Institution:
University of Cambridge

Unit of Assessment:
UoA2

Title of case study:
The epidemiology and promotion of physical activity

1. Summary of the impact (indicative maximum 100 words)

Physical inactivity is strongly related to coronary heart disease, type 2 diabetes, osteoporosis and some cancers. Research at the University of Cambridge has focused on the development and validation of methods for assessing physical activity in population studies and on the application of these methods to quantify the type and dose of physical activity that is important for different health outcomes. This research has contributed to development of public health guidelines. Research into the determinants of activity levels in different population groups and the evaluation of interventions aimed at individuals and the wider population has contributed to NICE guidance on different forms of interventions to increase physical activity.

2. Underpinning research (indicative maximum 500 words)

The MRC Epidemiology Unit has a long standing programme in the development and validation of methods for assessing physical activity in population studies led by Professor Wareham (since 1993) and, Drs Ekelund and Brage (since 2003). These methods include subjective and objective approaches which can be used in different settings, different population groups and for different purposes. These purposes include the descriptive epidemiology of physical activity (1), aetiological investigation of the association between activity and health outcomes, assessment of activity as part of risk stratification (2) and measurement of activity change in intervention studies. Between 1993 and 2010, the Unit has developed and validated a suite of instruments that are fit for purpose, has published validation studies (e.g. 1,2) and made the methods widely available by leading the development in 2011 of an on-line Diet and Physical Activity (DAPA) toolkit which enables researchers to identify the most suitable instrument for their particular study and to access all the necessary elements of the measurement instrument to allow them to use it independently. The Unit has contributed to understanding temporal trends in physical activity in the United Kingdom (3) and geographical variations in prevalence of inactivity globally. It has assessed the association in large-scale cohort studies between overall physical activity, different domains and different intensities on chronic disease outcomes including all-cause mortality, cardiovascular disease incidence (4), type 2 diabetes and cancers. Research using objective measurement of physical activity in cohort studies of adults and children has contributed to understanding of the direction and quantification of the relationship between different intensities of physical activity, sedentary behaviour and obesity and metabolic disease (5,6).

These results have contributed to recommendations for physical activity in the UK including recent refinements to focus not only on achieving 5 x 30 minute bouts of moderate to vigorous activity per week, but also to aim to increase overall activity through whatever means and to diminish sedentary behaviour. The studies have also informed the target of trials to evaluate individualistic approaches to promoting physical activity. The limited effectiveness of such individual approaches has led to investment in research on understanding the wider population determinants of physical activity, the effectiveness of planned and natural experimental interventions that impact on physical activity levels (7) and the estimation of the long term health benefits of changing activity (8). This research has been led by the Cambridge UKCRC-funded Centre of Public Health Research Excellence on Diet and Activity (CEDAR).

3. References to the research (indicative maximum of six references)

1. Ekelund, U., H. Sepp, S. Brage, W. Becker, R. Jakes, M. Hennings and N. J. Wareham (2006). "Criterion-related validity of the last 7-day, short form of the International Physical Activity Questionnaire in Swedish adults." Public Health Nutr **9**(2): 258-65. **PMID:** 16571181
2. Wareham, N. J., R. W. Jakes, K. L. Rennie, J. Schuit, J. Mitchell, S. Hennings and N. E. Day (2003). "Validity and repeatability of a simple index derived from the short physical activity questionnaire used in the European Prospective Investigation into Cancer and

Nutrition (EPIC) study." Public Health Nutr **6**(4): 407-13. **PMID:** 12795830
3. Stamatakis, E., U. Ekelund and N. J. Wareham (2007). "Temporal trends in physical activity in England: the Health Survey for England 1991 to 2004." Prev Med 45(6): 416-23. PMID: 17316777
4. Khaw, K. T., R. Jakes, S. Bingham, A. Welch, R. Luben, N. Day and N. Wareham (2006). "Work and leisure time physical activity assessed using a simple, pragmatic, validated questionnaire and incident cardiovascular disease and all-cause mortality in men and women: The European Prospective Investigation into Cancer in Norfolk prospective population study." Int J Epidemiol **35**(4): 1034-43. **PMID:** 16709620
5. Ekelund, U., S. Brage, H. Besson, S. Sharp and N. J. Wareham (2008). "Time spent being sedentary and weight gain in healthy adults: reverse or bidirectional causality?" Am J Clin Nutr **88**(3): 612-7. **PMID:** 18779275
6. Steele RM, van Sluijs EM, Cassidy A, Griffin SJ, Ekelund U (2009).Targeting sedentary time or moderate- and vigorous-intensity activity: independent relations with adiposity in a population-based sample of 10-y-old British children. Am J Clin Nutr. **90** (5): 1185-92. **PMID**: 19776141
7. Yang L, Sahlqvist S, McMinn A, Griffin SJ, Ogilvie D (2010). BMJ. **341**:c5293 **PMID** 20959282
8. Jarrett J, Woodcock J, Griffiths UK, Chalabi Z, Edwards P, Roberts I, Haines A (2012). Effect of increasing active travel in urban England and Wales on costs to the National Health Service. Lancet. **379**(9832):2198-205. **PMID** 22682466

