Behaviour change interventions to address sedentarism in different communities

Workshop report

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Contents

1 Executive summary

This report is based on keynote talks and discussions at the second *GetAMoveOn* (GAMO) workshop that took place in February 2018. The workshop brought together experts to highlight the challenges and opportunities of using digital technology interventions to reduce sedentary behaviour in different communities. The workshop was organised so that the keynote talks were delivered as introductions to breakout sessions where participants considered three stages of change across four different communities.

Keynote speakers highlighted different aspects of the generic insight that reducing sedentary behaviour (which is related but not identical to increasing physical activity) has benefits to the individual, the population, and society at large. They presented different theoretical and methodological approaches to delivering interventions. These included theories of social influencing, which explores the facilitators, barriers and strategies for change; the person-based approach, which focuses on understanding and accommodating the potential users in order to improve uptake, adherence and outcome; and social practice theory, which emphasises the detrimental and insubstantial effect of framing public health messages as purely individual responsibility. The various approaches were illustrated with examples of behaviour change programmes using different technologies including a smartphone app for the workplace, an online platform for those at risk of age-related cognitive decline and wearables for the over 55s.

The overarching theme from presentations was that designing effective behaviour change interventions is complex. Framing the problem as individual behaviour change is helpful, but not sufficient: such a perspective can take account of individual differences, for example in knowledge, motivations, circumstances and needs, but it cannot take adequate account of the social, physical or organisational contexts that shape behaviour. For this, different perspectives are needed and social practice theory provides one example.

Three stages of behaviour change were discussed during breakout sessions, based on the "stages of change" theory, including: pre-contemplation/ contemplation, action and maintenance. Four communities were considered over the different stages of change: older adults, children and young adults, the workplace and people with health troubles/ disabilities. The main themes were extracted from these discussions and are detailed in Section 6 of this report.

Overarching themes for behaviour change with these communities included consideration of individual circumstances and motivations, the carry over benefits from becoming less sedentary including reducing social exclusion, the need to understand how much change in sedentary behaviour is required for a clinical impact and the challenge of taking an intervention from research to implementation.

Overall the workshop highlighted both significant challenges and also many opportunities to reduce sedentary behaviours across the four communities discussed. The insights captured during the workshop and presented in this report are hoped to serve as a road map for future research to address issues with digital interventions and realise the potential opportunities for reducing sedentary behaviours across different kinds of communities. These themes will be further developed as the GAMO network proceeds.

2 Introduction

The workshop on Behaviour Change Interventions to Address Sedentarism in Different Communities was organised as part of *GetAMoveOn (GAMO),* an EPSRC Network+ directed by Professor Anna Cox, Professor of Human-Computer Interaction at UCL. The Network brings together experts in sensor networks, data analytics, interactive visualisation, human computer interaction, online citizen engagement, behaviour change, sports and exercise with the aim of transforming health through enabling mobility.

The sedentarism workshop was organised jointly by Professor Ann Blandford (Director of the UCL Institute of Digital Health) and Professor Anna Cox, and held in London on 20 February 2018. Its purpose was to explore the role of behaviour change and other theories that support reasoning about the social and community contexts within which behaviour takes place. The focus was on reducing sedentarism across communities, including schools, work places and care homes, where it is possible to introduce digitally enabled interventions to shape individual and group practices.

This report is based on the workshop proceedings and introduces some of the theories and practices being used in behaviour change. It includes the responses of workshop participants who discussed the opportunities and challenges for changing sedentary behaviours and made recommendations in respect to four communities: older people, schools, the workplace and people with chronic disease or disability.

The report is set out in five parts:

- Background
- Method
- Theory and practice from keynote lectures
- Discussion group reports
- Conclusion

3 Background

The GAMO network was set up in response to the explosion in availability of fitness trackers that have appeared on the market in recent years. The sedentarism workshop built on a symposium held in May 2017 by the GAMO network which concluded that there were three main areas to consider when attempting to increase physical activity:

- Target population: these devices were perceived as working extremely well for athletes and individuals who are already relatively active and who use them to track incremental improvements in their performance. However, there was a lack of engagement and a real shortage of devices for most of the population who do not already identify themselves as 'fit'. There have been attempts to engage those who may not be meeting current guidelines for physical activity with mobile apps such as Couch to 5K and Active10. These apps target people with more modest goals to become more active, regardless of their starting point.

- The technology: in addition to wearables and apps, consideration should be given to sensors embedded in the environment. For example, sensors could be embedded in furniture to monitor and provide information on the amount of pressure that an older person exerts on the arm of the chair on standing. This could help in monitoring chronic illness.

- Behaviour change techniques: most apps have several behaviour change techniques embedded in them. It is necessary to understand which work in which groups and under which circumstances.

4 Method

Participants in the workshop came from the academic, voluntary and commercial sector and were drawn from the UK, Europe and wider international communities. Participants chose which breakout group they would like to attend depending on the community (older people, schools, occupational or people with chronic conditions) that they were most interested in, or where they had most expertise. The day was organised in three sessions each broadly covering the main phases of promoting and achieving behaviour change:

- Contemplation: what makes people consider changing their lifestyle

- Action: theories and techniques to help people transition into action

- Maintenance: supporting maintenance of new behaviours

Each session was introduced by a keynote speaker who set out some underlying theory and provided practical examples. Breakout groups were maintained throughout the three sessions, giving a chance for individuals to network, share their understanding of any particular needs of that session and build progressively from contemplation to maintenance. Groups gave final feedback under these headings in the last session.

As an innovative feature, the workshop also provided an 'Open Mic' session for individuals interested in sharing their own work and seeking ideas and input from other participants.

5 Theory and practice from keynote lectures

5.1 Keynote lecture: Using technology to reduce sedentary behaviour in the workplace

Dr Jacqueline Mair, Edinburgh Napier University

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This presentation provided a structured approach to addressing sedentary behaviour in the workplace which included evidence on:

- The detrimental health effects of prolonged sitting

- The association of prolonged sedentary behaviour with office work

- The use of digital technologies to reduce sedentary behaviour

- The development and evaluation of technology to deliver and monitor exercise intervention based on a theory of social influencing and interactivity

5.1.1 Introduction to sedentarism

The health effects of prolonged sitting

Prolonged sitting is a risk factor for many diseases. Specifically, more than 11 hours of sitting per day is associated with a 40% greater risk of premature death. Increased sedentary behaviour is linked to mortality from cardiovascular disease and obesity, type 2 diabetes, certain cancers and metabolic syndrome. This link is independent of levels of physical activity; for example, sedentary behaviours, particularly TV watching, have been linked to higher levels of obesity and type II diabetes. For endometrial cancer, longer sitting time was found to be associated with a greater risk of disease, independent of amount of moderate to vigorous physical activity undertaken.

