Digital Transformation in Healthcare and How Pharma Can Keep Up to It

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Background

The COVID-19 pandemic has expedited the convergence of various healthcare trends, with consumers placing a premium on convenience and availability to care. Digital transformation is seen as a method for leading health systems to become more consumer-friendly while also transforming their operations, culture, and technology. The paper explored the topic of medical chatbots, telemedicine, and digital therapeutics, and examine how pharmaceutical businesses may leverage such technologies strategically.

Introduction

Over the past, medical information and diagnostics methods have only been available in what is referred to as the ivory tower of medicine. In traditional healthcare, patients do not have access to the ivory tower and must go through a physician to gain access to such medical information. This model is bound to change as patients have more patients now have access to more medical resources than ever with the help of the internet. As well as the shift of focus on patient autonomy and healthcare democratization (1). The new ecosystem model will involve the deconstruction of the ivory tower and require medical professionals to adapt to new norms such as technology literacy and new modes of communication. While at the same time, patients can offer their valuable insights to physicians, ultimately the patient-physician relationship becomes a collaborative partnership where both sides are benefited.

As the world is evolving into a technology-focused future, the healthcare field must adapt to these changes. The COVID-19 pandemic has radically exacerbated the need for digital transformation in the healthcare sector (2). We have seen technologies such as telehealth, remote monitoring, and digital triaging apps rapidly scaled up throughout the pandemic (2). Disruptive technologies and emerging trends such as artificial intelligence (AI), precision medicine, or

digital therapeutics (Dtx) will impact the future of the pharmaceutical industry. The industry must adapt to new technologies and innovations as we move forward into the future. Keeping up with digital transformation can be overwhelming for healthcare businesses and deciding on which emerging technologies to invest resources in and getting the team on board with the change can be a challenging part. The focus of this paper will be on the technology evaluation of different digital health technologies relevant to the pharmaceutical industry. The investigated topics will be summarized from both a business and scientific perspective. The paper will also explore potential technology applications that the pharmaceutical industry may leverage strategically.

Medical chatbot:

A chatbot or conversational agent is a computer program that uses Artificial Intelligent to conduct a conversation with users (3,4). Chatbots are text or voice-based aiming to mimic the natural human conversation (3,4). Various sectors such as retail, real estate, and banking commonly use chatbots for a variety of purposes primarily sales and customer services. The most common benefits of chatbots are the 24/7 support they can provide to the users and reduced workload for staff. Companies with a large user base tend to use a chatbot to engage with their users (5,6). This report will explore healthcare chatbots and identify opportunities within the pharmaceutical industry.

Healthcare chatbots can be split into 3 different categories:

- **Symptom assessment**: In non-urgent cases, patients can utilize a chatbot to assess their symptoms (3). The chatbot may gather information such as patient history, and symptoms to provide a diagnosis.

- **Healthcare assistant:** Perform administrative tasks for patients such as appointment booking, insurance coverage, and viewing test results (5).
- **Digital therapeutics (DTx):** These types of chatbots can provide evidence-based therapeutic interventions to prevent, manage or treat a medical disorder or disease (7). The majority of therapeutic chatbots are commonly used to help improve the well-being and overall mental health of patients. Some digital therapies are designed to be used in complimentary with medication or behavioral interventions. Digital therapeutics are subjected to regulatory oversight like drugs. These tools must undergo clinical studies and be prescribed by healthcare providers (8).

Please refer to table 1 for a list of chatbots that may be relevant to the pharma industry.

Chatbot	**Integrated or stand-alone app**	**Patient information gathered**	**Referrals or other follow-up treatments**	**Locations**
babylon	Integrated into Telus Health App	No	Connect with doctors, medication recommendations	United Kingdom
ada	Stand-alone app	Date of birth, gender, height, weight, medication, allergies, health background	Symptom tracking, medical information.	Germany
Healthily	Stand-alone app	Date of birth, gender, consultation history	Medical information, medication recommendations.	United Kingdom
buoy	Stand-alone app	Gender, age, locations.	Treatment recommendations, find the nearest medical center	United States

SENSELY	Stand-alone app	Date of birth, gender	Connect with nurses	United States
mediktor	Stand-alone app	Age, gender, height, weight, medication, race, allergies, risk factors, past medical history, past surgical history	Connect with doctors	United States
k health	Integrated into telemedicine app	Date of birth, gender, height, weight, medications, allergies, ethnicity, smoking, surgeries, chronic conditions, family history	Connect with doctors	United States

Table 1 outlines a list of symptom checker medical chatbots that may be relevant to pharmaceutical businesses.