4. Details of the impact (indicative maximum 750 words)

The establishment of a suite of instruments by the MRC Epidemiology Unit between 1993 and 2010 for measuring physical activity in different population groups and settings and the production of an on-line DAPA toolkit led by the Unit for the MRC Population Health Sciences Research Network in 2011 to facilitate methodological knowledge exchange (1) has promoted the use of measurement tools that are fit-for-purpose. For example, in its report on Measuring diet and physical activity in weight management programme, the National Obesity Observatory cites the DAPA toolkit as a source of information on questionnaires (2). It also cites validation work on the International Physical Activity Questionnaire (IPAQ) (Ekelund et al, Public Health Nutrition 2006), a widely used instrument for assessing the prevalence of inactivity which was used recently in an analysis of global physical activity levels.

Although instruments such as IPAQ are useful for surveillance, there was a need for a simple quick assessment tool that can be used in primary care to identify inactive individuals as part of the assessment of risk. The short version of the EPIC-Europe questionnaire that was validated by comparison to repeated measures of objectively assessed energy expenditure (Wareham et al, Public Health Nutrition 2003) has formed the basis of the General Practice Physical Activity Questionnaire (GPPAQ) recommended by the Department of Health (3) as a screening tool to be used in routine general practice to provide a simple physical activity index. The validity of the instrument provides one justification for its use, but the Department of Health report also cites the evidence from the Unit's research showing that this simple tool independently predicts events such as cardiovascular incidence and mortality (Khaw et al, Int J Epidemiol 2006).

The MRC Epidemiology Unit's research on physical activity, sedentary behaviour and different outcomes has contributed to the recent revision of the UK Chief Medical Officers' recommendation on physical activity (4) with the work in adults (Ekelund et al, Am J Clin Nutr 2008) and children (Steele et al, Am J Clin Nutr 2009) being cited in the review of the current scientific evidence relating sedentary behaviour to obesity (5) which was undertaken as part of the work leading to the formulation of the new guidelines which place a greater emphasis on the avoidance of prolonged periods of sedentary time.

A number of pieces of NICE Public Health guidance have emerged over the past 5 years aimed at describing the effectiveness of different approaches to promoting physical activity. The NICE Public Health Guidance (6) on physical activity and the environment cites the Unit's analysis of temporal trends in physical activity in the United Kingdom (Stamatakis et al, 2007). The more

recent guidance on promoting walking and cycling (7) cites the Unit's systematic review of interventions to promote cycling (Yang et al, BMJ 2010) in the supporting evidence for the guidance including Expert Testimony Paper 5 -Programmes to promote cycling. The recommendations for future research in this guidance draw heaving on Expert Testimony Paper 3 which cites multiple publications from CEDAR to demonstrate an approach to the evaluation of infrastructure developments which have the potential to integrated walking and cycling into people's daily routines. This includes the evaluation of interventions such as CONNECT2, a SUSTRANS project funded by the Big Lottery Fund to transform everyday travel for local people in communities across the UK, creating new bridges and crossings to overcome busy roads, rivers and railways, and linking these to networks of walking and cycling routes, making it easier for millions of people to walk and cycle for everyday journeys (8).

Evaluations of this type are able to demonstrate impact of overall and domain-specific physical activity levels but are unlikely to be able to demonstrate an impact on health outcomes, which need to be modelled rather than directly observed (Jarrett et al, Lancet 2012). The papers describing the results of these models have contributed to analyses not only of the benefits of promoting physical activity on health outcomes but are cited in more extensive analyses of the health effects of climate change (9) since physical activity, transportation, energy use, pollution and climate change are closely linked issues.

5. Sources to corroborate the impact (indicative maximum of 10 references)

1. Diet and physical activity toolkit. The Medical Research Council. http://www.dapa-toolkit.mrc.ac.uk/ (Last accessed 5th September 2013).
2. Measuring diet and physical activity in weight management programmes. National Obesity Observatory. http://www.noo.org.uk/uploads/doc/vid_10414_Assessment%20Tools%20160311%20FINAL%20MG.pdf
3. General Practice Physical Activity Questionnaire. Department of Health. https://www.gov.uk/government/publications/general-practice-physical-activity-questionnaire-gppaq
4. UK Physical Activity Guidelines. Department of Health. Sedentary Behaviour and Obesity. Review of the current scientific evidence. Department of Health. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/213745/dh_128225.pdf
5. Physical activity and the Environment. NICE. http://www.nice.org.uk/nicemedia/live/11917/38983/38983.pdf
6. Walking and cycling: local measures to promote walking and cycling as forms of travel or recreation. NICE. http://www.nice.org.uk/nicemedia/live/13428/58979/58979.pdf and http://www.nice.org.uk/nicemedia/live/13428/58977/58977.pdf
7. Working with the research community. SUSTRANS. http://www.sustrans.org.uk/our-services/who-we-work/researchers
8. Health effects of climate change in the UK 2012. Public Health England. http://www.hpa.org.uk/hecc2012