dHealth 2022
G. Schreier et al. (Eds.)

doi:10.3233/SHTI220355

Shaping the Future of Health Data: A Scenario-Based Approach

Sarah OHSE[a,1], Dr. Alexander FINK[a,1] and Beat MEYER[b,2]
[a] *ScMI AG, Paderborn, Germany*
[b] *Blauen Solutions, Pfeffingen, Switzerland*

Abstract. Background: The European health care industry faces massive changes which impose new challenges on its stakeholders. Objective: In this paper, we present the results of a market-based analysis for upcoming changes in the European health care industry and what this specifically means for issues corresponding to data. Method: Scenarios are a common tool to explain and analyze future changes in business environments. This method was used in a series of workshops together with an interdisciplinary group of experts. Results: Ten individual scenarios represent potential futures with distinctive subsets of data landscapes. Their assessment shows that the expected future of health data is still rather unclear, while desired changes are quite distinct. Conclusion: The Health Data Scenarios offer a comprehensive framework for analyzing future data-driven developments in the health care industry.

Keywords. Health data, data ownership, health services, scenarios, strategic management

1. Introduction

The health care industry is largely affected by changes driven from outside developments. Innovation is pushing forward new treatments, new scientific approaches and thus new business opportunities but also new ways of interaction. These changes are meeting a system which is, especially from a European perspective, largely based on national policies and laws having to meet up with the arising opportunities but also risk. Especially digitalization has brought up a variety of potential new use cases and ways to improve the lives of citizens. Just as perceived in many other industries, disruptive innovation could change the way we view and influence one's health. A key driver of the possibilities is patients' data. Alas, the sensible nature of health and its corresponding data imposes special carefulness from all parties involved [1].

Furthermore, especially in health services, several stakeholders are involved. This leads to differences not only in perceptive goals, but also in terms of specific Know-How and culture. Bringing these stakeholders together is thus a task desperately needed but on the other hand, one hard to solve [2]. With the challenges on the one side and the vast opportunities on the other side, a call-to-action is in place in order to create systems and landscapes which allow the usage of health data in a way that satisfies all parties involved.

1 Sarah Ohse & Dr. Alexander Fink, ScMI AG, Klingenderstraße 10-14, 33100 Paderborn, Germany; E-Mail: info@scmi.de.
2 Beat Meyer, Blauen Solutions, Vogtackerweg 11, 4148 Pfeffingen, Switzerland, E-Mail: beat.meyer@blauen.solutions

A common method of displaying future developments in challenging multi-stakeholder environments is the creation of scenarios. Scenarios postulate a sequence of consistent events, leading to plausible and consistent pictures of the future [3]. Today, such scenarios are used not only by individual companies, but also by groups of stakeholders or in processes of regional economic development agencies [4].

Tackling this challenge, the Basel health care initiative DayOne, ScMI and Blauen Solutions have created ten scenarios [5,6]. In a systematic online process with over 50 experts from different groups, supported by Deloitte, Novartis and the Canton of Zurich, the scenarios were developed describing possible futures of the "Health Data Ecosystem" from a European perspective. In the following, we will give a methodical overview and continue with a presentation of the scenarios.

2. Method

2.1. Methods to describe the future

We would only too gladly know what our future will look like. Therefore, the terms »forecast« and »planning« dominate in dealing with the future. Forecasts describe what the future will (probably) look like. In most cases, such forecasts arise as extrapolations of extensive studies of available past data. Planning processes are for example often based on such forecasts. In situations characterized by change, however, such forecasts are often flawed, resulting in planning errors [7].

In addition to past-related information, various types of trends are also employed to make forecasts. However, there are also many examples that show how even renowned experts and trend researchers were unable to predict the future accurately. Therefore, in addition to extrapolations and trends, a third tool's use is recommended: Scenarios. They do not attempt to predict the future exactly by means of a forecast, but describe several, imaginable »futures« in the sense of thinking openly about the future. The goal is no longer to suppress uncertainty, but instead to incorporate it into one's decision-making. Therefore, we also speak of scenario management [5].

This proactive approach to uncertainty through the development, interpretation and application of future scenarios is essential to make adequate decisions in changing environments. According to the VUCA model (Volatility, Uncertainty, Complexity, Ambiguity), there are three further changes on which the use of scenarios has a positive effect [8]:

- *Complexity:* The diversity and dynamics of markets, competition, and environments have increased steadily in recent years. Therefore, we are usually dealing with complex systems that can be adequately managed only through networked or systemic thinking. Scenarios incorporate this by considering influences from different areas and linking them together.
- *Volatility:* Scenarios are not only intended to provide a short-term impression of possible futures, but also to provide orientation over a longer period in increasingly rapidly changing environments. Therefore, scenarios tend to have a longer time horizon in mind but are observed at shorter intervals.
- *Ambiguity:* People tend to avoid ambiguous, unclear or contradictory situations. However, as we encounter such situations more and more often in reality, those who avoid the pressure to "unambiguate the world" [9] and develop a higher

tolerance for ambiguity have an advantage. Scenarios prove to be a helpful tool here to test the compatibility of different views of the future.

