

A nation of couch potatoes? Physical activity, sedentary behaviour and health in Ireland

Summary of the impact

Effective national level health guidelines and policy must be based on accurate information about how physical activity and sedentary behaviour contribute to health. Research undertaken at the University of Limerick has utilised technology to accurately quantify levels of physical activity and sedentary behaviours, and has related these measures to both health indices and behavioural determinants. Publications based on these findings have been widely reported in the national media and referenced at government level. Members of UL's Centre of Physical Activity and Health Research have contributed to the National Guidelines on Physical Activity for Ireland, Ireland's National Physical Activity Plan and Ireland's 2014 Report Card on Physical Activity in Children and Youth. The centre is currently taking a leading role in the Determinants of Diet and Physical Activity Choice (DEDIPAC) Knowledge Hub (www.dedipac.eu).

Underpinning research

Insufficient physical activity is the fourth leading independent risk factor for global mortality, responsible for an estimated 9% of European deaths. In Europe, lack of physical activity is responsible for an estimated 6-10% of coronary heart disease, type 2 diabetes, breast and colon cancer; and for 20.3% of risk of Alzheimer's disease. High levels of sedentary behaviour (time spent sitting/lying down) has a negative effect on our health and can be linked to obesity, type 2 diabetes and cardiovascular disease rates in adult populations.

Two studies recently published by Deirdre Harrington, Kieran Dowd and Alan Donnelly added significantly to current knowledge regarding effective measurement of physical activity and sedentary behaviour in females. The 2011 study (Ref 1) aimed to determine the accuracy of the activPAL™ physical activity logger in a group of young females (15-

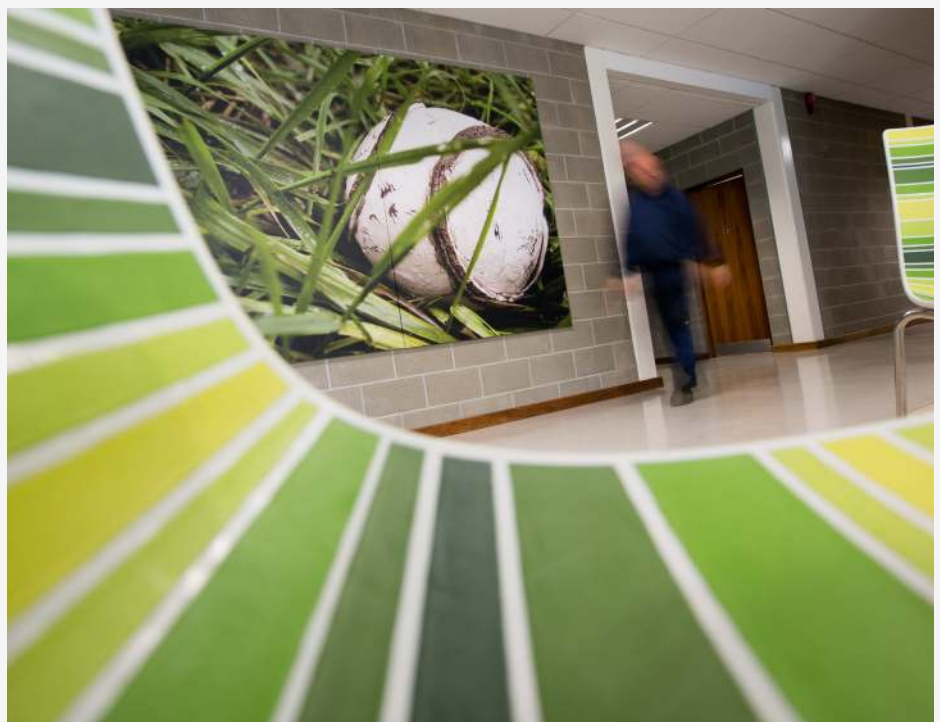
25yrs). Results showed that the activPAL's in-built equation significantly underestimated energy expenditure at high intensities. The study recommended development of a new activPAL equation including a variety of speeds and activities; the 2012 study (Ref 2) delivered the formula and established the activPAL as a valid, objective measurement tool for measuring both physical activity and sedentary behaviours. Our group subsequently used these findings to study physical activity and sedentary behaviours patterns in adolescent girls.

