

Smart Devices and their Growing Applications in Modern-Day Medicine

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Consider a 25-year-old male who was in his usual state of good health aside from a prior history of anxiety and depression, when one day he presented with palpitations and discomfort in his chest. He was notified by his smartwatch that he had an irregular heart rhythm called atrial fibrillation, a potentially life-threatening arrhythmia, which prompted him to seek medical help in the emergency department. In the emergency room, an electrocardiogram (ECG) confirmed atrial fibrillation, and the appropriate medications saved his life (Bedi et al., 2023). Stories like this one reveal the potential role of smart devices in health care.

Considering that the use of smartphones and smartwatches is ubiquitous, their role in medical care could apply to a large proportion of the population. Android and iOS are the predominant smartphone operating systems accounting for 98% of the market share and these devices are equipped with a multitude of applications that could prove useful in their health management such as recording and logging personal medical data (Massoomi & Handberg, 2019). Tools such as accelerometers, barometers, and global positioning systems allow estimates to be made for activity level, distance traveled, staircases climbed, and calorie expenditure (Massoomi & Handberg, 2019). Smartwatches are yet another layer of technology that shows great promise in the healthcare industry. Although Apple dominates the industry, products from Fitbit, Samsung, and Garmin allow users to benefit from additional sensors, which are used in conjunction with their smartphone (Massoomi & Handberg, 2019). Sensors on smartwatches provide information about heart rate, estimated energy expenditure, steps, distance walked, and hours standing. While

the accuracy of the information provided by sensors on smartwatches need further validation, initial data reveal that heart rate measurement is accurate within 5% to 10% of the measurement taken by an ECG (Massoomi & Handberg, 2019). Smartwatches effectively give signals to the wearer to become more active, and it has been shown that patients walking less than 5,000 steps per day only lost an average of 3.7% body weight versus those who walked more than 10,000 steps a day, who lost an average of 9% body weight (Massoomi & Handberg, 2019). This shows that the device's ability to sense parameters such as heart rate and energy expenditure combined with its ability to track information and give cues to its user has the potential to cause people to live a healthier lifestyle.

The Apple Watch and other smartwatches are developing a solid role in the field of cardiology.

As in the previously mentioned 25-year-old man, atrial fibrillation affects over five million people in the United States, and a person with this arrhythmia may have no symptoms and then suddenly have a stroke. Atrial fibrillation accounts for at least 15% to 25% of strokes which can be debilitating and life-threatening (Raja et al., 2019). Using photoplethysmography (PPG) technology, smartwatches are able to identify atrial fibrillation and notify the user, thus reducing mortality and morbidity associated with the condition (Raja et al., 2019). PPG measures volumetric change of the heart by using a device that shines light on the skin to detect a pulse while the heart contracts, at which point an artery close to the skin expands, and then measures the difference in light reflected back to the sensor (Raja et al., 2019). This ambulatory, continuous, and non-invasive way of monitoring heart rate and screening for atrial fibrillation has many advantages over more traditional methods. The heart can be monitored over longer periods of time since the device is usually worn daily, and data can be transmitted to other devices and be

assessed from anywhere, as opposed to a more traditional medical device known as a Holter monitor used for a relatively short period of time and limited by the need to be submitted for analysis (Raja et al., 2019).

Despite the promise shown by smart devices in healthcare, there are some potential limitations. While smartwatches have been proved to be accurate in estimating heart rate, their ability to estimate energy expenditure is in question. When compared with energy expenditure measurements taken via indirect calorimetry by expired gas analysis, smartwatches had a large margin of error, typically overestimating the energy expenditures (Massoomi & Handberg, 2019). Another potential drawback is the potential of causing anxiety for some people who are affected by frequent monitoring and constant availability of data (Massoomi & Handberg, 2019). False information provided from a smart device can also cause anxiety and increase health costs with unnecessary hospital visits (Raja et al., 2019). Lastly, bioethical concerns are raised, since it is not known whether or not medical information stored on a cell phone is considered a legal document (Raja et al., 2019). What if someone's health app indicates "do not resuscitate"? These are some of the issues which need to be resolved before the use of smart devices are considered standard in health care.

References

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