There are two approaches in which chatbots operate.

1. **Rule-based approach**: The chatbot is guided by a decision tree, where the structures and answers are all pre-defined by the chatbot programmer (3). Chatbot users are given a set of predefined questions that then lead to the desired answers. The majority of the symptom assessment chatbot uses this type of approach to make the diagnosis. A limitation of this approach is that the bot does not answer questions outside of the predefined rules. Though this type of chatbot is easy to build and can be integrated into existing systems with ease.
2. **AI-based chatbot:** These chatbots are built using Machine Learning models that enable the bot to self-learn from user inputs and generate answers accordingly (3). AI-based chatbots improve over time as it learns from the data provided by the users to perfect

their answers. A major limitation of this approach is the need for data required for implementation. As large data is required to train the bot, it can be a complex and expensive process for most companies(5,6,7).

Application of chatbots in the pharmaceutical industry

There are multiple cases where a medical chatbot could assist the healthcare industry. These applications may include medication management, organization, and offering solutions for simpler medical issues, these are possible scenarios in which a medical chatbot may step in and ease the burden for healthcare providers. For the pharmaceutical industry, there are several functions for which chatbots may be useful.

A chatbot may be utilized in the sales department for its ability to offer 24/7 support to customers. These chatbot systems may be available to the users through Facebook Messenger, or other built-in platforms. HealthTap is a common example of chatbot utilization for pharma. HealthTap chatbot interacts with patients through a machine learning model which allows the patients to check their symptoms and receive preliminary diagnosis and treatment recommendations (9,10). The treatment recommendation may include a referral to a specific brand name product or a class of medication. If the chatbot is unable to answer the questions, the bot will then connect the patients to a network of physicians for a live consultation. These live consultations often result in new prescriptions generated, ultimately creating revenue for the pharmaceutical company. The HealthTap chatbot is available through Facebook Messenger with a reach of up to 900 million users (9,10).

Another function that pharmaceutical companies may want to utilize is patient education. A chatbot can help direct the patients to the correct resources and 24/7 access to educational information. There are a few examples of this application by pharmaceutical giants like Bayer,

and Sanofi. Bayers implemented a chatbot function on one of their product pages Canesten, an over-the-counter (OTC) treatment for vaginal yeast infections (11). The chatbot assists the patients in navigating through the product webpage which contains educational articles and questionnaires related to women's intimate health. Patients were able to seek solutions quickly and find the information they needed through the chatbot with just a few clicks, available 24 hours a day. Though the purpose of the bot is primarily for patient education, the chatbot also made treatment recommendations for the patients to Canesten product, ultimately generating additional sales as a secondary benefit (11).

There have also been examples of chatbot utilization in salesforce support. Roche for example has developed KeBot for their sales team. It consists of two different functions, training before visiting the clients and self-performance assessment (12). The purpose of KeBot is to increase engagement and create a database on sales performance. Although many pharmaceutical companies have already utilized chatbots as part of their business operation, most chatbots were developed externally through a tech company rather than in-house.

Telemedicine

Telemedicine is the practice of medicine using telecommunications technology to facilitate the diagnosis and treatment of patients. Telemedicine practices can be largely categorized into 3 types of service models:

Brick and Mortar Providers Interacting Digitally Through Video Conferencing Platforms:

In this model, Brick and Mortal physicians engage with patients using consumer out-of-the-box tools like Zoom and WhatsApp. This type of service model constitutes 80-90% of the telemedicine visits (13).

Digital Telemedicine Platforms offered to Healthcare Providers

These are technology players with physicians practicing medicine on their platforms either on a part-time basis or through payor-provided services. Physicians are servicing patients outside of their regular primary care physicians. This type of service model constitutes 10% of the telemedicine visits (13).

Fully Virtual Clinics.

About 5% of telemedicine visits are provided through these fully virtual clinics that vertically integrated digital-only medical groups (13). These service providers tend to have a headquarter in a remote location, and the physicians are fully employed and practice medicine only digitally. Virtual clinics tend to provide an end-to-end service to the patients with a network of physicians ready for referrals and operate in an ecosystem. The majority of the virtual clinics are available to the patients through out-of-pocket payment either through a subscription fee or a service fee. Though, in Ontario, virtual visits are temporarily covered by the province until September 2022 (14).

