

# Implications and Perceptions of Digital Health Technologies: A Multiple Case Study on the Payers' Viewpoint

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**Abstract:** The study delves into the implications and perceptions of Digital Health Technologies (DHT) within the healthcare system. Among the many relevant stakeholders, the present study's objective is to explore the perspective of health insurers particularly. On this, we have conducted a survey (1 face-to-face interview, 5 online questionnaires) for a multiple case study on lessons from European health insurance entities from 5 countries regarding usage scenarios of DHT. Recognized for their transformative potential, DHT promises to address demographic shifts, streamline payment processes, and enhance patient management, especially for chronic diseases. However, the survey participants still see challenges in terms of their long-term effectiveness, demographic and regulatory constraints. Countries like Germany have pioneered regulatory frameworks, but issues of trust and interoperability persist. The economic implications of DHT present both potential cost savings and financial burdens. Health insurers emerge as pivotal players, acting as gatekeepers for DHT quality and driving adoption. As the DHT landscape evolves, continuous evaluation, adaptation, and multi-stakeholder collaboration are paramount for harnessing their full potential.


## 1 INTRODUCTION


### 1.1 Problem Statement

The demographical development in Western healthcare systems increases the morbidity of patients. Particularly, non-communicable diseases (NCDs), such as diabetes, hypertension, asthma, depression, and anxiety, impose a substantial health and economic burden on society (Vandenberghe & Albrecht, 2020). To address this challenge, healthcare delivery must rapidly shift from traditional processes to scalable digital health technologies (DHT; (Digital Therapeutics Alliance, 2023)). DHT (such as technology-supported blended care, patient monitoring, digital diagnostics, digital therapeutics) offer the potential to improve the quality, efficiency, and accessibility of healthcare (Chaudhry et al., 2006; Stroetmann et al., 2010).

However, there are still significant challenges to the sustainable and scalable implementation and

diffusion of DHT. One key challenge is developing and implementing effective business models that can support the long-term adoption and use of DHT (Gand, 2017; Veit et al., 2014). Another challenge is ensuring that DHT are accessible and reasonably priced or affordable for all stakeholders, including those in underserved and low-income communities (Suter et al., 2009). The fact that there are many different stakeholders in the healthcare system (various healthcare providers, health insurance companies, patients, politicians) or the importance of managing health-related data very carefully (cf., implications regarding privacy and security concerns) are major challenges for the implementation as well. To address these challenges, the present study's objective is to bring together the perspectives of payers and academics to discuss emerging business models of DHT. Thus, the research objective is to explore this perspective of health insurers particularly.

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## 1.2 Methods

To address these open points, we have conducted a *multiple case study* (Yin, 2014) on lessons learned and perspectives from health insurance companies regarding usage scenarios of DHT. A survey (1 as face-to-face interview, 5 as online questionnaires) has been used to get the respective insights. Details on the survey modes can be found in the appendix (see Table 4). The two survey modes are equally important *sources of evidence* with qualitative data for the overall case study. The participants and the organizations they represent constitute the partial cases in the sense of a *replication design* of the overall case study (Yin, 2014). The problem areas outlined above are operationalized in terms of the survey with the individual questions listed in Table 1 (Q#) and discussed in the corresponding sections in Chapter 2. The questions correspond to the elements of the questionnaire and the key questions of the interview.

Table 1: Details on the survey elements.

No.	Questions
Q1 – Sec. 2.1	How important are DHT for healthcare in general?
Q2 – Sec. 2.1	How important are DHT from the payer's point of view?
Q3 – Sec. 2.1	How can DHT help to make healthcare ready for the future developments?
Q4 – Sec. 2.1	How can DHT be used for prevention, healthy longevity, healthy aging, and elderly care?
Q5 – Sec. 2.2	How to cope with the economic burden of NCDs (with or without DHT)?
Q6 – Sec. 2.2	Which emerging business models of DHT are promising?
Q7 – Sec. 2.4	What needs to change in terms of regulations to make DHT successful?
Q8 – Sec. 2.3	Do you see a change in the role of health insurances in the future (given the rise of DHT or in general)?
Q9 – Sec. 2.5	Are you offering DHT? Did you develop these DHT yourself or are you partnering with start-ups or other companies?
Q10 – Sec. 2.5	Which DHT are already used and reimbursed? In which fields? How are these paid for?
Q11 – Sec. 2.5	For which diseases do you think we need DHT most? Where do you think DHT will work best?
Q12 – Sec. 2.5	What is your main goal in offering these DHT? (new revenue streams, cost-efficiency, customer loyalty)
Q13 – Sec. 2.6	What learnings did you generate? Are there DHT that worked better than others?
Q14 – Sec. 2.7	Could you already assess the effectiveness and/or efficiency of DHT?
Q15 – Sec. 1.2	Details of the representatives / respondents

