

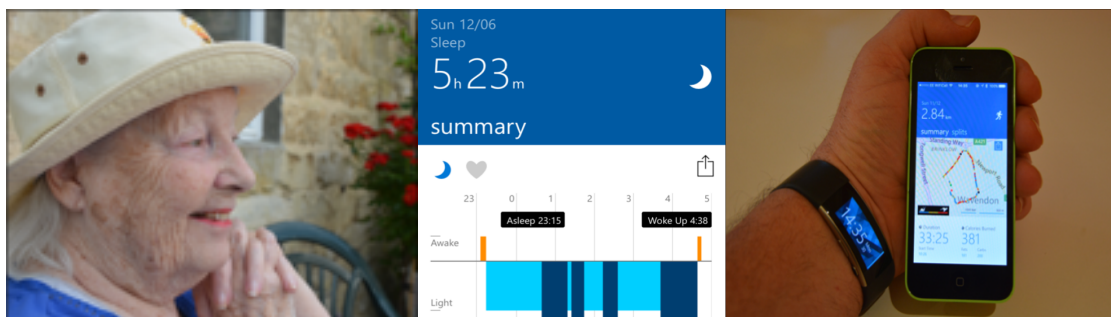
# Investigating the role of wearable activity-tracking technologies in the well-being and quality of life of people aged 55 and over

May 2016 - April 2017

The Open University, UK in collaboration with Age UK Milton Keynes and Carers MK

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Project website: <http://www.shaileyminocha.info/digital-health-wearables/> This project (May 2016 - April 2017) has been funded by the Sir Halley Stewart Trust. The views expressed in this report are those of the authors and not necessarily those of the Trust.

## 1. Rationale and research background

In this Sir Halley Stewart Trust-funded project (May 2016 - July 2017)<sup>1</sup> and in collaboration with Age UK Milton Keynes (MK) and Carers MK, our aim was to investigate whether and how wearable activity-tracking technologies can acceptably contribute towards self-monitoring of activity and health by people aged over 55. Example technologies include trackers from Fitbit, Garmin and Samsung, and smart watches. Typically, these devices record steps walked, sleep patterns, calories expended and heart rate.

Physical activity helps preserve mobility and motor skills as we age. An author of a study reported in 2015<sup>2</sup> said: “Physical activity may create a ‘reserve’ that protects motor abilities against the effects of age-related brain damage”. While walking has been shown to lower the risk of many chronic diseases in older people, its role in falls prevention remains unclear; however, walking has been considered as a useful adjunct to increasing their physical activity. Walking has been shown to improve cognitive performance and reduce cognitive decline among older people. Our previous research<sup>3</sup> has shown that walking with others can help reduce social isolation and loneliness among people aged 55 and over.

Given the UK’s ageing profile and as part of the agendas of Active and Healthy Ageing<sup>4</sup> and digital NHS<sup>5</sup>, there is an increasing focus on maintaining health in later life and encouraging physical activity to preserve mobility and motor skills, and self-monitoring of health and medical conditions. In a 2015 survey by Trustmarque and YouGov<sup>6</sup>, 81 per cent of respondents said they would like wearable devices to be used in healthcare to monitor vulnerable people or patients at home; helping patients follow diet and exercise regimes or courses of medicine: “self-monitoring devices ... could help the NHS save at least 60 per cent on the average cost per patient”<sup>6</sup>. Monitoring during and after treatment could address the concerns about delayed hospital discharge.

Although we have focussed on activity monitors in this project, our underlying objective is to determine the service design requirements for digital health wearables for people aged over 55 years, carers, and people being cared for. This will enable us to inform the service design of these devices when they are employed in self-monitoring and self-management of health for managing some specific medical conditions, or during recuperation.

