Physical activity and Exercise across the Lifespan: Implications for Obesity Prevention

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Andrew P Hills PhD
Professor of Allied Health Research, Mater Mothers’ Hospital
Director – Centre for Nutrition and Exercise
Mater Research Institute – The University of Queensland
Physical activity and health

• Humans are designed to be active!

• Thus, optimal health and fitness can only be achieved by people who are habitually active.

• Being active is normal and natural - modern environments have ‘engineered’ activity out of our lives.
Physical Activity and Health


The ABC of Physical Activity for Health: A consensus statement from the British Association of Sport and Exercise Sciences

GARY O’DONOVAN¹, ANTHONY J. BLA.ZEVICH², COLIN BOREHAM³, ASHLEY R. COOPER⁴, HELEN CRANK⁵, ULF EKELUND⁶, KENNETH R. FOX⁴, PAUL GATELY⁷, BILLIE GILES-CORTI⁸, JASON M. R. GILL⁹, MARK HAMER¹⁰, IAN McDermott¹¹, MARIE MURPHY¹², NANETTE MUTRIE¹³, JOHN J. REILLY⁹, JOHN M. SAXTON⁵, & EMMANUEL STAMATAKIS¹⁰

¹University of Exeter, Exeter, UK, ²Edith Cowan University, Joondalup, WA, Australia, ³University College Dublin, Dublin, Ireland, ⁴University of Bristol, Bristol, UK, ⁵Sheffield Hallam University, Sheffield, UK, ⁶MRC Epidemiology Unit, Cambridge, UK, ⁷Leeds Metropolitan University, Leeds, UK, ⁸University of Western Australia, Crawley, WA, Australia, ⁹University of Glasgow, Glasgow, UK, ¹⁰University College London, London, UK, ¹¹Brunel University, London, UK, ¹²University of Ulster, Newtownabbey, UK, and ¹³University of Strathclyde, Glasgow, UK

(Accepted 2 February 2010)
Evidence for a Causal Relationship Between PA and Reduced Risk of Disease

<table>
<thead>
<tr>
<th>Disease or condition</th>
<th>Strength of association*</th>
<th>Consistency</th>
<th>Temporal sequence</th>
<th>Biological plausibility</th>
<th>Experimental evidence</th>
<th>Dose–response</th>
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<tbody>
<tr>
<td>Cardiovascular disease</td>
<td>✓ ✓ ✓</td>
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<tr>
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<td>Post-menopausal breast cancer</td>
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<td>Colon cancer</td>
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<td>✓ ✓</td>
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<tr>
<td>Psychological well-being</td>
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<td>Clinical depression</td>
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<td>✓ ✓</td>
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<tr>
<td>Anxiety disorders</td>
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</tr>
</tbody>
</table>

* = moderate evidence. ✓ ✓ = strong evidence. ✓ ✓ ✓ = very strong evidence. **Very strong’ strength of association refers to a two-fold increase in risk associated with inactivity after adjustment for confounding variables. #Evidence refers to the incidence of advanced prostate cancer observed in large cohort studies.

(O’Donovan et al. 2010 J Sport Sci)
Wicked Problems and Worthy Pursuits: Resolving to Meet American Heart Association 2020 Impact Goals
Donna K. Arnett

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Benefits of physical activity in the obese

- Decreased loss of FFM in weight loss
- Assists with weight maintenance
- Improves cardiovascular and metabolic health, independent of weight loss
Weight maintenance

- Weight maintenance and low weight gain
- High physical activity and low weight gain
- Increased muscle strength
- Increased VO$_2$max
- Increased muscle metabolic economy
- Increased anaerobic metabolism
- Increased muscle size

(Hunter & Byrne 2005 JSC)
OBESITY: critical stages and vicious cycles

Understanding maternal & early life causes & consequences is critical for lifelong reduction of obesity & related diseases
Life course approach

- Health of adolescent, mother’s diet and body composition
- Fetal growth & development
- Infant feeding, growth, adiposity
- Child & adolescent diet, activity, adiposity
- Adult diet, activity, other risk factors

Life course

- Characterise phenotype
- Define markers of risk
- Nutrition & lifestyle interventions
WHERE TO NEXT?