These studies have been criticised as the effect sizes are small, particularly for the obesity link. However, there is evidence that changes in sedentary behaviour have impacts on cardio-metabolic risk factors such as waist circumference and HDL cholesterol levels. Recent research suggests that a high level of physical activity (60-75 minutes per day) eliminates increased risk of death associated with high levels of sedentary behaviour. However, only a small proportion of the population are physically active to this extent.

Sedentary behaviour and the workplace

Population-based accelerometer studies indicate that, depending on the age and gender of the adult, only 1% to 5% of the waking day is spent in moderate to vigorous physical activity of any kind, and only up to 1% of this fulfils the recommended duration of at least 10 minutes. Up to 63% of the waking day is spent at work, meaning that this setting is an obvious target for intervention to encourage more healthy behaviour.

Office workers in particular can spend up to 81% of their working day at a desk. Occupational sitting has been linked with increased mortality, diabetes and obesity. It has also been found that reducing sedentary behaviour alleviates musculoskeletal discomfort, increases worker productivity, improves fatigue and may be beneficial for mental health.

Digital technology interventions

According to the American College of Sports Medicine, in 2017 wearable technologies were the leading fitness trend. Self-tracking of health and fitness information has become increasingly common and has been facilitated by the high proportion of adults who own a smartphone (76% of adults in the UK). However, there are criticisms of the measurement accuracy of the devices and there is variable scientific evidence about their effectiveness in reducing sedentary behaviour.

Apps and wearables have been shown to positively change sedentary behaviour in the general population, and therefore could be useful in sedentary behaviour interventions in the workplace.

A pilot study at University College Dublin, by Mair et al. (2014), used a digital health technology solution to deliver and monitor exercise interventions at home and work for sedentary middle-aged adults. Participants were given an exercise 'prescription' whereby at some point during the day they would be encouraged to do 3 min vigorous activities as exercise 'snacks' throughout the day (totalling 27 min per week). The exercise intervention consisted of a stepping motion which was tracked by sensor pads and wearable devices. There was excellent adherence to the programme and, after four weeks, a significant improvement in cardiorespiratory fitness measured by submaximal VO2, heart rate and rate of perceived exhaustion; however, there was no change in muscle strength or body composition.

5.1.2 Interventions to address workplace sedentarism

Another intervention by Mair et al. (some results are yet to be published) took a different approach by encouraging a reduction in the amount of time sitting as opposed to increasing physical activity.

For this research, consideration was given to:

- The evidence that technology can help to reduce sedentary behaviour.
- What technology interventions would work in a workplace setting.
- What the best way to develop a feasible intervention is.

The whole research programme will proceed from a development phase to testing the feasibility and piloting, evaluation (assessing effectiveness and cost effectiveness), understanding change processes and finally dissemination, surveillance and monitoring, and long-term follow up.

Systematic meta-analysis of 34 studies by Mair et al. (2017) focused on how digital technology is being used to reduce sedentary behaviour generally. The key findings from this review were that interventions using computer, mobile and wearable technologies can be effective in reducing sedentary behaviour by approximately 41 min/day but this effect is short-term and lessens over time. Overall, however, the review criticised the reporting of behaviour change techniques within the interventions trialled and the numerous methodological flaws in the studies reviewed, including overall study design, long-term follow up and lack of objective measures of sedentary behaviour.

A previous systematic review had concluded that it was not known whether effective interventions for reducing sedentary behaviour also resulted in clinically meaningful and sustained improvements in health outcomes.

In developing their intervention, Mair et al. built on a number of theories and ideas:

- Social influence theory, which suggests that an individual's attitudes, beliefs and subsequent behaviours are influenced by others and that interactivity would be an important characteristic for behaviours.
- Recipients should be involved in the design of the intervention
- Individuals prefer positive to negative feedback (e.g. communicating benefits of decreasing sedentary behaviour rather than risks associated with high levels).
- Tailored communication to individuals would be more effective than generic.
- Messages emphasising positive attitudes towards healthy behaviour would be more motivating than those focusing on threats and risks.
- More advanced feedback/engagement strategies would lead to major improvements in engagement.

Unpublished work from Ulster University by Mair et al. looked at the barriers, facilitators and strategies to reduce occupational sedentary behaviour by asking those involved at all levels (e.g. workers, managers, board members) pertinent questions. Key themes emerged from the discussions:

- Knowledge: People were aware they needed to sit less but did not know why or how to change it. They were often unaware of how long they had spent sitting. They also lacked detailed understanding of the overall health impacts of sedentary behaviour and that the effect of this was, at least in part, independent of physical activity.

- Productivity: People at work are concerned that work comes first and will not engage in interventions if it impedes their work.

- The organisation: Reducing sedentary behaviour is not necessarily a priority for the organisation, particularly at board level, where it was not seen to influence factors such as employee health.

- Workplace culture: Particularly within the workplace, the social aspects such as conditioning to sit down during meetings, is an issue.

- Environment: Adapting the environment to encourage employees to reduce sedentary behaviour, for example by installing sit/stand desks, can be very costly.

Using this information, the group designed a mobile app with several features including self-monitoring, goal setting, feedback, prompts and reminders. Outcomes measured were time spent sitting, standing and stepping, productivity, and mood. Initial findings suggest that the success of behaviour change through the app was dependent on the environment changing – in this case having an adjustable height desk.

Future directions for research

Mair concluded her talk with several recommendations/ considerations for future research:

- More understanding is needed of the relationship between sedentary behaviour and health, particularly the clinical impact of reduced time spent sitting.

- Methods for objectively measuring sedentary behaviour at work should be a focus.

- The determinants and correlations of sedentary behaviour in different domains and different populations should be examined.

- The most effective interventions to reduce sedentary behaviour in the workplace should be determined.

- There should be methods to implement and up-scale interventions for impact.

5.2 Keynote lecture: Sedentary behaviour in older people in a community setting

Dr Max Western, University of Southampton

This presentation introduced the use of a *person-based approach* to the development of an intervention and provided an example of the use of this approach in a research programme, Reducing and Preventing Cognitive Decline in Older Age Groups (RECON), to plan and develop a digital intervention to facilitate the practice of healthy behaviours in the context of older age groups.