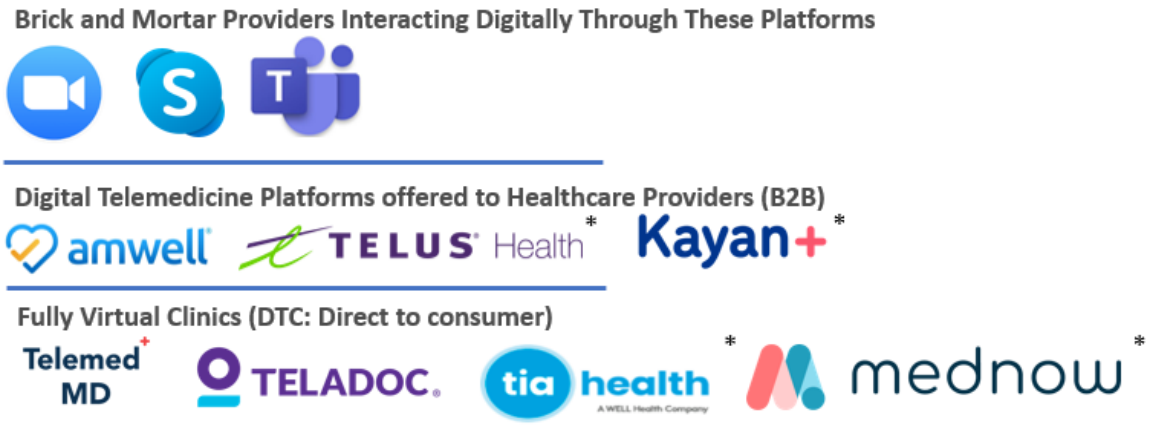

Figure 1 shows examples of different telehealth providers based on the type of service model

During the height of the COVID-19 pandemic, telemedicine usage surged as patients and providers sought alternative ways to access and deliver healthcare safely. According to McKinsey and Co, overall telemedicine utilization for office visits and outpatient care peaked at 78 times higher in April 2020, compared to February 2020 (15). That number has since stabilized at around 38 times more compared to the pre-pandemic level (15).

Post-COVID Patient Journey with Telemedicine.

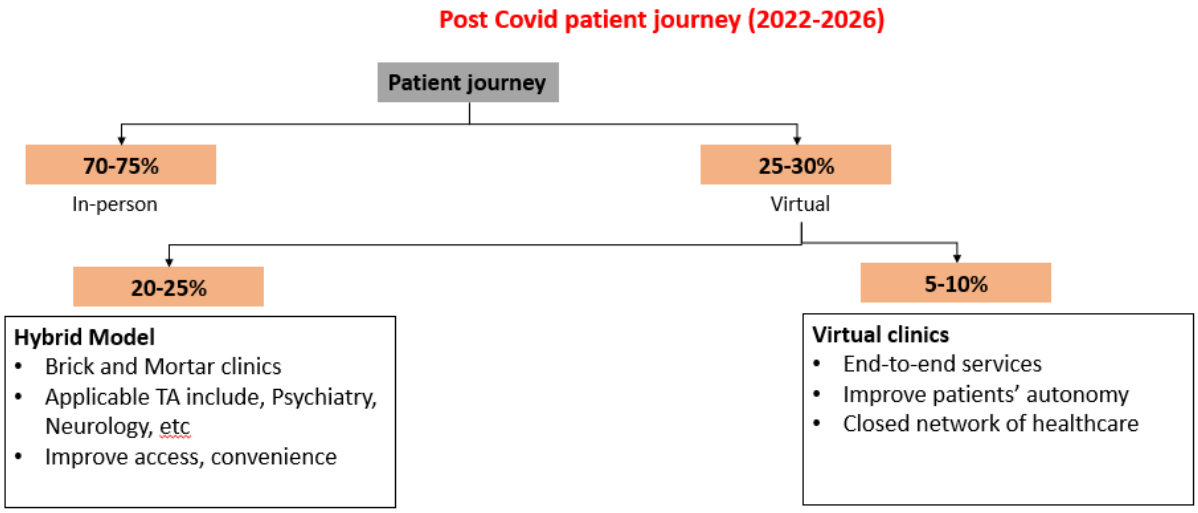

Figure 2 outlines the post-COVID patient journey with telemedicine technology.

