MEASURING CHILDREN & YOUNG PEOPLE

Evidence Presentation Note 1

From the Creating an Active Wales Research Seminar Series

Physical Activity & Sedentary Behaviour in the Under 5’s - Prof. John J Reilly, University of Strathclyde.

Project ALPHA (self-reported physical activity instruments in young people) and sedentary behaviour. - Dr Natalie Pearson, School of Sport, Exercise & Health Sciences, Loughborough University

Measuring childhood obesity in Wales - Dr Ciarán Humphreys, Public Health Wales.

Hosted by Swansea University
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CREATING AN ACTIVE WALES - RESEARCH SEMINAR SERIES
EVIDENCE PRESENTATION NOTE 1 - MEASURING CHILDREN & YOUNG PEOPLE

This evidence note collates the presentations given at the Creating an Active Wales Research Seminar on ‘Measuring Children & Young People’ at Swansea University on 6th September 2011.

**Purpose:** To explore the latest evidence related to the barriers, opportunities, methodological difficulties and findings associated with measuring physical activity and sedentary behaviour in children and young people.

**Content - 3 Presentations:**

1. Physical Activity & Sedentary Behaviour in the Under 5’s - Prof. John J Reilly, University of Strathclyde.

2. Project ALPHA (self-reported physical activity instruments in young people) and sedentary behaviour. - Dr Natalie Pearson, School of Sport, Exercise & Health Sciences, Loughborough University

Physical Activity & Sedentary Behaviour in the Under 5’s
By Prof. John J Reilly, University of Strathclyde

Definitions:
Prof Reilly started by exploring the accepted definitions and terms including:
• ‘Pre-school’ generally 3-6 years
• Physical activity
  - Light intensity (1.5-2.9 times REE; slow translocation of trunk)
  - Moderate-vigorous intensity, MVPA (≥3 times REE)
• Sedentary behaviour
  – Not absence of activity; no translocation of trunk; energy expenditure <1.5 times REE; sitting; screen time

Existing Evidence:
Reviews of existing evidence suggests:
• Mostly observational studies
• Mostly in pre-school children
• More physical activity is better
• No clear evidence that it has to be of a particular intensity for benefit.
• ‘Better’ for
  – Body fatness
  – Cardiovascular risk factors
  – Bone health
  – Movement skills
  – Social & emotional development
  – Later physical activity
  – Probably many other benefits

(Okely et al 2009; Reilly et al 2010)

Recommendations: For the early years
• Physical activity should be encouraged from birth
• Physical activity daily for at least 180 minutes
• (Note total volume, not MVPA)
• Minimise time spent sedentary

(Start Active, Stay Active – A report on physical activity for health from the four home countries’ Chief Medical Officers.) (2011)


Effects of sedentary behaviour in early childhood:
• Led to Australian recommendations (2010)
  – No screen time for the under 2’s
  – For over 2’s no more than 2h/day quality educational screen time
• Adverse associations with
  – Body fatness
  – Cognitive, social, emotional development
  – Possibly musculoskeletal health, cardio-metabolic risk factors, ‘poor’ diet

(Okely et al 2009)
**Validation of Scottish Health Survey PA Questionnaire:**
- Comparison with Actigraph in 6-7y olds
  - Mean error from questionnaire +122 mins MVPA/day (CI 124-169)
- No significant rank correlation between methods
- Compliance with 60 mins/day MVPA by method
  - Boys 83% vs 3% ; girls 56% vs 2%
  
  *(Basterfield et al Arch Dis Child 2008)*

**Typical levels of physical activity & sedentary behaviour in pre-school children:**
- Using objective measures, most studies from western countries find
  - 20-30 min/d in MVPA.
  - Light intensity PA typically 100-110 min/d
  - Sedentary behaviour 10-11h/d
  - TV approx. 120-180 min/d

  *(Okely, 2009)*

**Physical activity awareness in English adolescents:**
- n 799 English adolescents
- Perceptions inaccurate-overestimation of (objectively measured) MVPA widespread