UL's research was unique in developing valid techniques to quantify sedentary time. The group developed methodologies that enabled efficient interpretation of sedentary behaviour information, using data from the activPAL device. As a result, we were able to classify total time spent sitting/lying, standing, and in moderate to vigorous physical activity over the full 24-hour day. Quantification of sedentary behaviour patterns (Ref 3) indicated that adolescent females are either

sitting or lying down on average 19 hours per day (65% of their waking day and 79% of their total day). The study highlighted school as a particularly sedentary setting for adolescent females, and recommended interventions to alter this.

A study by Dowd and Donnelly expanded on the previous analysis, isolating light intensity physical activity (separating sitting from standing time). The study found for the first time that light intensity physical activity and breaks in sitting/lying time were associated with lower body fat (Ref 4). These findings have attracted funding from the Irish Heart Foundation to build on the existing research. UL is now collaborating with UCC in a Health Research Board-funded project measuring sedentary and health behaviours of 1,500 over-50's in Mitchelstown, County Cork.

Without knowing which determinants of behaviour to target and modify, it is impossible to plan health interventions in school,



This research is supported by

community or the workplace. Our current research focuses on further understanding determinants of physical activity and sedentary behaviour. A recent publication by Burns, Murphy and Mac Donncha (Ref 5) targeted adolescent females as a population at risk for low levels of activity. Their research used previously identified stages of change regarding physical activity: precontemplation, contemplation, decision, action, and maintenance. Results indicated that females in senior cycle at school and in earlier stages of change reported a significantly less positive physical activity correlate profile than females in junior cycle and in later stages. The study identified the most important predictors of females' stage of change: perceived competence, peer social support, and intention to be physically active. These findings have direct relevance to the design of interventions.

Our group emphasises translating research into forms relevant to the public. In 2008 Mac Donncha sat on the national committee that published "The National Guidelines on Physical Activity for Ireland" (<http://health.gov.ie/healthy-ireland/physical-activity/recommended-guidelines/>) and contributed to the award-winning "Get Ireland Active" website www.getirelandactive.ie, targeting individuals and promoters of physical activity. The committee subsequently prepared a physical activity plan for Ireland; their 2012 draft plan has underpinned the "National Physical Activity Plan" prepared by the Department of Health. This plan is a key pillar of the "Healthy Ireland" national framework, and will be implemented on a national basis (<http://health.gov.ie/healthy-ireland/physical-activity/>). In 2014, Donnelly and Dowd were members of a group representing Ireland in a consortium of 15 nations; each was tasked with preparing a Report Card on Physical Activity in Children and Youth to grade their country's levels of physical activity participation, and to provide a template for longitudinal evaluation (Ref 6).

References to the research

1. Harrington, D. M., Welk, G. J. and Donnelly, A. E. (2011) 'Validation of MET estimates and step measurement using the ActivPAL physical activity logger',



Journal of Sports Sciences, 29(6), 627-633.

DOI:10.1080/02640414.2010.549499, IF: 2.095, Cites: 28 (WOS)

2. Dowd, K. P., Harrington, D. M. and Donnelly, A. E. (2012) 'Criterion and Concurrent Validity of the activPAL™ Professional Physical Activity Monitor in Adolescent Females', PLoS One, 7(10), e47633. DOI:10.1371/journal.pone.0047633, 2012, IF: 3.73, Cites: 9 (WOS)
3. Harrington, D. M., Dowd, K. P., Bourke, A. K. and Donnelly, A. E. (2011) 'Cross-sectional analysis of levels and patterns of objectively measured sedentary time in adolescent females', International Journal of Behavioural Nutrition and Physical Activity, 8(1), 120-127. DOI:10.1186/1479-5868-8-120, IF: 3.68, Cites: 15 (WOS)
4. Dowd, K. P., Harrington, D. M., Hanigan, A. and Donnelly, A. E. (2014) 'Light-intensity physical activity is associated with adiposity in adolescent females', Medicine and Science in Sports and Exercise, 46(12), 2295-2300. DOI:10.1249/MSS.0000000000000357, IF: 4.48, Cites: 1 (WOS)
5. Burns, C., Murphy, J. J. and Mac Donncha, C. (2014) 'Year in school and physical activity stage of change as dis-

criminators of variation in the physical activity correlate profile of adolescent females', Journal of Physical Activity and Health, 11(4), 721-728.

