Seniors USP: Understanding Sedentary Patterns

Sedentary Behaviour Intervention Translation Manual

Supported by MRC LLHW [MR/K025023/1]

CONTENTS:

PURPOSE

This intervention translation manual aims to help researchers and practitioners tailor and target their sedentary behaviour interventions to modifiable determinants or preferences and needs of the older person. The information in this translation manual has been drawn from the work of the Seniors USP study. Briefly, this study measured the objective (and self-reported for validation purposes) sedentary behaviour for one week of 750 old adults. The older adults were all members of three cohorts (drawn from two longitudinal studies, the Lothian Birth Cohort 1936[1] and the West of Scotland Twenty-07 study[2]), with well characterised information on a range of cognitive, physical and social determinants, extending back to 2004 and 1987. A sub-sample of 44 older adults who had participated in the project (purposively selected to be spread across cohort, gender, socio-economic position and time spent sitting) were interviewed about their sedentary behaviour. Finally, a different group of 22 older adults had their objective and self-reported sedentary measured for 14 days to assess the sensitivity to change of the measures.

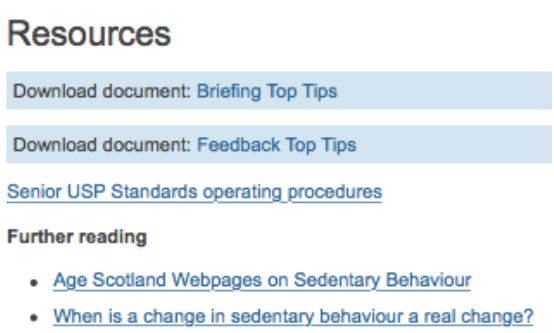
Further information on the study can be found at: https://www.gcu.ac.uk/seniorsusp/

This intervention translation manual is a working document. It is based on the published output from the Seniors USP study, along with unpublished observations as appropriate. The publications on which this manual is currently based are listed in the **Data Sources**.

Developing and evaluating complex interventions should be undertaken in a systematic manner, with attention paid to underlying theory. The following guidance on intervention development may be useful:

- MRC Guidelines on Developing and Evaluating complex interventions[3]
- 6SQUID: Six steps in quality intervention development[4]

Online resources are available to view on the Seniors USP Website:



INTRODUCTION

The Seniors USP Study

This intervention manual provides information from the Seniors USP study (understanding sedentary patterns), on potential opportunities for intervention to reduce sitting time, or increase breaks in sitting time in older adults. The Team (Appendix) was supported by a Dissemination Advisory Group (Appendix). Collectively, we aimed to produce definitive data on: the determinants of sedentary behaviour; the health/cognitive outcomes of long-term inactivity; the views of older people on becoming less sedentary; and the potential benefits to an older person of sitting less or breaking periods of sedentary behaviour.

Why do we want to 'target' sedentary behaviour reduction in older people?

Sedentary time is a modifiable determinant of poor health, associated with an increased risk of mortality and cardiometabolic disease in older people[5,6]. As we age, reducing sedentary time may be an important first step in adopting and maintaining a more active lifestyle[5]. There are many associations between sedentary behaviour and both physical and mental health outcomes, although there is insufficient longitudinal evidence to determine a dose–response relationship or a threshold for clinically relevant risk[6]. There are also differences emerging between associations seen with self-report and those with objective monitoring[7]. Some sedentary activities may well be cognitively enhancing so there is still much to learn about how we might best intervene[6].

