Disruptive Innovation to Transform Healthcare

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Healthcare is the subject of much debate in the U.S. While there have also been huge advancements in the field of medicine, healthcare delivery has changed little over the last three decades. It is still typically done within the confines of doctors' offices, hospitals, and outpatient clinics. The cost of equipment, premises, and trained professionals has risen so high that it is not sustainable. The need to increase efficiency as well as reduce capital costs and overhead has reached crisis proportions. In order to improve healthcare in the U.S., we need to break the old mold and find new ways to perform routine processes. We need to fundamentally change healthcare delivery so it is more efficient and affordable for providers and patients alike.

The treatment of epilepsy is a case in point. According to the Epilepsy Foundation, epilepsy affects nearly three million people in the U.S., with about 200,000 new cases being diagnosed every year. The Epilepsy Center at the University of Chicago has leveraged technology to improve processes and cut costs. It monitors patients' brain waves remotely so it can identify when a seizure has occurred and offer patients more effective treatment for their condition. The patient carries a computer modem-sized device like a purse and four electronic leads attach to the cranium of their head. Data is captured for further study through Bluetooth communications and a laptop.

Recognizing this method is cumbersome for the patient, the University of Chicago began searching for a better solution. It is now collaborating on the development of a new wireless, 16-channel amplifier that can operate for up to 24 hours without being recharged. The device under development is tiny and lightweight—just about the size of a business card, and approximately 1/8 inch thick—so it can be concealed under a hat. The amplifier connects to a Smart Phone, which streams the data to a monitoring station at the Epilepsy Center in real or near real time. When the patient goes into seizure, an alert is sent to his or her cell phone or a physician, parent, guardian, teacher, or other designated individual. The GPS capabilities on the Smart Phone enable the monitoring station's server to track the location of the patient.

The patient also receives an alert if connectivity is lost between the ambulatory unit and the server at the Epilepsy Center. A new connection can be established via the phone's WIFI capabilities, and the data can be transmitted via the Internet. Up to 10 days of data can be cached on a chip on the amplifier and the Smart Phone has sufficient memory to store months of data. When the cellular link is restored, real-time data streaming commences through one channel on the phone, and the cached data is transmitted through a different channel.

Technological advancements are fundamentally changing the way people live and work. Observing the impact on society, Clayton Christensen of Harvard University

coined the term "disruptive innovations" to describe innovations that improve a product or service in ways that the market does not expect. This typically happens by lowering the price or designing it for a different set of consumers.

Computer hardware has evolved from mainframes to client-server technology, desktops, laptops, palm devices, and now Smart Phones. Nowadays, an iPhone, Android, or Blackberry has the power of a mainframe from 30 years ago. These small devices, with 32 gigabytes of memory on board, are 16 times more powerful than the computers of the early nineties. They can run extremely sophisticated applications, with the only limitation being the size of the screen.

At the same time, communications technology evolved from a 1,200 baud modem plugged into a phone line to cable plugged into the wall and then to WIFI. A decade ago, T1 bandwidth speed was the corporate standard, and that ran at only 1.5 megabytes on networks. Today's 3G bandwidth speeds can run up to 10 megabytes per second, although most cell companies have reduced the speed to 1 or 2 megabytes per second. 4G speeds are at 100 megabytes per second on a cellular data network. The new iPhone 4.0 has better resolution, more memory, and a faster processor than the top of the line Macintosh in 2000. Moreover, high performance is available at a much lower price point. Computing solutions that used to cost thousands of dollars now can be acquired for a fraction of the price.

In healthcare, small, powerful computing devices and cellular networks can potentially transform service delivery. If the brain waves of epilepsy patients can be monitored, so can other functions, including heart rates, sugar levels, and oxygen levels, which can benefit patients with chronic conditions, such as heart disease, diabetes, and sleep apnea. Continuous monitoring helps prevent the development of more serious conditions, and costs can be reduced significantly for both healthcare providers and patients. The tools to enable change are within reach. All we need is the determination to grab them.

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