Physical activity and health promotion

- Making the case for physical activity
- Developing health promotion actions
- The role of the workplace
- Obesity prevention through physical activity ???

Adrian Bauman
Sydney University

adrianb@health.usyd.edu.au

Health benefits of physical activity

- In the elderly:
  - Functional status
  - Arthritis
  - Dementia
  - Reduced falls risk
- Coronary heart disease
- Diabetes prevention
- Stroke, CVD
- BMI
- BP
- Cholesterol
- Metabolic syndrome
  - NASH

Update 2007

Summary of epidemiological research: studies about PA and CVD risk

- Observational epidemiological studies [similar to tobacco relationships with disease]
- Better evidence in better designed studies
- Temporality shown
- Biological gradients, dose response shown

Update 2007

Summary of a few of studies 1990-2000

Lee 2001
Crespo 2002
Wagner 2002
Wannemethee 2000
Manson 2002
Yu 2003
Hu 2001
Tanasescu 2003

Physical activity & Cardiovascular disease 2000-2003

Level of self reported PA or fitness

CVD events / mortality risk
Manson JE et al

Walking compared with vigorous exercise
For the prevention of cardiovascular disease

NEJM 2002 347:716-25

'Fat and Fit': the interaction between physical activity and overweight

- The relationship between obesity and CVD may be mediated via PA levels
- Is obesity a true independent risk factor?
- Several similar epidemiological findings in other studies, with CVD, diabetes, hypertension as endpoints

PA and BMI on cardiovascular, cancer and all-cause mortality among a cohort of 47 212 middle-aged Finnish men & women


Estimates of the relationship between PA --- CVD published 2003-2006. [van der Ploeg & Bauman 2008]

Lee (1998) CVD Mortality:
PA and BMI effects and interactions

Fat and Fit': the interaction between physical activity and overweight
Adjusted RR for All-Cause Mortality by Fitness and % Body Fat

Adj.RR* for age, exam year, smoking, alcohol, and family history

Lean Normal Obese
Body Fat (%)

<16% (16-24%) (>25%)


Adjusted RR for CVD Mortality by Fitness and % Body Fat

Can PA / dietary interventions prevent DM?

Studies in

- China da Qing
- Finland
- USA (DPP)

Reduced incidence of DM secondary prevention trials

Diabetes Prevention Program

- Multi centre RCT (27 centers, N=3234)
- RCT
  - Usual care/placebo drug
  - Diet and exercise (low fat, 150 mins PA)
  - Metformin therapy (850 mg b.d.)
- Chose high risk for DM groups (enrolled)
- 3 year follow up – achieved wt loss [5-7%], achieved PA outcomes (30 mins/day average)
- Endpoints – rates of developing DM reduced by 58% (diet/exercise) compared to 31% reduction (metformin)
- Trial ended early – data answered res questions

Finnish DPP Results - risk reduction overall

Endpoints – rates of developing DM reduced by 58% (diet/exercise) compared to 31% reduction (metformin)

DPP results

- Multi centre RCT (27 centers, N=3234)
- RCT
  - Usual care/placebo drug
  - Diet and exercise (low fat, 150 mins PA)
  - Metformin therapy (850 mg b.d.)
- Chose high risk for DM groups (enrolled)
- 3 year follow up – achieved wt loss [5-7%], achieved PA outcomes (30 mins/day average)
- Endpoints – rates of developing DM reduced by 58% (diet/exercise) compared to 31% reduction (metformin)
- Trial ended early – data answered res questions

DPP results
**DPP results**

![Graph showing cumulative incidence of diabetes (%)](image)