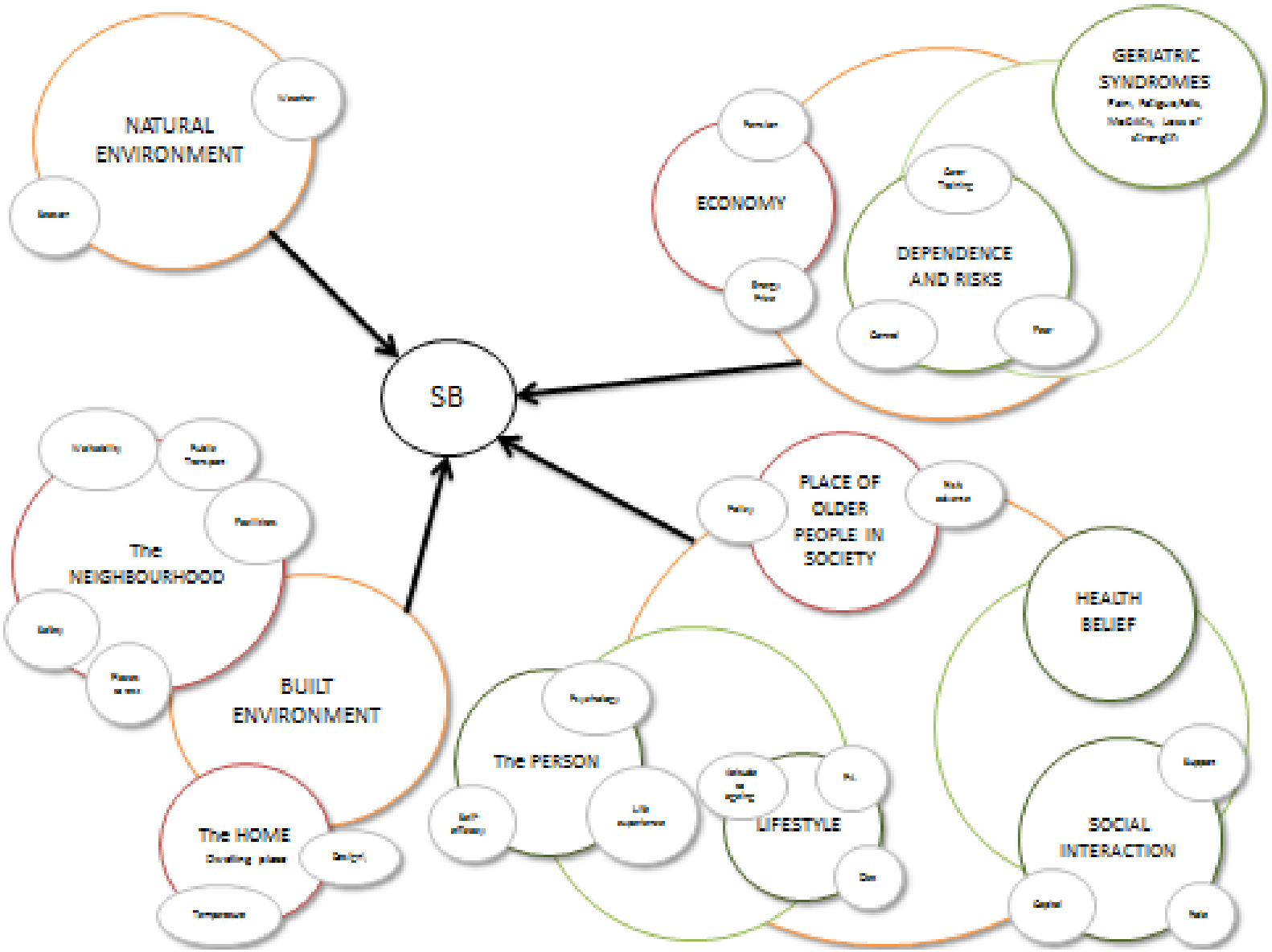
Complexity in Sedentary Behaviour

Sedentary behaviour is complex, encompassing physical, cultural and social elements. Sedentary behaviour is defined in research literature as a physical behaviour carried out while awake (i.e. not sleep) in a sitting or reclining posture, with an energy expenditure of less than 1.5 METs (1 MET is the energy you expend at rest)[7]. But sedentary behaviour is both abundant and pervasive; older adults, for example, sat an average 10 hours per day in this study. As such, it is a difficult thing to recall accurately. Indeed many of the older adults in this study, when interviewed about their sedentary behaviour, did not view themselves primarily as 'sitting' or 'not sitting', but as 'busy' or 'not busy'. In other words, for the individual, it was what they were doing while sedentary which characterised that behaviour, and not the physical act of sitting.