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<sup>1</sup> Digital health wearables research programme, <http://www.shaileyminocha.info/digital-health-wearables/>

<sup>2</sup> Physical activity, motor function, and white matter hyperintensity burden in healthy older adults, <http://www.neurology.org/content/84/13/1294>; also, see: <https://www.aan.com/PressRoom/Home/PressRelease/1357>

<sup>3</sup> Social isolation and loneliness in people aged 55 years and over in Milton Keynes, a report for the MK Council, <http://oro.open.ac.uk/43925/>

<sup>4</sup> Five Ways to Wellbeing, <http://www.milton-keynes.gov.uk/social-care-and-health/public-health/5-ways-to-wellbeing-mk>

<sup>5</sup> Digital NHS, <https://www.digital.nhs.uk>

<sup>6</sup> ‘wearable tech’ Raconteur. Healthcare/ Future of Healthcare (August 2016)

<http://www.raconteur.net/healthcare/empowering-patients-to-track-their-health-through-wearable-tech>

## 2. Research objectives

Our specific objectives were to investigate:

- a) experiences and perceptions of family members (carers or otherwise) of using these devices for the people they care for;
- b) experiences of the people aged 55 and over who are already using these devices;
- c) experiences of people aged 55 and over who haven't used these devices before and who *will be given devices in this project*: challenges of adoption, and perceived risks and advantages.
- d) ethical aspects: who has access to the data from these devices? How is the data being used?
- e) accessibility and usability aspects related to the design and use of these devices.

## 3. Empirical investigations

Our empirical investigations have involved the following data collection methods (please see **Appendix A** for the mapping of the methods to the research objectives).

### Surveys

Three targeted surveys: age 55 and over who use these devices; carers; and doctors and healthcare professionals; and one general survey to gain insights into the kinds of devices people use and the choices they make and with participants 18 years and over who use these devices.

### Behaviour change study

We gave activity-trackers to 22 participants in the 55 - 86 age-range and collected their experiences through email interviews, diaries, 4 workshops over 6 months in 2016 and pre-workshop questionnaires. In this study, we didn't analyse the data from these devices. We were interested in eliciting the perceptions and experiences of our participants to determine the potential of these devices in improving the well-being of people aged over 55 years and to examine the socio-technical challenges.

### Post-survey workshop with carers

This workshop was held at Carers MK Offices in Central Milton Keynes in February 2017.

Please see the **report of this workshop with carers** as a blog-post: 'Wearable Activity Trackers for carers and those they care for', <http://bit.ly/2q7YRrF>

## 4. Key observations from the data

In our empirical investigations, we have gathered user-based evidence on the usefulness, functionality, usability and accessibility of activity monitoring technologies, accuracy and reliability concerns of stakeholders, and ethical considerations of data-usage.

### 4.1. Benefits that older people experience in using such technologies

*“I was so shocked at how inactive I really was, and over a period of time managed to build that up to from less than 2000 steps a day to an average 10-11,000 steps per day.”*

#### Becoming aware of physical activity and sleep patterns

*Checking sleep patterns is useful, what is normal for me, did I really have a "bad night", how much exercise have I done in the past week or month? [Female 55-64, Fitbit Flex, over 55 survey]*

#### Perceived advantages for mental health

*Using just basic steps/day and aiming to increase steadily over time (weeks/months/years) helps motivate one to get off the couch and increase activity. A bonus is you meet all sorts of people whilst out especially friendly dogs who seem to like me and recognise me from far away. [Male 65-74, Fitbit Charge HR, over 55 survey]*

#### Adoption of healthy lifestyle

*The ability to understand how active you are as opposed to how active you THINK you are [Female 65-74, Fitbit One, over 55 survey]*

*“Us oldies often do not exercise enough nor drink enough water therefore a device that helps you monitor / change this is great” [Male 55-64, Fitbit Flex, over 55 survey]*

*Using the dashboard of the device on Tablet or phone to keep in touch with family and friends. My unexpected benefit by using the same mobile app (but no longer the same device) is that I'm more in touch with adult children who live far away. we share data and can keep an eye on each other. I watch over them more than they do over me at this point though. [Female, 55-64, UP2, over 55 survey]*

*I like the idea of being able to share it [the data from the device] with selected members of the family because of the concerns/fears because I live on my own that I will fall down the stairs one day and nobody will know. [Female, 65 years old, who whom we gave Fitbit Charge HR, workshop participant]*

This quote brings several benefits together: discipline of keeping up with physical activity, and improved physical and mental well-being.

