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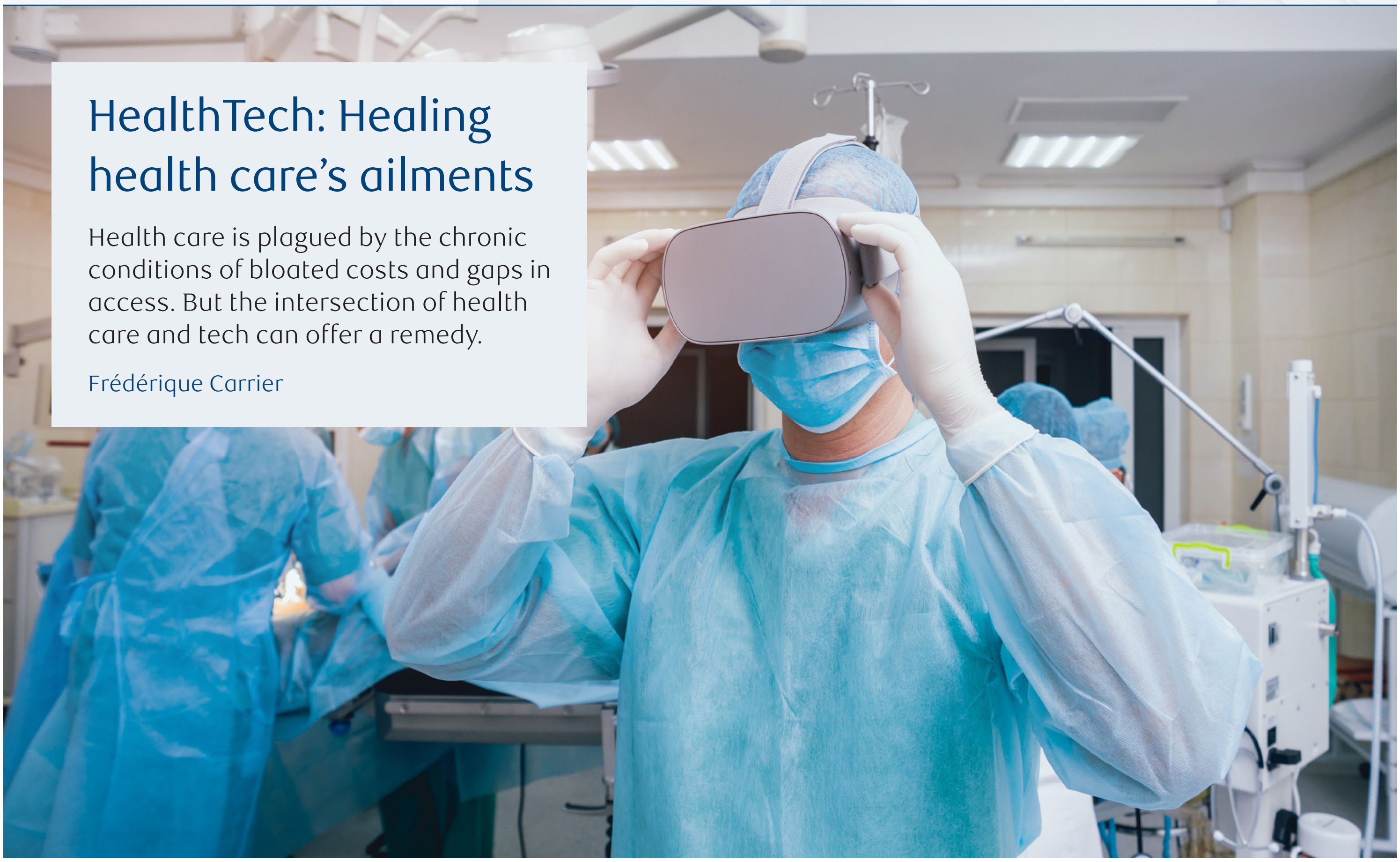
Monthly focus

June 2021



HealthTech: Healing health care's ailments

Health care is plagued by the chronic conditions of bloated costs and gaps in access. But the intersection of health care and tech can offer a remedy.

Frédérique Carrier

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MONTHLY
Focus

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HealthTech: Healing health care's ailments

With bloated costs and gaps in access to quality services, the traditional health care model is plagued by its own chronic conditions. But at the intersection of health care and technology, we're seeing the development of a remedy for what ails health care. We look at the change that is afoot and what it means for the investment landscape.

