Climacteric

ISSN: 1369-7137 (Print) 1473-0804 (Online) Journal homepage: https://www.tandfonline.com/loi/icmt20

Internet Of Things and women's health

Tevfik Yoldemir(ASSOCIATE EDITOR)

To cite this article: Tevfik Yoldemir(ASSOCIATE EDITOR) (2020) Internet Of Things and women's health , Climacteric, 23:5, 423-425, DOI: 10.1080/13697137.2020.1811563

To link to this article: https://doi.org/10.1080/13697137.2020.1811563

Published online: 15 Sep 2020.

CLIMACTERIC
2020, VOL. 23, NO. 5, 423–425
https://doi.org/10.1080/13697137.2020.1811563

Taylor & Francis
Taylor & Francis Group

EDITORIAL

Internet Of Things and women's health

Tevfik Yoldemir

ASSOCIATE EDITOR

Department of Obstetrics and Gynecology, Marmara University Hospital, Istanbul, Turkey

The Internet of Things (IoT) is a system of interrelated computing devices with unique identifiers and the ability to transfer data over a network without human-to-human or human-to-computer interaction. Perhaps the best known example of IoT is the concept of the 'smart home' which includes a number of devices supporting a common ecosystem controlled by associated devices such as smart phones. Of course, a major concern with systems such as IoT surrounds privacy and security, and this must be addressed before widespread use can occur. Notwithstanding this concern, the third wave of digital health care comprises personalizing medical applications, with increasing awareness of the consumer. It enables the intermingled synergy of software, mobile platforms and big data in order to facilitate earlier intervention in disease processes and also to predict health issues before they occur. Apart from the clear consumer benefits, the service providers will transform technological solutions into better health-care delivery, extracting valuable small data from the big data. The ultimate goal will be improvement of the health of populations, experience of care, and reduction of the *per capita* costs of health care[1].

Wearable and nearable technologies complete this third wave of digital medicine. Wristbands, smart contact lens and the smart bra are some wearables in use. Small wireless devices equipped with sensors that work as transmitters of data are the nearables. These will overcome the intricate and ineffectual institution-based care and substitute the current unyielding delivery processes with self-directed personalized medicine, when required. Implantables, which are invisible biomedical sensors/biosensors, will integrate with mobile devices and provider systems. They will encourage timely provider–patient dialogue and intervention before an expensive, invasive treatment is needed. Smart pills that wirelessly transmit biomedical data to the provider, chips that permit continuous monitoring of vital signs, a bionic eye that allows the blind to see, a cardioverter-defibrillator that treats sudden heart attacks are only some of the examples[1].

Health care will become better connected, minimally invasive, and increasingly commoditized. Technology will change behaviors, create new treatments, and build an in-depth provider–patient relationship.

Wearable technologies replenish consumer self-awareness, and advance 'actionable' dialogues with care providers, family and friends. Currently wearable technologies have become more clinically focused – for chronic disease monitoring and for data integration with health-care systems. Wearable devices offer richer, actionable data that extend beyond body diagnostics since various aspects of a patient's health are measured in real time. The advancement of mobile and Cloud platforms will allow increased mobile device integration with the electronic health records, personal health records, office systems and patient portals. This integration between wearable devices and an improved expanded and secure Cloud will provide a common platform to store and retrieve information, to interlace devices and systems and to improve diagnostic accuracy and patient engagement[1]. Midlife women wish to participate more in their health issues. Research has found that they find wearable devices comfortable, convenient, affordable and effective. The customer segments of wearable devices are widening, including women with chronic illness, care-providers and aging seniors. New business models will be adopted where clinical approaches incorporating wearable solutions will engage the patients. The objective is shared accountability, earlier intervention, and better health outcomes.

Application of IoT, where devices 'talk' to each other and to humans has been tried in some areas of women's health. A proper approach to solve the challenges in IoT systems is to enhance sensor nodes and apply an extra layer named 'Fog' between gateways and Cloud servers. The Fog layer is run on top of smart gateways to provide advanced services such as saving network bandwidth between gateways and Cloud servers by processing and compressing data, reducing the burdens of Cloud servers by pre-processing data at smart gateways, providing distributed local storage for temporarily storing data, and creating a convergent network of interconnected and intercommunicated gateways, thereby helping to overcome service interruption. It also facilitates many other advanced services including system fault detection, database synchronization, interoperability, and mobility-awareness. Electronic-health signals such as glucose, ECG, body temperature and contextual data such as room temperature, humidity, and air quality can be monitored remotely in real-time, by using wearables. This Fog-assisted IoT system allows

CONTACT Tevfik Yoldemir tevfik.yoldemir@gmail.com Department of Obstetrics and Gynecology, Marmara University Hospital, Fevzi Cakmak District, Muhsin Yazicioglu Street No 10 Ust Kaynarca, Pendik, Istanbul, Turkey

easier monitoring of diabetic patients with cardiovascular disease.

An IoT-based predictive system based on machine learning to successfully diagnose people with breast cancer and healthy people has been proposed. The dataset 'Wisconsin Diagnostic Breast Cancer' has been used in this research to test the predictive modeling. The experimental results showed high classification accuracy (99%), specificity (99%), and sensitivity (98%). Even though the proposed system performance was excellent due to the selection of more appropriate features, general utilization in clinical practice warrants real-life scenarios rather than recorded patient datasets.