A recent European Joint Programme Initiative project (**DEDIPAC**, determinants of diet and physical activity, www.dedipac.eu) conducted systematic reviews of published literature and an expert-led consensus process to identify and describe the contexts in which sedentary behaviour occurs across the life course[8]. The systematic literature reviews showed that currently there is a real dearth of information about the determinants (a factor which decisively affects the nature or outcome) of sedentary behaviour in older adults[9]. The little evidence available provides more information about who is sedentary rather than why they are sitting[10]. The resulting **Systems of Sedentary Behaviour (SOS) framework**[11] (figure 1) demonstrates the complex web of influence within which sedentary behaviour occurs. The project identified 190 potential determinants of sedentary behaviour and organised them into a system based framework. This model shows that sedentary behaviour results from the interaction of six main clusters of determinants:

- the health and health system;
- the socio-cultural context;
- the built and natural environment;
- the psychology of individual and organisations;
- the political and economical environment;
- the settings in which an individual lives, works or studies.

Figure 1: The SOS framework



What should be taken from this is that sedentary behaviour is complex, and one explanation is unlikely to cover all types of sedentary behaviour for all people. Additionally, no single study will be able to measure all the necessary information to effectively explain sedentary behaviour.

In the Seniors USP study, we concentrated on older adults. The previous measures collected by the two studies, although extensive, constrained the determinants of sedentary behavior which we could explore.

Identifying positive associations between determinants and sedentary behavior implies that intervening to change that behaviour may have a positive influence on reducing sedentary behavior. Null findings, the lack of an identifiable statistical association between a determinant and sedentary behavior, should be treated with a level of caution. They may represent true a lack of meaningful association with sedentary behavior on which to intervene, or they may mask an association through low power, homogenous populations or an inability to deal with complexity of interaction between behaviours. This intervention manual covers information from the Seniors USP study, on potential opportunities for intervention.

OPPORTUNITIES FOR INTERVENTION

What determinants (characteristics) should we consider and when?

In order to identify the best people to target for future SB interventions, and the aspects which might be best suited to change, we need an idea of determinants of SB and whether certain people are more prone to more prolonged sitting. SB is a complex problem and direct and simple associations are hard to find and might even be misleading. We have more work to do to integrate this complexity. However, we can recommend certain points for action.

Greater social disadvantage means people sit MORE (once they have retired)

*Seniors USP Source(s): Published article [2] Shaw et al. BMJOpen 2017;*7:e016436

Socio economic position (SEP) measures included prospective measures of social class, income, educational qualifications and parental social class and contemporaneous measures of area deprivation. **Among retired participants**, for most cohort and SEP combinations, greater social disadvantage was associated with increased sedentary time. For example, in the Twenty-07 1930s cohort those most deprived on the Carstairs measure spent 6.5% more of their waking time sedentary than the least deprived. **However, for employed people** the relationship between SEP and sedentary behaviour was much weaker. For example, in terms of social class differences, among the retired the most disadvantaged spent 5.7% more waking time sedentary whereas among the employed there was effectively no difference (-0.5%).

Older people who provide care sit LESS

Seniors USP Source(s): Published article [3] Shaw et al. Int J Environ Res Public Health. 2017;4;14(6).

Results from multivariable regression analyses indicated that providing care or volunteering was associated with reduced sedentary time in retired participants in all cohorts.

Fear of crime and perceived absence of services nearby INCREASED sitting time

Seniors USP Source(s): Published article [3] Shaw et al. Int J Environ Res Public Health. 2017;4;14(6).

Fear of crime and perceived absence of services were associated with increased sedentary time for retired 1950s cohort members. Higher crime rates were associated with increased sedentary time in all cohorts but this was not significant after adjustment for socio-demographic characteristics.