5.2.1 The person-based approach

The person-based approach focuses on understanding and accommodating the perspectives of the people who will use an intervention in order to improve uptake, adherence and outcomes. The approach evolved as a learning process developed over experience with 20 interventions for public health and illness management. The method is iterative and involves qualitative interviews with a wide range of people from the target population, undertaken at every stage from planning to feasibility. Through the interviews, it aims to identify guiding principles informed by an understanding of target users' attitudes, motivations, needs and circumstances. This approach enables developers to select intervention components that seem most acceptable, feasible and salient to the users and, importantly, also allows modification or avoidance of elements that would seem to be unpopular, impractical or invasive. It also allows facilitators to anticipate barriers and facilitators to the use of the intervention. The approach is iterative and guiding principles may themselves be modified during the pilot period.

5.2.2 Intervention planning

Development of guiding principles

Guiding principles help developers to summarise features of the intervention that they have identified as important. They cover:

- The aim of the intervention in terms of behaviour change and outcomes

- Important characteristics of the users

- Important behavioural issues, needs or challenges that must be addressed

- Key intervention design objectives

- Key features of the intervention that can achieve those objectives

Theoretical modelling can also be used to assess whether the behaviour determinants for the interventions components have been overlooked by setting out key design objectives and intervention features in table form. This can be achieved using logic models and planning tables. Briefly, logic models are used to identify hypothesised behaviour change techniques based on existing theory and evidence, and planning tables are used to systematically document the planning process for each behaviour change technique. Thus, for example, the planning table related to a particular intervention aim might include the development of relevant content and the setting up of systems, the intervention processes or activities that will be undertaken, the outputs or changes that are expected and the functional outcomes that may be measured. Theoretical modelling also helps plan what will be assessed when it comes to trialling the programme.

5.2.3 Intervention development

The aims for this phase are to determine whether all intervention components are comprehensible, acceptable, feasible, easy to use, motivating, enjoyable, informative and convincing. An example is to use a two-step method:

1. Think aloud studies to gain users reactions to every element of the intervention.

2. Allow users to try it for a few weeks and keep diaries and use retrospective interview.

Think aloud interviews ask participants to use the intervention and say aloud any thoughts that come into their mind. This can be good for assessing immediate reactions, particularly adverse reactions, and observing how the intervention is used. It is important to use neutral prompts, ask about content, use non-verbal cues, encourage critical content and position the user as the expert.

5.2.4 An example of the person-based approach

Box 1 provides an example of the use of the person-based approach focused on older people at risk of cognitive decline

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EXAMPLE OF PERSON-BASED APPROACH – 'RECON' - REDUCING AND PREVENTING COGNITIVE DECLINE IN OLDER AGE GROUPS

This will be in four phases: intervention planning, intervention development, feasibility trial with 360 participants followed up for one year and definitive trial with 20,000 participants and five year follow up.

IMPORTANCE OF DEMENTIA

The prevalence of dementia is estimated to be between 5 and 7% for individuals over 65. Although the prevalence has fallen slightly in the UK over the past 20 years, the total number of sufferers is likely to increase due to people living longer.

AIM of RECON

To determine whether internet-based interventions for older adults (both with and without existing cognitive impairment) are effective and cost-effective means of facilitating healthy behaviours, including physical activity, diet and cognitive exercise in order to reduce cognitive decline and maintain function.

GUIDING PRINCIPLES

Intervention objectives:

*   To facilitate practice of healthy behaviours (physical activity and healthy eating) and cognitive exercise amongst older adults in order to maintain cognitive functioning (as assessed by computerised cognitive assessment) amongst those with and without pre-existing mild cognitive impairment (MCI) or age-associated cognitive decline (AACD).
*   To be a sustainable and cost-effective means of supporting the necessary behaviours for the 5 year intervention duration (allowing for possible loss of digital support/contact).

Characteristics of the users and key challenges

The target population for RECON was characterised as older adults who may or may not have MCI/AACD. From the evidence in the literature and their own research, this population are the least active and most sedentary, are concerned about maintaining autonomy and independence, are more receptive to achieving positive benefits rather than risk avoidance, have limited but improving technology skills and access, and tend to feel daunted by language associated with increasing physical activity. They are more at risk of having limited social networks and being socially isolated, but they do value social support, especially where physical activity is concerned. Other important considerations, particularly when using a digital technology, are that many in this population have difficulties with memory, language, thinking and judging.

Intervention design objectives and key features

Based on the user characteristics and key challenges identified, the design objectives were set out in table form and features proposed to meet those objectives. Some selected examples are shown below:

Minimise cognitive load: clear and simple layout, language and navigation procedure
Positive framing: framing activities in terms of benefits – e.g. strength, balance, mood, quality of life
Promoting user autonomy: offering choice
Promote user competence: graded goal setting

INTERVENTION PLANNING

Theoretical modelling was created in tabular form; below are some of the headings and examples:

Intervention target (aim)
Intervention ingredients – e.g. developing the 'Active Brains' website content
Intervention processes – processes to engage participants in activities (e.g. detailed guidance on how to set goals) and maintain their engagement (e.g. social reward)
Proposed mediating variables: e.g. usage of website, increased physical activity
Functional outcomes: e.g. maintenance of cognitive function, improved functioning in daily life.

INTERVENTION DEVELOPMENT – the Think Aloud interviews

Results so far from the Think Aloud studies have allowed for adaptations to be made for several problems that were identified by users to make the programme more users friendly/ effective. These included; changing the phrasing of suggestions to make more sense and to be more positive, matching up activities with appropriate suggestions for how to improve, and changing the interface of the online platform to make it more user friendly.

NEXT STEPS

The next steps for RECON are to complete a Think Aloud study with new end users after alterations have been made from the previous iteration. They will also run a 3-week prototype of the interventions using diaries and retrospective semi-structured interviews in 20 users. Finally, the website will then be finalised for the feasibility trial.

5.3 Keynote lecture: Theories of practice and public health - from the obesogenic environment to healthy everyday life

Dr Stanley Blue, Lancaster University

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This presentation introduced ideas from a strain of social theory called practice theory. Whilst the presenter's own work generally focuses on challenging ideas about individual responsibility to climate change, the approaches and considerations of practice theory were presented in the context of public health topics such as smoking and obesity.

5.3.1 A practice theory approach

Considerations for practice theory

A recent collaboration between Blue et al. and NICE that was underpinned by practice theory was presented to introduce this theory as a tangible concept. This project aimed to tackle the public health issue of smoking by analysing how smoking habits have changed over time.

