The Importance of Wearable Health Technology on Improving Consumers’ Health

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Introduction

The presence of wearable health technology is notably increasing worldwide as people become more aware of monitoring their health and well-being, and how specific devices can help people achieve and maintain their wellness goals. Similarly, these technologies are becoming more involved in many sectors including the health care industry. However, the ubiquitous spread of wearable health technology will have repercussions across society with viable concerns such as health privacy, data accuracy, and social interactions. Fortunately, there are important research and implementations aiming to resolve the detrimental aspects of wearable technologies. By implementing the benefits that wearable health technology provides, it confidently can encourage people to make informed decisions so that people can proactively keep track of their long-term health and fitness.

Background

Wearable health technology, which includes smartwatches and activity trackers, is part of the growing number of electronics called the Internet of Things (IoTs). These are physical devices and technologies capable of accessing the Internet so that the collected data can be used for various purposes (Morgan, 2014). In the case of wearable health technology, also known simply as wearables, they are relatively small computer devices with many sensors that aim to provide personal health insights. Today’s wearables are worn mainly on the human wrist or the hip (Holland, 2016, p. 65). They are the combination of existing sensors and meters like the pedometer, accelerometer, and optical heart rate sensors. The most recognized device, but now relatively primitive to today’s wearables, is the pedometer. First developed around the days of Leonardo di Vinci, pedometers measure human movement with the intention to count daily steps (Holland, 2016, p. 60). Pedometers have historically been mechanical with an inner pendulum,
which required the user to wear the device around the hip. Today, pedometers have become more sophisticated with the accelerometer. Most accelerometers are tri-axial to detect motion more accurately. They often sample movement about 10-30 times per second, and thus are more integrated for precision control (Holland, 2016, p. 63). This means accelerometers can measure critical metrics like steps, distance, and simple energy expenditure calculations. Accelerometers, together with other sensors such as altimeters and gyroscopes, can also now measure sleep quality and floors climbed (Holland, 2016, p. 65-66). This makes the accelerometer a versatile component. Many wearables also include photoplethysmography, such as Fitbit’s PurePulse, a sensor that measures blood flow by emitting green light onto the user’s skin (Our Technology, 2017). This optical sensor, although imperfect, has algorithmic capabilities of measuring the user’s heart rate and related cardio metrics through photodiodes, which are light detectors that detect how much green light the body absorbed. This is different from electrocardiography that utilize a chest strap with electrical signals to measure heart rate. Although the chest strap is often more reliable at measuring a person’s aerobic fitness, the optical one is more convenient, permitting them to be used in wearables (Holland, 2016, p. 59-60). Although there are lots of other sensors integrated in today’s wearables like ambient light and bio-impedance sensors, the accelerometer and optical heart rate sensor are the foundation of most wearable devices today. These two components directly provide people the needed metrics to understand their physical health.

**Potential Benefits**

The benefits of wearables are applicable in many areas from personal health, professional sports, and medical surveys. This is because there are useful reasons to get these valuable biometrics such as improving overall health and increasing athletic performance (Holland, 2016,
p. 58). The devices are often paired with health and fitness applications on smartphones, which allow users to gain summarized insights of their collected data and permits them to manually input other metrics such as diet and weight. Conclusively, wearables help users keep track of their physical conditions and make proactive adjustments in their lifestyles (Gao, 2015, p. 1708). Additionally, the powerful functionalities make “hedonic [and intrinsic] motivations” to users, which may persuade others to adopt wearables (Gao, 2015, p. 1708). Likewise, wearable technology is revolutionizing health care systems as health personnel can use the “meaningful data comparisons and analysis [based partially from wearable users’ aggregated data]” to give “cost-effective, evidence-based treatments” to patients (Afshar, 2014). Patients can be more self-efficient and accountable through preventive care measures, and health professionals can develop a holistic viewpoint of personal and community health (Gao, 2015). Consequently, a preventive healthcare system model can reduce health insurance and morbidity costs and optimize health care operations. Also, wearables such as those from Fitbit and Apple additionally are being used in clinical studies for diseases like breast cancer, Parkinson’s and obesity. This can provide doctors additional incentives to encourage users to purchase wearables (O’Brien, 2016). Overall, wearables are poised to make a society with healthier individuals and more streamlined health care policies.