Rising health care costs and unequal access to care are widespread, chronic challenges, even more so now as populations are becoming greyer throughout the world and have ever greater medical needs. Demand for health care solutions is growing apace and seems unlikely to slow down. This compounding burden on the world's health care systems is not sustainable.

HealthTech, the convergence of health care and technology, has the potential to meaningfully reduce costs and improve efficiencies. We believe both will be needed in large measure to ensure a more sustainable health care spending path and to improve the quality of health care services delivered.

Resisting change

While many industries, such as autos and entertainment, have embraced the digital age, swiftly transforming in the process, health care has been a glaring exception. Several barriers have conspired to slow the adoption of new technologies, blocking consequential change: Stringent regulatory requirements; the need for a secure, personal connection between physician and patients; the natural tendency of health care organizations to resist change, perhaps due to the relatively advanced average age of doctors; and a track record of failing to implement ambitious information technology (IT) projects.

Japan is a case in point. Despite its high-tech reputation, the country ranks last for management and use of data in health care within the Organization for Economic Cooperation and Development (OECD), a group of mostly rich countries. There has been opposition from the medical profession on privacy concerns, while an aging population—with more than a quarter of the population older than 65 (vs. 15 percent in the U.S.)—has also proved to be a hurdle. Yet forces are increasingly in place for digitization to finally take root in that country and elsewhere.

Change is needed

Swelling health care costs are one reason to look to improve the efficiency of health care delivery. Moreover, according to the OECD, as much as one-fifth of health care spending is wasted, and it surmises that the same services could be provided with fewer resources. With most governments

MONTHLY FOCUS

HealthTech: Healing health care's ailments

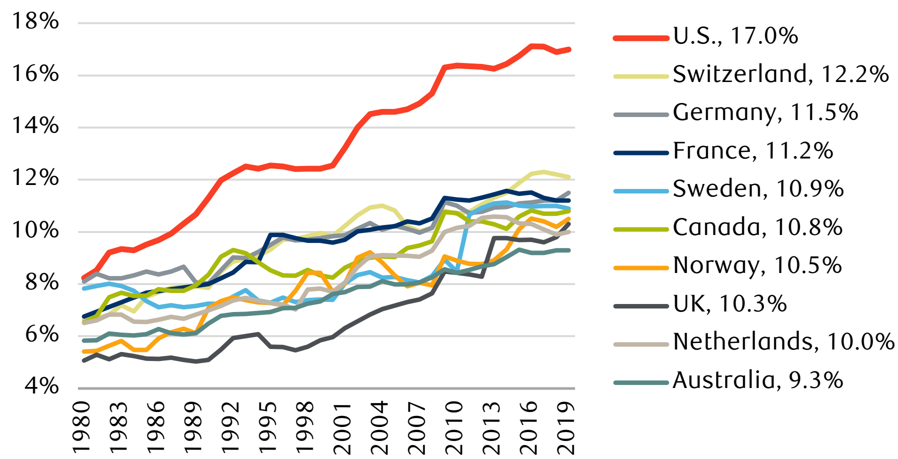
in OECD countries footing the bill for as much as three-quarters of health care costs, such waste undermines the financial sustainability of health care systems. Plainly, the incentive to improve is high.

In the U.S., the government contribution to health care costs is less, according to the Centers for Medicare & Medicaid Services (CMS), with both federal and state governments financing a lower 37 percent of the annual health care spend. But private health insurance companies, which finance 34 percent, and those who pay out of pocket (10 percent) are all equally keen to see their bills shrink, along with an improvement in health outcomes.

The U.S. also stands out with health care expenditures that are a high 17 percent of GDP, compared to an average for other advanced economies that is closer to 10 percent. This would be easier to accept if the health outcomes achieved were commensurately better. But the table on the next page reveals that on a number of measures the U.S. scores at the bottom of the OECD peer group.

U.S. health care spending is far above other nations, and rising

Health care spending as a percentage of GDP, 1980–2019



Source - OECD Health Data, OECD.Stat; 2019 data are provisional or estimated

This creates an interesting dynamic: the U.S. has the most to gain on both fronts—bringing costs down and improving outcomes. The U.S. is also home to the deepest, most diverse corporate health care sector. Properly incentivized, it should be the source of much of the HealthTech innovation in the coming decade with a potential customer base that could include all the developed economies.