**Best Bets**

**Healthy Schools**: Alternate approaches
**Healthy Workplaces**: Health & wellness
**Healthy Aging**: Addressing sarcopenic obesity

Multi-disciplinary, inter-disciplinary and inter-professional opportunities.
PHYSICAL ACTIVITY

Critical in the formative years – do not restrict!
Australian children lack the basic movement skills to be active and healthy

L. M. Barnett\textsuperscript{A,F}, L. L. Hardy\textsuperscript{B}, D. R. Lubans\textsuperscript{C}, D. P. Cliff\textsuperscript{D}, A. D. Okely\textsuperscript{D}, A. P. Hills\textsuperscript{E} and P. J. Morgan\textsuperscript{C} on behalf of the Physical Activity and Sedentary Behaviour Stream of the Australasian Child and Adolescent Obesity Research Network (ACAORN)

\textsuperscript{A}School of Health and Social Development, Faculty of Health, Deakin University, 221 Burwood Hwy, Burwood, Vic. 3125, Australia.
\textsuperscript{B}Prevention Research Collaboration, School of Public Health, University of Sydney, Lvl 2 K25 Medical Foundation Building, 92 Parramatta Rd, Camperdown, NSW 2050, Australia.
\textsuperscript{C}University of Newcastle Priority Research Centre in Physical Activity and Nutrition, Faculty of Education and Arts, University of Newcastle, University Dve, Callaghan, NSW 2308, Australia.
\textsuperscript{D}Interdisciplinary Educational Research Institute, Faculty of Social Sciences, School of Education, University of Wollongong, Northfields Ave, Wollongong, NSW 2522, Australia.
\textsuperscript{E}Centre for Nutrition and Exercise, Mater Research and Griffith Health Institute, Griffith University, South Brisbane, QLD 4101, Australia.
\textsuperscript{F}Corresponding author. Email: lisa.barnett@deakin.edu.au
International Olympic Committee consensus statement on the health and fitness of young people through physical activity and sport

Margo Mountjoy,1,2 Lars Bo Andersen,3 Neil Armstrong,4 Stuart Biddle,5 Colin Boreham,6 Hans-Peter Brandl Bedenbeck,7 Ulf Ekelund,8,9 Lars Engebretsen,1,10 Ken Hardman,11 Andrew Hills,12 Sonja Kahlmeier,13 Susi Kriemler,14 Esther Lambert,15 Arne Ljungqvist,1 Victor Matsudo,16 Heather McKay,17 Lyle Micheli,18 Russell Pate,19 Chris Riddoch,20 Patrick Schamasch,1 Carl Johan Sundberg,21 Grant Tomkinson,22 Esther van Sluijs,23 Willem van Mechelen24

Physical activity and obesity in children

Andrew P Hills,1 Lars Bo Andersen,2,3 Nuala M Byrne4

ABSTRACT

Globally, obesity is affecting an increasing proportion of children. Physical activity plays an important role in the prevention of becoming overweight and obese in childhood and adolescence, and reducing the risk of obesity in adulthood. Publicity and the following adolescent period are acknowledged as particularly vulnerable times for the development of obesity due to sexual maturation and, in many individuals, a concomitant reduction in physical activity. In many Western settings, a large proportion of children and adolescents do not meet recommended physical activity guidelines and, typically, those who are more physically active have lower levels of body fat than those who are less active. Active behaviours have been displaced by more sedentary pursuits which have contributed to reductions in physical activity energy expenditure. Without appropriate activity engagement there is an increased likelihood that children will live less healthy lives than their parents. Owing to the high risk of overweight adolescents becoming obese adults, the engagement of children and adolescents in physical activity and sport is a fundamental goal of obesity prevention.