Legal, Ethical, and Security Concerns

Wearables provide enormous potential to users, but these technologies can also lead to ethical and security consequences as these devices are meant to be very connected to people’s daily lives. As many wearables are not medical grade, it can lead to accuracy concerns. For example, global health experts Kelly Evenson and Michelle Goto conducted a reliability study comparing Fitbit wrist-based trackers and hip-based trackers in terms of distance and steps.
That study found some inconsistencies with the number of steps each device measures based primarily on device placement. Additionally, optical heart rate sensors have difficulties eliminating optical and motion noises, which can make readings faulty. This is especially true at high-intensity exercises (Holland, 2016, p. 60-61). These reasons may defeat the purpose of using wearables if inaccuracies prevent users from reaching their health goals.

Additionally, wearables also emit the same electromagnetic radiations as cellular phones such as Bluetooth and 4G signals, which theoretically can potentially cause tumors from long-term exposure. This is based on limited studies from the World Health Organization’s International Agency for Research on Cancer (Bilton, 2015). Thus, some experts advise consumers to practice precautionary measures when using wearables, such as syncing user data only once per day, as more research is needed to understand the long-term consequences of continuous wireless signals on human health.

Additionally, people’s vulnerable data may not be encrypted properly. This may cause the data to be used in unauthorized ways, including for commercial profit (Armstrong, 2016). Policies such as the U.S. Health Insurance Portability and Accountability Act (HIPAA) of 1996 was supposedly designed to resolve public concerns about how user health data will be used if the data is shared or released to the public (Yach, 2015). However, the wearable companies’ terms of use agreements are not always defined sufficiently, which may create privacy loopholes even with the best of intentions. This has resulted in controversies such as health insurance companies unfairly manipulating health care premiums by thoroughly monitoring consumers’ health data (Armstrong, 2016). They may also inadvertently penalize otherwise healthy individuals if they are using inaccurate data (O’Brien, 2016). Poor execution of the term agreements can lead to data leaks on insecure servers. This was the case with Fitbit in 2011 when
the company’s servers that stored users’ exercise and activity metrics was also indexed on Google, effectively allowing the public to see private information. This has caused individuals to question if they are willing to share their digital health data (O’Brien, 2016). To eliminate the perceived vulnerability and privacy risks of wearables, wearable companies and other stakeholders are currently developing guidelines for responsible use of the collected data (Yach, 2015). This will ensure that consumers can reliably depend on wearables for their future needs without any compromises of their sensitive information.

**Social Issues**

Wearables also have social concerns but are not as controversial as the legal consequences. Wearables today are arguably part of the recent social phenomenon of which people are self-quantifying themselves with self-improvement aspirations (Spicer, 2015). With the data-rich apps that accompanies with wearables, this self-quantifying concept becomes more evoking to users. However, the collected biometric data may not always inspire people to sustainably achieve their wellness goals, and self-quantification may backfire. By continuously managing the collected data, wearable users “can become [compulsively] obsessed with checking themselves” without gaining any meaningful insights (Spicer, 2015). Around-the-clock inner checking of people’s own bodies, even while sleeping, can make people act reserved (Spicer, 2015). This may consequently cause people to share their biometrics with friends narcissistically. That in the long-term could make people unhappy and unfulfilled (Spicer, 2015). Fortunately, the negative social implications such as self-obsession are offset with positive ones. Competitive gamification, which is provided by the wearable applications, and intrinsic incentives such as group wellness programs can make users collaboratively more engaged in
their wellness aspirations (Gao, 2015). Overall, the social issues of wearables today should not
distract the goal of making strong healthy communities.