  *(Corder et al 2011 - Arch Pediatr Adolesc Med)*

**Compliance with 180 minutes PA recommendation, pre-schoolers:**
- Published evidence limited
- Compliance probably poor in UK
- ‘HAPPY Study’, Melbourne
- n 501, Actigraph accelerometry
- 2.5% met 3h/d of total PA Australian recommendation

**Why should we be concerned about physical activity in pre-schoolers?:**
- Typical level of habitual physical activity sub-optimal, level of sedentary behaviour high
- Settings: Low levels of PA, high levels of SB in nursery (Reilly et al MSSE 2010 42: 502)
- Reach:
  - Spread of Nursery education
- Important biological period ?
  - early adiposity rebound ?; establishment of early obesogenic trajectory (Reilly Proc Nutr Soc 2008; 67: 317)

**Increasing physical activity: +ve systematic reviews:**
- Van Sluijs et al 2007 BMJ
- Dobbins et al Cochrane review 2009 (school-age children & adolescents)
- NICE guidance
  - PH8 Physical activity & the environment
  - PH17 Promoting physical activity for children & young people
Dominant environmental influence on physical activity:

- Fisher et al PLOS One 2010 - Accelerometry
- Franks et al Am J Clin Nutr 2005 - Physical activity energy expenditure (DLW & REE)
- Plomin et al 1980 - Pedometer
- Heritability of PA, walking, and PAEE <1%
- Hope for ‘environmental’ interventions

(Reilly, Int J Obes 2011)

Conclusions:

- Evidence-based recommendations now available for early years (Aus. 2010; UK 2011; Canada 2012).
- Levels of (objectively measured) physical activity and sedentary behaviour give cause for concern.
- Definite hope for improvements, though no simple ‘off the shelf’ solutions.

Useful Resources:

- Encyclopaedia of Early Child Development, CEECD 2011 www.childencyclopaedia.com
- MSSE issue on physical activity of pre-schoolers in childcare, March 2010
- Systematic review of interventions Van Sluijs et al BMJ 2007 335: 703
Project ALPHA (self-reported physical activity instruments in young people) and sedentary behaviour.

By Dr Natalie Pearson, School of Sport, Exercise & Health Sciences, Loughborough University

Research questions and types of measures:

- The research question being posed in any particular study is key to identifying the most appropriate assessment method(s) for physical activity.
- Other considerations affecting the choice of instrument include the sample of interest (e.g. Pre-school children vs. adolescents) study size, budget, resources, staff available.

Project ALPHA:

- EU funded project
- ALPHA – ‘Assessing Levels of PPhysical Activity and fitness at population level’
- Two year work packages involving reviewing the evidence, developing tools, and consulting with international experts, with an aim of producing recommendations for assessing physical activity and fitness in surveillance systems in Europe.

Project ALPHA - aim:

- Work package 4: ‘Recommendations for assessing physical activity in children’ (component 4.4)
• Primary focus was on self-report measures of PA for use with young people.
• Other work packages included:
  • Environment and transport related PA
  • PA in the workplace
  • Objective assessment at population levels
  • Assessing health-related fitness.

**Project ALPHA - methods:**
• Literature searches were conducted using:
  • Web of Science
  • PubMed (Medline)
  • PsychINFO
  • SportDISCUS
  • SIGLE
• Search terms, grouped into three categories were used:
  • Method terms: ‘measurement’, ‘surveillance’, ‘survey’

![Project ALPHA: methods](image_url)

- 24,190 titles from searches
- 22,351 articles excluded as duplicates or irrelevant
- 1839 titles and abstracts were assessed against inclusion criteria
- 437 full papers were assessed
- 89 physical activity measures identified

