Institution: University of Bedfordshire

Unit of Assessment: 24

Title of case study: Changing sedentary behaviour, inactivity, health and well-being through influencing policy, training and practice.

Period when the underpinning research was undertaken: 2014-2020

Details of staff conducting the underpinning research from the submitting unit:

Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Professor Angel Chater	Professor in Health Psychology and Behaviour Change; Director of Institute for Sport and Physical Activity Research (ISPAR); Lead of ISPAR's Centre for Health, Well-being and Behaviour Change	Feb 2005-Aug 2012 and April 2016-present
Dr Daniel Bailey	Senior Lecturer in Health, Nutrition and Exercise; Lead for Sedentary Behaviour & Health Research Group	September 2012-January 2020
Dr Lindsey Smith	Senior Lecturer in Sport and Physical Education	2015-present

Period when the claimed impact occurred: 2015-2020

Is this case study continued from a case study submitted in 2014? No

1. Summary of the impact

Sedentary behaviour and physical inactivity are distinct factors associated with an increased risk of obesity, type 2 diabetes, cardiovascular disease, poor mental health and premature death. Traditionally, guidelines, policy, training and practice have promoted the engagement of 150 minutes of moderate to vigorous physical activity (MVPA) per week, yet this does not address sedentary behaviour, and is not always achievable for large sections of the population. Research from this team has led to:

- ***revisions to and the development of international and national guidelines*** e.g. by the World Health Organization, Qatari public health, and the British Psychological Society, with recommendations specifically to limit sedentary behaviour;
- ***professional bodies that aim to change behaviour identifying barriers to decreasing sedentariness in education, training and practice*** e.g. the Swiss Tropical and Public Health Institute; University College London's Centre for Behaviour Change, numerous Active Partnerships;
- ***changes in occupational health and public health practices, and health outcomes*** for desk-based employees and those in healthcare settings;
- ***widening societal awareness*** e.g. engaging with politicians, Sport England, the Richmond Group of Charities, the media and the public.

2. Underpinning research

Sedentary behaviour is defined as any waking behaviour characterised by an energy expenditure less than or equal to 1.5 metabolic equivalents, while in a sitting, reclining or lying posture. Sport England classifies adults as physically inactive when they accumulate less than 30 minutes of MVPA per week. Individuals can meet the recommended guidelines for physical activity (150 minutes of MVPA per week) and still be considered as engaging in high levels of sedentary behaviour. Advances in technology and changes in the way we work have contributed to high levels of sedentary behaviour in modern society, particularly in office workers. Sedentary behaviour increases the risk of many adverse health outcomes (e.g. diabetes and cardiovascular disease) and thus represents a major public health concern. The interdisciplinary team within the Institute for Sport and Physical Activity Research's (ISPAR) *'Sedentary Behaviour and Health Research Group'* (led by Bailey) and *'Centre for Health, Well-being and Behaviour Change'* (led by Chater) have changed scientific understanding of sedentary behaviour, its effects on health and how to support behaviour change. The team have made the distinction between physical inactivity and sedentary behaviour clearer; produced novel evidence of its effect on health and disease; and have extended knowledge to enhance the design and implementation of interventions for sedentary behaviour and physical inactivity.

Sedentary behaviour and health

A meta-analysis [3.1] of 448,285 participants confirmed that higher levels of total daily sitting time were associated with an increased risk of cardiovascular disease and diabetes, independent of physical activity levels. These findings emphasise an important distinction between sedentary behaviour and physical activity, which is often misunderstood and has limited guidance. Supported by funding from Heart Research UK (£86,434), the Royal Society (£12,745) and the Society for Endocrinology (£10,000), the team has confirmed acute cardiometabolic and psychological benefits of breaking up sedentary time with short (2-5 minutes), frequent (every 20-60 minutes) bouts of light, moderate and high-intensity physical activity in laboratory conditions [3.2]. This includes beneficial effects on postprandial glucose, insulin and lipid levels (predictors of obesity, cardiovascular disease, and type 2 diabetes) in various populations including healthy adults, office workers, adults classified as overweight or obese, and those with a spinal cord injury [3.2]. With the Heart Research UK funding, individuals with a spinal cord injury showed improvements in cardiometabolic health and mood over a single day following 2 minutes of moderate-intensity arm ergometer physical activity every 20 minutes. Further research, in collaboration with international experts in orthopaedics and sports medicine, confirmed acute improvements in cardiometabolic health and cognitive function in response to breaking up sitting with moderate-intensity walking breaks in Qatari females [3.3], a population with high prevalence rates of obesity and diabetes.

