contributions through highly risky transactions. Therefore, to comply with the non-profit regulations and to secure the investment amounts (i.e., members' contributions), in the case of BARMER's investments, guarantees needed to be established through special assets and other investors, while the rate of return for the health insurance fund needed to be limited to a maximum of 2% per year (Brainwave Hub, 2023). Such an investment is, thus,

*“not to be understood as a conventional capital investment but rather as an investment in medical care. The returns [are] innovations and new forms of care. This is a prime example that public-law corporations, even without a profit motive, can make purposeful investments in startups and contribute to innovative improvements in healthcare” (Brainwave Hub, 2023).*

Hence, similar to in-house or collaborative DHT development efforts, financial investments in DHT start-ups might bring innovations and efficiency to healthcare systems, helping health insurance companies to gain valuable input from outside the health insurance world, and a knowledge advantage with regard to which innovations will next find a place in healthcare.

(c) Eventually, investing in DHTs can serve as a source of inspiration for other health insurance providers to explore similar avenues, potentially *catalyzing* a transformative shift in the entire healthcare ecosystem. When one health insurance sets a precedent by investing in DHT startups, they may motivate other stakeholders in the market to embrace similar strategies: *“When BARMER leads the way and creates new offerings, other health insurance providers may feel the need to follow suit” (JP).* This understanding goes beyond mere business strategy; it's rooted in a sense of responsibility and a commitment to fulfilling systemic obligations.

In conclusion, health insurance companies are recognizing that they can adopt various roles to drive the adoption of digital health technologies for the greater good, both at the individual patient level and the broader healthcare ecosystem.

## 4 CONCLUSION

In the ever-evolving landscape of healthcare, the integration of digital health technologies has ushered in an era of unprecedented possibilities. This paper delved into the evolving DHT landscape and the pivotal role health insurance companies play in shaping this transformation:

Firstly, DHTs allow for personalized and precise care of chronic diseases across the patient journey, enhancing treatment adherence, disease management, and, ultimately, potentially also treatment success. Although DHTs should not (yet) be considered independent treatment options, but rather an important piece of a larger puzzle, they might already support patients in managing their conditions and in adopting beneficial lifestyles and behaviors.

Secondly, to improve healthcare access and equity through DHTs, bias-free development approaches are just as pertinent in digital health as they are in analog medicine. For instance, DHT innovations that (a) directly cater to sex- or gender-specific conditions such as ovarian breast cancer, rheumatoid arthritis, or prostate cancer (Nature Editorial, 2023; Smith, 2023) or that (b) consider sex-specific factors in the development of DHTs for conditions that affect both men and women equally such as lung cancer or heart failure (Smith, 2023), have the potential to advance health equity in both digital and analog medicine concurrently. Notably, ‘menstrual cycle syncing’ strategies, which take into account the influence of hormonal fluctuations during the menstrual cycle phases, or female-focused lifestyle intervention, that consider the impact of hormonal fluctuations during perimenopause on specific conditions or symptoms, have yet to be systematically explored (Vitti, 2020) – and DHTs could offer a means to unlock this potential.

Ultimately, health insurers' involvement in digital health initiatives, such as creating, supporting, and investigating in innovative DHT, can be viewed as a manifestation of their evolving role in the DHT ecosystem. Based on their dual understanding as advocates of their insured and as key players in shaping the (digital) healthcare landscape, they are already and increasingly taking on responsibility as co-developers, investors, and catalysts, eager to drive change and encourage technological advancements.

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## CONFLICT OF INTEREST

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## APPENDIX

### Interview Guiding Questions

#### *I DHT Implementation and Effectiveness*

- Are you currently providing DHTs?
- Have you developed these DHTs in-house or are you collaborating with startups or other organizations?
- What criteria are essential when entering into partnerships with companies or startups?
- What is your personal perspective on DHTs?
- Which medical conditions do you believe require DHTs the most, and why?
- What is the primary objective of offering these DHTs (generating new revenue streams, enhancing cost-efficiency, fostering customer loyalty)?
- If these DHTs are already in use, do they meet your expectations and goals?

#### *II Objectives and Outcomes*

- What is your main goal in offering these DHTs? (new revenue streams, cost-efficiency, customer loyalty)?
- If already implemented, are your DHTs meeting these expectations/goals?
- How do you assess the economic outcomes of your investments in digital health, including both short-term and long-term financial implications for your organization and policyholders?
- How do you assess the integration of DHTs into the existing healthcare system, especially in terms of interoperability and data exchange between different stakeholders?

#### *III Quality Assessments and Learning*

- In what measure does the incorporation of digital health technologies enhance the quality of care and treatment for the insured, as opposed to being merely a supplementary aspect
- What is the importance of business ecosystems for these DHTs?

- What kind of learnings have you generated so far? Are there DHTs that work better than others? Why?
- What kind of DHT failed?
- What were the reasons?

#### *IV Digital Health Ecosystem and Business Models*

- What is the future role of a health insurance company in digital health ecosystems?
- Which digital health technologies (DHTs) are already used and reimbursed? In which fields?
- What are those offerings?
- How are these paid for? (self-paid, basic insurance, additional insurance, etc.)
- What are the most promising business models in digital health? Why do you find them compelling?

#### *V Future Challenges and Trends?*

- What are the key challenges that health insurance companies must overcome to fully embrace and benefit from digital health innovations?
- How would you improve the DHTs you are offering?
- How do you envision the evolution of digital health offerings from a health insurance perspective in the coming years? What emerging trends or technologies are you closely monitoring for potential integration?
- In your view, what role should public health policy play in fostering the growth of digital health solutions, and how might it impact the insurance industry's approach to healthcare delivery?