**Further Required Research**

The current state of wearables today has prompted research that aims to improve the
technology for future devices. For instance, accelerometers today do not always accurately
measure energy expenditure in more intense activities such as weightlifting or stair climbing
(Holland, 2016, p. 64). There are recently new forms of accelerometers like differential
capacitive accelerometers, which are used in professional sports. However, these accelerometers,
which promises more accurate expenditure and balance measurements, have not yet been
rigorously tested to be incorporated in everyday use (Holland, 2016, p. 63). In addition,
wearables today do not accurate measure metrics of special populations, such as the elderly and
the chronically-ill, so additional trials and improvements in the technology are needed to assist
those individuals (Holland, 2016, p. 72). Heart rate tracking also needs to be standardized.

Further research aims for more precise measurements, which may be done by collaborating
existing technologies like the electrocardiogram with new ones that are not yet developed. This
may permit future heart rate sensors to measure sleep quality if successful (Holland, 2016, p. 61).

That all being said, the rigorous improvements of these technologies are poised to benefit
individuals. It can be added into the novel “smart garments” that weaves meters and bio-sensors
into textiles (Holland, 2016, p. 69-70), and it can inspire new innovations such as sensors that
measure blood glucose and blood pressure instantaneously (Next, 2014). This will likely engage
the fields of clinical and personalized medicine as well as digital health companies (Next, 2014).

In a nutshell, wearables today are the basis of exciting new developments that will aim to bring
additional incentives and benefits for users and society overall.
Conclusion

Wearable health technology promises a salutary concept that will empower people to sedulously take charge of their overall well-being. As the adoption of wearables continues to rapidly grow across the world, the technology will continue to improve and become more collaborative and mobile. Wearables envisions a paradigm shift in healthcare, health insurance companies, and communities. With stronger security systems being developed to ensure people’s private data are protected, it ensures wearables will be a popular item among fit and regular individuals alike. Wearable health technology is very practical and interactive that has the destined goal to improve the health of humanity.
References


This electronic article from the Huffington Post is partially based an interview from an expert in the digital technology. It mentions benefits in the health care system and communities, and what future products that may hold enhanced technologies from today’s wearables. It also briefly mentions some social impacts from wearables like gamification and some limitations regardless of improvements to wearables. Although this reference may not necessarily scholarly, it does provide some practical information on the benefits of the technology. It is very current and it does feature an expert in the technological field.


This scholarly journal article access electronically through the British Medical Journal’s database via ProQuest from the Huffington Post focuses mainly on the privacy and security concerns of today’s wearables and the associated cloud-based infrastructure. It is divided into several subheadings such as poor protection, potential usage, and lack of guidance. It has sources that pertain to Great Britain, but it is applicable to the United States given American tech companies like Fitbit are cited. This source is useful with the privacy and ethical concerns of
wearable health technology. The scholarly article is also well cited, making the information quite credible and reliable for this paper.


This New York Times article focuses on the potential health concerns that today’s wearables may ironically bring. It mainly focuses on the ethical considerations of wearables’ wireless technologies, and compares them with other mobile technologies that use similar wireless signals like smartphones. The article references recent research studies and its connections to cancer and thermal heating issues to the brain. I find that even though this article is only hypothesizing the possible correlations of using wearables based on existing technologies, it does provide some similarities that are of concern. It does require some additional guidance, but the applicable currency of this article is necessary to be included in the ethical concerns of the paper.


This peer-reviewed, well-cited research review mainly studies the validity and reliability of the activity trackers and other wearable technologies currently in the market. It provides numerous amount of charts and graphs that showcase the results of several studies conducted in this
research paper. This leads to viable conclusions about not all trackers are accurate, and leading to potential research considerations on how to improve the technologies. This source is very credible given the recency of the research studies, and it links with other sources for this paper about how limitations may leads to legal consequences when people use wearables. It is cited extensively and the methodologies are well developed and documented, making this quite an objective research paper.