It is predicted that post-covid, 25-30% of the visits are expected to be virtual. 20-25% of those virtual visits would be offered in a hybrid environment, where point service providers as well as brick and mortar physicians adopt telemedicine to do the bulk of the virtual care visits (13). This model offers benefits related to improved access and convenience to the patients. But there are also challenges related to the ability to diagnose effectively and start treatment. Thus, it is predicted that therapeutic areas like Psychiatry, and Neurology may benefit most from this model, where most workflows are virtualizable. The other 5-10% of virtual visits will be from those fully virtual clinics as mentioned above (13). Several clinics are bulking to go beyond just

being a single acute event or telemedicine solution service provider. Functions like remote monitoring and second opinions are slowly being integrated into these virtual clinics' platforms, making them capable of providing end-to-end services for the patients. Chronic disease therapeutic areas like cardiovascular, respiratory, and mental health will benefit the most from this type of model.

Direct-to-Consumer Telehealth, A New Sales Channel

Imagine this: A female patient sees an ad for a new prescription medication for allergies. She then uses her phone to access the drug's website where the front page asks if she would like to "Speak with a physician and get started now!". The patient is then redirected to another telehealth webpage where she inputs her personal information, medical history, and credit card numbers. Within the next 10 minutes, a physician then contacts her virtually to ask more questions before approving her prescription request. Upon approval, she can then place the order for the medication from the website, and get it delivered to her home within the next 2 days. Through this model, the patient did not have to leave her home, visit the doctor's office, and pick up her medication from a pharmacy in person.

This new model is known as direct-to-consumer (DTC) telehealth, an emerging model that many pharmaceutical enterprises are exploring. Under the DTC telehealth model, the patient can obtain medical advice and treatment virtually without a prior doctor-patient relationship (16). This model provides convenience, accessibility, and flexibility for both patients and clinicians (16,17). The COVID-19 pandemic has exacerbated the emergence of many DTC telehealth start-ups primarily in the United States (17,19). Companies like Cove Health, Cerebral, Nurx, hims, and hers are big players in this space and growing at an astronomical rate.

Common products offered by DTC telehealth providers are for hair loss, migraine, allergy, and sexual health. These products are readily available through DTC channels, pose little risk, and can be self-administered by the patient (19). In contrast, products like biologics, gene therapies, and narcotics may require complex administration and require more diagnostic, thus would not be available through DTC channels.

DTC telehealth is not as common in Canada as in the United States. Currently, only one company (Felix Health) offers DTC telehealth services to Canada (19). Users pay a low out-of-pocket fee to get connected with a physician, and the communication between the patients and physicians is asynchronous (the patient fills out the questionnaire and the physician approves the prescription without having to meet with the patient one-on-one) the majority of the time (19). As direct-to-consumer marketing of prescription products is highly restricted in Canada, pharmaceutical companies that specialize in the above-mentioned indications may leverage the DTC telehealth channel to get their prescription products directly to the patients. Companies may work with a partner like Felix Health to launch a digital DTC channel. The partner will be responsible for providing the telehealth consultations, online fulfillment, and shipment to patients.

Digital Therapeutics

According to the Digital Therapeutics Alliance, digital therapeutic is defined as the delivery of interventions directly to patients using evidence-based, clinically evaluated software to treat, manage, and prevent a broad spectrum of diseases and disorders (8). Similar to traditional medicine, digital therapeutics may undergo a clinical evaluation and similar regulatory processes. It can be prescribed by healthcare providers either as a stand-alone product (monotherapy) or in combination with another medical intervention (adjunctive) (20). For

example, physicians may prescribe diabetes medication and pair it with a digital therapeutics app to keep track of the insulin level.

Digital therapeutics cover a variety of indications, mainly chronic diseases like diabetes, and mental health disorders where traditional pharmacological interventions may not be effective and behavioral changes are essential for end-to-end disease management (20).

