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Big Data: Improving Our Health For Generations To Come

Through the substantial development of technology, big data have revolutionized the way we interpret information. We have evolved into a society that records nearly all aspects of our lives, through different means. Whether it be completing an anonymous survey or merely liking a post on Facebook, our individual data are collected and analyzed. This leads researchers to draw conclusions and further action that may ultimately affect us. Even though the data gathered are important and have become much more accessible, the value is heavily placed on the analytics. With data analytics, we are capable of taking accurate and effective measures to better improve society in several aspects, such as in the field of health care. Our health records are kept for years and years but what becomes of them? How do our individual records aid in improving the health of thousands of individuals? Big data and their relevance in the medical field have provided us with all of the answers. Although seemingly invasive to our privacy, the development of big data serves as a big advantage for issues pertinent to public health.

Public health focuses on protecting and improving the health of the population collectively, thus increasing the average life expectancy of an individual. In particular, public health aims to prevent disease and injury, promote healthy lifestyles, as well as research any emerging or reemerging diseases. The Center for Disease Control and Prevention, the CDC, is currently the nation's leading public health agency. The CDC is successful in keeping America

regulated by means of several actions, two being: making sure our food and water are safe and controlling disease outbreaks within the country. As seen through the CDC, Epidemiology is one of the major fields which lies under public health as it studies the presence, or absence, of diseases and any determining or contributing factors. Researchers collect this data through several ways. Effy Vayena et al. discuss in their article "Ethical Challenges of Big Data in Public Health" the advances and drawbacks of Big Data with its relation to public health. They speak about how data are gathering, informing us, "...information relevant to public health is now increasingly generated directly by the population through their use of online services, without their necessarily having engaged with the health care system" (Vayena et al.). Essentially, we provide information to researchers regarding our health subconsciously through our Internet devices. They mention that our personal data can potentially transform public health and health care as there are many health apps available on our phones and there is an estimated release of a new higher-level Internet domain name of "health" (Vayena et al.). All of the visits we make to Facebook or Safari are documented for further use. Although these data may not be analyzed at first with intentions of tying them to public health, they ultimately lead to it. Epidemiologists thus use them to conduct their studies and draw accurate conclusions.

Big data grants epidemiologists insight on the distribution of current diseases and allows them to take measures with hopes of preventing future outbreaks, positively advancing our health. From the drastic destruction the Bubonic Plague posed on Europe to the deadly Ebola Outbreak in West Africa, epidemics have always been a major threat to the world. In the past, epidemiologists were not equipped with proper resources to successfully gather efficient data to aid in managing the spread of these diseases. With Big Data, however, we are capable of taking

necessary precautions, as can be seen through the first official eradication of a disease, Smallpox. Adam Frank, journalist and author of article "The Big Idea Behind Big Data", argues how big data and network science has positively affected the health of individuals, allowing researchers to accurately predict the outbreak of different diseases (Frank). He states, "Such month-by-month flu predictions, impossible in the past, can allow the CDC to better time the production and distribution of vaccines" (Frank). Essentially, Frank is arguing these new technological advances permit epidemiologists to accurately conclude facts about the flu. Thus, the CDC is able to produce and distribute vaccines to the public before the disease begins to impact large portions of the population. Because these methods were not available in the past, as a result, people were more reluctant to contracting diseases due to the lack of legitimate information on where potential disease hotspots were. Yet, due to the constant collection of data from several diverse areas, scientists are able to draw accurate conclusions on important issues such as disease outbreaks. However, big data is not seen by all as a true benefit for epidemiological studies.

Although it may be argued that the incorporation of big data into epidemiological studies yields an unclear and misleading effect, it is still seen by others as a positive attribute. In their article, Vayena et al. highlight the importance of misjudgment and how these algorithms may not always be validated, stating, "In 2013, when Google Flu trends overestimated flu prevalence levels in the US, further concerns were raised about the sensitivity of this methodology to the digital environments created by users' behavior…"(Vayena et al.). Virtually, they argue big data can be altered by our personal choices in terms of how we use the internet and thus lead to inaccurate calculation of critical diseases. They further argue how one of the main risks is that it

can harm individuals, businesses, and communities if research wrongfully labels them as an area infected with disease (Vayena et al.). This notion, however, has been proven false by several studies done with regards to the flu. Alessandro Vespignani is an Italian-American physicist famously known for his work on complex networks. His study on the effects of networks on diseases concluded that in an area with a large network size, the transmission or infectivity probability for the disease propagated, in order to sustain an outbreak, would be near zero. (Vespignani). This proves that with a more complex network, consisting of an abundance of data, there is little chance a disease will persist to affect a particular population. Through these networks, epidemiologists are also capable of distributing proper vaccinations to individuals to further prevent the growth of any disease. In addition to allowing us to predict these potential outbreaks, big data is also useful for responding to implications posed by handling the public health of the elderly.