- 89 physical activity measures identified
- 67 activity-based instruments
- 5 time-based instruments
- 17 proxy instruments
- 1 observation instrument
Data extraction / synthesis:
- Instrument name (indicative reference)
- Details of PA assessment (PA dimensions assessed, recall period, method and structure of instrument, number of items, other relevant information, measurement format)
- Age of participants
- Countries in which it had been used
- Reliability and validity information
- From the list of 89 instruments, a short list of 20 activity-based instruments was constructed:
  - Time-based, observational and proxy measures were not considered appropriate for population surveillance;
  - Inclusion criteria for short-listing was that some level of reliability and validity had been demonstrated.
- These 20 instruments were further summarised within a table including rating of reliability/validity, summary of PA assessment (time frame, number of items, time to complete, age range, use since 1998, use in large-scale survey, availability of European data.
- Reliability and Validity:
  - These key concepts must be understood when considering the accuracy and precision of any measurement technique.
  - Reliability: the degree to which an instrument measures the same way each time it is used under the same condition with the same subjects.
  - Validity: refers to the ability of a measure to measure what it is supposed to (e.g. Criterion validity is when a method (e.g. Survey) is validated against an objective method or a gold standard method).

Reliability and Validity of each of the 20 shortlisted instruments was assessed using the following criteria:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Score = 0</th>
<th>=1</th>
<th>=2</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>&lt;15</td>
<td>15-49</td>
<td>&gt;50</td>
</tr>
<tr>
<td>Sample</td>
<td>Convenience</td>
<td>Narrow</td>
<td>Diverse</td>
</tr>
<tr>
<td>Validity: criterion measure</td>
<td>Indirect</td>
<td>Direct</td>
<td></td>
</tr>
<tr>
<td>Reliability: test-retest period</td>
<td>Same day</td>
<td>1 week</td>
<td>&gt;=2 weeks</td>
</tr>
<tr>
<td>Absolute value of statistic</td>
<td>Poor</td>
<td>Fair</td>
<td>Excellent / strong</td>
</tr>
</tbody>
</table>

Reliability / validity rating
- 0 = none; 1 = weak (statistical value=0 or scores 3 or less)
- 2 = moderate (statistical value=1 and scores 4-5); 3 = strong (statistical value=1-2 and scores 6-7)
• Reliability / validity rating
  • 0=none; 1=weak (statistical value=0 or scores 3 or less)
  • 2=moderate (statistical value=1 and scores 4-5); 3=strong (statistical value=1-2 and scores 6-7)
• Expert assessment:
  • 5 international experts in the area of PA measurement were invited to contribute to the review:
    • Scrutinised the table of 89 instruments
    • Provided critical feedback on the shortlist of 20 instruments
    • Face-to-face meeting to discuss review methods
    • Asked to rate their ‘top 5’ instruments for use in population surveillance, and provide reasons for their decisions

**Project ALPHA: results**

Three scales received support, based on expert judgements and authors:
• Physical Activity Questionnaire (PAQ-C/PAQ-A)
• Youth Risk Behaviour Surveillance (YRBS)
• The Teen Health Survey

**Physical Activity Questionnaire (PAQ-C/PAQ-A)**
• Two versions: PAQ-C (children); PAQ-A (adolescents)
• Intended to measure habitual MVPA.
• PAQ requests responses for the last 7 days by asking participants to check a list of activities for frequency of participating on a scale from ‘none’, ‘1-2 times a week’, ‘3-4’, ‘5-6’, to ‘7 times or more’.
• Questions are also asked about PA in PE lessons, break times, lunch times, right after school, evenings, and ‘last weekend’
• A measure of frequency of participation is requested for each day ranging from ‘none’ to ‘very often’
• PAQ-C and PAQ-A are self-administered 7-day recall questionnaires
• Evidence was provided that supported the PAQ-C and the PAQ-A as reliable and valid (measured against objective assessments) measures of general physical activity levels in children and adolescents during the school year.
• However, the PAQ is designed for assessment only during the school year, and has not been tested in Europe.

