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Digital Medicine:

More convenient, more accessible, and faster healthcare

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Overview

Imagine a world where phones served not just for communication, but also as links to healthcare. We could pick up our phones, open mobile applications, and immediately connect to available mental health professionals at any time, even during the middle of the night. Maybe we could access treatment plans to help with anxiety and sleep issues, or use applications synced with embedded sensors in pills to track whether we are taking medications properly.

A new, ground-breaking innovation is taking the healthcare system by storm: digital medicine. Digital therapeutics are "evidence-based therapeutic interventions to patients that are driven by high quality software programs to prevent, manage, or treat a medical disorder or disease" as defined by the Digital Therapeutics Alliance. Digital medicine can be offered to patients in place of in-person treatments. Digital medicine is provided through various mediums, from innovative devices, to mobile applications, to virtual treatment sessions.

Digital medicine differs from traditional forms of medicine in that the inclusion of technology makes it faster, more convenient, and more accessible.

Digital therapeutics are already developed and in use today

Companies like Proteus Digital Health, Pear Digital Therapeutics, Omada Health, and Cognoa, and Akili are employing the use of technology to transform medicine and health care.

proteus DIGITAL HEALTH	***Proteus Discover*** is an ingestible sensor, and a sensor patch connected to a mobile application and provider portal. It is activated when the sensor is ingested with medications. The sensor transmits a signal to the patch on the patient's torso, which measures patient activity, helps monitor "medication-taking patterns," and provides physicians with tangible data regarding the effectiveness of medicines.
PEAR THERAPEUTICS	***PearConnect*** is a tracker and online therapy provider that treats patients suffering from substance use and opioid use disorders. The system is relatively confidential and allows for people to reeive therapy for issues for which they may be embarrassed to visit doctors in person. A dashboard gives clinicians resources and data, support for patients, and can loop in insurance companies to answer questions. ***reSET*** is a 90-day Prescription Digital Therapeutic for Substance Use Disorder"to give cognitive behavioral therapy. ***reSET-0*** is an 84-day Prescription Digital Therapeutic for Opioid Use Disorder"to give cognitive behavioral therapy**.**
omada	***Omada Health*** digital therapeutics utilizes behavioral science in order to guide people to healthy lifestyles and to prevent issues such as diabetes, hypertension, and high cholesterol. Services include: - Wireless smart scale - Web application to connect users to a health coach, peer groups, weekly lessons, and personal action goals - Tracker to measure progress in terms of blood pressure, meals, weight, etc.
cognoa	**Cognoa**'s digital therapeutics are still in the process of discovery and clinical trials. However, the company's goal is to provide parents, employers, and clinicians with a digital precision medicine platform technology to help provide personal treatment for children. It aims to help with early childhood development, and to give diagnoses during a window where the patient can still be helped.
AKILI	***Akili Interactive*** strives to help treat cognitive impairments, such as Attention Deficit/Hyperactive Disorder and Autism Spectrum Disorder withDigital medicines disguised as interactive video games. Most of the company's treatments are in the pilot phase, but a pivotal study was performed on its digital medicine for ADHD.

A variety of mobile applications can be downloaded for several treatments and conditions. These applications do not require prescriptions or regulation.

	***Abundance: A Meditation App*** uses guided meditations and mindfulness to help consumers increase their wellness, reduce stress, focus on goals, and achieve their potential.
	***Smoke Free-Quit Smoking Now*** is a smoking cessation application helps consumers track how long they have been smoke free, the amount of cigarettes not smoked, and how much money the consumers save by not smoking.
	***Wysa: Mental Health Therapist*** contains an AI bot to chat with and resources, such as guided meditations, that provide mental health therapy to consumers.
	***MyFitnesspal*** helps consumers track their health journey by logging weight, runs, and eating behavior.
	***Lifesum: Diet and Macro Tracker*** helps helps consumers maintain healthy eating patterns and accomplish their dietary goals, whether it is weight loss or gain.