No obvious relationship between SB and other neighbourhood or social participation markers

Seniors USP Source(s): Published article [3] Shaw et al. Int J Environ Res Public Health. 2017;4;14(6).

Most other neighbourhood and social participation measures showed no association with sedentary time. These included: objective and subjective neighbourhood measures such as natural space, and social cohesion. Other determinants included measures of social participation such as social support and social group membership.

No obvious relationship between lifetime cognitive ability and SB

Seniors USP Source(s): Published article [4] Čukić I et al. Psychol Aging (in press).

We find no evidence that sedentary behaviour in older age, when assessed using objective methods, is associated with measures of cognitive ability at different points in the life course, including cognitive change from childhood to older age.

No obvious relationship between biological age and SB

Seniors USP Source(s): Published article [5] Gale C et al. Clin Epigen. 2018; 10:4.

We find no convincing evidence that biological age, as indexed by extrinsic or intrinsic epigenetic age acceleration, was associated with objectively measured sedentary or walking behavior.

Other Determinants

We have a selection of papers submitted and this document will be updated as they are published *[9-13]*.

What do older people think about sitting and when we could best intervene?

Seniors USP Source(s): Published article [6] Palmer V et al. The Gerontologist (in press).

We interviewed 44 older adults to gain their views on sedentary behavior. Older adults described many different leisure time, household, transport and occupational sitting and non-sitting activities. Leisure time sitting in the home (e.g., watching TV) was most common, but many non-sitting activities, including 'pottering' doing household chores, also took place at home. Other people and access to leisure facilities were associated with lower sedentary behaviour. The distinction between being busy/not busy was more important to most participants than sitting/not sitting, and informed their judgements about high-value 'purposeful' (social, cognitively active, restorative) sitting and low-value 'passive' sitting. Declining physical function contributed to temporal sitting patterns that did not vary much from day-to-day.

Implications: Sitting is associated with cognitive, social and/or restorative benefits, embedded within older adults' daily routines, and therefore difficult to change. Useful strategies include supporting older adults to engage with other people and local facilities outside the home, and break up periods of passive sitting at home.

Tips to consider when designing your intervention

DO….

- Explain that not all sitting is bad, and that time to rest and enjoy ourselves is important
- Explain what sedentary behaviour is and is not – not everyone will internalize the behavior as physical (being in a seated posture), but may identify SB through the tasks they are doing whilst seated.
- Discuss assets the older people already have for breaking up long periods of sitting.

DON'T…

- Intervene on times that are valuable to older people
- Demonize sitting!

EVALUATING YOUR STUDY

Seniors USP Source(s): Published article [1] Dall et al. BMJ Open 2017;7:e013844

It is clear that the best way to measure sedentary behavior is using an **objective monitor**. Use of an objective measure of sedentary behavior, for example the activPAL3 which is acknowledged as the gold standard method for assessment of postural sitting, will enhance the rigor and reliability of the study, and should be used if at all possible. **Self-report methods** of measuring sedentary behavior, such as questionnaires, are subject to bias such as recall error. This is especially the case for sedentary behavior which is a ubiquitous and pervasive behavior, and which might not always be perceived as that by individuals being measured. We conducted a systematic literature review of the accuracy and responsiveness of 37 self-report questionnaires for adults and older adults. Self-reported sedentary behavior was inaccurate, and most tools that are currently used for population surveillance of SB systematically underestimate the amount of SB by 2 to 4 hours per day.

