Scalable Business Models in Digital Healthy Longevity: Lessons from Top-Funded Digital Health Companies in 2022

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Abstract: Digital health companies can address significant healthcare challenges and mitigate the demographic impact on the health system. Healthcare value delivery becomes increasingly complex based on multiple health problems, different treatment methods and payment schemes, various care methods, and payment schemes; therefore, scaling up a healthcare solution is not trivial, especially for new companies. To explore the business models of the top-funded digital health companies and analyze the respective scalable element of their value creation and delivery processes, this study systematically used venture databases and a business model framework to describe top-funded companies. Then, we performed literature and desk research to specify which business model elements helped them scale up. As a result, we identified ten top-funded companies in the field; our main findings suggest that these companies scaled up by developing a platform for a wide range of users, in contrast to specific demography and disease. We recommend that new digital companies in healthy longevity prioritize employers in customer acquisition and align incentives between patients and payers with the help of digital health data to improve transparency on return on investment.

1 INTRODUCTION

In recent years, much research has focused on a particular aspect of digital offerings on health outcomes (Safavi et al. (2019), Salamanca-Sanabria et al. (2022), Wang et al. (2021), Nebeker et al. (2020)). Still, little work has been done from the perspective of the business model. However, previous studies have shown that business elements such as cost-sharing schemes can affect patient engagement and health outcomes (Kaplan & Milstein, 2019).

It remains to be seen how companies, especially new private companies in digital health, should deliver their healthcare services. A business model can be a guide tool for creating and capturing values sustainably in a rapidly changing landscape such as digital health. To this end, we need to research and discuss how innovation in business models could create a new way to address longevity challenges, namely preventive care for non-communicable diseases (Winston et al., 2016). Therefore, companies can ease the stress on our healthcare system by reducing disease treatment costs. Moreover, at the same time, it increases the effectiveness of digital therapeutics on health outcomes.

Despite the rapid growth and widespread adoption of the digital health industry, most offerings focus on disease management rather than prevention (Cohen et al., 2020). Furthermore, the health outcomes of digital therapeutics with patients and its effectiveness should be better studied (Safavi et al., 2019). Finally, digital health interventions need a suitable ecosystem for their introduction to become genuinely efficient (Essén et al., 2022) and ultimately to increase the chance of scaling up the business.

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Furthermore, trustworthiness in digital therapeutics (De Santis et al., 2021) and cost-sharing models of health plans (Kaplan & Milstein, 2019) need to be addressed to increase user participation; this further underscores the importance of suitable business models for digital health (Grichnik & Hess, 2020), as they can significantly affect actual health outcomes of the demography. Therefore, it is necessary to research specific business models to guide our current system toward healthy longevity.

The purpose of this study was to identify and investigate private digital healthy longevity companies worldwide as they successfully scaled up and addressed concerns about healthcare delivery, such as access to care and reimbursement of treatments. Furthermore, this study will contribute to any company that aims to innovate its business model in order to build a sustainable revenue model.

Subsequently, this article describes the research methodologies and frameworks used for analyzing companies with digital offerings for healthy longevity. Subsequently, the study results suggest scalable business elements for each target company. Specifically, our research asks: (1) What are the top-funded companies offering healthy longevity DTx? (2) What services are companies offering? (3) To whom are companies offering services? (4) How do these companies scale their services?

2 RELATED WORKS

2.1 Demographic Health Impact

Life expectancy is now nearly double the average of 100 years before. Considering 150,000 years of human history, our longevity today is nothing less than extraordinary (K. M. Murphy & Topel, 2006). Our healthcare technologies and practices enable us to reduce medical risk and treat acute diseases more efficiently (Fleisch et al., 2021). However, this led to a cost that our generation may not have considered, a cost to stay alive. The healthcare system is now at risk of system failure due to increased healthcare costs and longer duration of care due to newly achieved longevity(A. Murphy et al., 2020).