**Youth Risk Behaviour Surveillance (YRBS)**
• Developed in the early 1990’s and has been extensively used, including use in large scale surveillance across a good range of children and youth in the USA
• Respondents can report PA for the past year or past week.
• It comprises of only 5 items for both moderate and vigorous PA.
• A measure of sedentary behaviour is also included.
• Reliability and validity (against accelerometers) was good for this instrument.
• No European data.
The Teen Health Survey

- 2-item instrument developed for adolescents to assess MVPA
- Items were shortened and adapted from YRBS.
- Recall period is either previous 7 days or typical week.
- Good reliability and validity (against accelerometers)
- Only been used among adolescents aged 14-17 years.
- It’s applicability to younger children has not been tested.
- No European data.

Project ALPHA – conclusions:

- A robust and useful measure of PA is crucial to population surveillance which, in turn, is a central component of a comprehensive public health response aimed at increasing levels of participation.
- Assessment of PA using self-report in young people is problematic.
- Instruments are only likely to pick up types of activities that can be easily recalled and are therefore ‘retrievable’ from memory.
- Likelihood of missing some of the short sporadic bursts or activity common among young people.
- Objective methods are increasingly common and feasible.
- It is likely that self-report methods will be required for some time due to costs, and that they provide information on both type and context of PA.
- Moreover, the design of effective interventions requires an understanding of what people do alongside how much they do.
- The PAQ scales may be the best placed for this as far as the selected scales are concerned.
- The perfect assessment of PA does not exist, they all present challenges and, as such, there is no existing instrument that can satisfy all criteria.
- It is essential that researchers take into account the pros and cons of instruments, aims of the research study, and indications of the evidence before selecting a tool.
- Following our detailed evaluation, three instruments were identified as potentially most suitable for use in population surveillance of youth (PAQ, YRBS, The Teen Health Survey).
- Those undertaking population surveillance are recommended to consider these instruments and their appropriateness for the type of assessment required.
- Population surveillance of PA in young people is strongly recommended, it is, however, evident that further research is needed to establish measures that demonstrate effectiveness in surveillance systems aimed at young people.
- Such work should be encouraged, particularly where it can also combine with an objective assessment.

References:


Sedentary Behaviour in young people

What is sedentary behaviour?:
- Refers to low levels of energy expenditure (typically 1.0-1.5 METs) through sitting and lying.
- A distinct construct from physical activity and should not be defined as failure to attain recommended levels of physical activity.
- The most prevalent sedentary behaviors include television viewing, computer use, sitting at school-desks, sitting while socialising.

How do we measure sedentary behaviour in young people?
- Self-report / proxy-report surveys
- Diaries and Ecological Momentary Assessment (EMA)
- Accelerometers
- Posture monitors (activPAL)
- Heart rate monitoring
- Multi-unit monitors
- Direct observation
- New and emerging technologies

References:
Measuring childhood obesity in Wales

Dr Ciarán Humphreys, Public Health Wales.

Childhood obesity:
- “Global public health crisis”
- Childhood
  - emotional, mental health
  - type 2 diabetes; risk factors
- Adult
  - persistence into adulthood
    - cardiovascular, diabetes, cancer, arthritis
  - ↓ life expectancy

2 Storing up the problems, RCP, RCPCH, FPH 2002, Royal College of Physicians: London.)

Measuring obesity:
- Obesity
  - excess adiposity accumulated to such an extent health adversely affected
- Measurement
  - body composition
  - Anthropometry
    - waist/hip circumference
    - body mass index (BMI)
- BMI
  \[
  \text{BMI} = \frac{\text{weight}(\text{kg})}{(\text{height}(\text{m}))^2}
  \]
  - simple
  - internationally used
  - normal clinical assessment
  - lean vs fat mass
- Adult:
  - underweight < 18.5 m/kg²
  - overweight ≥ 25 m/kg²
  - obese ≥ 30 m/kg²