INTRODUCTION

The rising prevalence of childhood obesity is to displace physical activity and exercise, there is an increased risk of children becoming overweight or obese.2 Without appropriate involvement in physical activity, there is an increased likelihood that children will live less healthy lives than their parents.22 As obesity is already a health risk in childhood because of its association with a clustering of cardiovascular disease (CVD) risk factors and atherosclerosis is believed to progress throughout life,24 the engagement of children and adolescents in physical activity and sport is a fundamental goal of obesity prevention.

This review provides an overview of the relationship between physical activity and obesity in children. Physical and psychosocial health problems associated with excess body fat are highlighted, along with a consideration of the key determinants of obesity. If childhood obesity is to be reduced, greater attention needs to be paid to opportunities for all youngsters, irrespective of size and shape, to engage in physical activity and sport.

OBESITY AND PHYSICAL HEALTH PROBLEMS

A number of potential health consequences are associated with excess body fat during the growing years and, without effective intervention, the risk of associated long-term harms to the adult

PA included in different intervention studies. It is important to note that none of the intervention studies reported how active children were before the intervention, and despite those recommendations included information regarding total MVPA. Moreover, few studies at that time had collected objective measures of PA.

Since this review, studies have been published where PA has been assessed objectively. Another improvement has been to analyse a composite score of CVD risk factors. These studies generally report stronger associations because CVD risk factors tend to cluster in sedentary and obese children. A further area of development has been studies analysing the association between PA and inflammatory markers.

Previous recommendations for PA in children have suggested a goal of 60 min of MVPA per day. However, our knowledge of PA levels of children has been limited, primarily because activity has been assessed by self-report — a method known to carry unacceptable levels of error in terms of measuring PA. The emergence of more
Addressing childhood obesity through increased physical activity

Andrew P. Hills, Anthony D. Okely and Louise A. Baur

Abstract | Obesity is affecting an increasing proportion of children globally. Despite an appreciation that physical activity is essential for the normal growth and development of children and prevents obesity and obesity-related health problems, too few children are physically active. A concurrent problem is that today’s young people spend more time than previous generations did in sedentary pursuits, including watching television and engaging in screen-based games. Active behavior has been displaced by these inactive recreational choices, which has contributed to reductions in activity-related energy expenditure. Implementation of multifactorial solutions considered to offer the best chance of combating these trends is urgently required to redress the energy imbalance that characterizes obesity. The counterproductive ‘shame and blame’ mentality that apportions responsibility for the childhood obesity problem to sufferers, their parents, teachers or health-care providers needs to be changed. Instead, these groups should offer constant support and encouragement to promote appropriate physical activity in children. Failure to provide activity opportunities will increase the likelihood that the children of today will live less healthy (and possibly shorter) lives than their parents.

Obesity and weight issues associated with developing from childhood to womanhood

- Exercise in pregnancy - maternal & infant outcomes;
- Patterns of gestational weight (body composition) change;
- Nutrition & physical activity interventions during pregnancy;
- Post-partum weight loss;
- Impact of early life exposure to physical activity;
- Obesity and disability, including movement limitations;
- Bio-psychosocial nature of obesity – including body image.
- Infant body composition assessment.
Age-related loss of muscle (sarcopenia), strength & functional ability

A ‘poverty of flesh’ including decrease in FFM. Often associated with an increase in FM, and body weight may not change.
‘Sarcobesity’: A metabolic conundrum

Evelyn B. Parr, Vernon G. Coffey, John A. Hawley

Glucose regulation
Depression
Cardiovascular disease
Hypertension

Mobility/frailty
Joint disorders
Strength/power
Functional capacity

↑ lifestyle-related chronic diseases

↓ protein synthesis
↑ fat accumulation
↓ basal metabolic rate
↑ insulin resistance

Inappropriate level of physical activity

Deterioration of muscle quality & quantity

↓ functional capacity
Life course approach: Muscle mass and strength

- **Early life**: Growth and development to maximise peak
- **Adult life**: Maintaining peak
- **Older life**: Minimising loss

Disability threshold

Range of mass & strength in individuals

Environmental changes can lower the disability threshold

Rehabilitation and ensuring quality of life

(Sayer et al. 2008 J Nutr Health Aging)
What is needed to tackle the epidemic?