**Costs of inactivity**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Condition</th>
<th>Percentage of DALYs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ischaemic heart disease</td>
<td>3.9</td>
</tr>
<tr>
<td>2</td>
<td>Acute and chronic respiratory</td>
<td>7.0</td>
</tr>
<tr>
<td>3</td>
<td>Type 2 diabetes</td>
<td>4.9</td>
</tr>
<tr>
<td>4</td>
<td>Stroke</td>
<td>4.1</td>
</tr>
<tr>
<td>5</td>
<td>Chronic obstructive pulmonary</td>
<td>3.4</td>
</tr>
<tr>
<td>6</td>
<td>Lung cancer</td>
<td>3.3</td>
</tr>
<tr>
<td>7</td>
<td>Alzheimer’s and other dementias</td>
<td>3.2</td>
</tr>
<tr>
<td>8</td>
<td>Colorectal cancer</td>
<td>2.4</td>
</tr>
<tr>
<td>9</td>
<td>Breast cancer</td>
<td>2.3</td>
</tr>
<tr>
<td>10</td>
<td>Breast cancer</td>
<td>2.3</td>
</tr>
<tr>
<td>11</td>
<td>Additional hearing loss</td>
<td>2.2</td>
</tr>
<tr>
<td>12</td>
<td>Road traffic accidents</td>
<td>2.0</td>
</tr>
<tr>
<td>13</td>
<td>Suicide and self-inflicted injuries</td>
<td>1.9</td>
</tr>
<tr>
<td>14</td>
<td>Pneumonia</td>
<td>1.4</td>
</tr>
<tr>
<td>15</td>
<td>Parkinson’s disease</td>
<td>1.4</td>
</tr>
<tr>
<td>16</td>
<td>Diabetes</td>
<td>1.3</td>
</tr>
<tr>
<td>17</td>
<td>Alcohol dependence and harmful use</td>
<td>1.2</td>
</tr>
<tr>
<td>18</td>
<td>Personality disorders (excluded)</td>
<td>1.2</td>
</tr>
<tr>
<td>19</td>
<td>Back pain (acute and chronic)</td>
<td>1.1</td>
</tr>
<tr>
<td>20</td>
<td>Schizophrenia</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Table 3.1: Proportion of disease burden attributed to selected determinants of health (per cent)**

<table>
<thead>
<tr>
<th>Determinant</th>
<th>Males</th>
<th>Females</th>
<th>Persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overweight</td>
<td>8.8</td>
<td>8.3</td>
<td>8.6</td>
</tr>
<tr>
<td>Tobacco smoking</td>
<td>8.5</td>
<td>6.1</td>
<td>7.8</td>
</tr>
<tr>
<td>High blood pressure</td>
<td>7.5</td>
<td>7.0</td>
<td>7.3</td>
</tr>
<tr>
<td>Physical inactivity</td>
<td>6.5</td>
<td>6.0</td>
<td>6.7</td>
</tr>
<tr>
<td>High blood/diabetes</td>
<td>6.5</td>
<td>5.7</td>
<td>6.1</td>
</tr>
<tr>
<td>Alcohol abuse</td>
<td>5.3</td>
<td>2.2</td>
<td>3.9</td>
</tr>
<tr>
<td>Alcohol harm</td>
<td>-1.6</td>
<td>-2.1</td>
<td>-1.8</td>
</tr>
<tr>
<td>Occupational exposures</td>
<td>2.6</td>
<td>3.0</td>
<td>2.8</td>
</tr>
<tr>
<td>Risk drugs</td>
<td>2.6</td>
<td>2.2</td>
<td>2.4</td>
</tr>
<tr>
<td>Lack of physical activity</td>
<td>1.9</td>
<td>1.0</td>
<td>1.4</td>
</tr>
<tr>
<td>Intimate partner violence</td>
<td>n.a.</td>
<td>2.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Child sexual abuse</td>
<td>0.3</td>
<td>1.3</td>
<td>0.6</td>
</tr>
<tr>
<td>Ulcers</td>
<td>0.4</td>
<td>0.6</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Note: No data available for smoking-related disability-adjusted life years (DALYs) as a proportion of total DALYs. The DALY equals one year of healthy life lost through premature death or living with disability due to illness or injury (see Chapter 2).