Behaviour change interventions for sedentary behaviour and inactivity

For optimal health outcomes, people need to be supported to change their behaviour. The team have used the Behaviour Change Wheel (BCW), a theoretical framework developed by University College London (UCL) Centre for Behaviour Change, where Chater is an Associate, to understand barriers and enablers to breaking up and limiting sedentary behaviour and physical inactivity [3.4]. At the hub of the BCW is the COM-B model, which considers factors that may influence Behaviour (B) related to people's Capability (C) (e.g. their knowledge of sitting and ability to regulate their behaviour), Opportunity (O) (linked to their physical and social environments) and Motivation (M) (e.g. their self-beliefs, attitudes, emotion and habit) [3.4]. The team, with others, have used this model to create a *COM-B behavioural diagnosis* of factors to target and behaviour change techniques (BCTs) to use in theoretically-driven interventions for a variety of populations. Through a systematic review, the team have identified optimal BCTs to be used in sedentary behaviour interventions to improve cardiometabolic health in the workplace [3.5]. In another systematic review and meta-analysis of 26 randomised-controlled trials, the team have identified the most effective BCTs to be used in interventions aimed at increasing physical activity and reducing sedentary behaviour in healthy inactive adults [3.6]. This research has informed a series of real-world interventions, that use an intervention development approach developed by Chater entitled IDDEAS (Intervention Design, Delivery, Evaluation and Adoption System). Interventions using this approach combine the BCW, COM-B analysis, BCTs and motivational interviewing to create clear protocols and logic models to enable replication; and have enhanced population health and well-being.

3. References to the research

3.1 **Bailey, D. P.,** Hewson, D. J., Champion, R. B. & Sayegh, S. M. (2019). Sitting time and risk of cardiovascular disease and diabetes: a systematic review and meta-analysis. *American Journal of Preventative Medicine, 57*(3), 408-416. [cited 24 times]

3.2 **Bailey, D. P.,** & Locke, C. D. (2015). Breaking up prolonged sitting with light-intensity walking improves postprandial glycemia, but breaking up sitting with standing does not. *Journal of Science and Medicine in Sport*, *18*(3), 294-298. [cited 290 times]

3.3 Chrismas, B. C., Taylor, L., Cherif, A., Sayegh, S., Rizk, N. M., El-Gamal, A., Allenjawi, S. H. & **Bailey, D. P.** (2019). Postprandial insulin and triglyceride concentrations are suppressed in response to breaking up prolonged sitting in Qatari females. *Frontiers in Physiology, 10*(706). [cited 4 times]

3.4 Ojo, S. O., **Bailey, D. P.,** Brierley, M. L., Hewson, D. J., & **Chater, A. M.** (2019). Breaking barriers: using the behavior change wheel to develop a tailored intervention to overcome workplace inhibitors to breaking up sitting time. *BMC Public Health*, *19*(1), 1-17. [cited 11 times]

3.5 Brierley, M. L., **Chater, A. M., Smith, L. R.,** & **Bailey, D. P.** (2019). The effectiveness of sedentary behaviour reduction workplace interventions on cardiometabolic risk markers: a systematic review. *Sports Medicine*, *49*(11), 1739–1767. [cited 9 times]

3.6 Howlett, N., Trivedi, D., Troop, N. A., & **Chater, A. M.** (2019). Are physical activity interventions for healthy inactive adults effective in promoting behavior change and maintenance, and which behavior change techniques are effective? A systematic review and meta-analysis. *Translational Behavioral Medicine, 9*(1), 147-157. [cited 96 times]

4. Details of impact

The interdisciplinary collaboration between sport and exercise science (Bailey, Smith), behavioural science and health psychology (Chater) has led to a unique use of mixed methods producing highly cited research, used to change or develop national and international guidelines, policies, training and practice. It has informed impactful interventions to reduce sedentary behaviour and physical inactivity, benefiting physical and psychological health, and has raised public awareness.