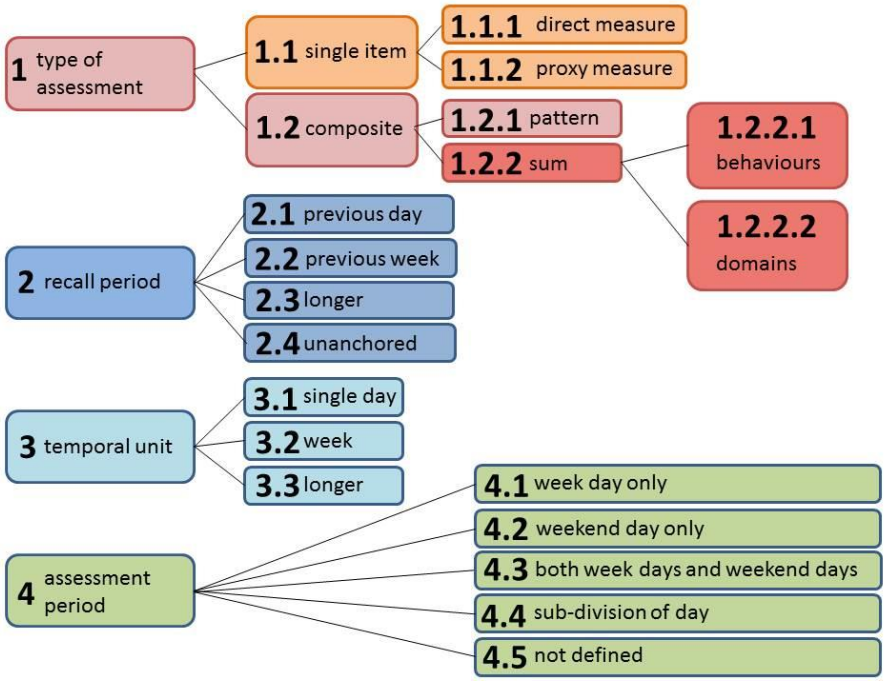
Recommendations for collecting self-reported sedentary behavior data

Seniors USP Source(s): Published article [1] Dall et al. BMJ Open 2017;7:e013844

There are many different tools available to measure sedentary behaviour using self-report methods. We conducted a systematic survey of the literature, identifying 37 distinct self-report tools designed for use in a general population of adults or older adults. The choice of tool to use can therefore be bewildering, and most validation or comparison articles cover only a few tools, making evidence-based selection difficult. We created a taxonomy – the TAxonomy of Self-reported Sedentary behaviour Tools (TASST) - providing a structure to describe and compare self-reported tools in the future. The taxonomy (figure 2), has four domains; type of assessment (what aspect of siting is considered), recall period (the time period over which a person is asked to recall their sitting), temporal unit (the time unit that a person is asked to express their sitting), and assessment period (describing any specific restrictions placed on the recall period e.g. weekend days).

Figure 2: The TAxonomy of Self-reported Sedentary behaviour Tools (TASST).

Seniors USP Source(s): Published article [1] Dall et al. BMJ Open 2017;7:e013844



Self-report vs objective monitoring

Seniors USP Source(s): Published article [7] Chastin et al. Int J Behav Nutr Phys Act. 2018; 15(1):21

We used the TASST taxonomy as a basis to assess the validity and responsiveness of 18 self-report measures (6 types of assessment across 3 recall periods) against objectively measured sedentary behavior, allowing systematic inferences to be made. All **self-report measures showed poor accuracy** compared with the objective measure of sedentary time, with very wide limits of agreement and poor precision (**random error > 2.5 hours**). Most tools under-reported total sedentary time and demonstrated low correlations with objective data. The type of assessment used by the tool, whether direct, proxy, or a composite measure, influenced the measurement characteristics. Proxy measures (TV time) and single item direct measures using a visual analogue scale to assess the proportion of the day spent sitting, showed the best combination of precision and data loss. The recall period (e.g. previous week) had little influence on measurement characteristics.

Choice of self-report tool depends on the **research context, design and question**. Choice can be guided by this systematic comparative validation and, in the case of **population surveillance**, it is recommended to use a **visual analog scale** and a **7 day recall period**. Comparison between studies and improving population estimates of average sedentary time, is possible with the **comparative correction factors** provided.

Such methods should only be used if objective monitoring is not possible.