**Risk factor contributors to preventable morbidity and mortality (burden of disease), Australia 2006**

**Trends in direct costs of physical inactivity**

- Stephenson, Buzan, Smith, Bellew 2000: Costs of Inactivity report for Commonwealth Govt
- 2007 Medibank Private report – Econtech, Sydney
- Used Same methodology

![Graph showing trends in direct costs of physical inactivity](image)
What to do next?
- made the case for physical activity
- Know how much to recommend
- Getting strategies developed – ideally independent of obesity!
- Implementing strategies
- Evaluating the programs

PA Guidelines
- What are they?
- What do they do?
- Why have them?
- Can they ever be counter productive?

think of movement as an opportunity, not an inconvenience.

be active every day in as many ways as you can.

put together at least 30 minutes of moderate-intensity physical activity on most, preferably all, days.
Settings for Physical activity / exercise programs

1. Individual program / individual personal trainer
   Tailored and targeted advice, individualized counseling
   Individual mailed materials; individual support

2. Disease based group programs eg. with diabetic patients
   Primary care clinic interventions, physician’s offices
   Group programs in health centers, exercise facilities

3. School level interventions
   School level interventions

4. Local level community programs, neighborhood
   faith based programs
   Regional / state level programs
   Web site based interventions

5. Mass media campaigns
   Environmental change interventions / Policy interventions
   National programs / national guidelines
   International efforts to promote physical activity

A social ecological framework for the influence of the physical environment on PA and obesity

Settings for intervention

1. promoting activity through general practice [doctors] and primary care settings
2. worksites as opportunities
3. whole community, media campaigns
4. intersectoral agencies working together
5. environments promoting activity; facilities and organisations
6. private industry, NGO sector

Evidence base for worksite HP

- Selected samples [participants] tend to improve
- ‘Reach’ is an issue
- Creative ideas
  - whole worksite programs?
  - stair walking challenges/ corporate challenges
  - active commuting to work
  - Specific developed programs, eg HeartMoves
  - Moving an office from North Sydney to North Ryde
    - subsidising active commuting

What to do?

Strategies needed in worksites

- advocacy – getting PA on the agenda at workplaces
- policy and planning – what can you do
  - workplace programs [classes]
  - Environmental interventions
- who are you targeting?
- What do you want to achieve? monitoring and evaluation

If you can, also enjoy some regular, vigorous exercise for extra health and fitness.

If you like, you can also make some regular, vigorous exercise for extra health and fitness.
Some of the outcomes sought:

- increased participation opportunities
- increased awareness of the benefits of PA
- increased participation in physical activity
- better health & quality of life
- quality infrastructure, programs and services
- decrease in health care costs

Evaluation of PA programs

- from evidence base
- To program planning and developing the right program
- Testing the program – does it work?
- Replication of the program
Radical ideas

- sitting and health promotion
- physical activity and obesity prevention

Physical activity – making the case

Physical inactivity contributes as much to ill health as hypertension, obesity or tobacco use in Australia – but receives very limited attention or efforts.

The Global Epidemic of obesity – IOTF slide

Trends apparent in obesity rates BMI >30 in developed countries from 1980 onwards.
Australian adults – obesity trends
Starting in 1980s clearly

- The myth that 30 mins of regular PA daily can reduce obesity
  - Not if inactive the other 23.5 hours
  - It is total energy expended that will influence weight

So we need to move more, throughout the day, AND do 30 mins PA to prevent obesity [...and eat less]

An Active Day?

- TV time & Blood Glucose
  - TV viewing time with blood glucose
    - 8,357 AusDiab adults >35 years
    - TV detrimentally associated with 2-hr PG, but not FPG
    - Independent of physical activity & waist circumference

Dunstan et al., Diabetes Care, 2007

TV viewing time & metabolic risk in physically-active adults

- Physical activity & sedentary time measurement
  - Accelerometer (Actigraph model 7164)
    - worn during waking hours for 7 days
    - min 5 days (inc. weekend day)
    - min 10hrs/day
    - 1 minute epochs
    - Physical activity diary

Adjusted for age, education, parental history of diabetes, smoking, income, alcohol intake, diet quality, and total physical activity time

Healy et al., MSSE In Press
**Summary**

1. Physical activity & sitting time are independently related to waist circumference, 2-hr blood glucose levels

2. Breaking up “sedentary time” has a beneficial effect on waist, BMI, 2-hr PG, triglycerides
   - Independent of total sedentary time / mod-to-vigorous physical activity and exercise time