DOI:10.1123/jpah.2011-0353, IF: 1.854, Cites: 0 (WOS)

6. Harrington, D. M., Belton, S., Copping, T., Cullen, M., Donnelly, A., Dowd, K., Keating, T., Layte, R., Murphy, M. and Murphy, N. (2014) 'Results From Ireland's 2014 Report Card on Physical Activity in Children and Youth', Journal of Physical Activity and Health, (11), S63-8.

Details of the impact

Among other impacts, our research has influenced national and European policy documents and defined and informed healthy behaviour in Ireland.

Dr Mac Donncha has a long involvement with the HSE relating to the promotion of physical activity (Source 5). In 2008 a National Physical Activity Guidelines Steering Group was established to disseminate national physical activity guidelines. In 2009 these guidelines were published (Source 6); in parallel, the Get Ireland Active website was redeveloped as the dissemination platform (<http://www.getirelandactive.ie/>) (Source 7). The website's guidelines are widely disseminated.



inated by the Department of Health and the HSE. In 2009 the existing committee was tasked to prepare a draft document that could be presented to key national policy makers to inform preparation of a National Physical Activity Plan (Source 8). This plan is now a central pillar of the "Healthy Ireland" framework for improving the health and wellbeing of people in Ireland (<http://health.gov.ie/healthy-ireland/>). Physical activity guidelines, a dedicated dissemination platform, and a national physical activity plan comprise a sea change for promotion of physical activity in Ireland. The importance of physical inactivity as a risk factor for health is now enshrined in national policy; UL has made a significant contribution to this landmark achievement.

In 2008, the research team influenced the strategic research agenda of the EU Joint Programme Initiative "A healthy diet for a healthy life", advocating for additional emphasis on physical activity and sedentary behaviour. In 2014, "Determinants of Diet and Physical Activity Choice" (DEDIPAC) commenced; both Donnelly and Mac Donncha were appointed as Work Package and Tasks leads. The primary impact of DEDIPAC is the development of a knowledge hub regarding determinants of dietary, physical activity and sedentary behaviours – an infrastructure for future monitoring, research, and translation of research to policy and practice. DEDIPAC's key strength is its ability to co-ordinate research and harmonise methodologies across Europe in order to answer key societal questions more comprehensively and effectively.

In pursuit of this aim, UL have led the development of a compendium of European datasets relevant to determinants of diet, physical activity and sedentary behaviour. This compendium is currently being used by researchers across Europe (n=50) to exploit existing datasets through data harmonisation and subsequent secondary analysis, leading to greater understanding of factors which promote/inhibit physical activity and sedentary behaviour; this will aid in designing effective health promotion interventions for all age groups in a range of settings (Source 9).

UL is one of DEDIPAC's leading research teams in the area of physical activity and sedentary behaviour measurement. Outputs from the UL group will include a toolbox



of methods for measuring physical activity and sedentary behaviour. The toolbox will standardise methods across Europe, as methods listed in the toolbox will become the standard when applying for EU-funded programmes.

The UL group has been integral in developing and validating a pilot pan-European surveillance system, which will be proposed as the physical activity and sedentary behaviour component of future health behaviour surveillance in the European region. In addition, UL are co-ordinating the harmonisation of existing European physical activity and sedentary behaviour determinant data. This component of DEDIPAC will provide significant insights into the factors which explain physical activity behaviour across the life-span.

The work of DEDIPAC will benefit a number of key stakeholders across Europe:

- 1) Healthcare Systems: The toolbox on physical activity and sedentary behaviour measurement will ensure that valid and reliable measures are employed in all large-scale data collection across Europe, strengthening links between activity behaviours, determinants and indices of health. The result will be more efficient and effective intervention, resulting in significant financial savings to European healthcare systems through non-communicable disease prevention.
- 2) Policymakers: Harmonising existing physical activity data will result in the

first-ever comprehensive dataset of data on physical activity patterns and sedentary behaviours in Europe's population. This will provide European policymakers with evidence about current population-wide health risk behaviours in various cultural and political settings across Europe.