Responsiveness of objective sedentary behavior data

Seniors USP Source(s): [8] Abstract - Dontje ML et al. J Aging Phys Act. 2016; 24Suppl:S25

To assess and interpret changes in sedentary behavior, over time or as a result of an intervention, measures that are reliable and responsive to change are vital. We collected objective sedentary behavior data from a separate group of 22 older adults, who wore an activPAL3 monitor for 14 days, allowing us to assess. This research is not yet published, and will be added when available *[9].*

Tips for collecting good quality objective sedentary behavior data

In this study we successfully collected objective sedentary behaviour data from over 700 older people who agreed to take part in the study, using the activPAL3 monitor. This research is not yet published, and will be added when available *[10]*.

DATA SOURCES: Seniors USP published articles

The information in this intervention translation manual is predominantly drawn from the following data sources:

1. Dall PM, Coulter EH, Fitzsimons CF, Skelton DA, Chastin SFM, on behalf of the Seniors USP Team. The TAxonomy of Self-reported Sedentary behaviour Tools (TASST) framework for development, comparison and evaluation of self-report tools: content analysis and systematic review. *BMJ Open* 2017;7:e013844.
2. Shaw RJ, Čukić I, Deary IJ, Gale CR, Chastin SFM, Dall PM, Skelton DA, Der G on behalf of the Seniors USP Team. Relationships between socioeconomic position and objectively measured sedentary behaviour in older adults. *BMJ Open*. 2017;7:e016436. doi:10.1136/bmjopen-2017-016436.
3. Shaw RJ, Čukić I, Deary IJ, Gale CR, Chastin SFM, Dall PM, Dontje ML, Skelton DA, Macdonald L, Der G, on behalf of the Seniors USP Team. The influence of neighbourhoods and the social environment on sedentary behaviour in older adults in three prospective studies. *Int J Environ Res Public Health*. 2017 May 24;14(6). pii: E557. doi: 10.3390/ijerph14060557.
4. **IN PRESS:** Čukić I, Shaw R, Der G, Chastin SFM, Dontje M, Gill J, Starr JM, Skelton DA, Dall PM, Gale CR, Deary IJ on behalf of the Seniors USP Team. Lifetime cognitive ability and objectively measured sedentary behaviour in older age: Evidence from three cohorts. *Psychol Aging*. 2018
5. Gale CR, Marioni RE, Čukić I, Chastin SFM, Dall PM, Dontje ML, Skelton DA, Deary IJ, on behalf of the Seniors USP Team. The epigenetic clock and objectively measured sedentary and walking behaviour in older adults: the Lothian Birth Cohort 1936. *Clin Epigen.* 2018 Jan 8; 10:4 doi: 10.1186/s13148-017-0438-z.
6. **IN PRESS:** Palmer VJ, Gray CM Fitzsimons C, Mutrie N, Wyke S, Deary IJ, Der G, Chastin SFM, Skelton DA, on behalf of the Seniors USP Team. What do older people do when sitting and why? Implications for decreasing sedentary behaviour. *The Gerontologist. 2018*
7. Chastin SFM, Dontje ML, Skelton DA, Čukić I, Shaw RJ, Gill JMR, Greig CA, Gale CR, Deary IJ, Der G, Dall PM; Seniors USP Team. Systematic comparative validation of self-report measures of sedentary time against an objective measure of postural sitting (activPAL). *Int J Behav Nutr Phys Act*. 2018 Feb 26;15(1):21. doi: 10.1186/s12966-018-0652-x.
8. Dontje ML, Dall PM, Skelton DA, Chastin SFM—on behalf of the Seniors USP Team. When is a Change in Sedentary Behaviour a Real Change? *J Aging Phys Act.* 2016; 24 Suppl: S25.
9. **SUBMITTED**: Dontje ML, Dall PM, Skelton DA, Gill JMR, Chastin SFM on behalf of the Seniors USP Team. Reliability, minimal detectable change and responsiveness to change: indicators to select the best method to measure sedentary behaviour in different study designs.
10. **SUBMITTED**: Dall PM, Skelton DA, Dontje ML, Coulter EH, Stewart S, Cox SR, Shaw RJ, Čukić I, Fitzsimons CF, Greig CA, Granat MH, Der G, Deary IJ, Chastin SFM on behalf of the Seniors USP Team. Characteristics of a protocol to collect objective physical activity/sedentary behaviour data in a large study: Seniors USP (understanding sedentary patterns).
11. **SUBMITTED**: Čukić I, Gale CR, Chastin SFM, Dall PM, Dontje ML, Skelton DA, Deary IJ, on behalf of the Seniors USP Team. Cross-sectional associations between personality traits and objectively-measured physical activity and sedentary behaviour in older age: the Lothian Birth Cohort 1936.
12. **SUBMITTED**: Okely JA, Čukić I, Shaw RJ, Chastin SFM, Dall PM, Deary IJ, Der G, Dontje ML, Skelton DA, Gale CR, on behalf of the Seniors USP team. Positive and negative well-being and objectively measured sedentary behaviour in older adults: Evidence from three cohorts.
13. **SUBMITTED**: Gale CR, Čukić I, Chastin SFM, Dall PM, Dontje ML, Skelton DA, Deary IJ on behalf of the Seniors USP Team. Attitudes to ageing and objectively-measured sedentary and walking behaviour in older people: the Lothian Birth Cohort 1936.