Practice theory methodology involves understanding the elements, connections and recruitments of the practices in question. The elements include everything that makes the practice possible, including the materials (e.g. tobacco plants and transportation), competencies (e.g. being able to roll a cigarette), and the cultural meanings (e.g. smoking is perceived as 'cool'). The connections of a practice to other practices are important to consider as many practices such as smoking do not occur in isolation. Often, unhealthy or unhelpful practices are tied up with other practices such as socialising, drinking alcohol or eating a meal. Finally, the recruitment of future smokers is dependent on people still taking up this practice and therefore the elements and connections of a practice still existing is a prerequisite.

The conclusions drawn from Blue's work with NICE were that, rather than trying to change the behaviours or engagement of individuals with a practice, efforts should be directed to altering those connections at a societal level. For example, for smoking, the ban on smoking in public houses weakened the tie between smoking and drinking.

5.3.2 A practice approach to obesity

Not every public health issue can be deconstructed in the relatively simple way achievable for smoking. Whilst smoking is a relatively non-complex issue and the harms associated have a direct aetiology, obesity is not so clear cut and poses unique challenges as eating is essential to life, more ingrained in our social lives and the precise aetiology of various eating practices as causative factors for obesity are much less clear.

A recent response by Public Health England to rising rates of obesity shows how limited the interventions can be for such complex challenges. A lot of public policy focuses on how individuals interact with their food environment. Most people know that they should be eating better and moving more but the environment is densely packed with opportunities to buy and eat food (often described as 'obesogenic'). A long-term strategy is to work with local councils to positively influence this obesogenic environment to enable people to make healthier food choices. Figure 1 shows material used as guidance for catering businesses to help customers make healthier choices. However, this approach has been highly critiqued for still focussing on individual decision making and therefore individual responsibility, and excluding a whole range of issues, forces and history that influence social practices such as the patterns of eating out vs eating at home.

Practice theory might suggest a better question for obesity such as how does eating become organised in everyday life and how has that changed over time?

Figure 1. Public Health England's healthier catering guidance for all types of businesses.

5.3.3 Temporal features of practices and a possible approach to obesity

Different activities have different temporal features such as sequence (e.g. drying clothes after washing them), periodicity (e.g. taking a daily shower), duration (e.g. sleeping takes longer than checking email), and synchronisation (e.g. eating a meal as a family). Engaging in a practice or set of practices means an individual may not be able to engage in another set. These temporal features of practices matter for how practices can be allocated during the day and how flexible/adherent they are.

Meal times have relatively fixed temporal features (i.e. they tend to occur three times, spaced out during the day), whilst other practices such as laundry are more flexible and liable to change. As well as daily temporal patterns there are more overarching rhythms and beats to the temporal pattern of daily life. For example, what day of the week it is, type of work or the stage of life.

Contrary to the notion that Western life is speeding up and becoming more fragmented, a recent study by the Sustainable Consumption Institute found that rather than being sporadic, fragmented and changing, meal times are still routinised behaviours.

Figure 2 shows time use data collected in 2000 (presented by Blue's colleague Shove in 2016). Meal times (green) in the modern day are pronounced at three times during the day: breakfast, lunch and dinner. Work (purple) and media use (light green) take up substantial energy during the earlier and latter parts of the day respectively. Sport and exercise does not occupy a substantial part of the day.
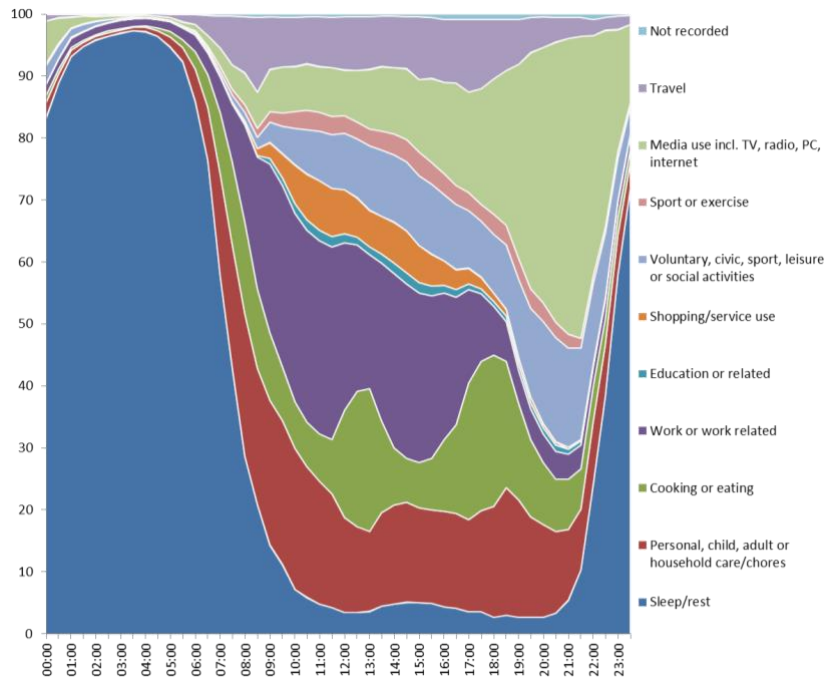
Figure 2. Time use data for the modern day (2000). The X axis is time and the Y axis is % of energy spent on each activity.

For the 1950s data (Figure 3), researchers modelled the data by removing the majority of media use as a practice. Sport and exercise (pale red) and other leisure activities (pale blue) have filled in the majority of this time. Furthermore, then cooking and eating times (green) becoming even more pronounced with work sandwiched between each meal.
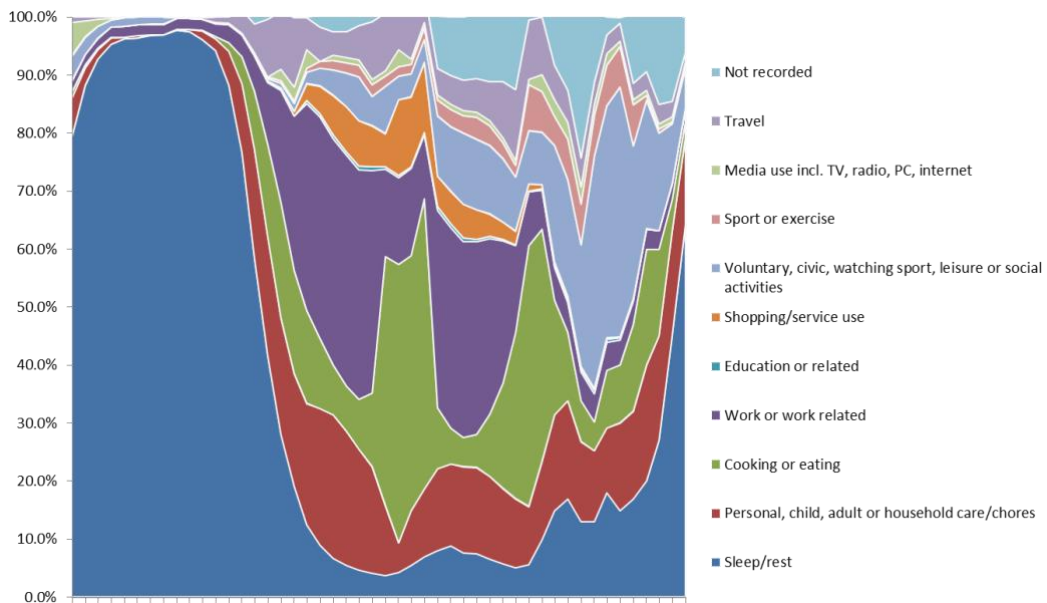

Figure 3. Speculative data for 1950s time use.

