Use of a wearable device to promote healthy behavior among employees

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Abstract. In 2013, a Dutch small-to-medium enterprise initiated use of a wearable device to promote health behaviors among its employees. All employees of the company agreed to use the device for an undetermined period. Three months into the project, qualitative research (interviews, observations and focus groups) was initiated in order to understand early expectations and actual experiences with respect to using the device, and opinions regarding its contribution to both personal health and team functioning in the workplace; the research last six months. Respondents were initially enthusiastic but later indicated that while they saw behavioral changes, especially in number of steps taken, the device alone was insufficient to sustain motivation and behavioral change. Sharing personal data was acceptable as long as both the employer and fellow colleagues were discrete about the data. However, there was some concern regarding further use of the data by the technology provider.

Keywords. mHealth, Wearables, Quantified Self, Employer Wellness Programs, Privacy

1. Introduction

In 2007, the 'Quantified Self Movement' was initiated to promote 'measuring the self' using technological tools such as apps on mobile devices, wearables, and other tracking devices. Various types of health-related data may be gathered, for example, blood pressure, heart rate, sleep rhythm, amount and type of exercise, caloric intake or burn, stress level, etc. All these variables may provide indications about the state of an individual's health and lifestyle. [1] The data produced by these applications can be processed automatically and used to generate results displayed in a number of easily understandable graphs and tables. Sometimes these data are coupled on concrete feedback about possible options for behavioral change. [2]

Such interactive interfaces arguably make it easier for individuals to engage in personal health information management, including transmission/storage of health data, real-time health monitoring, and (if necessary) remote consultation with professionals. This, in turn, is expected to facilitate more timely and effective health communication, improve patient education and personalized feedback and enable realistic goal setting for sustaining or improving individual health. In the case described here, this was also seen as a manner to improve team functioning in the workplace.

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This research reports on a small-scale initiative to promote use of quantified self monitoring devices in the workplace. Because this was the first known initiative of its type in the Netherlands, the research reported here was interested in individual and group experiences with using wearable self-monitoring technologies to track daily health practices.

2. Methods

A single case-study [3] of a small-to-medium enterprise that offers advice on innovation in healthcare was conducted. During this study, company employees (n=19) were provided with a wearable pedometer (wrist) and accompanying smartphone app with a social function, whereby could track both their personal progress and that of their team members. The company provided an additional platform via a 24/7 dashboard displayed on a laptop that all employees could see from their desks.

2.1. Data collection

Case study data was collected via interviews (n=6), participant observations (n=2) and a single focus group (n=8). At the beginning of the project, semi-structured interviews on basis of a topic list were held with three randomly selected employees and three managers in order to gain an impression of why the management initiated the project and outline employees' expectations for the project and ideas about key issues such as understanding of health, quantified self and privacy. All interviews were recorded with permission and transcribed verbatim. During the participant observation phase of this project, the first author shadowed two employees for a full day in order to observe how they used the wearable, app and dashboard. Field notes were made regarding behavior, as well as any discussions where the following topics were mentioned: the technology, exercise, personal health and team performance.

Insights derived from the early interviews and observations of use in practice were used as input for a focus group with eight employees (four interviewees, plus four new respondents). Focus groups are used to generate discussion of shared experiences [4] and employees were asked about their experiences with the technology over time, perceived change in behavior and understanding of health, and both ethical and practical dilemmas encountered during use of the technology. The focus group was also recorded with permission and transcribed verbatim.

2.2. Data analysis

The data was analyzed cyclically in different stages based on Creswell's step-by-step plan [5], which allowed the researcher to recognize recurring patterns or themes in the data. After each phase of data collection, Atlas.ti [6] was used to add labels to the primary data (inductive coding) and arrange these labels into theme-based groups. After the final data collection phase, the data was also coded deductively using a theoretical framework related to health literacy and technology acceptance.

3. Results

3.1. Fun gadgets, with preconditions

The managing director initiated this project out of curiosity about the usefulness of QS devices for increasing awareness of (and motivation to develop) healthy behaviors and also felt that it would give employees better insight into healthcare innovations. The project was announced during a standard company 'knowledge evening,' where employees discuss themes related to company work and share interests.

Initial interviews revealed that employees' first reactions were positive. They liked that the employer provided the wearable, which they saw as a new gadget to play with, and were interested in what the collected data would reveal about their behavior:

> *"Fun! The numbers tell the tale."*
>
> *"Also, it's simply fun, it's a gadget. And then the excitement of, what will do with it and what will the results be like?"*

Nonetheless, employees also wanted to set social boundaries regarding what information they would or would not share and what would be done with the data. They agreed to share only data on food intake and steps taken. Collecting data on sleep patterns was also a possibility, but several employees indicated that this was too private to be shared in the workplace (although some employees did still monitor this for personal use). Another social agreement was freedom of use, meaning that all employees were free to decide for themselves when they would use (or stop using) the wearable. Finally, other than the presence of the dashboard in the office, there were no additional activities or sessions planned in relation to the project.