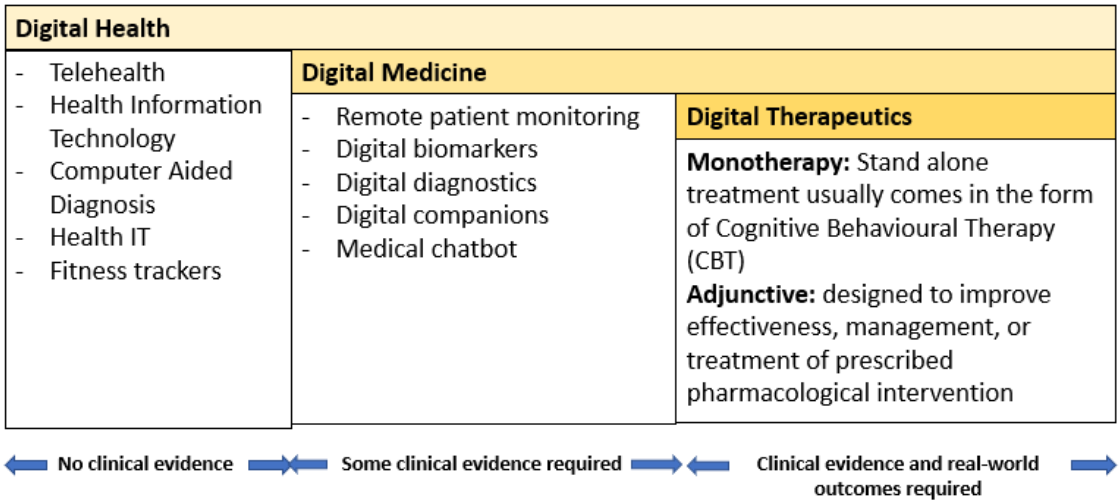

Figure 3 displays the differences between digital health, digital medicine, and digital therapeutics

Classification of Digital Health Apps.

Digital therapeutics may also be classified based on the level of clinical evidence and commercialization approach. Please refer to the table below for the continuum of digital therapeutics products. This classification system is important as it helps differentiate digital therapeutics against a plethora of thousands of health-related apps.

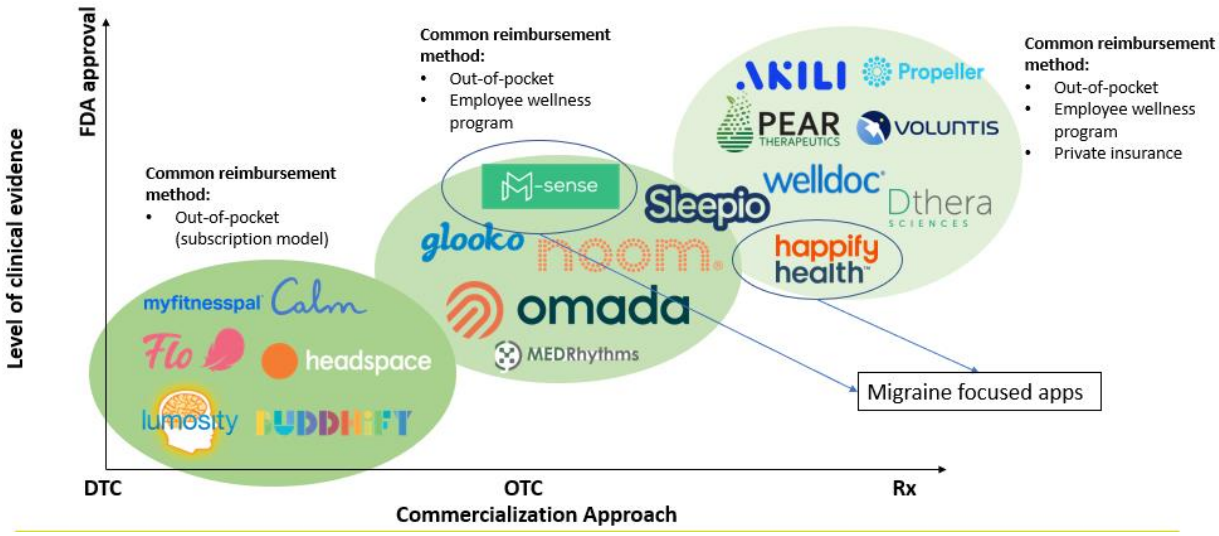

Figure 4 outlines the continuum of digital health applications.