A time use graph was also modelled for the 2050s (Figure 4), making work (purple) more substantial across the day and diminishing meal time routines. This predictive modelling assumed that in the future, meal times will become more irregular with people engaging less in social mealtimes.
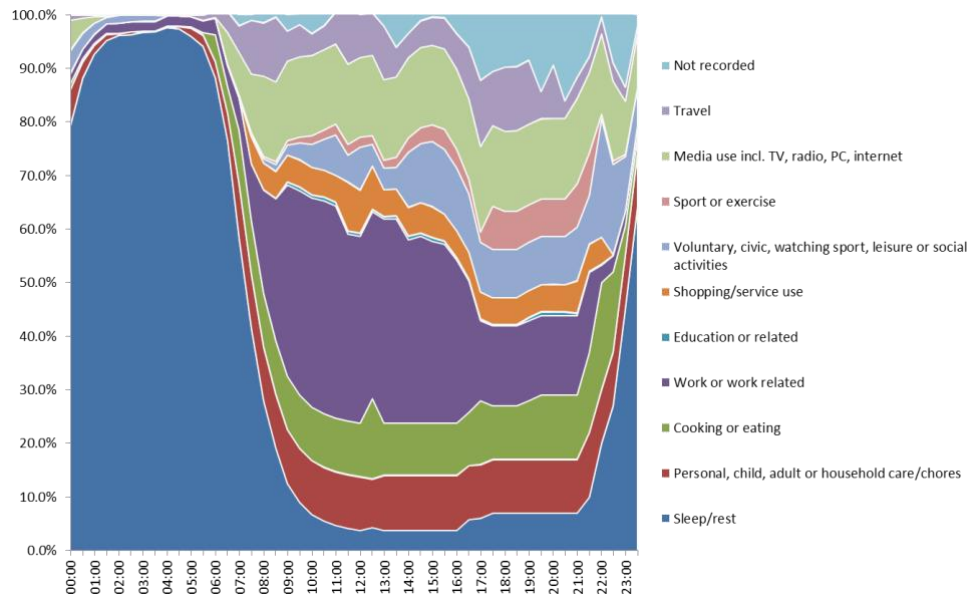
Figure 4. Speculative data for 2050s time use.

5.3.4 Conclusions

For digital interventions aimed at reducing sedentarism for different communities, consideration should be given to:

- The fixity and flexibility of practices in particular places
- The technology and design are part of the way practices are organised in social life
- The range of different kinds of connections between practices
- The importance of history and of the scale of change in the organisation of everyday life

5.4 Keynote lecture: The role of activity monitors in adopting an active and healthy lifestyle

Dr Shailey Minocha, Open University

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The final keynote lecture provided an example of developing and evaluating wearable activity monitors with a community of older people, using multiple methods. The research was initially funded by the Sir Halley Stewart Trust and later by an ESRC Impact Acceleration Award. A key characteristic was the involvement of four kinds of stakeholders from the academic, commercial and voluntary sectors as well as end users (i.e. older people, carers and healthcare professionals).

5.4.1 Background to the work

The work presented built on various projects related to older people undertaken with Age UK Milton Keynes and Carers MK, looking at the alleviation of social isolation and loneliness and the importance of digital skills for this age group. The research was undertaken in the context of the use of wearable devices in healthcare to monitor patients at home, for example, following a particular diet regime, to monitor sleep or the effects of a medication. People could monitor themselves and report back to health professionals or monitoring might be undertaken by carers. The devices could also be used as a 'social prescription', in which a GP, nurse of other health professional could refer patients to a range of local, non-clinical services.

The current research began in 2013 and focused on determining whether those over 55 could manage their health better using commercially available devices. Wider research objectives were to encourage active and healthy ageing, socialisation, self-management of health, self-monitoring, monitoring by carers and social prescribing. The key objectives for this study were:

- To assess whether digital devices that track activity support physical wellbeing and motivate continuous use.
- To understand the concerns and adoption barriers for their widespread use in this population.

5.4.2 Method

The research programme was developed as a collaboration including the following stakeholders:

- Universities: University of Buckingham and University of Oxford (Oxford Institute of Population Ageing)
- Commercial sector: Samsung was the main industrial partner but meetings were also held with other manufacturers, Micor, Activinsights, Activ8rlives and Sentimoto
- Local charities: Age UK Milton Keynes and Carers MK. These charities work with older people, carers and families in the Milton Keynes community and also provide a national perspective
- Participants: people aged over 55 years, carers and healthcare professionals

The research used a wearable activity monitor developed by Samsung, capable of recording various aspects of the individual's behaviour, including the number of steps taken, miles, heart rate and sleep patterns. The monitors had been found to be particularly useful for pre-rehabilitation before surgery.

A variety of methods was employed including surveys, workshops and interviews. Wide preliminary surveys were used including 245 participants over 18 years old and 518 over 55, 74 carers and 82 healthcare professionals to collect data and ask for participation in further interview and workshops.

Four workshops were held in 2016 -2017 for 14 older people who were given activity monitors and five workshops are planned in 2017-2018 with older people, carers, representatives of local charities and manufacturers. Interviews were held with ten people over 55 who had been using a device and were asked to observe changes in their lives since using them.

Exploratory research was also carried out with users. Researchers were aware that self-reported usage would be biased as people are tempted to say they undertake more activity than they actually do. In an attempt to reduce bias they used diaries and regular questionnaires. Rather than undertaking quantitative measurement of behaviour change, they tried to find out about self-awareness – participants learning about themselves, understanding their lifestyle and becoming more reflective.

5.4.3 Findings

Motivation

Reasons for participating and taking up the offer of an activity monitor included:

- Curiosity about the technology and being keen to learn about what these devices could do for them
- Wishing to monitor their activity because they were conscious that they were not as active as they should be
- Wanting to lose weight
- Concern about sleep patterns - some wanted to monitor their sleep patterns and to check their impression that they did not sleep well.