The Europe-wide professional network of the authors (contacts via the membership lists of two European associations accessible to the authors were contacted; total number of contacted not known) was used to look for suitable representatives of the payer or insurer side in the healthcare system (note: given the various healthcare systems, some with direct state reimbursement, some with private or public health insurers, the terms "payer" and "insurer" should be understood interchangeably here). If the feedback was positive, they were invited to participate in the survey. Table 2 provides an overview of the survey participants/analysis units of the case study.

Table 2: Overview of the representatives (R#) included - details on the analysis units of the case study.

No.	Country	Characteristics (pseudonymised)
R1	Hungary	Central national agency for the management of the National Health Insurance, maintenance of records, keeping financial accounts and fulfilling reporting obligations
R2	The Netherlands	Trade, interest, liaising organisation of companies offering health insurance; balances different interests in healthcare
R3	Romania	Public, autonomous national institution to ensure unitary and coordinated functioning of the social health insurance system
R4	Spain	Private health insurance with more than 50,000 customers that offers access to the medicine and other related insurance services
R5	Germany	Statutory (=non-profit, for the common good), nationally represented health insurance with more than 500,000 insured people
R6	Germany	Biggest statutory (=non-profit, for the common good), nationally represented health insurance with more than 11 million insured people

In principle, a larger number of participants would have been possible by using the survey instrument. In the context of the case study, however, the resulting number was considered sufficient after one follow-up reminder for the members of the requested associations.

## 2 INSIGHTS ON THE USE OF DHT

In general, we have chosen a summary perspective for the study. In the case of special aspects of individual

participants, these are reported specifically (see their no. as displayed in Table 2). Partly, the given answers did not fully fit the questions or if the participants could not give an answer. When analysing the answers, these have been partly clustered and summarised to understand and address better the primary study aim.

### 2.1 General Aspects

First, we asked the participants to rate the importance of DHT from their point of view on a 5-point Likert scale (Q1+Q2; see Table 3). For both, we got mostly high ratings (meaning (very) high importance) - putting digitisation as a cornerstone of healthcare.

Table 3: Responses for Q1 and Q2 (5-point Likert scale).

	Q1	Q2
<b>R1</b>	4	4
<b>R2</b>	3	3
<b>R3</b>	5	5
<b>R4</b>	4	4
<b>R5</b>	4	4
<b>Mean</b>	4	4
<b>Median</b>	4	4
<b>Mode</b>	4	4

Further on, we requested the participants' views on DHT's role in making healthcare ready for future developments. In this regard, on the more strategic/overarching level the participants mention a possible reduction in the pressure on healthcare providers, as remote access, for example, would make it easier to implement more efficient processes and overcome physical distance, thus reducing the overall costs of healthcare delivery, and helping to prevent illnesses (R1,4). Overall, DHT are associated with the hope of being able to address larger demographic changes, such as the lowering number of workers. Operationally, payment processes and access (also to medical) information could be facilitated, expensive duplicate examinations could be avoided with digitally available data (imaging procedures are particularly expensive in this regard and could often be easily reduced in number, which would also reduce radiation exposure). DHT could also help patients manage their chronic diseases by offering measures to monitor relevant vital parameters, help establish changes and offer support in everyday life (R1-6). It is important to stress that these effects can only be attained if the DHT offer a real benefit for patients and medical staff and are used on a voluntary basis (R5).

### 2.2 Economic Perspective

DHT help the payers to have very actual statistics regarding the situation of all diseases and can make optimised distributions of payments on that basis (R3). On the other side, by creating consciousness of how behaviour affects patients' disease, the economic burden that comes with it could be alleviated. This is achieved through earlier treatment or the avoidance of the illness or deterioration due to a behaviour that is better suited to one's own condition. DHT can, at least in principle, offer the potential to provide more constant support than is possible, for example, through occasional visits to the doctor (R2,5,6).

The best way to cope with NCDs would be to prevent them. With regards to the demographic change, it would need a prompt major change in individual behaviour of people and the circumstances they live in, to nudge a healthier lifestyle. But with regards to the ageing population, there also needs to be an investment in secondary and tertiary prevention, meaning that these diseases can be detected at an early stage and empower patients with NCDs to manage their disease. DHT could be respective means and, in this sense, investments. If these investments get reimbursed by a healthier population is, however, uncertain (R5).

