



Wearable Technology – How Can This Help Insurers?

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The demand for wearable health and wellness technology is expected to grow as new ideas and products emerge. Some devices are already important tools in clinical care while others are gizmos marketed as lifestyle accessories. A few insurers offer policies that reward policyholders who record their physical activity using wearable fitness devices. Whether or not insurers make such offers, the question is to what extent, if any, future pricing and product development will be shaped by policyholders' use of discrete devices that automatically track their biometric information.

Coined in 1965, Moore's Law states that computing power roughly doubles every 12 to 18 months.¹ Four years later the *Apollo Guidance Computer* steered men to the moon and back with less processing power than a mobile phone.² Gains in portable computing power have been enhanced by developments in Internet, wireless connectivity and micro-electromechanical systems. The *Internet of Things* (IoT) – when objects pass on data – is poised to deliver the space-age future we imagined while watching *The Jetsons*.³ This article looks at the development and application of smart technology in life and health insurance and specifically the role it may have in attracting better risks.

What is wearable?

Wearable systems are made when micro-sensors are embedded in textiles, applied to the skin or integrated into consumer electronics that can be worn, or carried, as an accessory. The IoT means virtually any object can be assigned a unique IP (Internet protocol) identifier so it can be communicated with over the Internet. A simple example of a unique identifier is the URL, or web address, that a browser uses to target and display a web page. Serious investment is pouring into the development of IoT devices that transfer data automatically across networks without human-to-computer interaction.

Many of the applications for this technology are in clinical domains such as health monitoring, mobile treatment and practical nursing.⁴ Sensors attached to the body or inside garments make it possible to track patients remotely and over extended

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periods of time – important for physical medicine and rehabilitation.⁵ Devices will soon allow continuous monitoring of physiological cues associated with such illnesses as epilepsy, Parkinson's disease and heart failure. Ultra-thin, flexible polymer skin patches can monitor muscle movement and use stored data patterns to deliver controlled doses of medicine through the skin and track the therapeutic response.⁶ A body patch can control an ingestible sensor embedded inside medication to improve compliance with treatment.⁷ Smart contact lenses can measure glucose levels in diabetic tears or track ocular pressure in glaucoma.^{8,9} Smart eyewear that overlays the real world with digital information using augmented reality is already in use in telemedicine and tele-radiology. Further development will allow storage of treatment data for re-use on multiple patients, transfer to other doctors, and sharing between hospitals and specialist treatment centres in multiple countries.¹⁰

Applications for wearable technology extend to monitoring breathing, heart rate and sleep, tracking hydration levels and calorie intake, recording movement, controlling therapy and pain management, and programming exercise. Much product innovation has come from small start-up companies but major corporations have also spotted the market potential; for example, Samsung, Apple, Nike, Microsoft, Philips and Google are all active. Wireless connectivity and simple interfaces help make devices user-friendly.

Beyond fitness applications

Unlike the analogue processes they aim to replace, electronic fitness devices prompt users into activity while logging output data and physiological signs unobtrusively and with little or no personal input. Devices let users set goals and offer prizes when they achieve them. Devices automatically upload data to the Web where they may be analysed or shared on social media or manufacturer platforms. It is likely that single-purpose activity monitors will disappear in favour of integrated solutions or be replaced by smartphones linked to wearable accessories. The direction of travel in mobile phone functionality is towards health and fitness tracking.¹¹ Some wearables manufacturers are leveraging the newest smartphone processors that were designed specifically to log movement and activity.¹²

Sensors sewn inside workout apparel can measure exercise duration and body position as well as collecting biometric data such as heart rate, exercise intensity, calories burned and recovery time. The results are calculated against pre-determined user inputs of age, build and gender.¹³ An alternative use of wearable health-monitoring sensors is to protect athletes from injury during contact sports. One such device packs an electronic monitor and sensors inside a cap. The device can measure acceleration of the skull that occurs when the head is hit, snaps back or hits the ground after a fall. A microprocessor calculates the impact using an algorithm similar to the head injury criterion used to assess the intensity of impact in sports.¹⁴

An earpiece can quantify personal energy levels using a combination of an infrared sensor, accelerometer, and algorithm.¹⁵ Heart rate earphones provide a soundtrack while measuring the impact of exercise using a sensor to track blood flow signals from the auricle – the external part of the ear – to capture heart rate and oxygen consumption.¹⁶ Other pocket-sized devices combine with online fitness programmes and promise to manage activity and nutrition, set goals and provide encouragement. Movement-based products package different functionalities including monitoring the quality of sleep.^{17,18,19,20}

Some of the devices spinning out of this development activity do appear, at least on first glimpse, to be solutions in search of a problem. Sony has filed a patent for a smart wig embedded with a variety of directional sensors and a communication interface.²¹ Microsoft has developed a prototype “smart bra” fitted with physiologic sensors – an electro-dermal activity sensor to track perspiration and an electrocardiograph – to monitor emotion and heart rate with the aim of preventing stress-related over-eating, and defend it as an important step towards the application of affective computing sensitive to mood changes.²² The nature of the scientific innovation process is to create outliers that never receive mainstream following.