Digital therapeutics provide increasing accessibility and control over our health. Digital medicine is potentially accessible over a global scale as it integrates the ever-expanding technology industry. This allows for worldwide communication, so that individuals and communities can virtually share healthcare techniques between opposite ends of the world. This accessibility to technology decreases reliance on clinical staff or in person sessions with a limited capacity, essentially allowing more citizens to access healthcare now that finite parameters are removed. Such communication could also enable different healthcare providers to share information about patients in common by creating a more convenient platform.

Also, a large percentage of the population has access to digital medicine via smartphones or computers, and access is an essential factor in pushing forth new innovations and incorporating them into our healthcare system. Because digital therapeutics can be used on demand versus by appointment, they give patients control of their health. This is important as thus far, clinicians have had more control, but by giving patients jurisdiction over their health they become empowered to maintain a healthy lifestyle and responsibly. However, we must still determine how to increase access to digital medicine for the portion of the population without regular access to internet services.

CONNECTIONS

Digital medicine provides means to pursue precision medicine, in which an individual's genomic data and personal lifestyle is used to devise an individualized treatment pathway, with the integration of technology.

Subsequently, health care could become faster and more convenient in future generations as digitally stored data is used to make informed decisions regarding treatments.

Precision medicine may also benefit from digital medicine as advanced computer programs will allow for medical treatment to be personalized. Large databases will help store information for big data and let clinicians analyze multiple genomic data sets easily.

Digital medicine has the potential to offer countless benefis, however, there are also several issues to take into account as we move forward with implementation. Most of these problems branch from the idea that digital therapeutics are medicines and may be treated like modern day physical medications:

Mobile and web application accessibility

Most mobile and web applications are used for leisure and are accessible for all consumers to download. For example, all customers are able to access GPS or homework help applications. These applications do not require external guidance. However, access to digital therapeutics platforms may need to be restricted solely to the patients they are prescribed to. Like physical medications, digital medicines should likely not be offered to patients who are not eligible for the medicine. This raises questions of patient access and who will regulate the administration of digital therapeutics.

Helping patients use digital medicine

Doctors ensure that their patients do not abuse prescriptions and take medications appropriately. Likewise, customers must be monitored and helped in using digital therapeutics accurately and properly. For example, Inspira Health Network incorporated a Health+ bar that is inspired by Apple's Genius Bar. The Health+ bar allows patients with chronic diseases to test and use digital health tools. Provisions must be undertaken to provide aid to digital medicine customers.

Determining efficacy

Healthcare companies and providers can utilize evidence from clinical trials and studies to understand the effectiveness of medications. Similar provisions must be made to ascertain the efficacy of digital therapeutics. Although technology cannot be held to a level of standards as high as medical clinical trials, its standards must be more defined than simple beta testing. A balance must be found. Health and measurement companies are helping to create this balance. Evidation Health, for example, looks for "inventive methods for capturing, quantifying, and analyzing behavior data in the context of human health." Other companies such as VitreosHealth work with healthcare organizations to help them attain "clear and measurable results" so they can analyze the efficacy of their products.

The potential of digital medicine

Having established the benefits of digital medicine, it is necessary to understand the possible risks in order to attain a holistic view.

Potential risks for individuals:

- How will we preserve security and ensure that data is not leaked?

- How can we make sure that databases with personal information are not hacked?

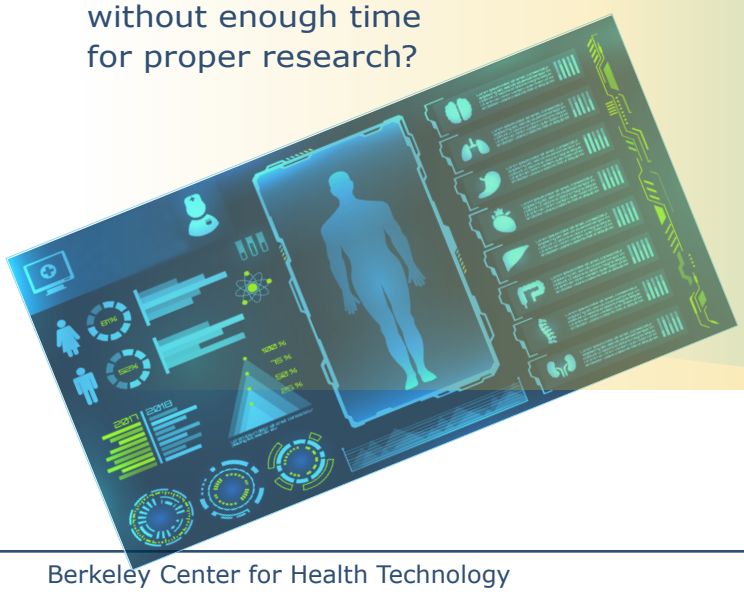
- Will individuals be willing to pay if digital medicine is expensive?