In addition to investments, business models should also be considered as part of the advantages, compensation, or benefits of these investments (Mettler, 2016). However, scaling DHT also generates additional costs. It may also not be clear how or to what extent these additional costs can be offset. Partly, the insurers' budgets are relatively rigid. It is also questionable whether the healthcare providers will be willing to pass on the efficiency gains associated with digitalisation (cost shift away from personnel towards infrastructure) or to accept a corresponding change in budget structures. On the other hand, to realise the benefits, it would also be necessary to consider how patients or users of DHT could be more effectively incentivised. Direct cash benefits are sometimes difficult. If necessary, agreements in the pharmaceutical sector would also be conceivable. This would allow to control better that less expensive but still effective drugs are used. On a small scale, some existing prevention or bonus programmes already have incentive mechanisms (small payments or monetary-like benefits), which might be expandable. Such mechanisms might then also go hand in hand with a changed relationship between the insured and the insurance in the direction of a stronger companionship (R6).

### 2.3 Potential Shift of the Role of Health Insurers

There is a growing interest of health insurances in the DHT market, and adoption models are being considered to a greater extent. The participants see a shift towards putting more pressure to adopt proven DHT in healthcare through their purchasing power (R1,2). Also, there is a shift towards more preventative care and shared decision-making. It will become more and more important that health insurances guarantee the quality of the healthcare system by only reimbursing DHT and other means that have proven their positive effect. Health insurances will be some kind of gatekeeper for high-quality healthcare (R5). Also, they should act as a gatekeeper and driver for using data. As particularly highlighted in the case of Germany (R5,6; probably true also for others), since a lot of valuable data is stored on the statutory health insurance's side, it might or should be their future role to use this data to improve healthcare. This data can be analysed on an individual level (e.g., to find risk factors for serious health threads) or on an aggregated level (allowing population risk factor analyses). Data will also be/need to be made available through the EHDS (European Commission, 2023a), even increasing the need for effective digitisation.

An interesting approach could also be that patients or insured persons are more strongly guided through the still complicated processes of the healthcare system (where he/she must go, which steps are pending) by DHT on the insurer side. Also, a kind of pre-analysis of symptoms plus greater use of video consultations could be possible to speed up processes and enable control with increasingly limited resources. As another example, it would be interesting if the data of the healthcare service providers were directly available to the health insurance funds. A quick pre-check based on the planned treatment would be conceivable in this way (the concrete design for compatibility with the GDPR remains to be seen). A second opinion could be offered to be able to provide more information about a cost-intensive and possibly risky treatment. The autonomy of the individual would and should, thus, be strengthened by the support of DHT. Digitalisation could thus be seen as an opportunity to guide and direct more, which hardly ever happens today. This would result in an approach of *hybrid treatment* or *blended care* (R6). Additional restrictions on the part of the Medical Device Regulation (MDR; (European Commission, 2023b)) could then also have to be considered.

### 2.4 Regulations

First, broad access to DHT is important so that no user (both on the patient and healthcare provider side) is excluded (R1). This also touches on issues of interoperability and usability of DHT (Katehakis & Kouroubali, 2019). To achieve a uniform solution that does not distort competition, pan-European regulation is desirable. The direction currently being taken by the legislator, including better use of (health) data, is certainly conducive to a better basis and ultimately also acceptance of DHT (R6; see, for example, the recent European Data Governance Act (European Commission, 2023c)).

For the case of Germany (R5,6), the situation is a bit special as the country pioneered the field of DHT (formally called "DiGA" - German abbreviation for Digital Health Application) by making them reimbursable by the statutory healthcare system back in 2020 (Federal Institute for Drugs and Medical Devices, 2023a). So, it is not the regulation that is holding back the success of DHT, but rather a lack of trust and fear of transparency of some stakeholders. Interoperability challenges also remain. For example, no data-side connection is currently possible between DiGAs and the official electronic health record. Also, specifications for data interfaces are not yet binding or clear enough so that DHT solutions can always function similarly. However, a basic framework would be sufficient. Detailed regulations and the concrete design could certainly be left to the individual actors avoiding overregulation (R6).