*“I was so shocked at how inactive I really was, and over a period of time managed to build that up to from less than 2000 steps a day to an average 10-11,000 steps per day. By combining increased activity levels with a healthier diet, I have lost over 4 stone in weight and significantly reduced my BP levels which were borderline high before I embarked on a healthy living campaign.*

*Even though I have had challenges with my mental health in the last 12 months, having my Fitbit has definitely motivated me to keep up the activity levels, which has definitely helped to make my way through those challenges. As we get older it is easy to slide into an inactive lifestyle which can have a disastrous effect on our physical mental and emotional well-being. Being constantly motivated to stay active definitely helps guard against the health challenges we face as we grow older". [Female, 55-65, Fitbit Charge HR, over 55 survey]*

## **4.2. Challenges for adoption of these technologies**

There are several challenges such as parameter-setting for monitoring and data-interpretation. Currently, off-the-shelf devices are calibrated for use by physically fit (typically young active people) with unrealistic fitness targets for the older generation, and there are concerns about accuracy and reliability of the devices.

*you know there's a risk of pushing people I look after to do 6000 steps a day, unless that's based on some sort of evidence then I might actually be making their health worse [Carers MK workshop participant]*

*Questionable accuracy but regardless I still walk more. [Male 55-64, Garmin Vivosmart, over 18 survey]*

## **4.3. Accessibility and usability challenges**

*"Some are not simple to use-from personal experience. It may be as simple as small screens that are difficult to read or incomprehensible instructions."*

There is the need to design for age-related impairments (e.g. vision, hearing, memory, dexterity) and to consider the digital skills and capabilities of older people, carers and people being cared for (we do realise that digital skills are not necessarily age-related as there is quite a range of skills from aged 55 years and over due to a diverse range of factors); and our participants expressed preference for an activity monitoring device that is also a watch.

*Making them work! Some are not simple to use-from personal experience. It may be as simple as small screens that are difficult to read or incomprehensible instructions. [Medical professionals' survey]*

*Even the first time I got the Fitbit even wearing it was very tedious because the strap is so very difficult to wear I thought I would have to ask somebody to wear it but then I got used to it. [Male, 72 years old, Fitbit Alta, Carers workshop participant]*

*Legibility of the screen (not just size). I can barely see the readout in well-lit areas. [Male, 55-64, Fitbit Charge, over 55 survey]*

*Not used daily, check activity for typical days, fuss of charging and getting back in strap, it's ugly, don't want to wear continually [Female 55-64, Fitbit Alta, over 55 survey]*

*Some devices need regular recharging/not waterproof. [Medical professionals' survey]*

*I mean I didn't have any instructions at all in my box. I mean all I had was a little booklet like that one which was health and safety and warranty and I searched and searched and searched in that box. [Female, 64 years, to whom we gave Misfit Shine 2, workshop participant]*

*Fear and lack of skill using the technology [amongst older people] [Medical professionals' survey]*

*I've had a few comments "what on earth is that you've got on your wrist"? It looks like some sort of monitoring device & I feel very conscious of it now. I had lady in the shop on Saturday who said what's that? Maybe she thought it was an electronic tag. When I said what it was she looked at me as if to say what the hell have you got that for? [Female, 55 years old, to whom we gave Misfit Shine 2, workshop participant]*

*I explicitly chose a stand-alone device rather than a smart watch to manage complexity. If I were to buy another one I would probably consider the Withings [which looks like a watch and has an activity tracker built in], which doesn't look like a tracker at all. [Female, 55-64, Fitbit Charge HR, over 18 survey]*

#### **4.4. Positive behavioural changes of using activity monitoring devices**

*"It is making me do things that I might not ordinarily do, forcing myself to drink more water"*

These results are from the behaviour change study. Wearable devices raise awareness on: not walking as much as people should; food intake; role of sports; not using the car wherever possible; formed lunch-time and weekend walking groups; joined gym; pacing themselves with adequate rest-times; diagnosis and solutions for non-optimal sleep; realisation that device reveals trends; awareness of the ethical implications of the data – when and why they would be willing to share and with whom?