- A focus on obesity prevention
- Evidence-based practice – Translation – Implementation Science
- Multi-level, multi-sectoral approaches – including complex interventions
- Sustainable changes in all areas e.g. education, transport, health etc.
- Program evaluation
- Learning from ‘Positive Deviants.’
Think BIG!
Aim high, be bold, be persistent

‘Sometimes a problem reaches a point of acuity where there are just 2 choices left: bold action or permanent crisis.’

(David Rothkopf)
A Proposal to Speed Translation of Healthcare Research Into Practice
Dramatic Change Is Needed

Rodger Kessler, PhD, Russell E. Glasgow, PhD

Abstract: Efficacy trials have generated interventions to improve health behaviors and biomarkers. However, these efforts have had limited impact on practice and policy. It is suggested that key methodologic and contextual issues have contributed to this state of affairs. Current research paradigms generally have not provided the answers needed for more probable and more rapid translation. A major shift is proposed to produce research with more rapid clinical, public health, and policy impact.

(From the College of Medicine, University of Vermont (Kessler), Burlington, Vermont; and the Institute for Health Research, Kaiser Permanente Colorado (Glasgow), Denver, Colorado)

Address correspondence to: Rodger Kessler, PhD, College of Medicine University of Vermont, Given Courtyard, 4th Floor, Burlington VT 05405. E-mail: rodger.kessler@uvm.edu


‘You cannot solve problems by continuing to use the same solutions that created the problem in the first place.’ (Albert Einstein)
‘The definition of insanity is doing the same thing over and over again and expecting a different result.’ (Albert Einstein)

We propose a 10-year moratorium on efficacy RCTs in health and health services research. This would provide the necessary time for researchers, practitioners, policy-makers, and citizens to collaboratively identify and evaluate innovations that have real potential for translation.
The behaviour change wheel: A new method for characterising and designing behaviour change interventions

Susan Michie¹*, Maartje M van Stralen² and Robert West³
Proposing a conceptual framework for integrated local public health policy, applied to childhood obesity - the behavior change ball

Anna-Marie Hendriks1*, Maria WJ Jansen1,3, Jessica S Gubbels4, Nanne K De Vries2,4, Theo Paulussen5 and Stef PJ Kremers4

Abstract

Background: Childhood obesity is a 'wicked' public health problem that is best tackled by an integrated approach, which is enabled by integrated public health policies. The development and implementation of such policies have in practice proven to be difficult, however, and studying why this is the case requires a tool that may assist local policy-makers and those assisting them. A comprehensive framework that can help to identify options for improvement and to systematically develop solutions may be used to support local policy-makers.

Discussion: We propose the 'Behavior Change Ball' as a tool to study the development and implementation of integrated public health policies within local government. Based on the tenets of the 'Behavior Change Wheel' by Michie and colleagues (2011), the proposed conceptual framework distinguishes organizational behaviors of local policy-makers at the strategic, tactical and operational levels, as well as the determinants (motivation, capability, opportunity) required for these behaviors, and interventions and policy categories that can influence them. To illustrate the difficulty of achieving sustained integrated approaches, we use the metaphor of a ball in our framework: the mountainous landscapes surrounding the ball reflect the system's resistance to change (by making it difficult for the ball to roll). We apply this framework to the problem of childhood obesity prevention. The added value provided by the framework lies in its comprehensiveness, theoretical basis, diagnostic and heuristic nature and face validity.

Summary: Since integrated public health policies have not been widely developed and implemented in practice, organizational behaviors relevant to the development of these policies remain to be investigated. A conceptual framework that can assist in systematically studying the policy process may facilitate this. Our Behavior Change Ball adds significant value to existing public health policy frameworks by incorporating multiple theoretical perspectives, specifying a set of organizational behaviors and linking the analysis of these behaviors to interventions and policies. We would encourage examination by others of our framework as a tool to explain and guide the development of integrated policies for the prevention of wicked public health problems.