### 2.5 Reasons and Modes to Offer DHT

There may be a general positive opinion about DHT. But offering or even developing DHT is another matter. R1 has no offer here now. For R2, at least some healthcare insurers offer various DHT in various fields. These are mostly offered through third-party developers - not developed in-house. Payment also ranges from self-pay to basic insurances to private additional insurance. Also for R4, there are DHT offered - both in-house developments and in partnerships with external companies. In general, telemedicine is a common offering nowadays. Payment models vary without a common policy.

Overall, the participants have only limited capacity to act as providers or developers of DHT themselves. Therefore, they are also dependent on what software providers offer and can only partially control which areas and diseases DHT focus on (R1). Selectability is partly seen as a non-existent luxury,



as the transformation agendas towards digitalisation are still in the conception phase (R2).

As primary goals for using DHT, the participants name enabling patient access, cost efficiency (R1-5), maintaining quality and affordability of care and the healthcare system. In fact, the system can only be maintained if innovative solutions such as DHT are used (R2,5). Also, DHT can increase the loyalty of customers/insured people, improve the system on the technical part and add more services, cover more diseases (R3,4). It should also be noted that even large to very large insurers may not necessarily have a target group that matches the demographic and population characteristics of the overall population. For example, if younger people and families are the target group, the focus may be more on DHT for pregnant women (R6).

In general, a particular need for DHT is seen mostly in the field of management of chronic diseases (R4,5). Monitoring the health status (with various means) would also be a reasonable area DHT can contribute easily (R2,4,5). On that basis, patients may establish changes in everyday life to become healthier (R5). Also for R3, the available DHT are offered rather in the management of diseases. DHT can also offer good added value, especially around psychological support, or mental illness. Here it is particularly important that help is found at an early stage and at a very low threshold. Shame and social acceptance are still problematic with mental issues. The anonymity of DHT (compared to face-to-face therapy) could be particularly advantageous in this sense (given that mental health issues are still often shameful). Simple but very effective analogue means such as diaries and daily or nutritional advice are also very easy to transfer and make available in DHT (R6).

DHT also make it easier to deal with cases that are still difficult today in general, such as the coverage of (rarer) foreign languages or also the connection of remote (foreign-language or very specialised) doctors. Precision and clarity (not only but also linguistically) are essential (R6). Health insurances need (and want) to ensure high-quality healthcare as some kind of gatekeeper to ensure an efficient and effective use of means (R5).

For Germany (R5,6), the situation is again a bit special. The statutory health insurances must fully reimburse the DiGAs, which are listed by the Federal Institute for Drugs and Medical Devices (German abbreviation: BfArM) and prescribed by a physician to a patient (with no additional costs for them). Furthermore, the health insurances can reimburse DHT, which are not (yet) part of this list, via special contracts and offer DHT of their own (choice). In this

case, the data flow can also be controlled much more easily, user statistics are available. Due to the complicated legal situation of the public health insurance funds in Germany, only a few participate directly in developers but rather buy or license the DHT from external providers (R6).

Regarding focus, the DHT listed by BfArM are mostly for the management of diseases, and only a few are for prevention. The role of the gatekeeper for quality results from the fact that offers from the health insurance funds are either checked via the BfArM procedure or come into reimbursement via selective contracts and thus become attractive for patients because they receive the offers on prescription. Google and Co. are (so far) pushing into the second healthcare market, where offers are paid for themselves, and these are not officially checked (also with a view to data protection). However, there is a limit here (in the German market) with "lifestyle" offers because these are generally not reimbursed by the statutory health insurance (R5).

There was the further comment that electronic patient records should also be counted as DHT and very important ones at that. Especially from the insurers' point of view, there is a great added value here, as significantly better data availability goes along with it. In Germany, in particular, the records have a somewhat difficult public image, but their use is increasing.

## 2.6 General Learnings

From the participants' experiences with the offer of DHT, some generalisable experiences emerge. For example, clinical validation or proof of benefit is considered central. However, this is difficult to achieve, especially for software development start-ups (as service providers), partly because they lack experience. So, also the buying/licensing side somehow stays with this kind of uncertainty. It is crucial that a good, clear use case/minimal viable product is defined so that everyone knows what benefit the DHT can provide or address (R4). Also, there are already some insights on the distinct use of DHT (R5): These are mostly used by women. As already mentioned, DHT are usually developed for one specific disease, which does not necessarily reflect the full needs of the patients. That could be problematic for those who suffer from further diseases (co-morbidities). Patients often do not complete the whole recommended treatment cycle. This, in turn, reduces the overall added value of implementing DHT.