This peer-reviewed empirical research study investigates the role of wearable technology in consumers and the impact on health care practices. It provides reasons that favor or against the adoption rates of wearable technology among the general public. Additionally, it examines how health care can get involved in using wearable technology for medical purposes as well as privacy considerations. This study is very reliable and balanced given its well-broad presentation. It has many references included in the study’s citations documented, and it has a well-developed hypothesis and methodology practices to conduct the empirical study.

This book accessed electronically, which is a part of the Advances of Educational Technologies and Instructional Design Book Series of Emporia State University, contains expository and research writings with detailed information about the history of the technology, the benefits and issues of the technology, and recent studies and implementation techniques. It listed many existing sensors and what can wearable technologies have in the role of future technologies. I find that this source is very worthwhile filled with lots of information that can be cited for this topic. The book is very comprehensive yet covers numerous topics; I see this reference as a helpful contributor to my understanding of wearable technology. The book is also very credible as it documents numerous references and field experts.


This Forbes article is well-organized into sections to help readers understand the meaning of the Internet of Things (IoTs). The articles mentions how the Internet of Things, include wearable technology, impacts society and the future of civilization. It also lists out opportunities and drawbacks of the growing presence of these technologies. Even though this source is not well-scholarly and generalized, it is an applicable source for my paper in terms of placing wearable
technologies in the realm of IoTs. I also liked how the article is guided by a keynote speaker who has expertise in the future of technologies, giving some credibility to the article.


This brief article from the Daily Herald accessed on ProQuest is quite short, but it does provide a summarized yet conclusive idea of how wearables of the future can improve preventive health care. It also mentions how wearable devices today are envisioning another class of wearables such as smart garments that provide additional biometrics. Additionally, it also mentions the important role of wearables in clinical trials and precision medicine, which is notable. Because this article is so brief, this source was used sparingly during my research. It is however consistent with other sources that mention the future use of these technologies such as Holland’s book.


This newspaper article is from the Irish Times the benefits and concerns in regard to activity trackers and the associated data. It mentions benefits to users of the wearable health technology and health care system and research studies. At the same token, it mentions privacy concerns and security breaches as people’s data are being transmitted to the Internet. I see this article as quite balanced with O’Brien thoroughly discussing both sides of the story. Despite the author may not necessarily be an expert on this topic, the information presented is relevant for my paper.
Additionally, its recent nature means that the information presented is still credible and applicable, and it contains sources that I can always verify – making this source quite reliable.


This commercial website from Fitbit showcases the current technologies and software of recent Fitbit devices. It includes using the accelerometer for sleep tracking and explaining the current optical heart rate technology. This webpage uses simple language that allows users to understand the mechanisms of the sensors. As Fitbit is a commercial company, there will not be any peer-reviewed citations that directly support the information presented in that web page. However, given that the very same sensors are also used in its competitors’ devices, Fitbit’s information is likely to be current and accurate.


This article from the World Economic Forum focuses on the social consequences on wearable technology today. The article is divided into subheadings that organizes the article’s argument such as “Data is not enlightenment” and “Unsocial media”. In addition, there are some sources informally used that support Spicer’s arguments. This source has an interesting insight that I find to be useful for my paper regarding wearables’ social issues; wearables are designed to allow people be get connected with themselves but at the same time wearables may ironically work against them. Although the article may not necessarily be peer-reviewed, but it does contain sufficient details that are supported as aforementioned with references.

This article from the World Economic Forum focuses on the privacy and security considerations of wearable technology. It references past instances like the Human Genome Project that ponders the same ethical considerations of using private biometric data, but in this case it questions how health insurance and digital companies use data collected from wearables. It does mention about certain regulatory frameworks and discussions that are currently trying to help safeguard the collected information. This source does not have a lot of cited works in the article, but it does feature an expert that can mention generally the privacy circumstances of today’s technology. Also, the source is very recent, which provides some credibility to these ethical considerations.