Informing, developing and changing public health guidelines and policies

The updated World Health Organization global guidelines on Physical Activity and Sedentary Behaviour [5.1] cites Bailey's research [3.3], recommending that: *"Adults should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits".* Bailey was an invited contributor for the 2nd edition of the National Physical Activity Guidelines for Qatar [5.2], which have changed focus to now include specific recommendations to limit and break up sedentary behaviour. The research that demonstrated that breaking up prolonged sitting with light walking can significantly improve postprandial glucose [3.2] has been highly impactful, cited 290 times and included as evidence in the first global expert statement [5.3] on reducing sedentary behaviour in the workplace (cited 376 times). Prior to this expert statement, which recommends that office workers should aim to spend 50% of their working hours standing or engaging in light activity [5.3], no guidance existed on limiting workplace sedentary behaviour to promote occupational health.

The British Psychological Society's (BPS) COVID-19 Behavioural Science and Disease Prevention Taskforce have used the team's research [3.4-6] to produce guidance for policy makers and practitioners on ways to mitigate longer-term public health risks associated with sedentary behaviour and inactivity [5.4]. To increase the awareness of the guidance, Chater has presented to Directors of Public Health, Cabinet members, commissioners and public health teams through invited events, such as Public Health England's Lunch and Learn and the Behavioural Science and Public Health Network events hosted by Health Education England. This guidance is part of a series that offers a COM-B behavioural diagnosis and intervention roadmap to support public health behaviour change.

Changing professional education, training and practice

The team's research has heavily informed a community-based programme to reduce inactivity for those at risk of cardiovascular disease and mental health concerns entitled 'Active Herts' [5.5]. After hearing Chater speak about her IDDEAS approach and systematic review [3.6], the physical activity lead for Hertfordshire County Council invited Chater to adapt the Active Herts programme. This was to ensure that it included the behaviour change techniques (BCTs) identified [3.6] as most effective at increasing physical activity behaviour (e.g. action planning, graded tasks, self-reward [3.6]). The 12-month Active Herts programme involved one-to-one consultations with registered exercise professionals (REPs), the use of a behaviour change booklet, adapted by Chater in collaboration with University of Hertfordshire colleague (Howlett), and access to exercise sessions in the local area. To ensure BCTs were used appropriately, Chater provided ongoing training to the REPs who were delivering the Active Herts programme, supported by funding from Herts Sports Partnership (£36,400: Dec 2016). The research-informed training changed the REPs practice to use motivational interviewing to perform a COM-B behavioural diagnosis of barriers and enablers to physical activity [5.5]. This training was considered instrumental in the programme's success, enhancing care given to over 4000 people. The Active Herts lead stated: *"Get this right, and the project has every chance of success!"* when promoting the use of Chater's behaviour change training to other Active Partnerships [5.5; slide 36]. Active Herts is a case study used by UCL's Centre for Behaviour Change in their professional training, and in guidance on how to use the Behaviour Change Wheel published by Public Health England [5.6; page 24]. Active Herts has been included as a case study on the Local Government Association (LGA) website [5.7] as an example of best practice for physical activity programmes to improve the lives of local communities.

The team's research has further informed BPS guidance on *'Psychological perspectives on obesity: Addressing policy, practice and research priorities'*, highlighting the importance of reducing sedentary behaviour alongside increasing physical activity, and ensuring that service providers receive adequate training to enable effective behaviour change. Following a description of Active Herts, the guidance recommends that: *"A nationwide training and supervision programme in the provision of psychologically informed behavioural support for weight management should be made available to all those working with people to help them to lose weight and maintain weight loss.*" [5.4 (part 2); page 41].