Change is afoot

A new model is emerging in which patients are the central health care decision-maker, replacing the traditional model where doctors and pharmaceutical companies are in the driver's seat. This has been made possible by recent advances in big data and artificial intelligence (AI). Big Tech and surprisingly well-funded start-ups are now challenging the incumbents. RBC Capital Markets' health care analysts note that the former benefits from an aggregate $500 billion in balance sheet cash, or

MONTHLY FOCUS

HealthTech: Healing health care's ailments

more than twice that of the combined top-20 global health care companies; the latter is backed by private investment which is accelerating at record levels, with over $9 billion raised in just the first nine months of 2020 amidst the pandemic.

This new model was gaining traction when the COVID-19 pandemic struck. With hospitals turning away patients requiring other treatments, and lockdowns forcing lifestyle changes, the trends became entrenched. As the world returns to normal, we believe some of the changes implemented by the medical professions during the pandemic are here to stay, particularly for routine outpatient visits and treatment of infectious diseases such as the flu. Thanks to remote care, those suffering from the flu will pose less of a risk to other patients or medical staff. Moreover, the way consumers shop for care and wellness is changing for good.

The evolving landscape has caught the eye of regulators, who are becoming increasingly supportive. Last year, spurred by the ravages of COVID-19, the CMS announced that the U.S.'s Medicare program, which serves more than 60 million elderly, would allow online patient visits. Canada's single-payer system moved to allow family physicians to be reimbursed for telephone consultations.

In September 2020, the U.S. Food and Drug Administration announced the launch of the Digital Health Center of Excellence. The initiative is geared toward digital health products, such as smartphone apps, wearable devices, and software-based treatments, and is part of an effort to modernize digital health policies, regulatory approaches, and tools.

U.S. outcomes surprisingly poor given the high cost of health care

Selected health care outcomes in OECD countries

	Health outcomes	Best	Worst	U.S.
Poor U.S. health outcomes	Life expectancy at birth (years)	Switzerland: 83.6	U.S.: 78.6	–
	Suicide rates (deaths per 100,000), 2016	UK: 7.3	U.S.: 13.9	–
	Adults with multiple chronic conditions*(%), 2016	Netherlands: 14%	U.S.: 28%	–
	Obesity rate (%)	Switzerland: 11.3%	U.S.: 40%	–
	Practicing physicians per 1,000 population, 2018	Norway: 4.8	U.S.: 2.6	–
	Survival rate for cervical cancer (%)	Norway: 73.3%	U.S.: 62.6%	–
	Avoidable mortality** (deaths per 100,000), 2017	Israel: 127	Hungary: 387	262
Good U.S. health outcomes	Adults age 65 and older immunized (%)	UK: 73%	Norway: 34%	68%
	Women age 50–69 screened for breast cancer (%)	Sweden: 90%	Switzerland: 49%	80%
	Survival rate for breast cancer (%)	U.S.: 90.2%	UK: 85.6%	–

* "Multiple chronic conditions" is defined as two or more of: joint pain or arthritis; asthma; diabetes; heart disease; hypertension/ high blood pressure. ** "Avoidable mortality" refers to deaths which would be either preventable or treatable with timely access to effective and quality health care.

Source - OECD Health Statistics 2019

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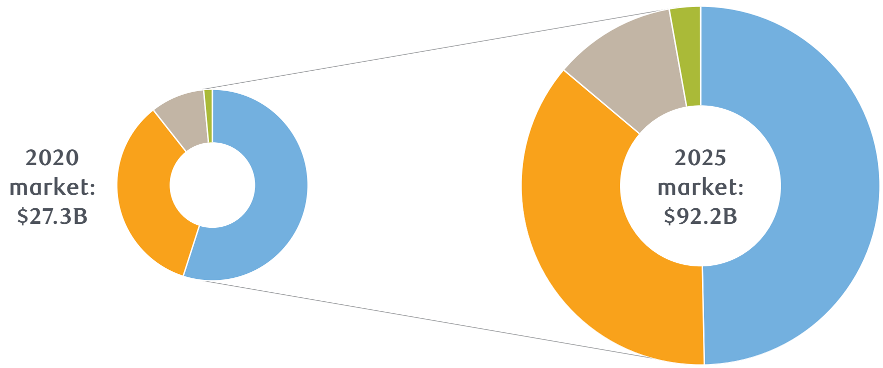
HealthTech: Healing health care's ailments

Strong growth expected in all segments over the next five years

Digital health segments market opportunity, 2020 and 2025



Digital health segment	2020	2025E
Prescription digital therapeutics (PDTs)	$2.5B	$10.2B
AI-enabled drug discovery	$0.4B	$2.6B
Telehealth	$15.0B	$45.8B
Wearables	$9.4B	$33.6B

Source - RBC Capital Markets, RBC Wealth Management

The new face of health care

In its report Digital Health—Hitting Fast Forward, part of the "Imagine 2025" series, RBC Capital Markets identifies key opportunities for HealthTech. Taken together, RBC Capital Markets sees these markets at some $27 billion as of 2020, and growing to about $92 billion by 2025, or by more than 25 percent each year.