Another application of IoT is the prediction of falls. A multi-parametric score based on standardized fall risk assessment tests, as well as on sleep quality, medication, patient history, motor skills, and environmental factors has been studied. The resulting total fall risk score would consequently be used for fall-preventing interventions. Similarly, traditional measures of gait and/or signal-based features extracted from raw data collected from a hip-worn, triaxial accelerometer during walking have been proposed to predict fall risk. For this to work, data from patterns of walking under free-living conditions as well as data collected in laboratory and clinical settings will need to be combined for accelerometer-based assessments of fall risk[2].

Wearable devices track steps taken, distance traveled, physical activity intensity and heart rate. Some even estimate repetitions during resistance training exercises – important in cases of sarcopenia. Many applications provide exercise programs, including progressive resistance training and balance exercises. The wearables and applications may be the prescribed for postmenopausal women to prevent sarcopenia. Another opportunity for midlife women may be the development of specific apps to calculate daily allowances of protein and other nutrients relevant to the health of muscles and the body overall, and to prevent against sarcopenia[3].

Regarding the menopausal complaints, a suit of sensor-based smart clothing used for home-based and ambulatory health monitoring has been proposed. The smart clothing monitoring system could effectively measure the skin temperature and relative humidity in different body areas for individuals. Information on the frequency, duration, and intensity of a hot flush could be retrieved and physiological quantification of vasomotor symptoms achieved[4]. A recent study on the use of sensor-based smart clothing for menopausal women showed the most frequently reported complaints were hot flushes (65%), tiredness (62.5%), sleep disturbances (60%) and night sweating (52%).

Sleep disturbance, a common problem amongst postmenopausal women, has also been studied. Sleep quantity was measured using a Fitbit® tracker and a sleep diary, whilst sleep quality was measured using the Pittsburgh Sleep Quality Index and the NIH Patient-Reported Outcomes Measurement Information System (PROMIS) sleep disturbance short form.

The DOREMI project (Decrease of cOgnitive decline, malnutRition and sedEntariness by elderly empowerment in lifestyle Management and social Inclusion) aims to track user performance over long periods. The system will provide early detection of malnutrition and physical and cognitive deterioration. The DOREMI system utilizes four technologies such as 'Smart Carpet', a Wii-based balance board for daily weight assessment; an Android tablet containing the three applications; a wrist-worn DOREMI bracelet that collects patient metrics and sends them to a centralized home-based station; and environmental home-installed sensors to assess life-style habits and level of socialization. There are three applications which focus on fitness, cognition via a series of games, and diet[5].

The traditional model of hospital-centric care is more reactive and tends not to involve patients as an active part of the medical process. However, the present system has deficiencies. First, physicians lack real-time information on a patient's daily routine such as physical activity, diet, sleep, and social life, all of which are important in diagnosis and treatment. Second, the lack of patient adherence to treatment and medical advice increases the risk of poor health outcomes, hospitalization and an increased economic burden on both the individual and the health system. Third, big cities will demand more health-care infrastructure to serve the rising population. Last, as the demand for health-care services increases, so too does the demand for health-care workers[6].

Patient-centered care is the solution for the increased demand for medical services world-wide. In order to truly integrate hospitals or clinics with patients in patient-centered care, there is a need to utilize the powerful ecosystem of IoT. Incorporating smart wearable sensors into the routine care of patients could enhance physician–patient relationships, and increase the involvement of patients in their own health care. Nevertheless, wearables should only complement the traditional methods of scoring mental, physical and emotional health parameters.

The combination of mobile health and Intelligent Hospital is a prerequisite transition from reactive to proactive methods of health and wellness management based on the principles of Systems P4 (Predictive, Preventive, Personalized and Participatory) Medicine[5]. The interconnectivity of technology, the need for efficient and cheaper workflow, mobile health, and the Intelligent Hospital will revolutionize better sharing of information and making well-informed, data-driven decisions. Needless to say, the privacy of each person should be respected and stringent measures should be established to warrant compliance with national and international regulations on personal data protection.

Potential conflict of interest The author reports no conflict of interest.

Source of funding Nil.

Further references may be requested from the author.

ORCID

Tevfik Yoldemir http://orcid.org/0000-0001-6925-4154

References

1. Krohn R, Metcalf D, Salber P, *Connected Health: Improving Care, Safety, and Efficiency with Wearables and IoT Solution*. Boca Raton, FL: CRC Press; 2017
2. Hua A, Quicksall Z, Di C, *et al*. Accelerometer-based predictive models of fall risk in older women: A pilot study. *NPJ Digit Med* 2018;1:25
3. Scott RA, Callisaya ML, Duque G, Ebeling PR, Scott D. Assistive technologies to overcome sarcopenia in ageing. *Maturitas* 2018;112:78–84
4. Luo J, Mao A, Zeng Z. Sensor-based smart clothing for women's menopause transition monitoring. *Sensors (Basel)* 2020;20:1093
5. Vinciguerra S, Vinciguerra M. Smart devices and healthy aging. *NHA* 2019;5:13–19
6. Farahani B, Firouzi F, Chang V, Badaroglu M, Constant N, Mankodiya K. Towards fog-driven IoT eHealth: Promises and challenges of IoT in medicine and healthcare. *Future Gener Comput Syst* 2018;78:659–76 //doi. org/10.1016/j.future.2017.04.036