Direct-to-consumer (DTC) Apps

The lower left of the classification graph represents the common "wellness" apps that are widely available for download through the App Stores. These apps are mainly used for fitness tracking, sleep support, and meditations. DTC apps do not have clinical evidence to support their efficacy. The majority of these apps are available free of charge to the consumers, or at a small price. Patients pay out-of-pocket, often through a small monthly subscription fee (21). Private insurance and public payers tend to not cover these types of apps on their formularies (20).

Over the counter (OTC) Apps

In contrast to DTC apps, OTC apps are not widely available on the App Store and can only be accessed through certain providers. These apps do have some level of clinical evidence and may be seeking regulatory approval in the future. In terms of reimbursement, patients can pay out-of-pocket often through a monthly subscription model. In addition, most apps are also available through employee wellness programs paid by employers (21). Private payers

occasionally cover OTC apps as the health economic evidence is relatively weak relative to the traditional pharmacological therapies (20,21).

Prescription DTx Apps

Prescription DTx apps have strong clinical evidence and regulatory approval from the health authority. In contrast to OTC and DTC apps, prescription DTx apps are developed for a specific indication. In the listed examples, Akili is approved for attention deficit hyperactivity disorder (ADHD), Voluntis for diabetes, Propeller for asthma, etc. The first prescription digital therapeutic to be approved by the FDA was Pear Therapeutics in 2017 for patients with substance use abuse disorder. Today, there are roughly 30 to 40 prescription DTx apps available on the market (20). As the health economic evidence is stronger, private payers are more willing to cover DTx apps on their formulary (21).

Key Therapeutic Areas

The list of indications for which digital therapies are being developed is constantly expanding, with the majority of existing and future products focusing on chronic diseases and neurological/psychiatric disorders. DTx could be developed in any therapeutic area with evidence-based behavioral or psychological characteristics and where digital intervention can be a valuable treatment component, especially if demand is expected to outstrip treatment capacity. This is especially true for chronic diseases, whose incidence will rise dramatically as the population ages, and a shortage of healthcare providers is expected. A systemic review of clinical studies that use DTx interventions shows that mental health and chronic diseases are the most researched indications in this field as seen in **Figure 5** (22).

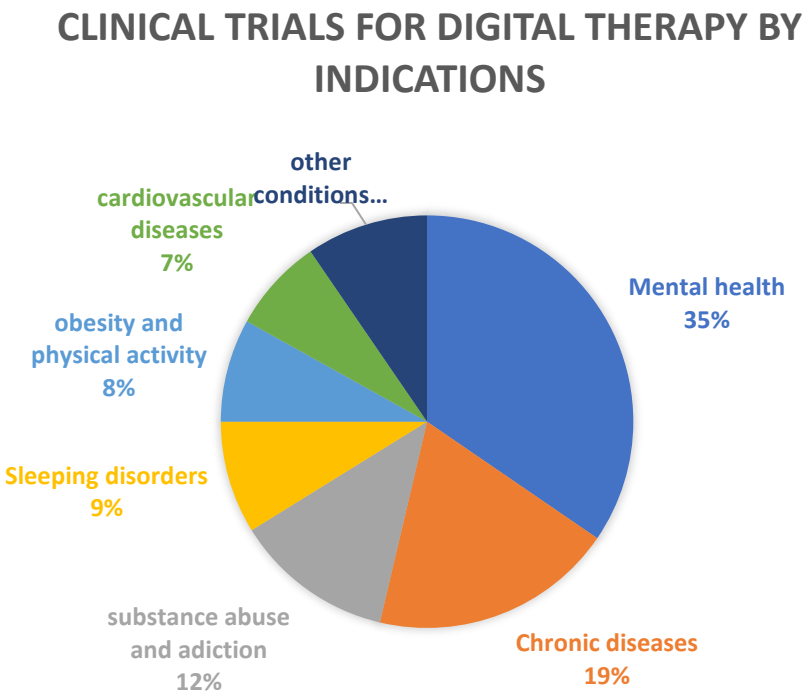

Figure 5 describes clinical studies where digital therapeutic interventions were used, categorized based on indications.