REFERENCES

1. Deary IJ, Gow AJ, Pattie A, et al. Cohort Profile: The Lothian Birth Cohorts of 1921 and 1936. *Int J Epidemiol.* 2012;41(6):1576-1584.
2. Benzeval M, Der G, Ellaway A, et al. Cohort Profile: West of Scotland Twenty-07 Study: Health in the Community. *Int J Epidemiol*. 2009;38(5):1215-1223.
3. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ*. 2008;337:a1655.
4. Wight D, Wimbush E, Jepson R, Doi L. Six steps in quality intervention development (6SQuID). *J Epidemiol Community Health*. 2015:jech-2015.
5. Dogra S, Ashe MC, Biddle SJH, et al. Sedentary Time in Older Men and Women: An International Consensus Statement and Research Priorities. *Br J Sports Med* 2017; pii: bjsports-2016-097209. doi: 10.1136/bjsports-2016-097209.
6. Copeland JL, Ashe MC, Biddle SJ, et al Sedentary Time in Older Adults: A Critical Review of Measurement, Associations with Health, and Interventions. *Br J Sports Med* 2017; pii: bjsports-2016-097210. doi: 10.1136/bjsports-2016-097210.
7. Tremblay MS, Aubert S, Barnes JD, et al Sedentary Behavior Research Network (SBRN)–Terminology Consensus Project process and outcome. *Int J Behav Nutr Phys Act*, 2017; *14*(1), 75.
8. Lakerveld J, van der Ploeg HP, Kroeze W, et al Towards the integration and development of a cross-European research network and infrastructure: the DEterminants of DIet and Physical ACtivity (DEDIPAC) Knowledge Hub. *Int J Behav Nutr Phys Act*, 2014; *11*(1), 143. https://doi.org/10.1186/s12966-014-0143-7
9. Chastin SFM, Buck C, Freiberger E, et al. Systematic literature review of determinants of sedentary behaviour in older adults: a DEDIPAC study. *Int J Behav Nutr Phys Act*, 2015; *12*, 127–138. https://doi.org/10.1186/s12966-015-0292-3
10. Brug J, Chinapaw M. Determinants of engaging in sedentary behavior across the lifespan; lessons learned from two systematic reviews conducted within DEDIPAC. *Int J Behav Nutr Phys Act*, 2015; *12*(1), 134. https://doi.org/10.1186/s12966-015-0293-2
11. Chastin SFM, De Craemer M, Lien N, The SOS-framework (Systems of Sedentary behaviours): an international transdisciplinary consensus framework for the study of determinants, research priorities and policy on sedentary behaviour across the life course: a DEDIPAC-study. *Int J Behav Nutr Phys Act*, 2016; *13*(1), 83. https://doi.org/10.1186/s12966-016-0409-3

APPENDICES

Members of the Seniors USP Team:

Dawn A Skelton (PI), Sebastien Chastin, Simon Cox, Elaine Coulter, Iva Čukić, Philippa Dall, Ian Deary, Geoff Der, Manon Dontje, Claire Fitzsimons, Catharine Gale, Jason Gill, Malcolm Granat, Cindy Gray, Carolyn Greig, Elaine Hindle, Karen Laird, Gillian Mead, Nanette Mutrie, Victoria Palmer, Ratko Radakovic, Naveed Sattar, Richard Shaw, John Starr, Sally Stewart, Sally Wyke.