- Need to increase PA and to reduce sitting for good health

---

**Next radical idea**

Very radical views on Leisure time physical activity and obesity

---

**The lack of a role for leisure time physical activity in preventing obesity**

Adrian Bauman
School of Public Health, Sydney University, Australia

---

Leisure-time physical activity alone may not be a sufficient public health approach to prevent obesity – a focus on China

A. Bauman<sup>1,2</sup>, M. Almeida-Faria<sup>1,3</sup>, H. Huxley<sup>2</sup> and W. R. T. James<sup>4</sup>

Keywords: energy expenditure, obesity prevention, physical activity, obesity reviews (2009) 9 (Suppl. 1), 110–126
This talk the hypothesis is proposed that 
"At the population level, leisure time PA has little role in obesity prevention"

The evidence is for clinical trial effectiveness of PA

<table>
<thead>
<tr>
<th>Weight Loss</th>
<th>Maintenance/Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big changes</td>
<td>Small Changes</td>
</tr>
<tr>
<td><strong>Diet</strong></td>
<td>++</td>
</tr>
<tr>
<td><strong>Physical activity</strong></td>
<td>- ++</td>
</tr>
<tr>
<td><strong>Combined</strong></td>
<td>++ +++</td>
</tr>
</tbody>
</table>

In clinical settings, PA is relevant
But what about 'whole population change'?

Second, ecological associations

We are sometimes unduly worried by the methodological limitations of ecological data
here, we ignore it despite its inconsistency

25 year trends in PA in Finland: Proportions
LTPA ≥ 30 min 2x/week, and ≥ 15 mins/day
active commuting to work

Canada – % insufficient LTPA (<3 KKD]

Ecological relationship to obesity trends

- Despite increased LTPA levels, obesity has increased markedly in Finland and Canada

- (Kautianen, Int J Obes Rel Metab Dis 2002:26:544-552)
Ecological relationship to obesity trends

• Spanish national surveys, noted that LTPA increased 1987 – 1997, but obesity also increased from 36 to 41% (women) and 47 to 56% of men (Artalejo F, Prev Med 2002;72-81)

• obesity also increasing in Dutch adults (Visser 2002) and children

Response rates NSW health surveys

<table>
<thead>
<tr>
<th>Year</th>
<th>MALE</th>
<th>FEMALE</th>
<th>TOTAL</th>
<th>Response rate %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>17,497</td>
<td>15,442</td>
<td>15,937</td>
<td>65%</td>
</tr>
<tr>
<td>1999</td>
<td>15,830</td>
<td>13,622</td>
<td>13,988</td>
<td>67.6%</td>
</tr>
<tr>
<td>2000</td>
<td>11,861</td>
<td>9,768</td>
<td>11,500</td>
<td>69.0%</td>
</tr>
<tr>
<td>2001</td>
<td>61.2%</td>
<td>61.2%</td>
<td>61.2%</td>
<td>61.2%</td>
</tr>
<tr>
<td>2002</td>
<td>57.7%</td>
<td>57.7%</td>
<td>57.7%</td>
<td>57.7%</td>
</tr>
</tbody>
</table>

Table 1: Total number of interviews completed, number of interviews with people aged 16 years and over, and overall response rates for 1998-2002.

It doesn’t make sense….

• If LTPA is increasing, why doesn’t it prevent obesity?
  – Because its too not enough LTPA
  – because it is too little as a fraction of total EE
  – Because Energy intake overwhelms it
  – all of the above
If we think of obesity as the result of energy imbalance...

Energy Input (food)  Energy expended (total PA)

Likely eating more

Likely expending less?

We need to think carefully about TOTAL physical activity and its role in obesity prevention

- There are several domains [settings] for energy expenditure
  1. Energy expended at workplace
  2. At home, domestic physical activities
  3. Active transport, commuting to work and other places in active ways
  4. Leisure time PA

TOTAL PA that might contribute to obesity in populations

- Hypothetical time spent in each of the PA segments – contributions to total daily PA
  - Leisure time PA - hope to achieve 30 mins / day
  - Work place: 6-8 hours of time
  - Domestic: 6-8 hours of time
  - Active transport: up to 1-2 hours per day

How much EE is ‘LTPA’?

in population studies [EXCLUDES MOST DLW]

Dong and Block 2004 IJBNPA

Dong and Block estimate that 5% of total population EE is due to LTPA, sport and active recreation

So in any area of needs assessment, if we found an area contributing that little to the outcome, is that where we would invest in developing interventions ???