Evidently, one major factor that puts our healthcare system under severe stress is the high cost of health management for non-communicable diseases (NCDs) and common mental disorders (A. Murphy et al., 2020). The Prospective Urban and Rural Epidemiology Study (PURE) with data from 18 high-, middle-, and low-income countries indicated that NCD households spent their effective income on healthcare significantly more than non-NCD households, for example, 16% vs. 6% in China. To make matters worse, as the population ages, they are prone to suffer from multiple NCDs, and this comorbidity can alter disease severity drastically (Wallace & Lemke, 1991). Therefore, healthcare costs can increase exponentially with multiple NCDs (Hajat & Stein, 2018).

As eminent concerns rise, WHO declared that a decade from 2021-2030 will be a decade of healthy ageing (World Health Organization, 2020). This initiative aims to address the issues of the ageing population around the world. Furthermore, it recognized an urgent need to reform the healthcare system and promote a better life for a rapidly growing senior population (World Health Organization, 2020).

To achieve these goals collaboratively and address functional abilities, WHO set priority action areas as follows: change how we think, feel, and act toward age and ageing, ensure that communities foster older people's abilities, deliver person-centered integrated care and services that respond to older people's needs, and provide access to long-term care for older people who need it.

2.2 Digital Therapeutics (DTx)

As information and communication technologies advance, it is apparent that digital therapeutics can contribute to a healthy, long-lasting society (Digital Therapeutics Alliance (2022), Fleisch et al. (2021), Jaconson et al. (2022)). Even though the technological benefits are well received, the current implementation of digital therapeutics needs to be personalized to utilize its full potential. Furthermore, more studies are required on evidence-based DTx (Kowatsch & Fleisch, 2021). However, it is commonly agreed that current regulations on DTx are inappropriate and must be addressed to accommodate further development and use in a large population (Ryll, 2021). Here, some countries, such as Germany, are at the forefront, and some are lacking behind (Essén et al., 2022).

However, the development and use of digital biomarkers for DTx is necessary for system improvement. Digital biomarkers are objective and quantifiable physiological and behavioural data derived from digital devices, which can be used to analyze, change or predict health outcomes (Coravos et al., 2019). DTx can leverage these digital biomarkers to enable patients to care for their health. An essential contribution of DTx is that it allows users to become healthier as they know the factors

that influence their health outcomes. In summary, the development and integration of DTx can play an essential role in providing more sustainable healthcare.

2.3 Digital Health Business Models

In a time of rapid technological change, DTx needs a suitable ecosystem to become genuinely efficient (Essén et al., 2022). Healthcare practices should value the health outcomes of patients by collaborating with multiple stakeholders, such as payers, healthcare providers, and patients themselves. This requires a reformation of our healthcare value delivery and capture models.

We observe novel business models for DTx. Taking the example of digital mental health companies and their DTx offerings, we can see that it is a winner-takes-it-all landscape (Salamanca-Sanabria et al., 2022). Therefore, DTx companies can adapt their business model to accommodate established platforms and bring healthcare providers and payers together, such as employers and health insurers, instead of launching their DTx.

Different target customers imply different ways to deliver and capture value. Therefore, to ensure the effectiveness of the DTx offerings in healthy longevity, especially for those hard-to-reach populations, such as patients with low socioeconomic status (Mackenbach et al., 2008), the monetary aspect of healthcare must be closely integrated. In this study, we will explore such implications concerning the scalability of business models.

3 METHODS

This article established a three-step process to approach a systematic business model analysis similar to the previous work by Salamanca-Sanabria et al. (2022), as shown in Figure 2. First, the authors specified a business model analysis framework throughout the study to avoid putting unnecessary weight on ideation. This leads to conclusions about the elements of the scalable business model of the top-funded digital healthy longevity companies. The first step is a screening process for top-funded companies. The second is a business model analysis. And third is a discussion of findings and insights from the perspective of a contribution to healthy longevity.

Figure 1: Three-step analysis approach.

