THE IMPACT OF BIG DATA AND WEARABLE TECHNOLOGY ON THE HEALTH INDUSTRY

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Introduction

Growth of wearable technology in the past few years have been incredibly substantial. With the increasing popularity of gadgets such as the Apple Watch and fitbits and new developing technologies such as auto-lacing shoes and virtual reality headsets, there's no doubt that the wearable technology sector is a long lasting and growing industry. However, with this access to this new technology that is readily available almost 24/7, there are many consequences that might not have been considered, some good, some bad. With that being said, it's important to think about both the positive and negative consequences this explosion in data and growth of wearable technology can have, and the impact that these items can have on the user, the health industry, and society itself.

Some Background Information/ The Development of Wearable Technology

Data Science is a relatively young field, and while the definition of a data scientist is still up for discussion, there's no doubt that it's having a drastic effect on many different industries, with one of the most prominent being the health industry. The health industry has always had a need for data analyzation, which can vary from determining whether a tumor is cancerous to determining whether a new drug will work effectively. However, data science didn't play a large role in the health industry for most of its history; trials were conducted by scientists, analyzations were performed by specialists,

and data was simply recorded and manipulated by people. This of course has many negatives, especially with people working in the health industry having one of the busiest occupations. People make errors as they are overworked, underprivileged areas don't have equal access to medical professionals, and natural human bias occurs leading to erroneous results. However, the Data Science has recently exploded, and almost immediately it is drastically changing the health industry and the way health data is managed and analyzed. So what changed?

There were many difficulties that data scientists faced in the health industry. A big one was that there simply wasn't enough data to actually analyze; technology and the internet wasn't sophisticated enough to document and share large amounts of data, and most information was kept discrete from hospital to hospital. Not only that, but there was also a difficulty in measuring the data itself. Sensors were bulky and expensive, and for the most part data could only be recorded while there were patients within the hospital. For example, Shah and Rubin's *Journal of Electrocardiology* mentions how 'one study found that of all computer predictions for non-sinus [non-regular] rhythms, only about 50% were correct' (Source 1). To put quite frankly, data scarce and available data was bad, which made data analytics extremely difficult. What data scientists needed was a dependable way to get good data, and a lot of it.

With the development of smart technology such as smartphones and tablets, technology took the world by storm, and soon smart devices became integrated into everyday life. IoT or Internet of Things devices have nearly doubled from 15.41 billion in 2015 to 26.66 billion in 2019, and is projected to increase fivefold to 75.44 by 2025

(Source 2). As these devices became normalized in everyday life, new technologies tagged along. Items such as the Apple Watch, Fitbit, and other technologies began to form a new category of technologies known as ‘wearable technology’, and soon that also became a dominant market, so much so that CCS Insight estimates that worldwide smart wearable device sales will double by 2022, becoming a $27 billion dollar market with around 233 million unit sales (Source 2). These technologies would be the key between health industry data scientists and useful analysis.

The Impacts

As with any other technology, development over time leads to more advancements in functionality and decrease in pricing, and wearable technology was no different. As engineers developed more and more sensors, prices of wearables decreased significantly and wearable technology soon began to record data on a much larger expansion of categories. The Apple Watch, which had initially started off with basic functions such as time and heart rate monitoring, now comes with a built in ECG and apps that help monitor sleep. Advanced heart rate monitors and ECGs that measure variability in heart rate, which were once exclusive to patients in care at the hospital, have decreased so much in size and price that you could order one on Amazon at any minute for around ten dollars. Health industry Data Scientists now had great potential to gain massive amounts of data, and massive amounts of data they got. In 2015, the Obama Administration provided millions of dollars to FlexTech Alliance in hopes that the company would create a new tech hub for wearable devices (Source 3). A cross industry survey done by NewVantage Partners claimed that “seventy-seven

percent of healthcare executives reported that their organizations are accelerating investments in big data analytics and AI" (Source 4).

A lot of people are interested in wearable technologies and big data and for good reason. While initially just a neat device, these wearable technologies have brought unbelievable benefit to society both for the user and for the rest of the world. For one, users now have access to a plethora of information literally at their fingertips. Education and awareness for items such as calorie intake, sleep quality, heart rate, and many others make it so that users can make informed decisions to improve their lives. Along with this, users have the ability to track their changes over time and discover trends that would have been much harder to notice before. This heavily relates to the research I did, which utilized a smart ring that tracked precise measurements of heart rate and sleep patterns. Utilizing data science techniques, I was able to create visuals and find relations between the interbeat interval and the amount of deep sleep a subject had. And unsurprisingly, I'm not the only one doing data exploration. Now with access to tools, many data scientists and healthcare workers are utilizing these populations with sensors to generate massive datasets that allow for populational analysis and development of AI to help predict future difficulties. In fact, it was the creation of a dataset of ECG monitors 500 times larger than previous datasets that allowed for the creation of a neural network that exceeded a panel of renowned cardiologists in determining heart issues (Source 1). This is incredible, not only because of how successful this technology is, but how expandable this information is. Previously, professional cardiologists would be needed to diagnose such difficult diseases, but the

creation of items such as this artificial intelligence opens options to creating cheap and efficient robotics that can do the diagnostics for these cardiologists. In a sense, these cheaper technologies could (and are) helping third world countries and areas where medical professionals are a rarity.

The amount of information that these wearable technologies are providing scientists and researchers is invaluable and has helped society develop in incredible ways. However, technology also isn't just all amazing. There's an issue with privacy and anonymizing these large datasets. There are also issues with fully depending on AI results, especially when the input data might suggest bias or any other issues. Of course, this is not to say that big data and technical innovation should be avoided for fear of these issues. It's just important to remain cognizant of these potential ethical issues, as these issues are parallel with technological advancements in other fields.

The Future

Overall, the future is looking bright for big data and wearable technology for the health industry. The impact that this new information has had for the world has allowed users to improve their lives, have given data science the necessary information to work and create incredible analytics tools, and are helping medical professionals diagnose diseases earlier and earlier. However, it's always important to remember the difficulties with a rise of technology, and to remain cognisant of ethical and moral issues that come along with it. While big data and wearable technology is changing the way we think about the health industry, we don't want to forget that the data comes from real people, and there are real consequences, both good and bad.

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