It is also interesting that the obvious group of presumed digital affine people (<40 years) are partly not so much in the focus on the use or offer of DHT (apart from more specific target groups such as pregnant women). This group is simply less affected by diseases, so the benefit expectation in relation to DHT is lower. Thus, it is rather the 40–60-year-olds where the need for support through DHT is greater or content for filling the electronic health record is available because there is already a certain medical history. In the meantime, a certain digital competence is also available. Nevertheless, the digitally more affine society is growing, so that user-side limitations will certainly decrease in the future (R6; (United Nations Economic Commission for Europe, 2021)).

If there is a failure of DHT (or their lack of sustainable use or upscaling), this can have further causes. A DHT may have been developed for a very, probably too specific purpose. In such cases, the DHT was not able to cope with the complexity of the overall system in real-life use, or its overall added value was too low, and it could not be cost-effective (R2,5). The situation is similar if the use case is poorly designed, i.e., not very appropriate to the needs or the healthcare system (R4). Or, in some cases, the provisionally assumed clinical/medical benefit does not materialise in the form of greater practical benefit, so further use was discontinued (this was the case, for example, with some DiGAs that were delisted by the BfArM again; R6; (Federal Institute for Drugs and Medical Devices, 2023b)).

## 2.7 Learnings Regarding Effectiveness and Efficiency of DHT

Another kind of experience is that, so far, hardly any statements can be made on the effectiveness and efficiency of the use of DHT; the positive effects of several available DHT are not finally proven, which could be problematic (R5). They are still a too new technology (e.g., DiGAs have only been available in Germany since 2020), and there is not enough (long-term) data available on the effect on individual patients or their clinical pictures, and this effect may only occur over a longer period or is generally not easy to specify. The effort required for such a survey is also considerable (R2). Nevertheless, the size of an insurer is sometimes positively related to the evaluability of DHT offerings. A larger user base at least potentially facilitates evaluation because there are likely to be more actual users in absolute terms. This, in turn, may also have a slight advantage in terms of attractiveness towards DHT providers, as the

insurer could more easily accompany an evaluation (R6).

In general, prevention is a meaningful concern where DHT can provide good and low-threshold support so that, ultimately, patients can take better care of themselves or their health with this additional support (R2,6). Nevertheless, a higher burden on the healthcare system can also arise here if the attention of patients is increased for possibly non-critical health aspects. All in all, the financial effects of preventive measures or the evidence for them, at least in the short term, is not entirely clear. But from the point of view of care and medical science, more prevention certainly makes sense in principle (R2,6).

Only in the case of DiGAs, it is the case that at least an initial proof of benefit must be provided for them to be officially listed by BfArM. However, they can also be delisted if no effect or an undesirable effect should occur in the longer term (R5,6).

It is true that a prescribed DiGA must also be paid for. The success in introducing the DiGAs (there are currently over 40 officially listed) is, on the one hand, gratifying. However, with costs per application and user averaging over 200 EUR, this also leads to new financial burdens, whereas the savings effects have yet to become apparent (potentially through avoidance of doctor's visits and improved health in general).

Another observed effect was that even with high-quality DHT, a certain saturation effect occurs at some point. If so, these solutions would have to be improved and extended by further functionalities. Of course, this then jeopardises cost-effectiveness and makes it more difficult to prove usefulness due to changed circumstances (R4).

## 3 CONCLUSIONS

The integration and adoption of DHT within the healthcare landscape, especially from the perspective of health insurers, is both promising and challenging. The unanimous recognition of DHT's importance underscores the potential of digitization in revolutionizing healthcare. DHT promise to address the challenges of an aging population, streamline payment processes, enhance patient management, especially for chronic diseases, and potentially reduce healthcare costs. However, several challenges and considerations emerge as a summary from the above:

- *Effectiveness and Efficiency:* Despite the potential benefits, there's a notable lack of long-term data on the effectiveness and

efficiency of DHT. While some initial benefits are observed, the long-term impact, especially in terms of cost savings and clinical outcomes, remains uncertain.