Table 2: Activities that account for 90% of energy expenditure in the United States, not including DLW

<table>
<thead>
<tr>
<th>Rank</th>
<th>Activity Description</th>
<th>Around 90% of Total EE shown here</th>
<th>MET</th>
<th>Percent of Total Score (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Driving car</td>
<td>2.2</td>
<td>19.9</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Job: Office work, typing</td>
<td>1.8</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Washing dishes</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>T.V./ Gaming</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Activities performed while sitting quietly</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Eating (cooking)</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Cleaning home, general</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Talking, eating, in person or on phone</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Jobs: Industrial plants/industry (e.g. assembly line)</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Food preparation (e.g. cooking, baking, setting table)</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Jobs: Construction site</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Jobs: Light intensity, standing (e.g. hospital staff, real versus)</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Yard work (general) (e.g. mowing, lawn, trimming hedges)</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Aiding with social (e.g. walking, talking while sitting)</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Shopping for groceries (e.g. walking)</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Jobs: Light standing (e.g. store clerk, bartender, bar staff, lab work)</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Jobs: Farm hand chores (baking, cleaning, gardening)</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Job: Restaurant staff (e.g. waiter, chef)</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Jobs: Teaching class</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Laundry</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Walking moderately (e.g. doing errands, walking to school)</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Piling and sweeping</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Cleaning kitchen</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Shopped for food, eating or preparing</td>
<td>1.0</td>
<td>8.6</td>
<td></td>
</tr>
</tbody>
</table>
Physical activity by setting

- Hypothetical contribution of each of the PA segments to total daily PA
  - Leisure time: 30 mins x 6 METs = 180 mets.mins
  - Work place:
    - Active job: 8 hrs x 3 METs = 1440 Met.mins
    - Sedentary job: 8 hours at 1.5 METs = 720 Met.mins
  - Domestic
    - Active at home: 2 METs = 720 mets.mins
    - Sedentary at home: at average of 1.2 METs = 420 mets.mins
  - Active transport:
    - 1 hour/day: 4 METs = 240 mets mins
    - Sit in car to work: 1 hour/day: 1.2 METs = 72 met.mins

Then it is TOTAL PA that might contribute to obesity in populations

What people do to expend energy:
* at work
* in domestic setting
* for active transport contributes more to total energy expended than “leisure time PA” alone

The solution to the ‘energy expended’ part of physical activity is to increase TOTAL PA

- To prevent CVD, diabetes – we need to get the population moving for 30 mins / day
- For obesity prevention, we need MORE than 30 mins – maybe 60 mins/day for population obesity prevention, and 75-90 mins / day for individual weight loss

One of the causes of obesity has been the probable decline in total PA **

- Decreased energy expended at work
- Decreased active commuting
- Decreased energy expended at home

** but we don’t have much data on total EE
  - declines in occupational PA (Anderssen 2007)
  - increases in sedentary time ?
  - decreased domestic EE ???

The energy expended in food production and domestic tasks has declined

The energy expended in active transportation [active commuting] has declined [in China]
Think about energy balance across the 24 hours of the day

Cultural acceptance of sedentary lifestyles

One central question

- Weight loss and weight maintenance – how much PA is required?

**WHO Obesity Guidelines, 2000**

**Technical Report Series 894**

**PAL = 1.0**

- RMR = 1Kcal/Kg/Hr  \( \text{VO}_2 = 3.5 \text{ ml/kg/min} \)
- 50 kg body weight = 50 x 24 = 1200 Kcal/day
- 70 kg body weight = 70 x 24 = 1680 Kcal/day
- 100 kg body weight = 100 x 24 = 2400 Kcal/day
Physical Activity Level - PAL
Multiple of Resting Metabolic Rate