Activation

- Participants' activity levels made them conscious of their life styles – primarily, of how low their levels of physical activity were.
- They formed lunch-time walking groups; they encouraged their friends to buy these devices – so that they could walk together over the weekends and set targets and compared themselves with others.
- Instead of taking the car for the newspaper or minor shopping trips, they started walking; some took up cycling to work instead of the car.
- One of them was able to share the sleep data with her GP – who after initial reluctance accepted the data and looked at it and suggested some tests; this person is enjoying much better sleep and health since her treatment.

Maintenance

After 13 months:

- All participants reported that they had lost weight.
- Two participants felt that they no longer required devices as their exercise patterns had become routine and they knew how much activity they needed to maintain.
- All participants reported improved fitness levels – more active and healthier than they were before they started using the devices.
- For some participants the device had also become a way of socialisation – bringing families closer together (see Example 1).

Example 1: Improved family connectedness

A device was given to one participant, whose daughters then bought their own devices and each day they set targets and compared outcomes with one another. The daughters also knew from the dashboard when their mother was up in the morning and reached out to her for an early morning conversation. As a family, they are feeling better connected and have that sense of presence (by looking at the activity on the dashboard).

Barriers

The workshops and interviews revealed several concerns from participants using these devices, including the marketing of these devices, user manuals, the size of the screen, the small size of dials, the ease of set-up with apps, tablets, phones and charging devices.

There were also a number of wider adoption barriers, the principal ones being costs of the technology and internet access. Other problems included lack of training and support in understanding how the devices work, difficulty in making sense of the recorded data and concerns that the device generated data which may not be reliable and accurate and which may disturb ongoing use of medication and other treatments.

5.4.4 Conclusions and wider impact

The major impact of the work was in raising awareness amongst users that activity monitors can play a role in improving well-being and quality of life in older people. People will differ in how they use them, the length of time they need them and how they engage with supportive strategies, such as joining a walking programme or gym, or other social support through which experiences can be shared.

On the provider side, by involving manufacturers as key stakeholders in the programme, they became aware of the challenges that older people have in using devices, findings that could inform future design of monitors and apps.

Overall the research programme provides an evidence based model for charities and policy makers of a digital intervention that can support active ageing and social prescribing policies for addressing social isolation and loneliness.

5.5 Open Mic session

Prior to the workshop, delegates were invited to volunteer for an open mic session where they could pitch their research. Four delegates did so, and their short pitches are summarised below.

Rosie Riley from the Centre for Environmental Policy at Imperial College London, working within the Air Quality Network, spoke about her research which aims to develop technological interventions to help people change their behaviour to improve air quality. Specifically, as 25% of the pollution in cities comes from transport, Riley is researching the opportunity to change how people use transport and encourage alternate ways of travelling (e.g. walking or cycling).

Daniel Ritman from Living Streets, a UK charity whose aim is to encourage people to walk, spoke about the charity's campaigns aimed at behaviour change. The charity is targeting national and local levels by providing blueprints for change tailored to individual cities. He detailed a school based project where teachers log the method of transport for each child's journey to school.

Xenia Fletcher is working on her PhD project at the University of Basel which looks at using remote communication to coach individuals by encouraging engagement with a physical activity programme. The programme has been adapted for coaching specific groups such as the elderly and those with diabetes. All participants have access to an online platform in order to self-monitor, plan and interact with the trained coach. There will be a 1 year follow up to assess whether leading them through a physical activity programme results in better adherence.

Lisa Eckerstorfer is working on a PhD project at University of Graz in Austria. Eckerstorfer has designed a game app to motivate people to walk more. The game involves setting a goal in the morning for how many steps the individual thinks they will achieve in the day. They do this by 'buying' a tree to plant in a virtual landscape on their mobile phone. The different types of tree have different step 'costs'; smaller trees cost less and more exciting trees cost more. If the user fulfils the goal then the tree stays but if they don't then the tree is replaced with a tree stump. These stay there for 10 days as a reminder of how well the user has reached their daily goals.

6 Discussion group reports

As noted above, participants chose the breakout group they wished to join and membership of the group remained consistent throughout the day. The four groups focused on:

- Older adults
- People with health troubles/disabilities
- The workplace
- Children and young adults

They were asked to focus on different aspects of behaviour change throughout the day. Each stage was interspersed with the keynote talks of the day. The three stages were:

1. Pre-contemplation/contemplation – what makes people consider changing their behaviours?
2. Action – how might they put their plans into action?
3. Maintenance – what makes people maintain their newly adopted habits and stop them from relapsing?

6.1 Overarching themes from breakout groups

Different challenges and opportunities were highlighted in the context of the four different groups. However, common themes were revealed that overlapped many groups. These included understanding:

- *Individual circumstances*: Socioeconomic status, health status, and wider environmental and social contexts are important to consider. Establishing capabilities on an individualised basis rather than grouping people together into large demographics with similar characteristics is essential. This is particularly important for groups where there may be a wide range of capabilities such as the elderly or those with conditions affecting mobility. Setting realistic and achievable goals for the individual is important for all stages of behaviour change and all groups of people.

- *Personal motivation*: Motivation is unique to individuals so understanding what drives people to begin and adhere to new behaviours is essential. For example, whilst some may be motivated by the health and social benefits they realise from being less sedentary, others may be more motivated by a new hobby which they enjoy that reduces sedentary behaviour as a secondary benefit.

- *Social motivation*: The importance of other people as motivators and facilitators was highlighted for all groups. Other people's support and encouragement are thought to play a substantial role in how successful behaviour change interventions will be.

- *Carry over effects:* It was identified that maintenance of healthy behaviours can be motivated by the benefits of leading a healthier life such as feeling better physically and mentally, and/or connecting with others.

- *Clinical context*: Evidence is required for how much a reduction in sedentary behaviour or increase in physical activity is necessary to make positive changes to an individual's health. A generic guideline of 150 minutes of activity a week is not useful for those with differing needs and situations.

- *From research to implementation*: If an intervention is developed as a research programme it is vital to get the community to 'own' it.

The main themes from the discussions within the separate breakout groups are detailed below, and followed in each section by the suggestions related to contemplation, action and maintenance.

6.2 Older adults

Older adults as a demographic can be stratified into many different groups: those with and without frailty or age-related diseases; those over 65; those over 80; males and females. Each group will have different motivations, requirements and starting points.