BMI in children:
- Growth varies with
  - age
  - gender
- Various charts in use
  - British 1990
  - International Obesity Task Force
  - World Health Organisation
  - Other e.g. USA
Current measures:

<table>
<thead>
<tr>
<th>Study</th>
<th>Coverage</th>
<th>Age</th>
<th>Frequency</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welsh Health Survey</td>
<td>Sample, 2000</td>
<td>2-15 years</td>
<td>Annual</td>
<td>Wales level; Non-response</td>
</tr>
<tr>
<td>Health behaviour in school aged children</td>
<td>Sample, 3200</td>
<td>11, 13, 15</td>
<td>4 yearly; interim 2 yearly</td>
<td>International, self reported; 65% response 2007</td>
</tr>
<tr>
<td>School nurse services</td>
<td>Population</td>
<td>Reception (4-5)/year 1/other</td>
<td>Annual</td>
<td>Efforts to gain national picture to date unsuccessful</td>
</tr>
</tbody>
</table>

Feasibility study 2009:
- Assess feasibility of a national programme
- Purpose of programme:
  - population surveillance
    - trends in childhood growth
    - effectiveness of interventions
    - epidemiological research.

Study aimed to assess:
- Feasibility of introducing standardise data collection using existing systems
- Quantitative
  - data quality
  - effect of opt-in/out on uptake
  - impact of offering feedback of results
- Qualitative
  - views of children, parents & staff
- Cost estimates

Study method:
- Population
  - state schools, 7 local authorities*
  - all reception year pupils (as England)
  - year 4 (as WHO Europe initiative)
    - cluster randomised: opt in vs opt out consent
- Measures
  - height & weight by nursing staff
  - adapted existing data collection systems

Selected findings:
- 14,100 children measured
  - 457 schools
- Quality of data – mostly very high
  - date of birth, gender, school
  - ht, wt & BMI plausible (99.4%)
  - ethnicity poor
Uptake: % children measured:

<table>
<thead>
<tr>
<th></th>
<th>Reception</th>
<th>Year 4 opt-out</th>
<th>Year 4 opt-in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merthyr Tydfil &amp; Cynon Valley</td>
<td>96.4</td>
<td>93.7</td>
<td>78.2</td>
</tr>
<tr>
<td>Pembrokeshire</td>
<td>94.5</td>
<td>90.6</td>
<td>62.2</td>
</tr>
<tr>
<td>Powys</td>
<td>86.2</td>
<td>83.8</td>
<td>58.1</td>
</tr>
<tr>
<td>Swansea (part)</td>
<td>90.6</td>
<td>81.8</td>
<td>46.3</td>
</tr>
<tr>
<td>All</td>
<td>91.7</td>
<td>86.9</td>
<td>59.4</td>
</tr>
</tbody>
</table>

Opt out vs opt in p <0.001 in all areas
Analysis does not take account of clustering effects, and may overestimate significance

Percent overweight/obese:

<table>
<thead>
<tr>
<th></th>
<th>Boys</th>
<th>Girls</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reception</td>
<td>20</td>
<td>25</td>
<td>22</td>
</tr>
<tr>
<td>Year 4 opt-in</td>
<td>23</td>
<td>29</td>
<td>26</td>
</tr>
<tr>
<td>Year 4 opt-out</td>
<td>26</td>
<td>32</td>
<td>28</td>
</tr>
</tbody>
</table>

Deprivation and overweight or obese:

![Graph showing deprivation and overweight or obese]
Feedback of results:
- 4,202 families offered results
- 1,722 (41%) requested results
  - 70% of opt-in v 27% of opt-out
  - 29% (~500) “overweight/very overweight”*
- Impact on service:
  - dedicated phone line & website (NHS Direct Wales)
    - 11 calls (4 answered), 7 website hits
  - GP survey (Pembrokeshire)
    - no impact on service (75% response)
  - Nursing service – 1 enquiry relating to results

Study conclusions:
- Standardised ht & wt data collection feasible
- Data quality good
  - changes required to data systems
- Overweight/obese 22% reception to 28% yr 4 (opt out)
- Opt-out improves uptake & validity
- Programme acceptable
  - communication with children could be improved
- Feedback to parents did not result in measureable demand on NHS services

Child Measurement Programme (CMP) objectives:
- to describe population prevalence of underweight, overweight and obesity, at national and local authority levels
- it will also allow anonymised population level information to be used for surveillance, research, monitoring or audit purposes and planning of health services.