Potential risks for businesses:

- How can businesses derive revenue from digital medicine?

- Will pharmaceutical companies cover the costs of digital medicines?

- Are companies rushing in too fast, without enough time for proper research?



Digital medicine has major potential to transform the healthcare system positively, but it is still necessary to be cautious as we turn to technology and understand that there are issues we must resolve and consider before we can fully implement this innovation. Digital therapeutics promise great benefits to healthcare providers and patients who will adopt the practice. In the future, everyday consumer products such as Amazon Alexa or smartphones may play fundamental roles in the healthcare system. The question is: how can we strike a balance? How can we integrate technology into healthcare without fully replacing physical clinical care?

For more information about digital therapeutics visit:

www.dtxalliance.org/dtx-solutions/

stanmed.stanford.edu/2018fall/digital-medicine-improve-patient-care.html

Works Cited

- "Akili Interactive." Akili Interactive, www.akiliinteractive.com/.
- Bazzoli, Fred. "30 Hot Consumer Health and Fitness Apps." Health Data Management, 23 July 2018, www.healthdatamanagement.com/list/30-widely-used-consumer-health-and-fitness-apps.
- Biswas, Kushan, et al. "Digital Therapeutics: Improving Patient Outcomes Through Convergence." Deloitte United States, 26 Feb. 2019, www2.deloitte.com/us/en/pages/life-sciences-and-health-care/articles/digital-therapeutics.html.
- "Child Development Community for Parents." Cognoa, www.cognoa.com/.
- Cohen, Jessica K. "Hospitals setting up tech bars for chronic disease care." 12 Oct. 2019, www.modernhealthcare.com/patients/hospitals-setting-up-tech-bars-chronic-disease-care.
- "Digital Therapeutics Get First FDA Clearance, Novartis Focuses on Digital after Announcing Job Cuts and Other Q4 Pharma News." MobiHealthNews, 26 Dec. 2018, www.mobihealthnews.com/content/digital-therapeutics-get-first-fda-clearance-novartis-focuses-digital-after-announcing-job.
- "Evidation." Evidation, evidation.com/.
- Freedman, David H. "By Targeting Each Patient's Unique Tumor, Precision Medicine Is Crushing Once-Untreatable Cancers. But Only a Fraction of Patients Currently Benefit. Can Medicine Close the Gap?" Newsweek, 16 July 2019, www.newsweek.com/2019/07/26/targeting-each-patients-unique-tumor-precision-medicine-crushing-once-untreatable-cancers-1449287.html?mc_cid=00d34db80b&mc_eid=150f4cc508.
- Health, Omada. "Digital Therapeutics for Chronic Disease | Omada Health." Digital Therapeutics for Chronic Disease | Omada Health, www.omadahealth.com/.
- Nature News, Nature Publishing Group, www.nature.com/collections/egjifhdcih.
- "Pear Therapeutics." Pear Therapeutics, peartherapeutics.com/.
- PricewaterhouseCoopers. "Digital Therapeutics and Connected Care Reshape the Life Sciences Industry." PwC, www.pwc.com/us/en/industries/health-industries/top-health-industry-issues/digital-therapeutics-and-connected-care.html.
- Proteus Digital Health, www.proteus.com/.
- Roberts, David. "10 Ways Digital Could Transform Healthcare." EY, EY, 25 Apr. 2018, www.ey.com/en_gl/digital/10-ways-digital-could-transform-healthcare.
- White, Tracie, et al. "How Digital Medicine Is Improving Patient Care." Stanford Medicine, stanmed.stanford.edu/2018fall/digital-medicine-improve-patient-care.html.

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