Microfluidics – the manipulation of tiny amounts of fluid (think inkjet printers) – now has the potential to provide home versions of medical laboratory tests and as a result is, perhaps, of greater interest to insurers. The technology allows for the results of blood, saliva and mucus testing to be run through a smartphone using a simple microfluidic adapter. The first product of this type goes on general sale in 2015, initially providing home testing for influenza, testosterone, vitamin D, inflammation, and fertility.²³ In theory, any test could be performed using this technology, giving users detailed health feedback far beyond steps and calories.

Swings and roundabouts

Currently, life and health insurers that promote fitness and wellness as an integral part of coverage offer policyholders rewards for compliance with set health goals. Some programmes rely on data gleaned from wearable fitness devices – counted steps, burned calories and attained heart rates, for example. The source of this data is attractive because it is more verifiable than, say, optional visits to the gym.

A study of the impact of engagement in an incentive-based wellness program, offered by a health insurer, found it was associated with lower healthcare costs. Highly engaged members had lower costs per patient, shorter stays in hospital and fewer admissions compared with other groups. Admission rates were lower for cardiovascular disease, cancer, endocrine and metabolic diseases in the highly engaged group.²⁴

Insurers must rely upon the good faith of a policyholder to generate fitness data personally and not to pass a motion-sensitive wearable device to a friend in marathon training or simply put it in the tumble-dryer. Even when used and calibrated correctly, the accuracy of the devices is far from guaranteed. In a test against a GPS-equipped device, one step-counting gadget underestimated the total kilometres walked by 7% while another popular device was off by 25%.²⁵ In a comparison test of two pedometer devices, reviewers physically counted out 200 steps but found neither was 100% accurate.²⁶

Investors and manufacturers believe in the future of wearable technology but consumer buy-in may be less than certain. Ownership of wearable fitness devices has tripled between 2012 and 2013 and demand is expected to continue to grow significantly during 2014. The market for fitness and activity-tracking devices is predicted to top \$1 billion this year in the U.S. alone.²⁷ But the market potential is not the whole story; it is about the data and what is done with it.

The mass appeal of sophisticated and relatively expensive technology to monitor health and to share personal data across a network or to compete with and against other users remains unproven. Not everyone is likely to be highly engaged. A survey found 25% of people could picture wearing a wrist or clothing sensor in the future – up from a present baseline estimate of 4%. However just 4% would consider wearing smart contact lenses and fewer still would favour having permanent sensors attached to their body.²⁸ Some devices may already be too complex or niche-based to attract mainstream customers. For some the desire to be part of an exercise-based social network is strong, while other people would run a mile from it (but not literally).

Towards digital health data

Technology already helps shape motor insurance premiums. Assisted-driving and automatic safety innovations in new vehicles help reduce the frequency and severity of accidents. In the future, self-driving cars may improve this further.²⁹ Motor insurers use “black box” telematics technology to monitor driver behaviour and allow them to offer cover to young high-risk drivers. Motor manufacturers are making a big push for vehicle connectivity via the Internet and mobile phone networks.

Much has been written about big data in a life insurance context. Health metrics that are collated on a portfolio of lives would certainly qualify as such. Yet there is little clarity about how such data may be used effectively or how its accuracy may be validated. However, this may not be the point. Insurers may see simply attracting customers who are stimulated by the very idea of a fit-for-life health programme as a proxy for selecting virtually

preferred lives, whether they exercise or not. Consumers may be prepared to provide an insurer with explicit permission to access their personal data if they find the rewards on offer suitably attractive. Whether policyholders will sustain regular physical exercise in return for a freeze, or small saving, on premiums is debatable but they may do it in return for more tangible leisure-related benefits.

Trials on patients with bipolar illness have successfully collected data on sleep, communication, mobility and vocal patterns via smartphone and analyzed them for changes representative of manic episodes.³⁰ Giving doctors access to behavioral trends could, in future, help patients with mental health problems avoid hospitalisation and even suicide. Sensors can already pick up information on heart rate variability, breathing, oxygen saturation, pollen count and air quality. Processing these targeted outputs, and combining the results, could help doctors predict asthma attacks in their patients and intervene with treatment or advice.