Keywords: Conceptual framework, Intersectoral collaboration, Integrated approach, Health policy, Childhood obesity, Prevention, Behavior change, Organizational change, Local government

* Correspondence: anna-marie.hendriks@maastrichtuniversity.nl

1 Academic Collaborative Centre for Public Health Limburg, Regional Public Health Service, Geleen, The Netherlands

Full list of author information is available at the end of the article
Sequential phases of developing complex interventions

- **Pre-phase**: Explore relevant theory
- **Phase I**: Identify and develop the components
- **Phase II**: Exploratory trial
  - Further development of intervention components and delivery system
- **Phase III**: Definitive (randomised controlled) trial
  - Compare a fully defined intervention
- **Phase IV**: Long term implementation
  - Replicate your intervention & translation

Continuum of increasing evidence
What can we learn from Positive Deviance?

‘Solutions before our eyes.’
‘Best bets’ for health improvement.

• In every community there are individuals whose uncommon practices/behaviours enable them to find better solutions than others who have access to the same resources.

• Identifying solutions to community issues within the community!
Positive Deviance and Obesity Prevention

Look at the following successes

**Individual**
- Leaner people living in the same obesogenic environment
- Women with good pregnancy outcomes
- Women who breastfeed $\geq$ 6 months
- Children who watch $\leq$ 2 h screen time per day

**Interpersonal**
- Families who are active together

**Local communities**
- With walkways, bike paths etc.
- Local champions

**Nations**
- Nutrition and physical activity policies etc.
- Willingness to make the harder decisions
- ‘Whole-of-government’ approaches
Self-efficacy and physical activity/exercise

‘One’s confidence in the ability to take action and persist in action.’

_**Self-efficacy** expectations are important determinants of:

• Choice of activities people engage in;
• How much energy they expend on these;
• Degree of persistence in the face of failure/adversity.
The protocol of a randomized controlled trial for playgroup mothers: Reminder on Food, Relaxation, Exercise, and Support for Health (REFRESH) Program

Sarojini MDR Monteiro, Jonine Jancey, Peter Howat, Sharyn Burns, Carlie Jones, Satvinder S Dhaliwal, Alexandra McManus, Andrew P Hills and Annie S Anderson

Abstract

Background: Mother’s physical activity levels are relatively low, while their energy consumption is generally high resulting in 58% of Australian women over the age of 18 years being overweight or obese. This study aims to confirm if a low-cost, accessible playgroup based intervention program can improve the dietary and physical activity behaviours of mothers with young children.

Methods/Design: The current study is a randomized controlled trial lifestyle (nutrition and physical activity) intervention for mothers with children aged between 0 to 5 years attending playgroups in Perth, Western Australia. Nine-hundred participants will be recruited and randomly assigned to the intervention (n = 450) and control (n = 450) groups. The study is based on the Social Cognitive Theory (SCT) and the Transtheoretical Model (TTM), and the Precede-Proceed Framework incorporating goal setting, motivational interviewing, social support and self-efficacy. The six month intervention will include multiple strategies and resources to ensure the engagement and retention of participants. The main strategy is home based and will include a specially designed booklet with dietary and physical activity information, a muscle strength and flexibility exercise chart, a nutrition label reading shopping list and menu planner. The home based strategy will be supported by face-to-face dietary and physical activity workshops in the playgroup setting, posted and emailed bi-monthly newsletters, and monthly Short Message Service (SMS) reminders via mobile phones.
Participants in the control group receive no intervention materials. Outcome measures will be assessed using data that will be collected at baseline, six months and 12 months from participants in the control and intervention groups.

Discussion: This trial will add to the evidence base on the recruitment, retention and the impact of community based dietary and physical activity interventions for mothers with young children.