Funding Acknowledgment:

MRC Reference: MR/K025023/1

The Seniors USP (understanding sedentary patterns) project is funded by the UK Medical Research Council (MRC) as part of the Lifelong Health and Wellbeing Initiative (LLHW) [MR/K025023/1]. LBC1936 data collection are supported by the Disconnected Mind project (funded by Age UK and MRC [Mr/M01311/1 and G1001245/96077]) and undertaken within the University of Edinburgh Centre for Cognitive Ageing and Cognitive Epidemiology (funded by the BBSRC and MRC as part of the LLHW [MR/K026992/1]). The West of Scotland Twenty-07 Study was funded by the MRC and the data were originally collected by the MRC Social and Public Health Sciences Unit (MC_A540_53462).

Cohorts Acknowledgments:

The Lothian Birth Cohort 1936 (LBC1936) thank the cohort members, investigators, research associates and team members. We also thank the radiographers at the Brain Research Imaging Centre, and the research nurses and Genetics Core staff at the Wellcome Trust Clinical Research Facility. LBC1936 data collection are supported by the Disconnected Mind project (funded by Age UK and MRC [Mr/M01311/1 and G1001245/96077]) and undertaken within the University of Edinburgh Centre for Cognitive Ageing and Cognitive Epidemiology (funded by the BBSRC and MRC as part of the LLHW [MR/K026992/1]).

The West of Scotland Twenty-07 Study was funded by the MRC and the data were originally collected by the MRC Social and Public Health Sciences Unit (MC_A540_53462). We thank all of the cohort participants, and the survey staff and research nurses who carried it out. The data are employed here with the permission of the Twenty-07 Steering Committee.

Members of the Dissemination Advisory Group:

Contact	Organisation
Dawn Skelton (Chair) Professor of Ageing and Health **Philippa Dall** Senior Researcher	Glasgow Caledonian University
Gerry Power Programme Director for Co-production	Long Term Conditions Alliance Scotland
Bob Laventure Consultant in Active Ageing	Later Life Training
Edith MacIntosh Rehabilitation Consultant	Care Inspectorate
Jenny Ackland Consultant Allied Health Professional	Age Scotland
Agnes McGroarty Vice Chair Scottish Seniors Alliance	Scottish Seniors Alliance
Niall Taylor Strategy Manager, Active Scotland Division, Scottish Government	Scottish Government
Daniel MacIntyre Population Health Services Manager	Public Health England
Katharine Ross Workforce Consultant	Scottish Care
Jenny Milne Employment and Health Team NHS GGC	Healthy Working Lives, GGC
Tessa Strain PhD Student	Ex ScotCen

Contributors (early input into group):

Mark McGreachie (Scottish Government Joint Improvement Team)
Catrina Henderson (Healthy Working Lives, NHS GG&C)
Diane Woods (Scottish Social Services Council)
George Chalmers (Scottish Seniors Alliance)
Irene Oldfather **(**Long Term Conditions Alliance Scotland)
Anne Simpson (National Osteoporosis Society)
Angela Ingram **(**Healthy Working Lives, NHS GGC)
Judith Midgley (Coalition of Care and Support Providers in Scotland)
David Rennie (Scottish Care)
Gail Mountain (University of Sheffield)
Bette Locke (NHS Forth Valley Trust)
Stephen Hinchcliffe (ScotCen)
Anna Terje (ScotCen)
Joanne Hudson (Swansea University)
Diarmid Campbell Jack (ScotCen)

With thanks to the participants of the two cohorts.