Big data allows physicians and other medical personnel to examine and customize proper care for elderly patients, thus positively affecting our health as well. Senior citizens have setbacks, such as physical or geographical barriers, that may inhibit them from receiving the proper health care they require. Yet, through the incorporation of big data analytics, the medical field has slowly begun to address this issue. Mike Montgomery is a journalist who emphasizes the important benefit big data has posed on the health of our elderly citizens in his article "The Future of Health Care Is In Data Analytics"; he summarizes, "The telehealth system uses smartphones, Fitbits, Bluetooth, and sensors to collect information about things like blood pressure, physical activity, glucose levels, medication intake and weight" (Montgomery). We use our smartphones daily for numerous tasks: any website we visit, item we purchase through an

app, or video we watch on YouTube. All of these different apps we have serve to memorize specific facts relative to us. They record the data and with this information, the telehealth system and doctors, as well as anyone close to the patients, are able to provide them with proper proactive care. With elderly patients, the gathering of this information through cell phone usage is very practical as it can be done despite any geographical barriers (Montgomery). Vayena et al. would precisely agree with this as well as they also discuss the importance benefit technology and big data have on public health, stating, "[It] draws on developments such as the widespread availability of Internet access, the explosive growth in mobile devices, and online sharing platforms, which constantly generate vast amounts of data containing health-related information…" (Vayena et al.). Because providing the elderly with the best healthcare has always been as issue as there have been several constraints posed, this new method has been on the uprising for some time now. These technological devices collect all of our information and deliver them to the professionals who, in return, develop different treatments that are used to better our health; one of the biggest improvements observable is that of the senior citizens. However, with all of this information being recorded, one cannot help but wonder where it all goes. Who possesses all of our information and how do we know what they do with it?

Even though the controversial topic of privacy has constantly manifested with big data analytics in public health,big data nonetheless provides many assets to our society in terms of public health. Where is the fine line, the threshold, in which these researchers can obtain our information without invading our privacy? Well, it is safe to say there really is none, at least in terms of public health. Our data has always been recorded in terms of our health, whether it may be through our visits to the doctor's office or with each time we visit a pharmacy, picking up

prescribed medication. The data used in these analytics is not assessed with malicious intents; these epidemiologists, researchers, and physicians are evaluating the information we give them willingly with aspirations of improving the health of both their individual patients as well as that of the more broad, general population; it is essential for human development and prosperity. In contrast, however, corporate activity may use the same data only for different purposes, such as advertising, aiming to acquire a certain profit (Vayena et al.). With this "context-sensitive" understanding of these ethical obligations, it is arguable these data can be used for public health purposes. In addition, the Health Insurance Portability and Accountability Act, HIPAA, which was passed in 1996, requires protection and confidential handling of all health information for all patients. Mila Araujo reminds us about how our health records are protected by this law in her article "HIPAA Law and the Privacy Rule to Protect Your Medical Information/Protecting the Privacy of Your Medical Records". She mentions how although there may be skepticism regarding potential breaches and hackers, this law is "intended to lead to reduced fraudulent activity and improved data systems" (Araujo). In addition, Araujo also ties with Vayena's claim of how corporate activity may use our data differently and how the HIPAA Law does not necessarily pertain to it(Araujo). Furthermore, even though there is serious concern for our privacy in terms of big data in public health, the focus of the field allows us to fully appreciate how it is a practice aimed at improving the health of every individual, benefiting everyone.

The new uprising with big data analytics is affecting several aspects of our lives; with its development, big data is positively advancing our healthcare system, particularly focusing on public health. This can be observed through epidemiological studies and how it has helped researchers predict disease outbreaks; they are then able to take proper measures to help control

and prevent major epidemics from sweeping nations. In addition, big data has also proven useful for increasing the health of our senior citizens. As there are several drawbacks which may prevent the elderly from receiving the appropriate attention they deserve towards their health, big data, mainly the analysis of it, have helped diminish any setbacks and ensure they are receiving any attention, medication, and treatment they deserve. Despite the existence of privacy concerns, it can be concluded that the usage of our data with hopes of benefitting the health of the general public is permissible and not violating our personal rights. There are several laws enacted to protect our privacy and with them, researchers are capable of improving public health for generations to come without crossing the line of false confidentiality.

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