While predictive analytics remain some way in the future, the smartphone is likely to emerge as the hub where existing single-purpose devices are de-siloed and combined into a single health monitoring system. This development, combined with microfluidics, promises to put detailed digital health data in the hands of a much wider spectrum of people. It seems plausible that currently available wearable fitness-related gadgets appeal only to a subset of the insurable population. Tech-savvy early adopters are those most likely to invest the money and effort required to track and trace their lifestyles. As the same technology is incorporated within existing multiple-purpose devices, such as smartphone apps, then adoption by a wider population seems likely to increase.

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Endnotes

- 1 http://www.computerhistory.org/semiconductor/assets/media/classic-papers-pdfs/Moore_1965_Article.pdf.
- 2 <http://www.thedailycrate.com/2014/02/01/geek-tech-apollo-guidance-computer-vs-iphone-5s/>.
- 3 http://en.wikipedia.org/wiki/The_Jetsons.
- 4 Lukowicz P "Wearable Systems for Health Care Applications", *Methods of Information in Medicine*, 2004 (Vol. 43): Issue 3 2004 232-238.
- 5 Bonato P "Advances in Wearable Technology and Applications in Physical Medicine and Rehabilitation", *Journal of NeuroEngineering and Rehabilitation*, 2005, 2:2 doi:10.1186/1743-0003-2-2.
- 6 <http://spectrum.ieee.org/tech-talk/biomedical/devices/electronic-skin-patch-with-memory-and-drug-delivery-could-treat-parkinsons>.
- 7 <http://www.proteus.com/technology/digital-health-feedback-system>.
- 8 <http://spectrum.ieee.org/tech-talk/biomedical/devices/google-working-on-smart-contact-lens-to-monitor-diabetes>.
- 9 <http://spectrum.ieee.org/biomedical/diagnostics/diagnostic-contacts>.
- 10 "Wearable Medical Devices Market (Heart Rate Monitors, Activity Monitors, ECG, Pulse Oximeters, EEG, EMG, Glucose/Insulin Management, Pain Management, Wearable Respiratory Therapy) – Global Industry Analysis, Size, Share, Growth, Trends and Forecast (value and volume), 2013 – 2019", Transparency Market Research, January 2014; available at <http://www.transparencymarketresearch.com/self-care-medical-devices.html>.
- 11 <http://9to5mac.com/2014/03/17/this-is-healthbook-apples-first-major-step-into-health-fitness-tracking/>.
- 12 <http://fittechnica.co.uk/fittechnica/2014/01/new-fitbit-activity-tracker-is-the-iphone-5s/>.
- 13 <http://www.underarmour.com>.
- 14 <http://theinstitute.ieee.org/technology-focus/technology-topic/athletes-cap-sends-out-alerts-about-head-injuries>.
- 15 <http://www.androidauthority.com/vigo-energy-gauge-325024/>.
- 16 <http://www.lg.com/us/fitness-activity-trackers/lg-FR74-heart-rate-monitor>.
- 17 <http://www.wearabledevices.com/2013/10/22/nike-fuelband-se/>.
- 18 <http://www.wearabledevices.com/2013/10/22/withings-pulse/>.
- 19 <http://www.wearabledevices.com/2014/02/07/lg-lifeband-touch-activity-tracker/>.
- 20 <http://www.fitbit.com/uk>.
- 21 US patent application number 20130311132, 2013, available at <http://appft.uspto.gov>.
- 22 <http://www.wearabledevices.com/2013/12/05/microsoft-develops-smart-bra/>.
- 23 <https://cue.me/#inflammation>.

- 24 Patel D et al "The association between medical costs and participation in the vitality health promotion program among 948,974 members of a South African health insurance company". American Journal of Health Promotion: January 2010, Vol. 24, No. 3, pp. 199-204.
- 25 <http://fittechnica.co.uk/fittechnica/2013/12/misfit-shine-review/>.
- 26 <http://www.techradar.com/reviews/gadgets/fitbit-flex-1124344/review>.
- 27 Consumer Electronics Association (CEA), press release, <http://www.ce.org/News/News-Releases/Press-Releases/2013-Press-Releases/Consumer-Interest-in-Purchasing-Wearable-Fitness-D.aspx>.
<http://www.wearabledevices.com/2013/12/13/demand-fitness-technology-quadruple-2014/>.
- 28 Rotman S et al "Fitness Wearables – Many Products, Few Customers Product Strategists Must Broaden Wearables' Appeal Beyond Fitness", Forrester 2013.
- 29 Kingdollar, C. "Auto: Going, going...where?" Insurance Issues, March 2014, Gen Re, available at <http://www.genre.com/knowledge/publications/iinapc1403b-en.html>.
- 30 "Smartphone app may revolutionize mental health treatment." <http://www.aftau.org/newsroom?013b74fd-3866-4d2c-b79d-6a8b5afe1677>.

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