In 2018, Chater delivered a keynote and facilitated training for the Swiss Tropical and Public Health Institute as part of the *Healthy Life* project. The invitation came after hearing Chater speak about her research on behaviour change interventions for inactive adults [3.6]. The international partners identified this research as the most valuable synthesis of evidence to provide as an accessible resource to address national health objectives related to inactivity and behaviour change. Chater spoke at a two-day event to over 100 policy makers and public health practitioners responsible for reducing the burden of non-communicable diseases in Moldova. She presented considerations for behaviour change interventions based on her IDDEAS approach and facilitated an interactive workshop with public health officials on the use of the Behaviour Change Wheel and COM-B model, which led to practical outputs in the form of regional behaviour change implementation plans. The partners later developed and launched a Health Promotion and Behaviour Change course, stating: *"Building on the conference insights provided by Dr. Angel Chater and on the results of a needs assessment of the National Agency for Public Health in Moldova, which showed the need for additional courses for professionals, the Healthy Life project facilitated the development of a practical training course on Health Promotion and Behaviour change for Moldovan public health specialists"* [5.8].

Changing occupational health and public health outcomes

Supported by a donation of sit-stand desks from Ergotron (£12,400), a number of interventions with desk-based office workers were developed, delivered and evaluated. Employees at Bedfordshire Police, the University of Bedfordshire, and Bedford Borough Council were supported to reduce their workplace sitting, leading to improvements in productivity, health and well-being. Based on the team's research, Beat the Seat Ltd were keen to refine and evaluate their corporate wellness programme that is delivered nationally. Evaluations of 89 office workers at Kier Group plc Head Office showed significant reductions in prolonged sitting (39 minutes per work shift), increases in physical activity (12 minutes per shift) and reductions in waist circumference, with 100% agreement from participants that the intervention did not hamper productivity. Beat the Seat Ltd continue to use the behaviour change strategies in their corporate wellness programme [5.9]. The team's research also led to an event hosted by SHINE (a charity who represent individuals with Spina Bifida and Hydrocephalus), where over 100 people engaged in educational and practical activities aimed at reducing sedentary behaviour and physical inactivity.

The Active Herts programme led to significant reductions in inactivity, and improved health outcomes such as weight loss and enhanced mental health [5.5]. Its success has helped to secure funding to develop and roll out a number of legacy services including 'Active Watford & Three Rivers' [5.5 (part 2)] funded by Watford Football Club. Alison Goodchild who leads the service said: *"Using these strategies during consultations with clients and through the behaviour change booklet, which is based on their research has helped to deliver a service that meets the needs of our clients. This has had a significant positive impact on service delivery and client engagement."* The Active Watford & Three Rivers service has reached over 700 adults, reducing inactivity, and improving life satisfaction, happiness, and anxiety.

The Cardiology Department at Bedfordshire Hospitals NHS Foundation Trust have also changed the care given to their patients. This department, who receives 500 patient referrals annually, has changed clinical practice to deliver BCTs that encourage patients to reduce and break up their sedentary time [5.10]. Conference organisers, such as those from the BPS Division of Health Psychology (2020/2021) have scheduled hourly 'stretch and screen break' practices; and the Bedfordshire, Cambridgeshire and Hertfordshire Police Tri-Force Annual Well-being Conference 2019 embraced a standing portion to their day-long event. Bedfordshire police have embedded strategies provided by the team (e.g. regularly scanning QR codes situated across Head Quarters) to promote activity breaks, benefiting occupational health. The University of Bedfordshire have redesigned their estates to embrace the ISPAR movement #ActiveCampus. With funding from the Vice Chancellors office, sit-stand and treadmill desk workstations are now located across the campus, and staff embrace standing classrooms and standing meetings.

Widening societal awareness

In addition to impacting on science, guidelines, policy formation, professional practice, clinical care and population health, the team have created a number of pathways to impact. Bailey and Chater's research has been discussed in numerous media interviews [5.11] including on BBC World Service (150 million weekly listeners), BBC News (picked up by over 300 outlets), BBC Radio 4 (11 million listeners), BBC

Wales, BBC World Business, BBC Three Counties Radio (119,000 listeners), and Radio Slovenia Channel 2; through published media e.g. Daily Express (313,000 daily copies), Reuters Health (33 million monthly visitors), Employee Benefits, Coach Mag, the Telegraph (363,000 daily copies); and on primetime television on the BBC One *'The truth about improving your mental health'* show, (filmed 2020), which featured the Active Herts/Watford & Three Rivers programmes and Chater demonstrating to presenter Tanya Byron how to use the COM-B model. This saw an increase in referrals after it was aired. Chater has shared evidence on behaviour change as an invited speaker in an All Party Parliamentary Group meeting on 'Understanding Obesity' in the House of Commons (2018), at the Cheltenham Science Festival (2019) and in roles e.g. as an expert advisor for Sport England/Richmond Group of Charities 'We are Undefeatable' campaign, promoting physical activity for long-term conditions.