2.2. Creation of scenarios

Describing a complex ecosystem, we aimed at recruiting participants from many different business areas as well as differing professional backgrounds. Overall, 50 experts from large renown companies, start-ups, think tanks, consulting and state-near institutions participated. In order to investigate the future of health data together with different stakeholders, we designed an online scenario process based on the following steps:

- *Scenario field analysis: Defining our questions about the future with the help of key factors*
  After the fundamental areas of interest had been visualized in a system image, a total of 72 influence factors were identified and described in detail. A network analysis then provided insights into how active or passive the individual factors were in the »Health data ecosystem«. In addition, as presented in Figure 1, a visual factor network was created, which enabled a balanced factor selection and was further used in the later phases. On this basis, the scenario team selected a total of 22 key factors. These key factors can be understood as »our questions to the future«, which are specifically addressed in the scenarios.

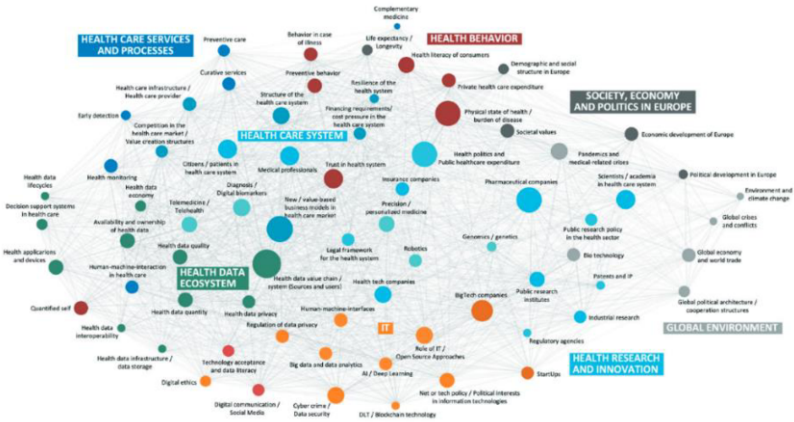

Figure 1. Factor landscape of key factors.
Note: Colors represent the cluster corresponding to the system image, while the size of the points represents their degree of interconnectedness.

- *Scenario prognostics: Future projections as building blocks for the scenarios*
  The next step was to develop up to five possible development options for each key factor in the form of alternative future projections. In a corresponding portfolio, the projections were collected with the aim to integrate as much relevant information about the key factors as needed. These projections can be described as the »building blocks« from which the scenarios can be assembled during the following steps.
- *Scenario creation: Systematic construction of a »map of the future«*

In the third step, we assessed how plausible the occurrence of two of the projections in one and the same scenario would be. The basis for scenario building is thus the compatibility (consistency) of the individual future projections – and not their probability or desirability. With the help of a scenario software, ten consistent draft scenarios were built. On the one hand, each of these raw scenarios represents a coherent future in itself. On the other hand, they are constructed in such a way that the raw scenarios differ from each other as much as possible. This content-wise bandwidth allowed the depiction of the entire future space in a "map of the future".

- *Scenario interpretation: Deriving well-founded estimates on expected changes* Immediately after the third step of scenario creation, the projections of all 22 key factors were evaluated by the scenario team in terms of their proximity to the present and to the expected and desired future. These detailed statements could then be extrapolated to the scenarios so that the proximity of the scenarios to the present as well as to the expected and desired future was derived. This made it possible to interpret the map strategically and derive first consequences.

3. Ten scenarios describing the future of health data

3.1. Overview of the scenarios

Combining all 22 key factors has led to ten distinctive scenarios. Every scenario consists of a statement about each of the 22 key factors, i.e. an individual projection. Thus, for every scenario, we extracted 22 consistent statements. With the software system "Scenario Manager", we have created a visual representation of the scenarios, a so-called map of the future. Scenarios which show some similarities in their statements are depicted close to each other. Although each key factor statement is relevant for the description of the scenario, there are some key differences which divide the map of the future into different areas. In this visual representation, we can observe some differences between some of the scenarios which serve as orientation points and allow us to identify key distinctions between the scenarios.