CMP (Wales) regulations (1st August 2011):
Take measures & process data
- Conditions:
  - Relevant child able and willing to stand unaided
  - Parent has not withdrawn child
  - Conducted in ... [privacy]
  - Arrangements managed by relevant person

Data can be processed for
- Releasing to parent
- Providing advice to parent
- Releasing to relevant healthcare professional in line with good practice
- Releasing such that child cannot be identified...for surveillance, research, monitoring or audit and health service planning

CMP approach:
- Programme Plan
  - 2year work plan
  - 2011/12: transition period
  - reception year only
• Protocol
  – what exactly needs to be done
• Local implementation Plans
• Work streams
  – taking measurements
  – communications
  – information & data
  – training
  – quality assurance
  – year four requirements
  – height screening requirements

Opportunities:
1. Use of data
   National Community Child Health Database
   Record linkage
2. Year four measurements
   – Childhood Obesity Surveillance Initiative (WHO Europe)
3. Informing parents

1. Use of data:
   • All children across all of Wales
     – National Community Child Health Database
     – pseudonymised
   • Linkage
     – NHS, secure anonymised information linkage (SAIL) databank
   • Longitudinal follow-up
     – cause, effect,
     – effectiveness (if planned)

SAIL datasets "500 million records 21 datasets“:

   Individual level – NHS:
   • Population (Welsh demographic service)
   • Inpatients - PEDW (HES)
   • Births [ONS]
   • Deaths [ONS]
   • Outpatients [HSW]
   • Child Health Database Wales
   • NHS Direct Wales
   • A&E [Variable]
   • GP Data [Variable]
   • Laboratory systems [Variable]
   • Out of Hours Services [Variable]
   • Radiology- Imaging

   Individual level – non-NHS:
   • Social Services [Variable]
   • Educational Attainment
Clinically rich databases:
- Cancer [WCISU]
- Screening (multiple conditions)
- Congenital Anomalies [CARIS]
- Myocardial Infarction
- Diabetes
- Arthropathies

Ecological datasets (many are GIS):
- Census- small areas
- Ordnance Survey - Mastermap
- Transport
- Environmental Health
- Government departments & agencies

2. Year four:
- Sample vs whole population
- Cohort information
- Requirements paper in development
- Childhood Obesity Surveillance, WHO Europe
  - mandatory school form
  - voluntary hip, waist circumference
  - voluntary family form

COSI family record form (voluntary):
- How usually gets to/from school?
- In your opinion, are the routes to and from school safe...
- How far is school from home?
- Member of one or more sport or dancing clubs....
- Time spent
  - playing outside
  - homework/reading
  - computer games
  - watching TV

3. informing parents
- Regulation allows for feedback with advice
- Consider
  - include physical activity initiatives
  - inform about ongoing physical activity research
- Other joint working opportunities?

Conclusions:
- Height weight & BMI data will be available on all school children
  - reception +/- year 4
- BMI imperfect, but the best we have
- Uptake affects BMI measured
- Opportunities include
  - planned use of data for evaluation
  - development of year four measures
This report was compiled by the Physical Activity & Nutrition Networks for Wales. Please direct any queries, concerns or requests to;

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Further copies of these reports can be viewed and downloaded from the Physical Activity & Nutrition Network for Wales website: www.physicalactivityandnutrition.wales.org.uk

Or the Planet Health Cymru (Planning for Environment, Transport & Health) website: www.planethealthcymru.org