Trial Registration: Australian and New Zealand Clinical Trials Registry ACTRN12609000735257
Results of a randomized controlled trial to promote physical activity behaviours in mothers with young children

Sarojini Maria Dos Remedios Monteiro a, Jonine Jancey a,b,*, Satvinder S. Dhaliwal a,b, Peter A. Howat a,b, Sharyn Burns a, Andrew P. Hills c,d, Annie S. Anderson d,e,f,g

a Western Australian Centre for Health Promotion Research, School of Public Health, Curtin University, PO BOX U1987, Perth, Western Australia 6845, Australia
b Centre for Behavioural Research in Cancer Control, School of Public Health, Curtin University, PO BOX U1987, Perth, Western Australia 6845, Australia
c Mater Mothers’ Hospital and Mater Research Institute - University of Queensland, Level 3 Aubigny Place, Raymond Terrace, South Brisbane, Queensland 4101, Australia
d Centre for Musculoskeletal Research, Griffith Health Institute, Griffith University, Queensland, Australia
e Centre for Public Health Nutrition Research, Level 7, Mailbox 7, University of Dundee, Dundee, Scotland DD1 9SY, UK
f Centre for Research into Cancer Prevention and Screening, Level 7, Mailbox 7, University of Dundee, Dundee, Scotland DD1 9SY, UK
g Population Health Sciences, Medical Research Institute, Ninewells Hospital and Medical School, University of Dundee, Dundee, Scotland, UK

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ABSTRACT

Objective. Increasing levels of physical activity in mothers have long-term health benefits for the mother and family. The study aimed to evaluate the effect of a six-month, physical activity RCT for mothers of young children.

Methods. Women were recruited via playgroups and randomly assigned to intervention (n = 394) or control group (n = 322). The intervention group received a six-month multi-strategy programme delivered via playgroups in Perth, Australia. measures were mean minutes per week of moderate (M) and vigorous (V) intensity physical activity (PA), and number of days/week of muscle strength exercises.

Results. The intervention had a significant effect on mean time for vigorous (p = 0.008), moderate (p = 0.023) and total physical activity (p = 0.001) when compared to the control group. The intervention group increased their vigorous activity by a mean of 24 min/week, moderate activity by 23 min/week and total physical activity by 72 min/week.

Conclusions. A relatively minimum home based intervention was able to demonstrate modest but statistically significant improvements in physical activity in a hard to reach group. These changes if maintained over a longer period are likely to improve the health of mothers and have a positive impact on their partners and children.

Australian and New Zealand Clinical Trials Registry ACTRN12609000735257.
Physical activity and nutrition behavioural outcomes of a home-based intervention program for seniors: a randomized controlled trial

Linda Burke¹*, Andy H Lee¹, Jonine Jancey¹, Liming Xiang², Deborah A Kerr¹, Peter A Howat¹,³, Andrew P Hills⁴ and Annie S Anderson⁵
‘Small Changes’ to Diet and Physical Activity Behaviors for Weight Management

Andrew P. Hills\textsuperscript{a}  Nuala M. Byrne\textsuperscript{b}  Rachel Lindstrom\textsuperscript{c}  James O. Hill\textsuperscript{c}

\textsuperscript{a}Mater Mothers’ Hospital, Mater Research and Centre for Musculoskeletal Research, Griffith Health Institute, Griffith University, South Brisbane, \textsuperscript{b}Institute of Health and Biomedical Innovation, School of Exercise and Nutrition Sciences, Queensland University of Technology, Brisbane, Australia, \textsuperscript{c}Anschutz Health and Wellness Center, University of Colorado School of Medicine, Aurora, CO, USA
Main points

- Eating and activity behaviours ‘cluster’, therefore we need to address both eating & physical activity in obesity prevention;

- Parents and the family environment, plus schools and workplaces, are critically important;

- ‘Positive Deviants’ may provide important signals for action;

- ‘Small changes’ can be effective and are likely to be tolerated by most;

- Self-efficacy is a critical ingredient!