For the ten scenarios describing the future of health data, we can observe key differences in accordance to the *use of technology*. As Figure 2 shows, this difference divides the map of the future horizontally. While scenarios on the lower part of the map are characterized by moderate and incremental technological changes in the healthcare sector, scenarios in the upper part of the map all share a strong and disruptive technological change in the healthcare sector. The second key axe divides the map of the future vertically and describes differences concerning *cultural* and *process-driven changes*. While scenarios on the left-hand side can be characterized by an overall rather traditional culture and slow process changes, scenarios on the right-hand side are all characterized by a high degree of cultural and process-driven changes.

From the analysis of the two main axes, it follows that the map of the future can be divided into four main quadrants. Figure 2 provides an overview over the two main axes (in grey) as well as a depiction of the ten scenarios and their location in the quadrants. Since the scenarios all inheld individual insights, they are each presented in the following:

- *Scenario 1a: Traditional system – moderate growth:* A low level of innovation preserves traditional structures and players in healthcare processes. In a treatment-

based healthcare market, a low degree of regulation leads to a corporate-driven system with a lack of trust in highly monetized health data. The rare areas where data-driven healthcare innovation is implemented are controlled by a few companies in narrow value chains.

- *Scenario 1b: Resurgence of nationalism – protectionist mindset:* Protectionism leads to a drastic de-globalization, including in research and development. National players shape healthcare, which leads to huge differences between countries. Traditional systems and actors remain in charge, while citizens hardly seek to be in charge of their own health. Healthcare innovation is incremental and occurs only at the national level as a result of protectionism. Data is mainly powered, owned and evaluated by national authorities.

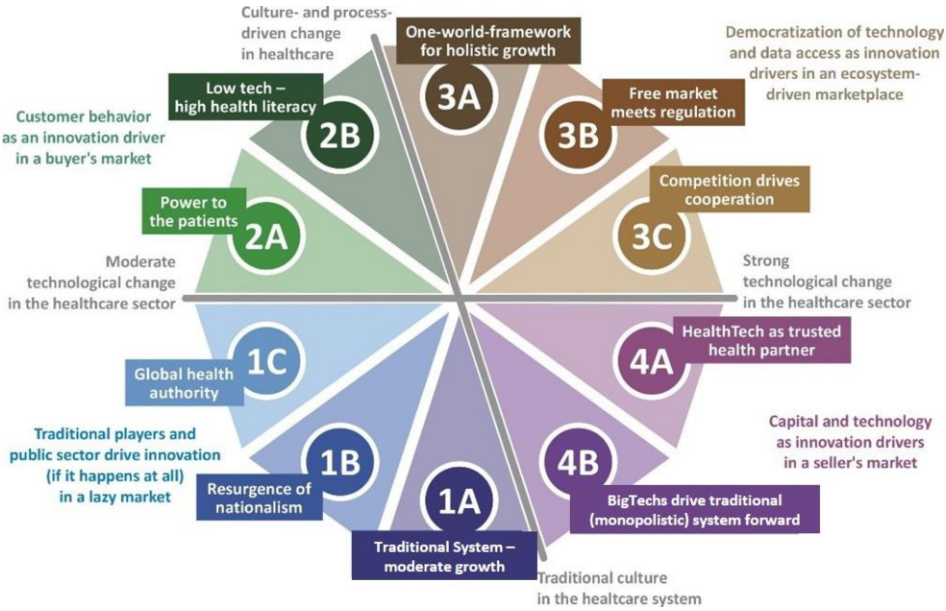

Figure 2. The ten scenarios describing the future of health data.

- *Scenario 1c: Global authorities – health data as public good:* In a collaborative regulatory effort, governments shape a global health market. Political authorities become more active and engaged in healthcare processes. This serves to bolster trust, but also inhibits advances and innovations. Since data is viewed as a public good, value chains are organized by the state and only involve a few players.
- *Scenario 2a: Patients in control – new business models arise:* Citizens assume responsibility for their health. While technological innovation lags behind, change is driven forward by a progressive culture. With citizens and their needs taking center stage, the healthcare system needs to adapt. Health data is regulated to enable patient-centered usage, offering open accessibility but limited monetization opportunities.