3.1 Definitions

Our research defines companies that offer healthy digital longevity as companies that use digital health interventions according to the FDA definition as a tool to contribute to WHO priority action areas; see Figure 1. The U.S. Food and Drug Administration (FDA) interprets digital health as a digital tool that can accurately diagnose and treat disease and improve health care delivery to the individual, including mobile health, health information technology, wearable devices, telehealth, and telemedicine (FDA, 2020). At the same time, the World Health Organization (2020) defined 'Healthy Ageing' as a process of developing and maintaining the functional ability that enables well-being in older age. More specifically, the ability to meet one's basic needs, learn, grow, make decisions, move, build, maintain relationships, and contribute to society.

In this paper, we extend the 'ageing' to 'longevity' by including offerings that cater not only to the elderly but also to the total population.

3.2 Inclusion Criteria

Define search categories and terms used in the Crunchbase venture database to extract related companies for healthy digital longevity. Keywords are digital health, longevity, ageing, fitness, elder care, biological age, health care, and biotechnology.

Our research excluded pre-seed and seed funding rounds. Additionally, since the business model is dynamic and considers its environment (Steinhöfel et al., 2016), our research restricted the analysis to companies with full commercial track records. Another reason is to ease the hype effect of immature technologies (Linden & Fenn, 2003).

3.3 Data Extraction

The authors extracted data related to our research questions from two venture databases: Crunchbase and PitchBook. Below are the overall coding logic and data points captured from the venture capital database for our private pre-IPO company selection process on 14 November 2022.

3.3.1 Data Coding

This study uses resources, definitions, and analysis methods to establish a systematic framework.

- Data source: Crunchbase and Pitchbook, as these venture databases are among the most accepted by researchers (Retterath & Braun, 2020).
- Categorization: FDA and WHO definitions
- Model analysis: Established business model analysis framework (Gassmann et al., 2020)

3.3.2 Data Points

Table 1 indicates the data point and its source. For total funding, we compared two venture databases to ensure validity.

Table 1: Data points from venture databases.

Data point	Source
Company name	Crunchbase
Location	Crunchbase
Employees	Crunchbase
Year founded	Crunchbase
Total funding	Crunchbase, PitchBook

3.4 Business Model Analysis Framework

We used the Business Model Navigator (BMN) framework to systematically assess the top-funded companies (Gassmann et al., 2020). This framework was used in favour of others. Such as the Business Model Canvas (Lima & Baudier, 2017) or the integrated business model (Wirtz & Daiser, 2017), because the assessment criteria focus on analyzing existing models rather than new ideas for business model innovation. To investigate each crucial business element, we ask; What are the top-funded companies offering? Who is the target customers? How are services delivered? And how do these companies achieve value?

The BMN framework focusses on recombining business model patterns rather than inventing. Initially, we analyze the environment to ensure the external consistency of a specific business model rather than focusing on ideation. This approach takes a neutral role of an analyzer rather than an active entrepreneur role in Wirtz (2013).

4 RESULTS

4.1 What Are the Top-Funded Companies Offering Healthy Longevity DTx?

In Table 2, we identified ten top-funded companies that offer digital healthy longevity services based on combined definitions from FDA and WHO. Table 2 also shows that all companies, except one, have over 100 employees and were all founded from 2008 onwards. In contrast to the fact that the venture market in the USA is four times the size of other leading markets (Teker et al., 2016), there are interestingly five non-US companies out of 10 companies in the field of healthy longevity, namely from India, France, Germany, the Isle of Man, and Chile.

As the total funding volumes between PitchBook and Crunchbase have a Pearson's correlation coefficient of 0.906, which can be interpreted as a very high positive correlation (Witz et al., 1990), we then used Crunchbase values for a funding representation.

Table 2: Ten top-funded companies.