Generally, as individuals age they become more sedentary. There are many underlying reasons for this and they differ between individuals. For example:

- *Social conditioning*: there is a justification culture around old people becoming more sedentary as they age. This stereotyping of older people can change the expectations of people around them – for example, younger generations are inclined to reinforce the message.

- *Physical/mental decline*: age related disorders may affect mobility through physically making it difficult to move or by reducing cognitive capacity. Many elderly people rely on others to assist in looking after them.

- *Change of interests*: often as a consequence of physical and mental decline older adults may start to disengage with previous more active hobbies and pick up new ones, such as knitting, that are conducive to being sedentary.

The implicit message to older people that sedentary behaviour is negative may be damaging. It may even be counter-productive as sedentary behaviour may be associated with other behaviours that are beneficial, for example, spending time with family at a meal or doing crossword puzzles.

6.2.1   Pre-contemplation/contemplation

- *Entering a new life stage*: Life transitions common in this group include retirement, having assisted care at home, moving into an elderly home and/or becoming grandparents. These might spark new needs, motivations and challenges for changing behaviours.

- *More leisure time*: Typically after retirement people have more time on their hands and therefore may want to engage more in physical activity.

- *Onset of age-related disease*: Declining health may prompt people to become more active, particularly for those conditions with a link or association with sedentary behaviour (e.g. CVD, obesity and diabetes).

- *Changes in environment*: Changes to living environment could facilitate less sedentary behaviour, for example, fewer chairs in elderly homes.

- *Education*: Knowing how much they should be active when considering their personal situation.

6.2.2   Action

- *Social support*: Friends, family and/or role models will help to encourage less sedentary behaviour.

- *Monitor and measuring*: objective measures of duration and patterns of sedentary behaviour, and in what context it is likely to occur, may help to elucidate avenues for interventions.

- *Giving back to the community*: Volunteering or raising money for community causes either by taking part in activities (e.g. walking groups) or where physical activity is a by-product.

- *Rewards and positive framing*: This group may respond better to strategies that are positive rather than negative.

- *Facilitating self-determination*: Encouraging autonomy and competence through supportive interventions is important.

6.2.3   Maintenance

- *Goal setting*: It is important to see improvement and confirm that goals are attainable and achievable, these should be personalised to the individual and their circumstances.

- *Seeing physical/psychological change*: The more people exercise the easier it becomes. Experiencing improvements in overall health and wellbeing may be enough to encourage maintenance.

- *Social connections*: Isolation and loneliness are key issues for the older population so forming friendships through group activities may motivate them to maintain the activity.

6.3 Workplace

Decreasing sedentary behaviour within the workplace is a challenge, in particular for those with desk-based jobs. This is due to several factors including:

- *Concerns about productivity*: Individuals can view any efforts to decrease sedentary behaviour and increase physical activity as a distraction that will take them away from their work. Designing useful interventions that prompt people to move is difficult as they may come at the wrong time or during periods when they are not welcomed (i.e. if you have a deadline the last thing you want is more pressure).

- *Workplace culture and traditions*: Sitting during meetings is often seen as the thing that is done in order to be professional. This means that deviating from this norm may be seen as rude, distracting or odd behaviour. This culture of sitting is detrimental to encouraging individuals to be less sedentary and reinforces associations that when you are at work you should be sitting.

6.3.1 Pre-contemplation/contemplation

- *Supportive culture*: Getting staff at all levels to buy in to the idea of reducing sedentary behaviour in the workplace is useful. Gaining the support of particularly senior members of the organisation may also facilitate culture change.

- *Ambassadors and champions*: Having dedicated individuals to give advice and help champion the initiative, to be a port of call for encouraging people to make changes.

- *Environment*: Having furniture that will facilitate reducing sedentary behaviour (e.g. sit/stand desks, poser tables for meetings and coffee breaks). This will decrease the pressure and responsibility of individuals to make an effort to reduce sedentary behaviour.

- *Education:* Promoting the benefits of reducing sedentary behaviour including feeling better about oneself. Having regular breaks from work is likely to be good for productivity so evidence that this is the case will be valuable.

- *Incentives for workers*: Setting goals and targets for individuals or teams to achieve rewards or access to essential services (e.g. Wi-Fi fuel, where exercise is exchanged for Wi-Fi access).

6.3.2 Action

- *Goal setting and making pledges*: Setting specific, measurable, assignable, realistic, time-related (SMART) goals for individuals and as a wider team.

- *Planning coping strategies*: Considering the barriers and challenges that present themselves and how to cope with them.

- *Internalise change*: Supporting people to think differently about themselves i.e. as active people.

- *Self-monitoring*: Manual monitoring of behaviour is not ideal as it can be biased and burdensome, passive data collection through apps or wearables may be better.

6.3.3 Maintenance

- *Variety of goals*: Having specific, measurable, assignable, realistic and time-related (SMART) internal and external goals for different time periods.

- *A shift from expectation to experiences*: Encouraging the sharing of individual experiences with others in the workplace (e.g. writing blogs). This may also help to normalise setbacks.

- *Making it harder to relapse*: Making public pledges within the workplace to reduce sedentary behaviour may mean individuals are more likely to do so. This may also help reinforce the goal so the individual is less likely to forget.

- *Regular self-monitoring*: Reflecting on what is and is not working as individuals and as teams by monitoring/keeping a diary.

- *Coping plan*: It is almost inevitable that at some point people fall off the wagon, therefore, having a robust coping plan for when things do not go to plan can help.

6.4   People with health troubles/disabilities

This broad group covers individuals with any physical or mental health conditions. Many people have both physical and mental health problems, but there is a real chance that in this case one of these aspects is overlooked. Reducing sedentary behaviour and/or increasing physical activity is likely to lead to improvements in both physical and mental health.

Those with health conditions may already be monitoring their lifestyle, symptoms and/or markers of disease. For example, people managing diabetes often monitor their blood glucose levels and diet. These activities may provide opportunities to reduce sedentary behaviour but it is important to be mindful not to overburden patients with additional targets and monitoring tasks.

It is important to take into account personal circumstances. Within such a broad group of people there will be those with little physical impairment but substantial mental health issues, those who are physically challenged and all combinations between. Understanding the different challenges presented to those with a mental and/or physical condition is important for tailoring interventions. This group of individuals is likely to be taking medication, some of which have side effects including weight changes, fatigue and/or agitation. These factors may make individuals more or less inclined to take up physical activity.

There is a stigma associated with many conditions, particularly mental health issues, which means that individuals may feel isolated from the rest of society. This means they may be less likely to engage in activities out of their comfort zone and with unfamiliar people, often through fear of embarrassment or anxiety about how others view them.