- *Scenario 2b: Low tech, high literacy – preventive medicine is to become a business:* Staying healthy is the overarching consumer trend. Innovation is consumer driven and focuses on processes, not on technology, regulation is supportive of this trend. In a stagnant economic environment, citizens take control of their health, shifting expenses from interventional to preventive medicine. This strong cultural change in consumer behavior disrupts the traditional healthcare landscape, allowing for new players to enter the field.
- *Scenario 3a: Reinventing healthcare – in a data-driven one-world framework:* Harmonization of both technological and legal standards provides a growth framework for data-driven healthcare services and business models. Patient and citizen empowerment will lead to the emergence of new players embracing value-based approaches, including preventive measures and non-medical interventions. Through strong regulation, governments enable an egalitarian health data ecosystem that is accessible to all stakeholders and controlled by citizens.
- *Scenario 3b: Free market meets regulation – the one-level playing field:* With data-driven technologies thriving, progressive cultural change embraces innovation and regulation focuses on diminishing big tech monopolies, as market barriers for new players are lowered. The health tech sector will focus on citizen or patient-centricity, building efficient ecosystems around their needs. New business models arise around value-based healthcare, prevention and non-medical intervention. Health data, owned by the originator of the data, will be freely exchanged through open platforms.
- *Scenario 3c: Interconnectivity drives innovation – in a highly competitive and fragmented healthcare market:* In a technology-driven and competitive healthcare market, health tech companies gain importance, but collaboration with incumbent providers is still their main access to market. Lack of regulation leaves capital and market power to shape the healthcare system, enabling technological innovation in line with the demands of the digitally empowered patient. Different business and data models coexist. The ownership of health data can be both with the patient and with the provider, who position themselves as custodians of the data.
- *Scenario 4a: A completely new vendor landscape – in a corporate-driven healthcare world:* The infusion of medical knowledge results in pharma, biotech, big tech and health tech companies merging to create healthcare conglomerates that dominate the market. Traditional healthcare structures and providers will remain in place, assuming the role of value-added distributors of the innovation advanced by the health conglomerates.
- *Scenario 4b: Health tech drives Innovation – empowering established structures:* Digital technologies continue to be based on medical know-how. The trust of citizens will remain with incumbent providers. Healthcare systems will be shaped by traditional structures, but health tech companies will establish themselves as new stakeholders in the role of empowering innovation.

3.2. Scenario assessment

The creation of ten different scenarios for the future of health data ecosystems has allowed us to explore different potential paths of development. In the next step, the scenario team assessed the scenarios concerning their probability using a 5-point likert scale on the basis of the projection portfolios derived in the scenario creation process. The assessment is clustered in three dimensions:

- Which scenario is closest to the current situation?
- Which scenario is most likely to become reality?
- Which scenario would one like to see becoming reality?

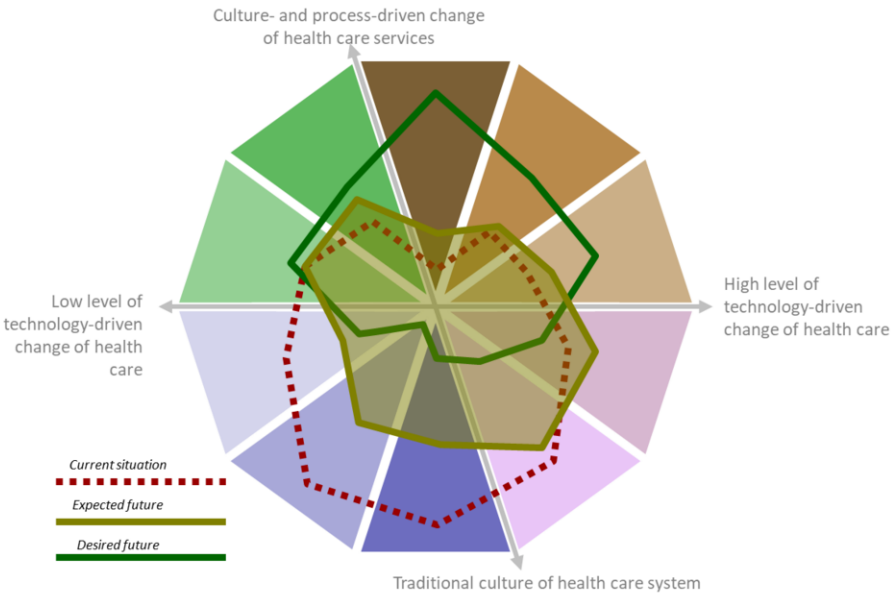

Figure 3. Results of the scenario assessment.

Figure 3 provides an overview over the results of the scenario assessment. The evaluation of the present situation shows that given the assessment of the 22 key factors, the largest similarity is found in scenarios in the lower left. Highlighting only evolutionary change of health care with a strong governmental influence, a rather traditional system is observed for the current situation. Accordingly, the lowest similarity is seen for scenarios on the opposite side of the map of the future. Overall, participants observe a low degree of innovation in the current state of health data ecosystem.