No.	Company Name	Location	Employees	Year	Funding (millions)
1	Noom	New York, USA	1001-5000	2008	$ 657
2	Cult.fit	Karnataka, India	101-250	2016	$ 624.6
3	Alan	Paris, France	501-1000	2016	$ 558.2
4	Omada Health	California, USA	501-1000	2011	$ 448.5
5	Human Longevity	California, USA	101-250	2013	$ 330
6	Livongo	California, USA	251-500	2008	$ 235
7	Juvenescence	Douglas, Isle of Man	11-50	2016	$ 219.2
8	Betterfly	Santiago, Chile	101-250	2018	$ 204.5
9	Lark	California, USA	251-500	2011	$ 195.7
10	Ada Health	Berlin, Germany	101-250	2011	$ 189.5

4.2 What Services Are the Companies Offering?

The service categories are listed in Table 3, we observed that each company offers more than one type of product and service. Digital health companies made an effort to reduce the barrier to access to the healthcare they provide by generating multiple offerings to cover a variety of use cases. For example, Cult.fit extends its offering from offline gym membership to digital online fitness courses, covering mental health consultation and home test analytics.

A closer inspection of Table 3 shows that although the main category may vary across the list, most companies personalize their product and tend to offer telemedicine or personal consulting services. It is a somewhat expected result, but worth mentioning that, in addition to Human Longevity, all companies are

incorporating the mHealth app into their offering, mainly to communicate privately with users.

Table 3: Services categorization.

No.	Company Name	Service Category
1	Noom	Consumer Engagement, mHealth App
2	Cult.fit	Care coordination, telemedicine, mHealth App
3	Alan	Payer Administration, Telemedicine, mHealth App
4	Omada Health	Health Management, Telemedicine, mHealth App
5	Human Longevity	Analytics, Telemedicine
6	Livongo	Digital Medical Devices, Personal Health Tools, mHealth App
7	Juvenescence	Personal Health Tools, Analytics, mHealth App
8	Betterfly	Consumer Engagement, Payer Administration, mHealth App
9	Lark	Health Management, Telemedicine, mHealth App
10	Ada Health	Analytics, mHealth App

4.3 To Whom Are the Companies Offering Services?

Table 4 reveals an interesting aspect: nine out of ten companies approach corporate customers, whether an employer, health insurers, government bodies, or healthcare facilities. So even when your offering aims at end users who are patients, the service is packaged so that the company can introduce and integrate it into their healthcare practices.

Table 4: Target customers.

No.	Company Name	Target Customers
1	Noom	Patients, Employers, Payers
2	Cult.fit	Patients, Employers, Providers
3	Alan	Patients, Employers, Providers
4	Omada Health	Patients, Employers, Payers
5	Human Longevity	Patients
6	Livongo	Patients, Employers, Payers
7	Juvenescence	Patients, Providers
8	Betterfly	Patients, Employers, Payers
9	Lark	Patients, Employers, Payers
10	Ada Health	Patients, Providers

In particular, companies with healthy digital longevity are targeting human resources to introduce benefits to improve the organization's brand image and increase talent retention rate. Alan, Omada Health, and Lark specify return-on-investment indicators to illustrate gains for the companies. The following typical target customer is a payer, such as health plans; in such cases, digital health companies aim to integrate them into their customer channel so that care is effortless from the beginning to the reimbursement.

4.4 How Do These Companies Scale Their Services?

Table 5 lists a delivery model of each company. We follow the classification and summarize our top-funded companies based on the model classification in digital health for diabetes from Kikuchi et al. (2021).

The analysis results can be correlated to the offerings, where half of the companies act as an intermediate platform where one stakeholder is participating in delivering the product's value. Three companies are substituting previous solutions; for example, Ada Health offers diagnosis through self-report questionnaires and replaces the traditional search method for relevant medical information online. Human longevity aims to substitute general disease prediction by collecting diagnostic facilities in one place, including blood tests, magnetic resonance imaging, and Whole Genome Sequencing (WGS).

Table 5: Delivery models.