Telehealth

The use of telecommunications technologies, such as the telephone, video links, and the internet, to deliver telemedicine (e.g., clinical services such as doctor-patient visits as well as remote patient care) and non-clinical services (e.g., administration and training)

Telehealth is perhaps the biggest opportunity in the health care industry. It aims to improve the quality, convenience, and effectiveness of care, and to lower its cost.

An example of telemedicine is the video conferencing technology which became part of the daily routine for many of us during the pandemic. This approach is more time-efficient than traditional in-person service and requires less staff, freeing up resources.

Clearly, not all doctor visits will, can, nor should be replaced by video. Virtual contact cannot completely replicate in-person interactions during which invaluable non-verbal cues can be observed, empathy expressed, and trust built. But telemedicine does have an important role to play.

A study by McKinsey in April 2020 estimated that more than 20 percent of outpatient visits could be performed virtually. Embedded in this are assumptions that 20 percent of all emergency room visits, 24 percent of health care office visits, and 35 percent of home health visits could be replaced with a virtual alternative. RBC Capital Markets believes 35 percent to 40 percent of medical care and 75 percent to 80 percent of behavioral/ mental health visits could eventually be done virtually.

As for non-clinical services, by using AI and integrating disparate sources of data, telehealth can help in a variety of areas such as:

- **Triaging** or assessing patients and directing them to the most appropriate level of care
- **Simplifying administrative tasks** by integrating appointments into scheduling systems and connecting into electronic health records, e-prescribing networks, and billing systems, thus automating a number of manual processes
- **Delivering care** by integrating electronic health records, thereby providing a more comprehensive picture of a patient's condition, and enabling physicians to control devices on the patient's end (e.g., digital stethoscopes, remote cameras, and other diagnostic devices); this can broaden the range of physiological data that can be collected and assessed in a shorter time frame, and without necessitating travel/ transport
- **Accessing deeper pools of health care providers** by creating wide networks of medical experts, potentially elevating the quality of care by facilitating patient interactions with specialists in practically any part of the world

Telehealth's competitive landscape is evolving quickly. Over the past 18 months several notable new entrants have emerged, such as Amazon and its Amazon Care offering, a pilot program offering a combination of virtual health and in-person care. In addition, many vendors are striving to broaden and increase their scale. The $18.5 billion merger in late 2020 between Teladoc, a U.S. virtual health care company, and Livongo, a digital disease management company focused on diabetes and hypertension, is a case in point. Meanwhile, some major insurance companies are taking steps to internalize more of these functions. For example, in February 2021 Cigna announced it entered into an agreement to buy MDLIVE, a provider of online health care delivery services and software for patients, hospitals, employers, and insurance companies.

Telehealth is more than telemedicine

Telehealth	
Clinical services	**Non-clinical services**
• Telemedicine: Remote patient care	• Triaging • Integrating health records • Enabling physicians to control at-home devices • Creating large networks of specialists • Training nurses and physicians

Source - RBC Wealth Management

Wearables

Devices that enable more detailed and frequent real-time data gathering from patients in-between physician office visits, or potentially in lieu of actual visits

Once a consultation with a doctor has taken place, the patient often has to manage their condition by themselves. According to the RAND Corporation, a U.S. think tank, this happens all too often given that as many as 60 percent of Americans now live with at least one chronic condition, i.e., an ailment that lasts at least one year and requires ongoing monitoring or treatment.

Patients are becoming empowered as consumers and are finding new, more effective ways to manage their condition. The emergence of wearables is being fueled by recent advances in device technology. Coupled with progress in data processing and AI, wearables provide patients with proactive interventions to detect early signs of illness, as well as to help prevent or minimize conditions becoming more acute.

This technology includes not only the devices used to capture the data but also the tools that enable the aggregation of all relevant data, as well as the software that analyzes it and determines an optimal course of action.

Wearables themselves range from mass market items to more specialized devices, though both have the same objective of gathering and assessing data.