Concerning the expected future of health data ecosystems, the highest ranking can be observed for scenarios in the lower right. Participants expect a high influence of private players for the future. Innovation thus stems from private corporate-driven activities. Overall, with scores tending towards the middle, it becomes clear that while participants expect change to happen, the direction remains unclear.

Given the expectation of both technological innovation and consumer behavior shaping the future health data ecosystem, one might ask which development is in favor of different stakeholders within the system. The examination of the desired future was conducted with the indication of assessment perspective, but interestingly, the results did not differ according to subgroups. Overall, participants rank both culture and technology changes as highly desirable. Participation in the form of patient inclusion as well as a high degree of innovation are thus developments which are not evaluated as being harmful to given business and state models, but rather as beneficial for both personal and corporate spheres. We would like to see a cultural change in the healthcare system with changed processes – more than clearly.

The analysis of all three assessment dimensions shows large differences. While for the present the healthcare system is viewed as rather traditional and stagnant, this is expected to change during the next years. Both technological as well as cultural momentum are expected to transform the health data ecosystem without being able to already tell the direct path of development. Despite this unclear expected development, the desired future clearly lies in a transformed system with holistic growth.

4. Discussion

The Health Data Scenarios make it clear how interconnected the digital ecosystem is with the entire healthcare industry - and that its future development can no longer be adequately described by one-dimensional forecasts. To our understanding, only few alterative scenario processes concerning the future of health care exist which cover a much smaller range of potential futures [10, 11]. Furthermore, comparable scenario processes considered fewer key factors and did not provide an assessment of the expected and desired future. Therefore, the Health Data Scenarios contribute to an overall understanding of potential future developments, their probabilities and their corresponding opportunities and risks. Furthermore, knowledge was sourced in an open multi-stakeholder process, allowing the inclusion of a variety of insights and perspectives. Given the urgency of the development of a functioning health data ecosystem, the process was continued in 2021 through several stress test workshops for individual stakeholder groups. In terms of content, the scenario assessment reveals a massive desire among broad stakeholder groups for fundamental change in the health care system. Such a transformation process can be significantly supported by health data solutions.

References

[1] Ballantyne A, Schaefer G.O., Consent and the ethical duty to participate in health data research. 2018. Journal of Medical Ethics :44:392-396.
[2] Concannon, T.W., Grant, S., Welch, V. *et al.,* Practical Guidance for Involving Stakeholders in Health Research. 2019. *J GEN INTERN MED:*34, 458-463.
[3] Fink, A, Siebe A. Szenario-Management: Von strategischem Vorausdenken zu zukunftsrobusten Entscheidungen. 2016. Campus, Frankfurt/New York.
[4] Fink, A, Juergensmeier, H, Strategische Ausrichtung von Standorten und Wirtschaftsförderungen. 2021. Stember, J, Vogelgesang, M, Pongratz, P, Fink, A, Handbuch Innovative Wirtschaftsförderung. Band 1: Theoretische Grundlagen und Aufgaben. 2. Auflage, 61-82.
[5] Brenzikofer, T, Fink, A, Meyer, B, Ohse, S.: Shaping the health data future – the DayOne Scenarios. A study based on the insights of 50 experts and carried out in close collaboration with ScMI, Blauen Solutions. 2021. Basel Area Business & Innovation, Basel.
[6] Fink, A, Szenario-Management – Entwicklung, Bewertung und Nutzung von Zukunftsszenarien. 2021. Hellmann, W, (edit.) Kooperative Versorgungsformen – Chancen für den ländlichen Raum. Praxisbeispiele, Konzepte, Wissensvermittlung. KU Gesundheitsmanagement, 112-121.
[7] Gardner, D. Future Babble. Why Expert predictions are next to worthless. And You can do better. 2011. New York.
[8] Johansen, B. Get There Early. Sensing the Future to Compete in the Present. 2007. Berrett-Koehler, San Francisco.
[9] Bauer, T. Die Vereindeutigung der Welt. Über den Verlust von Mehrdeutigkeit und Vielfalt. 2018. Reclam, Ditzingen.
[10] European Health Forum Garstein, The EHFG Health Futures Project. Scenarios for health in 2037. Url: https://www.ehfg.org/projects-events/health-futures, last access: 31.03.2022.
[11] Foresight and Modeling for European Health Policy and Regulation, FRESHER Health Scenarios. Url: https://www.foresight-fresher.eu/fresher-project-results/four-fresher-scenarios, last access: 31.03.2022.