3.2. Initial expectations-no personal health change, but team benefits

Establishing social agreements regarding use of the quantified self device was an important precondition to employees joining in the project. While most employees indicated not being worried about sharing their data (*"because I am healthy"*), some did voice concerns about stretching their personal limits (e.g. going overboard with measuring activities) and social responses to what their data revealed (e.g. being judged on one's shortcomings, rather than rewarded for one's efforts).

Initially, respondents indicated expecting little effect from the gadget with regard to actual changes in health behavior. One responded indicated not realizing that the device would also work when close to one's person, but not actually being worn (for example, when in a bag or pocket). Another respondent indicated feeling competent enough in knowledge of his/her health and failed to see what the wristband would add.

Interestingly, they saw more potential benefits for the organization. Rather than seeing the wearable as a tool to facilitate individual health understanding, they viewed it as part of an experiment that would ultimately help improve how the team functioned together.

> *"I did feel as though maybe more of a team feeling would arise. That the team spirit would become stronger, because we are all in this together, all wearing the same device. I imagined it would be a conversation piece."*

Respondents primarily saw beneficial effects in using the wearable as a reminder to take short breaks, which they felt would lead them to be more effective and fit when working at their desks, but not necessarily change longer-term personal health behaviors.

3.3. Experiences – caloric input hassles and data accuracy; increased number of steps

Respondents initially began tracking both movement and caloric intake. However, after the first few days, they stopped tracking caloric intake, because this required manual input into the app that accompanied the wearable device. This was seen as "*too much of a hassle*" in that the user first had to search in an integrated database for consumed foods/drinks and portion sizes; if the consumed food or drink was not in the database, then the user had to input the amount of calories based on their own calculation. Because the app tended not to list the food that the respondents typically consumed during the day, manual input took more time than expected.

> *"Too much work and still not accurate enough. It's relatively a lot of work, and if you have to add every coffee or cappuccino, then that takes a lot of effort. Sleep, for example, is tracked automatically – all you have to do is push a button to let the device know you are going to bed. That's a smaller effort and that makes it easier to integrate in your daily routine."*

In addition to the important point of the amount of effort required and alignment with daily routines, both of which are important to user uptake of new technologies [7], this response also points to the issue of input accuracy. Besides the manual input of caloric intake, several users questioned the accuracy of the data for exercise and sleep, despite the automatic monitoring. Because the feedback that users receive depends on the quality of data generated by the different sensors in the device the accuracy of this data is extremely important.

Moreover, the employees found that the device alone was not enough to keep them motivated to change their behavior – often missing context in relation to their personal efforts. The dashboard that had been set up did not work well in the beginning. Once employees realized that the readings it gave did not correspond to data from all users, they stopped paying attention to it. Nonetheless, all respondents indicated that the wearable served as a reminder to take more steps. Whereas without the device it was easier to opt for using the car, also for short distances, all the respondents indicated that they now actively tried to meet the daily target of 10,000 steps. In that regard, taking a walk together at lunchtime (instead of driving) and taking short walking breaks between long periods of sitting were the most noticeable changes in employee behavior.

3.4. Socio-ethical dilemmas

When asked about dilemmas encountered during use, the first subject that most respondents raised was privacy. Whereas they felt they had nothing to hide about the number of steps taken, they were less open about sleep patterns and caloric intake, which they felt revealed more about the state of their health.

> *"Well [exercise] information is not that relevant but when it would be heart rate or something then that would be different. Especially from the fear that others might judge me, you know, about the diseases I might get in the future. And that it would also have an impact on whether I get a mortgage or life insurance"*
>
> *"I do not feel unsafe or anything. Unless [the data] is used against me. We shouldn't assume that from the start, but if it were to happen, I would immediately stop using the device."*

This issue of how the collected data might be used was especially important in employer-employee relations. In this regard, respondents indicated the importance of trust in the environment where the monitoring was taking place. Not only one's colleagues, but also one's employer, were now privy to otherwise personal health data. As a result of the social agreements made early on, respondents expected all persons involved in the project to handle the generated data with discretion and saw privacy protection as a shared responsibility between employer and employee. One interesting aspect was that most respondents only realized later in the study that their data was property of the wearable provider, meaning it could possibly be stored and used for other purposes at a later date. But, they also felt that they should have thought through such possible consequences of open data-sharing before agreeing to participate.

4. Discussion

Although this was a small, explorative study based on a single case, it revealed the following aspects about the uptake of a monitoring device and promotion of healthy behaviors in the workplace. First, the organization must establish and adhere to certain conditions and participation is facilitated by establishing shared social norms early on. This enables employees to trust both their colleagues and employer. Second, the device itself is not enough to increase user understandings of healthy practice or to facilitate change in behavior. Users question not only the accuracy of input data about themselves, but also the quality of feedback generated on the basis of this data, as well as the cohort information being mirrored to the entire group. Finally, uptake of such devices is facilitated by proper alignment with personal daily routines, but users might not fully understand all the ins and outs of the processes behind data collection. Therefore, when introducing such devices in similar programs, explanations regarding how the device works to help individuals monitor their health should include sufficient information regarding how personal data is handled by the service provider.

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