For example, in certain countries, the Apple Watch is becoming one of the first mass consumer medical devices as it can perform a mobile electrocardiogram (ECG). The watch can notify wearers of an irregular heartbeat that might lead to heart failure and can even place a call to emergency services if it detects a sudden fall and the wearer doesn't dismiss the alert in a certain time frame. Another function monitors blood oxygen saturation levels, and others are under development.

As for specialized devices, several examples come to mind. The Zio patch is a monitor that sticks to a patient's chest like an adhesive bandage. Designed by medical devices company iRhythm, the patch can collect data for up to 14 days, gathering millions of heartbeats per patient. iRhythm uses machine learning algorithms to translate the data into a 10-page report, which can help cardiologists make diagnoses.

Private company TytoCare has developed connected diagnostic devices, including stethoscopes, tongue depressors, and thermometers, which enable health care providers to perform thorough virtual medical exams. The devices are designed for in-home use and can help doctors remotely examine a patient's heart, lungs, throat, skin, and body temperature.

Smartphone components, such as the screen, microphone, or the accelerometer (the sensor which tracks different motions including shaking, tilting, and swinging), can also be used to capture and analyze patient data, assisting physicians' decision-making. For instance, a smartphone's microphone can be used to perform remote self-exams and analyze bodily functions such as coughs to detect signs of pneumonia.

Prescription digital therapeutics (PDTs)

Software-driven, evidence-based interventions that are intended to prevent, manage, or treat a medical condition, not simply assess or monitor a condition, or transmit data to the physician

These devices are considered to be Class II medical devices in the U.S. and require regulatory approval to support the makers' claims of risk and efficacy. Their costs may be reimbursed by health insurance or Medicare/Medicaid in the U.S. and thus differ from wellness tracking or lifestyle applications, which typically require a paid subscription from consumers.

An example is Propeller Health's device, which is attached to a patient's existing asthma inhaler. The Propeller sensors track medication use and send the data to an app on the user's smartphone. According to the company, over time, the app can learn about the pattern of flare-ups and medication use, helping the patient to manage symptoms and identify triggers. Propeller also produces reports which physicians can use to adjust treatment plans.

PDTs can address a wide range of conditions and help prevent, manage, or treat a medical condition

Prescription Digital Therapeutics (PDTs)

- Software and hardware to improve **asthma and COPD** (chronic obstructive pulmonary disease)
- **ADHD:** adaptive sensory stimulus software through video game experience
- **Sleep disorders:** through cognitive behavioral therapy* (CBT) techniques
- **Pediatric behavioral health:** AI-based digital diagnostics
- **Chronic pain:** digital delivery of exercise, therapy, and education
- **Concussion:** intervention tool to train cognition in patients
- **Type 2 diabetes:** insulin dose calculation
- Personalized programs to prevent diabetes and other **chronic diseases**
- Therapy for **cognitive dysfunction** caused by neurological disease
- **Self-management** for diabetes, hypertension, and obesity
- Outpatient treatment for **substance abuse**

*Cognitive behavioral therapy attempts to help people develop alternative ways of thinking and behaving in order to reduce psychological distress

Source - DTx Alliance, RBC Capital Markets, RBC Wealth Management

AI-enabled drug discovery

AI that helps develop innovative medicines faster and at a lower cost while improving success rates

Traditional drug development costs between $500 million and $3 billion due to the high rate of failure, and with a timeline often stretching beyond 10 years, making drug development a risky affair. As a result, only the most promising avenues are pursued, while abandoning research on other projects for which there may be demand, but not enough to justify the development costs.

AI is particularly well suited for the task, given the iterative nature of drug development. When AI and other digital tools are applied to clinical trials, the potential benefits can include more efficient trial designs, quicker enrollment, and increased patient engagement and retention, contributing to lower costs and improved success rates.

While there have been a number of early success stories, the use of AI in drug development is still largely in its infancy. The meeting of Big Pharma and Big Tech in this area has helped provide conceptual validation, but many of the emerging AI-enabled platforms still have much to prove. RBC Capital Markets expects capital to continue flowing to the category as the current R&D spend and return on investment are unsustainable.

Long-term fairway of growth

While society now seems to appreciate the crucial role technology can play in the delivery of health care services, HealthTech still faces hurdles to truly becoming a global force to lower costs and improve outcomes. Many health care systems are not digitized, and concerns about security, privacy, and hacking should not be brushed away. Additionally, digitization needs well-functioning broadband networks—still elusive in many regions, even in the developed world. Many developed countries are putting digitization at the center of their investment plans, including Japan and Italy, but many emerging economies today simply do not have the financial means to do so. Moreover, these tech-fuelled devices typically carry a hefty price tag, keeping them out of reach for many, and they may be ill-suited for the less tech savvy.