Whilst digital technology may be useful to motivate and monitor, the person factor may be more important for this group than others, therefore, working with skilled professionals may be more valuable. Many feel vulnerable because of their condition so developing relationships and trust between affected individuals and professional staff could combat anxieties and insecurities about becoming more physically active.

6.4.1   Pre-contemplation/contemplation

- *Personal context*: Determining the individual's personal situation beyond their condition (including what medication they need, their support system, and their current level of activity) is essential.

- *Environment*: It may not be necessary to go outside to reduce sedentary behaviour; however, considering the benefits of being in nature and with others, being accompanied – either by professionals or a trusted group - may ease anxiety and help with mobility issues.

- *Timing*: When the individual starts to consider a behaviour change is important: for example, time of year, how their illness progresses etc.

- *Role models*: It is important to see people like them succeeding or achieving goals that they may not necessarily associate with themselves. These can be people in the public eye but also local role models in the same community.

- *Self efficacy*: Encouraging and empowering individuals to take control of their health and change their behaviours.

6.4.2   Action

- *Free schemes*: There are countless free apps and local exercise groups where individuals may participate, which may be a motivating factor, particularly if money is a concern.

- *Incentives*: Schemes to encourage physical activity may give rewards to those completing goals (e.g. access to attractions or a free T-shirt).

- *Socialisation*: Making physical activity a social activity (e.g. local walks or park run) may be helpful, engendering the feeling of being part of a community.

- *Gamification*: Digital games that require movement to play (e.g. Pokémon Go! App where you have to walk around to 'catch' Pokémon in the App). This has the benefit of providing entertainment, interaction and competition between users, as well as physical activity as a by-product.

- *Balance reward and achievability*: Finding an optimal point where reward is substantial enough and impact is achievable.

6.4.3   Maintenance

- *Feedback*: Whether from others or digital technology, having feedback about progress will be important for individuals to stay motivated.
- *Habit formation*: Making reduced sedentary behaviour a part of everyday life.
- *Carry over effects*: making the most of the additional effects for both physical health and mental as well as social life.

6.5   Children and young adults

Children and young adults have grown up with digital technologies as a ubiquitous aspect of daily life and spend a lot of their time watching screen media. The effects of this screen time on social interactions and mental health are not fully understood and many claim that children are addicted to digital technology, in particular their smartphones.

Children, particularly younger ones, are not in control of their own environment and behaviours. When designing interventions, it will be important to consider the influencing roles of parents, schools and carers. Even when interventions appear to be successful in increasing physical activity, such as the Daily Mile Foundation (https://thedailymile.co.uk/), some schools will not commit to it because of the time taken.

Schools and parents may also mediate how children use digital technology. In particular, if parents and teachers are trying to reduce the amount of time the children spend connected, then designing interventions using digital means is likely to cause tensions between competing forces. Therefore, striking a balance between digital interventions and trying to get children to depend on digital media less is difficult.

Children use digital media and smartphones in ways that differ from what adults or designers expect, participants in this breakout group noted that: 'they scroll past loads of stuff'; 'they tend not to use phones to talk to people'; 'now they create stories using their phones and videos'.

In Canada, there is a lot of investment in the built environment but sedentary behaviour continues to get worse. It will be necessary to think about social engineering – how to get people interested or change attitudes. For example, 'a few years ago it was unthinkable to spend a day inside' but this seems now to have changed.

6.5.1   Pre-contemplation/contemplation

- *What young people care about and value*: Understanding what is important for children and what motivates them will help to design interventions they will interact with. For example, children might like walking to school because it gives time to talk to their friends.
- *Social influences*: Children are more likely to be influenced by their peers so if some of their friends or role models are taking part in something they may want to also.
- *How they want to engage with tech*: Understanding how and what they want to get out of using technology by getting ideas from them. How can we leverage that to change their behaviour?
- *Gamification*: encouraging movement through digital games.

6.5.2   Action

- *Control:* controls can be in the form of adults' own belief and behaviours but also personal circumstances and what can be afforded.
- *Environment*: The environment needs to facilitate the action, e.g. safe cycle route and bike sheds. Physical activity interventions could be built into school curriculums.
- *Intention of digital intervention*: Creating interventions based on how adults want children to interact with technology may not work. Understanding how children use technology already could help to design interventions.
- *Engaging children in creating interventions*: Encouraging children to come up with their own solutions will engender engagement. It was suggested that schools should work as a group to programme their own game that involved physical activity.
- *Physical activity as a side effect of other rewards or goals*: Interventions to encourage other activities that are pleasurable where the side benefit is decreased sedentary behaviour (e.g. going to meet a friend to do an activity).

6.5.3 Maintenance

- *Activities of everyday living:* The physical activity should be enjoyable acts that fit into their everyday lives.

- *Less screen time*: Creating barriers to screen time, stopping notifications coming through, may encourage physical activity.

- *Feedback on progress*: Feeding back what the child has achieved in something that seems more impressive (e.g. number of steps to climb Everest) rather than just number of steps.

- *Need to recognise the social side*: Physical activity would not be an end in itself – for example, pairing up young people who want to run with older people who can't get to the shops. In this, the physical activity is embedded in the community element.

7 Conclusions and next steps

The workshop highlighted both significant challenges and also many opportunities to reduce sedentary behaviours across the four communities discussed. Organising the workshop in terms of the "stages of change" model provided a valuable structure but also created challenges since many issues and opportunities were not easily framed in terms of stages; nevertheless, important insights relating to the different target user populations were identified. Many of these are summarised in Section 5.1 as overarching themes.

Keynote speakers highlighted different aspects of the generic insight that reducing sedentary behaviour (which is related to but not identical to increasing physical activity) has benefits to the individual, the population, and society at large. They also made it clear that the problem is complex; that improving health outcomes (even health outcomes that are directly linked to sedentary behaviours) is not a simple and direct consequence of reducing sedentary behaviour, and that there are many measures of sedentarism (just as there are of physical activity) associated with a range of potential health benefits.

Speakers also presented different theoretical and methodological approaches. Clearly, framing the problem as individual behaviour change is helpful but not sufficient; such a perspective can take account of individual differences (in knowledge, motivations, circumstances, needs), but it cannot take adequate account of the social, physical or organisational contexts that shape behaviour. For this, different perspectives are needed; social practice theory is one example. The approach of taking a community-based focus in discussion groups helped to bring out some of the opportunities and challenges of working with different kinds of community, as summarised above.

Looking forward, insights from the workshop will hopefully lay foundations for future work addressing user needs for reducing sedentary behaviours across different kinds of community, and these themes will be further developed as the programme proceeds.

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