- *Adoption and Usage:* The demographic target group for DHT is not just the younger, tech-savvy population. Middle-aged individuals (40-60 years) present a significant user base, given their health needs and growing digital competence.
- *Regulation and Trust:* While countries like Germany have pioneered in creating a regulatory framework for DHT, challenges like trust, transparency, and interoperability persist. Overregulation is a concern, but so is the need for a framework that ensures the safety and efficacy of these technologies.
- *Economic Implications:* DHT present both an opportunity for cost savings and a potential financial burden. The balance between these two outcomes is yet to be determined. The role of health insurers in this equation, especially in terms of reimbursement models and partnerships with DHT providers, is pivotal. It should also be noted, however, that *hardly any new business models have emerged so far*. It is rather the case that the topic of DHT arises extrinsically, either to be able to meet the supply situation better or to take regulations into account (e.g., the introduction of DiGAs). The non-mention of new business models is thus also a recognition that, in case of doubt, there is still potential for change here. In part, there is still a rather restrained adoption, a very gradual, partly small-scale engagement with the topic.
- *Role of Health Insurers:* Health insurers are poised to play a significant role as gatekeepers, ensuring the quality of DHT and potentially driving their adoption. Their role in data management, especially in leveraging patient data for improved healthcare outcomes, is also noteworthy.
- *Future Directions:* As the DHT landscape evolves, continuous evaluation and adaptation are crucial. Technologies that fail to deliver tangible benefits might need to be phased out or improved. Furthermore, as the DHT landscape becomes more saturated, innovations will need to offer added functionalities and address specific healthcare challenges to remain relevant.

In summary, the present case study was able to provide some relevant, exploratory insights into the payer side's perspective on DHT. Figure 1 provides a summary of the given challenges.

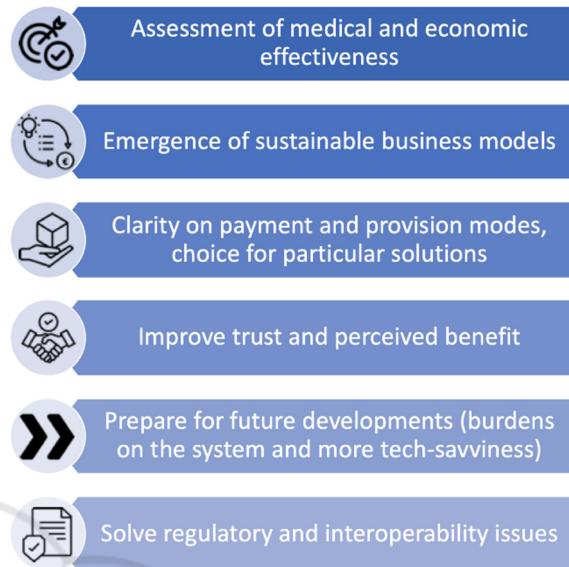


Figure 1: Summary of the given challenges in the field of DHT (This figure has been designed using images from Flaticon.com).

Here, it should also be noted, however, that the study cohort hardly showed any (national) differences regarding the above-mentioned questions. There was no major outlier in the responses, hardly any strongly divergent opinion. On the one hand, this is due to the relatively small size of the cohort, which, however, is not critical in the sense of case study research. At the same time, participation in the survey was not controlled by the inviters (voluntary participation in case of own interest). This resulted in a sample distribution that was not known in advance and is only of limited diversity. Accordingly, the potential for future research results in a broader coverage of more diverse aspects or healthcare systems or the implementation of in-depth analyses for particularly interesting aspects.

Overall, while DHT offer transformative potential for the healthcare sector, their integration requires a balanced approach, considering clinical outcomes, economic implications, regulatory frameworks, and the evolving needs of the patient population. Collaboration among stakeholders, including health insurers, DHT providers, regulators, and patients, will be crucial in realizing the full potential of DHT.

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## APPENDIX

Table 4: Details on the mode of the survey.

Mode of the survey	Details
Online survey (N=5; for R1-R5)	<ul style="list-style-type: none"> <li>A LimeSurvey instance by the main authors’ institution has been used with the elements as displayed in Table 1. The link to the survey has been sent via the Europe-wide network of the authors to contact representatives of the payer or insurer side in the health care system. A reminder was sent out two weeks later.</li> </ul>
Guideline-based in-person interview (N=1; for R6)	<ul style="list-style-type: none"> <li>The elements in Table 1 have served as a guideline for the interview.</li> <li>Not every single element was gone through step by step. On the one hand, the flow of the conversation should not be interrupted unnecessarily. On the other hand, partial aspects of some questions were already addressed in a previous answer, so that all relevant aspects were nevertheless covered.</li> <li>The conversation lasted about 1 hour. Two people took part on both the respondent and interviewer sides. This ensured a good match with the survey objectives.</li> <li>A written summary of the interview has been created based on the notes taken during the interview.</li> </ul>