Pharmaceutical Investment in DTx

The annual global digital therapeutics market is currently valued at $3.4 billion and is projected to reach $13.1 billion by 2026, increasing at a compound annual growth rate (CAGR) of 31.4$ during this period (20). DTx software products have attracted a huge number of investors because of their lower development costs, simplicity of distribution, and ability to scale up their application. According to Rock Health's Digital Health Funding database, investment in digital therapeutics products grew 2.6 times between 2020 and 2021 (23). Notable investments include a $110 million Series D round for a video game therapy Akili Interactive Labs and a $400 million Series E round for Hinge Health, a musculoskeletal sensor developer (23).

Big data and advanced analytics, hardware engineering, human-centered product design, and inventive, flexible business models are all qualities that successful digital-therapeutics firms

have. Pharmaceutical businesses will need such capabilities as healthcare moves toward a digital future. However, considering the high amount of failed start-ups, integrating such technology in-house would almost certainly require a major investment with high risk. As a result, forming partnerships with digital-therapeutics businesses is a more appealing tactic for many pharmaceutical enterprises. Such partnership will enable pharmaceutical businesses to gain access to new capabilities and technology, while digital-therapeutics start-ups gain scale and access to more providers and patients.

Pharmaceutical giants are entering the digital therapeutics space primarily through partnerships, mergers, and acquisitions rather than developing in-house. For example, Sanofi struck a deal with Happify Health to develop an app for management and improving psychological outcomes for multiple sclerosis patients (24). In another example, Otsuka Pharmaceutical collaborated with Proteus Digital Health, who developed the first-ever digital pill version of Abilify, a treatment for schizophrenia (25). The digital pill keeps track of patient medication intake through a mobile app and ensures that the patient is adhering to their medication plan, a pressing issue for many schizophrenic patients (25). From these two examples, we see that the goal of the partnerships is to build values for their products. Offering complimentary digital products for their existing pharmacological product will make the product more appealing and provide a competitive advantage over the generic competitors.

Conclusion

Digital transformation is critical for enhancing health care and boosting consumer interactions. It is more than just technological investments; it results in changes in organizational culture and employee engagement; it is an enterprise investment that requires participation from all levels of the company.

Digital transformation will have an impact on all elements of health care, facilitating better access to care, enhancing quality, and lowering costs. Consumers can contact their preferred provider quickly and easily. Digital transformation can improve operational and financial efficiencies, as well as bring long-term objectives for health systems to reality.

Reference list:

1. Mesko, Bertalan. A GUIDE TO ARTIFICIAL INTELLIGENCE IN HEALTHCARE. The Medical Futurist, 2019.
2. Ibid; Deloitte, *Enterprise digital transformation as a competitive necessity: The leadership imperative for life sciences* , accessed November 11, 2021Mitchell JB. Artificial intelligence in pharmaceutical research and development. Future Med Chem. 2018 Jul 1;10(13):1529-1531. doi: 10.4155/fmc-2018-0158. Epub 2018 Jul 3. PMID: 29966438.
3. Safi Z, Abd-Alrazaq A, Khalifa M, Househ M, Technical Aspects of Developing Chatbots for Medical Applications: Scoping Review, *J Med*. Internet Res 2020;22(12):e19127. URL: https://www.jmir.org/2020/12/e19127
4. Almalki M, Azeez F. Health Chatbots for Fighting COVID-19: a Scoping Review. *Acta Inform Med*. 2020;28(4):241-247. doi:10.5455/aim.2020.28.241-247
5. Mesko, Bertalan. "The Top 12 Healthcare Chatbots." *The Medical Futurist*, 17 Sept. 2021, https://medicalfuturist.com/top-12-health-chatbots/.
6. Mesko, Bertalan. "Big Pharma, Big Money: Johnson&Johnson, Pfizer, Bayer, Novartis in Digital Health." The Medical Futurist, 12 Oct. 2021, https://medicalfuturist.com/big-pharma-part-one/.
7. Dang A, Arora D, Rane P. Role of digital therapeutics and the changing future of healthcare. *J Family Med Prim Care*. 2020;9(5):2207-2213. Published 2020 May 31. doi:10.4103/jfmpc.jfmpc_105_20
8. *Digital Therapeutics Definition and Core Principles*. Digital Therapeutics Alliance, Nov. 2019, https://dtxalliance.org/wp-content/uploads/2021/01/DTA_DTx-Definition-and-Core-Principles.pdf.
9. Yeung, Ken. "Healthtap Launches Facebook Messenger Bot That Provides Fast Access to Health Care." *VentureBeat*, VentureBeat, 13 July 2016, https://venturebeat.com/2016/07/13/healthtap-launches-facebook-messenger-bot-that-provides-fast-access-to-healthcare/.
10. "HealthTap Creates Chat Bot for Facebook's Messenger App." *MobiHealthNews*, MobiHealthNews, 14 Apr. 2016, https://www.mobihealthnews.com/content/healthtap-creates-chat-bot-facebooks-messenger-app.
11. "Bayer Canesten." *Bayer Canesten - Indigo.ai*, https://indigo.ai/en/customers/canesten/.
12. "Vidiemme Develops KeBot for Roche Pharma: A Chatbot for Pharma Reps." *Vidiemme Consulting Srl*, 4 Apr. 2018, https://www.vidiemme.it/en/a-chatbot-to-train-pharma-reps-vidiemme-develops-kebot-for-roche/.
13. Summer, V., & Unnikrishnan, V. (2021). ZS Impact webinar: Telemedicine revolution & its effects on pharma.
14. Government of Ontario, Ministry of Health and Long-Term Care. (2021, July 30). *OHIP – bulletins – health care professionals – MOHLTC*. OHIP – Bulletins – Health Care Professionals – MOH. Retrieved June 6, 2022, from https://www.health.gov.on.ca/en/pro/programs/ohip/bulletins/redux/bul210704.aspx
15. Bestsennyy, O., Gilbert, G., Harris, A., & Rost, J. (2022, February 28). *Telehealth: A quarter-trillion-dollar post-covid-19 reality?* McKinsey & Company. Retrieved June 6,