*I've always known I'm not active enough so it's quite gratifying to start to see the number of steps building up but I do have a job that keeps me tied to my computer 8 hours a day, I get here tired because I commute to Northampton, don't have a dog to go out and walk or anyone to go out and walk with so I do tend to be far too sedentary in my normal life. [Female, 65 years, to whom we gave a Fitbit Charge HR, workshop participant]*

*It is making me do things that I might not ordinarily do, forcing myself to drink more water. [Female. 65 years, to whom we gave a Fitbit Charge HR, workshop participant]*

#### **4.5. Concerns about access and use of data**

*"I don't worry but not particularly happy manufacturer owns data and can do whatever they want with it"*

There are concerns from such devices on who has access to the data from the devices and how it could be used by insurers, employers and manufacturers.

*Overall, I'd not considered that the data would be used by any third party without my express permission to do so. [Female, 55-64 years, Fitbit Flex, over 18 survey]*

*Concerned employers will use devices to manage my performance. [Male, 55-64, Sony, over 18 survey]*

*I don't worry but not particularly happy manufacturer owns data and can do whatever they want with it. [Male, 65-74, Smartwatch, over 18 survey]*

*Do you foresee a time coming when insurance companies will be looking at your premiums based on data in the same way that motor insurance companies are putting devices in cars based on your driving? [Male, workshop participant involving older people to whom we gave the devices]*

#### **4.6. Need for an online community or forum**

Respondents pointed out that there is a need for a shared space where older people and carers could discuss the functionality of these devices and learn from one another.

*We are all hunting individually and some of us having a bit more difficulty than others and have found the fact [in the workshop] that there are these things there that you can programme your device to show you, I am just going with the factory set up. [Male, 61 years old, to whom we gave a Fitbit Alta, workshop participant]*

*I think this is useful information about the community of users and sharing experiences, it's not just setting the thing up but "mine does this, does anyone feel this is a useful feature"? [Male, 61 years, Microsoft Band 2, workshop participant]*

## 5. Conclusions

The participants in our research programme have also expressed the need for an online community/forum where older people and carers could discuss the functionality of these devices and learn from one another.

Despite the wide-spread use of wearable activity monitors by older people (e.g. gifts by concerned relatives) and carers, the functionality of these devices is not informed by the kinds of activities that these users undertake, their digital skills, their data requirements and those of medical professionals, and data management and security.

## 6. Outcomes and benefits

Ageing population, retaining independence of older people, support to carers, and using internet-enabled technologies to transform healthcare services are some of the national concerns. As far as we are aware, for these devices we are pioneers in creating an empirically-grounded knowledge-base of requirements of older people, carers, people being cared for, and medical professionals.

## 7. Outputs

Shailey Minocha, Duncan Banks, Caroline Holland and Jane Palmer, Investigating the influence of wearable activity - tracking technologies on behaviour change in people aged 55 and over. In: *3rd Centre for Behaviour Change Digital Health Conference: Harnessing Digital Technology for Behaviour Change*, 22-23 February 2017, Mary Ward House, Tavistock Place, London. Available in Open University's Research Repository, <http://oro.open.ac.uk/50102/>

Shailey Minocha, Role of wearable activity-tracking technologies in the well-being and quality of life people aged 55 and over, Legacy and Supporter Event of The Open University, CBI Offices, London, 10 March 2017.

Shailey Minocha, Caroline Holland, Duncan Banks, Catherine McNulty and Ana Tudor, Investigating the role of wearable activity-tracking technologies in the well-being and quality of life of people aged 55 and over, Wearable Technologies Special Interest Group, ACTIS (Advanced Clinical Technology Innovation Support) programme, 10 May 2017.

Regular blog-posts and news items: please see the project page

<http://www.shaileyminocha.info/digital-health-wearables/>; for example, please see the **report of our workshop with carers** as a blog-post: Wearable Activity Trackers for Carers and those they care for, <http://bit.ly/2q7YRrF>



## 8. Follow-on project and funding

The follow-on project has been funded by an Economic and Social Research Council (ESRC) Impact Acceleration Account Award<sup>7</sup> and will provide a unique opportunity for Knowledge Exchange (KE) and bring manufacturers in direct contact with end-users of their technologies.