No.	Company Name	Delivery Model
1	Noom	Direct-to-Customer
2	Cult.fit	Substitute
3	Alan	Intermediary
4	Omada Health	Intermediary
5	Human Longevity	Substitute
6	Livongo	Intermediary
7	Juvenescence	Direct-to-Customer
8	Betterfly	Intermediary
9	Lark	Intermediary
10	Ada Health	Substitute

Table 6 is quite revealing in several ways. A striking observation from the analysis was the major trend of incentive alignment for payers. Furthermore, unlike other companies that focus on cost reduction, Betterfly offers psychological value while providing benefits for life insurance (payer). Finally, it is worth mentioning that Betterfly exchanges the digital token "SweatCoin" as a symbol of contribution, which has no medical function.

Table 6: Advantages of scaling up

No.	Company Name	Competitive Advantages
1	Noom	Collaboration between providers and payers
2	Cult.fit	Physical and digital blending at home offerings
3	Alan	The health plan bundle of providers and payers
4	Omada Health	Regulation certification and ROI incentive for payers
5	Human Longevity	Unique specialization in DNA longevity sciences
6	Livongo	Bundle physical and digital with IoT smart devices
7	Juvenescence	Research teams on anti-ageing drug
8	Betterfly	Societal motivation through a virtual coin exchange
9	Lark	Regulation certification and ROI incentive for payers
10	Ada Health	High clinical diagnostic accuracy with the A.I. algorithm

To underline the revenue model, it is commonplace to find that healthy longevity companies offer corporates a subscription package. Most services are designed to use subscription plans to differentiate the population segment and manage payment for different types of digital health intervention. An example of a Livongo is the separation between smart device purchase and analytic consultation.

5 DISCUSSION

The findings of this study clearly show that our top-funded companies tend to target a whole demographic rather than a specific type of patient, as they use advantageous high accessibility of digital offerings. Furthermore, by using widely adopted communication technology such as the web or mobile applications as a channel, companies successfully reached users with a lower socioeconomic status who are the most vulnerable to NCDs and common mental disorders.

One explanation for such a delivery model is that a digital platform bundles digital and physical offerings and provides more personalized care. They have developed multiple key partner relationships throughout their value chain; some act as a marketplace to address a broader range of health continuum; this was also suggested in Feld Birnbaum et al. (2015) work. Ultimately, this approach reduces the burden of receiving care and increases adherence to the care routine.

Capturing value is conventional as a fee-for-service mor value-based subscription model where incentives are addressed for patients and payers. In addition, low-barrier payment methods such as packages and subscription models are prevalent on all platforms. A greater variety of payment options also addresses the concern about access to healthcare care for users with a lower socioeconomic status.

6 CONCLUSIONS

We identified and analyzed ten top-funded digital health companies that received 1.730 billion USD in funding for healthy longevity offerings. According to our findings, leading digital health companies that promote healthy longevity successfully scale their business by offering personalized care to a wide range of populations and striving to become a one-stop-service platform for their members.

From a value-delivery perspective, our findings underline the importance of the direct patient-care provider network and the low-burden health interventions set up with existing adopted technology. In addition, companies that aim to provide their services to business counterparts made an apparent effort to increase transparency on return on investment, especially for payers, with the help of digital health data.

Although the finite number of evaluated companies limited this study, it can suggest a more scalable business model that affects the population's health outcomes on a large scale; digital companies offering DTx for healthy longevity may consider aligning profits of both patients and payers through scalable DTx—for example, using digital biomarkers, as a result, tracking and interpreting them as financial impacts for organizations. In future work, a detailed analysis of evidence-based health outcomes should be studied. Additionally, the validity of implementation in a certain location or a specific setup should be considered.

CONFLICTS OF INTEREST

WM and T.K. are affiliated with the Centre for Digital Health Interventions (CDHI), a joint initiative of the Institute for Implementation Science in Health Care, University of Zurich; the Department of Management, Technology, and Economics at Swiss Federal Institute of Technology in Zürich; and the Institute of Technology Management and School of Medicine at the University of St Gallen. CDHI is funded in part by the Swiss health insurer CSS. CSS was not involved in the design, data collection, analysis, or interpretation of the results of this study. TK is also a co-founder of Pathmate Technologies, a university spin-off company that creates and delivers digital clinical pathways. However, Pathmate Technologies was not involved in this study.

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