Nevertheless, the traditional system appears to be coming apart at the seams, and this will likely only worsen as the world's population grows greyer. While the adoption of these technologies may not be immediately universal, they will continue to gain traction, in our view, led by the U.S. where the payoff is likely to be the greatest. According to RBC Capital Markets, health care companies that increasingly offer digital services are likely to see their valuations expand over time, reducing the gap with tech companies' valuations.

We would build strategic positions in HealthTech in portfolios, as the secular growth trends in this area should be well underpinned by both demand and technological innovations for the foreseeable future.

Appendix: Big Tech's big push into health care

Company	Notable health initiatives	Category
Alphabet	**Verily Life Sciences:** Stand-alone life sciences company spun out of Google X in 2015. It offers a variety of data-driven solutions across research, care, and innovation. Projects range from broad data collection efforts to disease-specific research and development.	R&D
	Calico: A research and development company focused on the diseases associated with the aging process. Calico has a portfolio of more than 20 early- and late-stage preclinical compounds in cancer, neurological diseases, and tissue homeostasis and repair.	R&D
	Google Health: Somewhat loosely defined group within Alphabet that is focused on research and clinical tools to improve patient care, often with the help of AI.	—
	Other: Alphabet has a number of other products and services that either indirectly or directly relate to health care including Google's online search ("Dr. Google"), Google Cloud, and Fitbit.	Diagnostics & wearables, chronic disease management
Amazon	**PillPack:** Acquired in 2008 for c. $750M, PillPack, a full-service online pharmacy, gives Amazon a foothold in the industry while avoiding the operational and regulatory hurdles associated with building a mail pharmacy from scratch.	Online pharmacy
	Amazon Care: Launched in 2019 as a pilot health care service available to Amazon employees in the Greater Seattle area. It is described as a "first stop" for health care with both virtual and in-person services. While peers offer similar programs, Amazon Care is more external-facing, which suggests it could ultimately be expanded.	Telehealth, delivery of care
	Haven Healthcare: It is a non-profit joint venture between Amazon, Berkshire Hathaway, and JPMorgan Chase tasked with improving employee satisfaction and reducing health care costs for their U.S. employees.	Providers and payers models
Apple	**Apple Watch** enables Apple to collect a vast amount of data, a considerable competitive advantage. The smartwatch device can check for heart rates by detecting the amount of blood flowing through the user's wrist and its digital crown can measure the electrical signals across the user's heart, which can be used with the ECG app. Apple, along with partners such as Stanford Medicine and Johnson & Johnson, is researching areas including women's health and hearing.	R&D
	The **ResearchKit** framework allows researchers and developers to create apps for medical research covering areas such as identifying autism in children and providing screening tools for parents to use at home, or melanoma where participants can take photos of their mole over time and track changes—after tens of thousands of images are collected, an algorithm can screen for melanomas in early stages.	Apps
Facebook	The **Preventive Health tool** connects people to health resources and offers checkup recommendations from leading health organizations such as the American Cancer Society. The tool itself is based on a user's age and gender and provides a personalized list of recommended health checkups. For each recommendation, the user can view additional information; mark it as "done"; set a reminder; and find locations.	Telehealth
	The **Oculus division** produces virtual reality (VR) headsets. Primarily used in digital gaming, they have potential applications in health care such as medical training (e.g., surgical simulations). For example, Oculus is partnered with Children's Hospital Los Angeles to build VR simulations that place medical students and staff in high-risk pediatric trauma situations.	Telehealth
Microsoft	**Microsoft Cloud for Healthcare** is an industry-specific cloud offering which helps support the end-to-end security, compliance, accessibility, and interoperability of health data. It aims principally to (1) enhance patient engagement by creating individualized care plans; (2) improve health team collaboration by leveraging the Microsoft Teams platform, including its Bookings app to help health care providers schedule, manage, and conduct virtual visits in Teams; (3) improve clinical and operation data insights by using automated workflows to analyze data (for instance, Swedish Health Services used Microsoft Power Apps to build a solution to track critical hospital supplies); and (4) provide a highly secure, cloud-based tool to share patient information.	Telehealth

Source - RBC Capital Markets, RBC Wealth Management

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