3) Funding Agencies: Through identifying 'gold standard' surveillance methods for physical activity and sedentary behaviour in free-living populations, this work will inform European funding agencies of the most appropriate measurement methodologies. It is envisaged that all European funding applications will refer to our recommendations when choosing measurement methodologies.

4) Researchers: The results of physical activity data harmonisation will benefit researchers in fields including epidemiology, sociology, health sciences and behavioural sciences. This output of DEDIPAC will recommend standardised measurement tools for physical activity and sedentary behaviour, which will be shared through the web-based toolbox in order to guide academics on best practice for activity measurement. DEDIPAC's process of data harmonisation and secondary data analysis will facilitate collaborative research on factors which promote and inhibit physical activity and sedentary behaviour.

Research published by the team in 2011 (Ref 3), highlighted alarmingly high levels of sed-



entary behaviour in Irish adolescent females. The findings of this research were reported widely in the media (Source 1) and commented on in Dáil Éireann highlighting the low levels of physical activity and high levels of sedentary behaviour in Irish schools, and the need for increased promotion of physical activity (Source 1 & 2). The publication was a key reference for Ireland's first Report Card for Physical Activity in Children, which examined all existing physical activity data in Ireland to assign the country a physical activity participation/promotion "grade" (Source 3).

In 2013/14, members of the research group helped develop Ireland's 2014 Report Card on Physical Activity in Children and Youth (Ref 6) as part of "A Global Matrix of Grades comparing 15 Countries". The report card assigned Ireland an overall grade of D-. This received much media coverage (Source 2 & 3), effectively translating academic findings to the general population. The report card findings have been utilised to inform priorities, policy and strategies for physical activity promotion in children and youths in Ireland. The findings are used by a number of health promotion organisations, including Safefood Ireland, the Federation of Irish Sport, Early Childhood Ireland, Obesity Hub Ireland, and the Irish Nutrition and Health Foundation (Source 4).

Health and wellbeing are human rights which are put at risk by sedentary behaviours and lack of physical activity. UL's research is helping Ireland and Europe identify the most effective strategies for combatting these ever-increasing threats to health, and to promote health for citizens of all ages.

Sources to corroborate the impact

1. **Teenage girls sit or lie down for 19 hours a day, study finds**, Irish Times, 6 March 2012.
2. **Child activity level to be rated globally**, Irish Examiner, 21 October 2013
3. **Our children get D minus for physical activity in global test**, Irish Independent, 21 May 2014.
4. Hosting of Report Card findings on NGO websites: **Safefood Ireland**, the **Federation of Irish Sport**, **Early Childhood Ireland**, **Obesity Hub Ireland** and the **Irish Nutrition and Health Foundation**.
5. Brian Neeson, Lead on Health Inequalities, Health Service Executive.
6. Department of Health and Children, Health Service Executive (2009) **The National Guidelines on Physical Activity for Ireland** <http://health.gov.ie/healthy-ireland/physical-activity/recommended-guidelines/>

7. Promoting Physical activity in Ireland: Get Ireland Active. www.getirelandactive.ie
8. Dr Nazih Eldin, Chair of National Physical Activity Steering Group, Health Service Executive.
9. Dr Donal O Gorman, Deputy Lead DE-DIPAC Thematic Area 2, Dublin City University.

Case Study Team: Prof Alan Donnelly, Dr Ciaran Mac Donncha, Dr Kieran Dowd, Dr Fiona Ling

Find out more: Watch the video at www.ul.ie/research



Alan Donnelly
Associate Professor
Physical Education and Sport
Sciences Department
Email: Alan.Donnelly@ul.ie



Dr Ciaran Mac Donncha,
Lecturer and Course Director
Sport and Exercise Sciences
Physical Education and Sport
Sciences Department
Email: Ciaran.MacDonncha@ul.ie