2022, from https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/telehealth-a-quarter-trillion-dollar-post-covid-19-reality
16. Bollmeier SG, Stevenson E, Finnegan P, Griggs SK. Direct to Consumer Telemedicine: Is Healthcare From Home Best?. *Mo Med*. 2020;117(4):303-309.
17. Hutchinson, J. R., & *, N. (2021, April 19). *Telehealth care could lead to more follow-up visits*. Insurance Journal. Retrieved June 6, 2022, from https://www.insurancejournal.com/news/national/2021/04/19/608723.htm
18. Flaherty, M., & Lou, R. (2020, October 1). *Direct-to-patient (DTP) sales channels might be the next frontier for pharmaceutical companies*. Deloitte United States. Retrieved June 6, 2022, from https://www2.deloitte.com/us/en/blog/health-care-blog/2020/direct-to-patient-sales-channels-might-be-the-next-frontier-for-pharmaceutical-companies.html
19. News Wire. (2021, November 2). *Felix Health Becomes the First Canadian Telemedicine Provider to Offer Integrated Digital Mental Health Services*. Cision. Retrieved June 6, 2022, from https://www.newswire.ca/news-releases/felix-health-becomes-the-first-canadian-telemedicine-provider-to-offer-integrated-digital-mental-health-services-825974025.html
20. Christian, J., Vanoli, G., Bernhardt, T., Verri, C., & Musci, V. (2021). *Digital therapeutics: Catalysing the future of health*. Retrieved June 6, 2022.
21. Reuter, E. (2022, April 11). *Can digital therapeutics become profitable?* MedTech Dive. Retrieved June 6, 2022, from https://www.medtechdive.com/news/digital-therapeutics-commercialization-challenges/621820/
22. E Santoro, L Boscherini, E G Caiani, Digital therapeutics: a systematic review of clinical trials characteristics, *European Heart Journal*, Volume 42, Issue Supplement_1, October 2021, ehab724.3115, https://doi.org/10.1093/eurheartj/ehab724.3115
23. Krasniansky, A., Evans, B., & Zweig, M. (2022, January 10). *2021 year-End Digital Health funding: Seismic shifts beneath the surface: Rock Health*. Retrieved June 6, 2022, from https://rockhealth.com/insights/2021-year-end-digital-health-funding-seismic-shifts-beneath-the-surface/
24. Sanofi. (2019). *Sanofi and happify health solidify collaboration around prescription DTX designed to address mental health in people with MS*. Sanofi. Retrieved June 6, 2022, from https://www.sanofi.com/en/media-room/articles/2019/happify-collaboration
25. Digital drug fortunes falter. *Nat Biotechnol* **38,** 117 (2020). https://doi.org/10.1038/s41587-020-0425-3