This project will use the knowledge gained to date to set up KE dialogues with/between stakeholders for improving the design of activity monitoring technologies (and digital health wearables, in general) for older users, carers and medical professionals. The stakeholders will comprise of: academia; industry (manufacturers of digital health wearables; the OU is member of ACTIS: Advanced Clinical Technology Innovation Support and has links with SEMLEP<sup>8</sup>); statutory and voluntary groups such as Bucks Vision, Dementia Friends, older people and carers through Age UK MK and Carers MK; and the OU's partnerships with medical networks – e.g., Oxford Academic Health Science Network, Northants Healthcare NHS Foundation Trust and MK University Hospital, and membership of the International Society of Telemedicine and eHealth.

The expected outcomes of the ESRC-funded project are:

- dissemination by Age UK MK, Carers MK and associated organisations to their service-users on the role of activity monitoring technologies, criteria for choosing devices, and available IT support. Age UK MK and Carers MK will share the results with their national networks.
- guidelines for designers/manufacturers on functionality, usability, accessibility, privacy and security aspects in designing and marketing wearables for older users and carers.
- guidelines on ethical considerations of sharing and using data from wearables.
- a project report for public dissemination; a couple of academic papers to target areas as telecare, telemedicine, geriatric medicine and the Lancet.



<sup>7</sup> ESRC Impact Acceleration Account Award, <http://bit.ly/2ofeUGb>; also, see:

<http://www.open.ac.uk/research/main/news/new-grant-assess-success-wearable-technologies-monitor-health>

<sup>8</sup> SEMLEP, South East Midlands Local Enterprise Partnership, <http://www.semlep.com>

*I think these wearables have a great future I really do from the medical point, it would help the national health greatly or the surgery to be able to communicate especially elderly people without having to go out to the surgery, you know you could communicate with the doctor in the future, I'm quite happy to pass it [the data] over. [Female, 86 years old, workshop participant]*

*Huge possibilities and potentially massive but not with the technology we have as it is. [Male, 72 years, carer, Carers MK workshop]*

## Appendix A: Data collection methods mapped against the research objectives

Objective	Behaviour change study	Survey	Post-survey workshop
Experiences and perceptions of family members (carers or otherwise) of using these devices for the people they care for		<b>Survey 2:</b> (n=34) carers who were informed by Carers MK via their mailing list of carers	(n=5) carers at Carers MK Offices in Central Milton Keynes (February 2017)
Experiences of the people aged 55 and over who are already using these devices		<b>Survey 1:</b> (n=514) participants, age 55 and over who use these devices <b>Survey 2:</b> (n=67) carers including n=34 who were informed by Carers MK via their mailing list of carers	
Experiences of people aged 55 and over who haven't used these devices before and who will be given devices in this project – challenges of adoption, and the perceived risks and advantages.			
Ethical aspects: who has access to the data from these devices? How is the data being used?	We gave activity-trackers to 22 participants in the 55 - 86 age-range and collected their experiences through email interviews, diaries, 4 workshops over 6 months in 2016 and pre-workshop questionnaires.	<b>Survey 1:</b> (n=514) participants, age 55 and over who use these devices <b>Survey 2:</b> (n= 67) carers including n=34 who were informed by Carers MK via their mailing list of carers <b>Survey 3:</b> (n=82) doctors and healthcare professionals for gathering their insights on activity monitors and digital health wearables, in general. <b>Survey 4:</b> (n=275) participants aged 18 and over who use these devices	
Accessibility and usability aspects related to the design and use of these devices.		<b>Survey 1:</b> (n=514) participants, age 55 and over who use these devices <b>Survey 2:</b> (n= 67) carers including n=34 who were informed by Carers MK via their mailing list of carers <b>Survey 3:</b> (n=82) doctors and healthcare professionals for gathering their insights on activity monitors and digital health wearables, in general <b>Survey 4:</b> (n=275) participants aged 18 and over who use these devices	