5. Sources to corroborate the impact

5.1 World Health Organization (2020). *WHO Guidelines on Physical Activity and Sedentary Behaviour* https://www.who.int/publications/i/item/9789240015128

5.2 Qatar National Physical Activity Guidelines (*in press*) and testimonial from Professor Marco Cardinale, member of technical advisory group *[provided as PDF]*

5.3 Buckley, J. P., Hedge, A., Yates, T., Copeland, R. J., Loosemore, M., Hamer, M., Bradley, G. & Dunstan, D. W. (2015). The sedentary office: an expert statement on the growing case for change towards better health and productivity. *British Journal of Sports Medicine, 49*(21): 1357-1362. https://bjsm.bmj.com/content/bjsports/49/21/1357.full.pdf

5.4 British Psychological Society Guidance documents:

1) British Psychological Society. (2020). *COVID-19 Public Health Road Map: Sedentary Behaviour.* Leicester: BPS. https://www.bps.org.uk/sites/www.bps.org.uk/files/Policy/Policy%20-%20Files/Covid-19%20Public%20Health%20Road%20Map%20-%20Sedentary%20behaviour.pdf
2) British Psychological Society (2019). *Psychological perspectives on obesity: Addressing policy, practice and research priorities*. Leicester: BPS https://www.bps.org.uk/sites/www.bps.org.uk/files/Policy/Policy%20-%20Files/Psychological%20Perspectives%20on%20Obesity%20-%20Addressing%20Policy%2C%20Practice%2C%20and%20Research%20Priorities.pdf

5.5 Presentation and Testimonial from 'Active Herts' and 'Active Herts & Three Rivers' leads:

1) Slides by Adan Freeman, former Active Herts Programme Manager. (2018). *Active Herts: A behaviour change approach to physical activity.* https://www.activeessex.org/wp-content/uploads/2018/09/Active-Herts-Workshop-Presentation.pdf
2) Testimonial from Alison Goodchild, Active Herts Registered Exercise Professional and Active Watford & Three Rivers programme lead *[provided as PDF]*

5.6 West, R., Michie, S., Atkins, L., Chadwick, P. & Lorencatto, F. (2019). *Achieving Behaviour Change: A guide for local government and partners.* London: Public Health England. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/875385/PHEBI_Achieving_Behaviour_Change_Local_Government.pdf

5.7 Local Government Association (2019): *Case studies* https://local.gov.uk/active-herts

5.8 Testimonial from Florence Sécula, Swiss Tropical and Public Health Institute 'Healthy Life Project' Lead *[provided as PDF]* and Sécula, F., Erismann, S., Cerniciuc, C., Chater, A., Shabab, L., Glen, F., Curteanu, A., Serbulenco, A., Silitrari, N., Demiscan, D. & Prytherch, H. (2020). Evidence-based policy making for health promotion to reduce the burden of non-communicable diseases in Moldova. *BMC Proceedings, 14*(1), 1-10.

5.9 Case study from Beat the Seat Ltd Head of Operations: http://beattheseat.co.uk/case-studies/

5.10 Testimonial from Julie Walker, Cardiac Rehabilitation Team Lead, Bedfordshire Hospitals NHS Foundation Trust *[provided as PDF]*

5.11 Selected media mentions:

1) Radio Slovenia Channel 2: https://val202.rtvslo.si/2017/02/ambulanta-202-67/
2) Employee Benefits: https://www.employeebenefits.co.uk/daniel-bailey-office-employee-health/
3) Reuters Health: http://uk.mobile.reuters.com/article/idUKKCN10N21R
4) BBC News https://www.bbc.co.uk/news/health-49795808
5) BBC One, The Truth about Improving Your Mental Health, 20th Jan 2021, 9pm, [from 48 mins] https://www.bbc.co.uk/iplayer/episode/m000rhg8/the-truth-about-improving-your-mental-health