<table>
<thead>
<tr>
<th></th>
<th>MEN</th>
<th>WOMEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMR</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Very Light</td>
<td>&lt;1.46</td>
<td>&lt;1.41</td>
</tr>
<tr>
<td>Light</td>
<td>1.46 - 1.65</td>
<td>1.41 - 1.55</td>
</tr>
<tr>
<td>Moderate</td>
<td>1.66 - 1.90</td>
<td>1.56 - 1.75</td>
</tr>
<tr>
<td>Heavy</td>
<td>1.91 - 2.25</td>
<td>1.76 - 2.05</td>
</tr>
<tr>
<td>Exceptional</td>
<td>&gt;2.25</td>
<td>&gt;2.05</td>
</tr>
</tbody>
</table>


Physical Activity and Obesity

- Risk of overweight low if PAL ≥ 1.75
  A PAL of >1.75 is needed to prevent “unhealthy weight gain” [based on results of 40 international studies]

- Prevalence of PAL ≤1.75 rapidly increasing in developed and developing countries - especially as they adopt computer and communication technology.


Energy requirements – how to encourage PAL increases to ≥ 1.75

<table>
<thead>
<tr>
<th>Male 35 years</th>
<th>BMR</th>
<th>PAL 1.5</th>
<th>PAL 1.75</th>
</tr>
</thead>
<tbody>
<tr>
<td>kJ per day</td>
<td>7100</td>
<td>10650</td>
<td>12425</td>
</tr>
<tr>
<td>+3550</td>
<td></td>
<td>+5325</td>
<td></td>
</tr>
<tr>
<td>+1775</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Allman-Farinelli 2007; Bauman, Allman-Farinelli, Huxley, James 2008

How much can LTPA increase PAL

<table>
<thead>
<tr>
<th>Activity</th>
<th>PAR</th>
<th>Increment in PAL Per 30 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow Jogging [~6 km/hr]</td>
<td>6.34</td>
<td>0.11</td>
</tr>
<tr>
<td>Tennis (doubles)</td>
<td>5.8</td>
<td>0.10</td>
</tr>
<tr>
<td>Brisk walk</td>
<td>3.8</td>
<td>0.06</td>
</tr>
<tr>
<td>Climbing stairs</td>
<td>8.9</td>
<td>0.17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Sedentary</th>
<th>Some LTPA</th>
<th>More LTPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep 8 h</td>
<td>8 h</td>
<td>8 h</td>
<td>8 h</td>
</tr>
<tr>
<td>Personal care 1 h</td>
<td>1 h</td>
<td>1 h</td>
<td>1 h</td>
</tr>
<tr>
<td>Eating 1 h</td>
<td>1 h</td>
<td>1 h</td>
<td>1 h</td>
</tr>
</tbody>
</table>

Male 32 y BMI 22 kg/m² BMR 7075 KJ
Male 32 y BMI 22 kg/m² BMR 7075 KJ

<table>
<thead>
<tr>
<th>Activity</th>
<th>Sedentary</th>
<th>Some LTPA</th>
<th>More LTPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep 8h</td>
<td>8h</td>
<td>8 h</td>
<td>8 h</td>
</tr>
<tr>
<td>Personal care 1h</td>
<td>1h</td>
<td>1h</td>
<td>1h</td>
</tr>
<tr>
<td>Eating 1h</td>
<td>1h</td>
<td>1h</td>
<td>1h</td>
</tr>
<tr>
<td>Walking 0.5h</td>
<td>0.5h</td>
<td>0.5h</td>
<td>0.5h</td>
</tr>
<tr>
<td>Clerical work 9h</td>
<td>9h</td>
<td>9 h</td>
<td>9 h</td>
</tr>
<tr>
<td>Driving 2h</td>
<td>2h</td>
<td>2 h</td>
<td>2 h</td>
</tr>
<tr>
<td>Housework 1h</td>
<td>1h</td>
<td>0.5 h</td>
<td>0 h</td>
</tr>
<tr>
<td>TV and reading</td>
<td>1.5h</td>
<td>1.5 h</td>
<td>1.5 h</td>
</tr>
<tr>
<td>Jogging</td>
<td>0 h</td>
<td>0.5 h</td>
<td>1.0 h</td>
</tr>
<tr>
<td>PAL</td>
<td>1.49</td>
<td>1.57</td>
<td>1.64</td>
</tr>
</tbody>
</table>

Increasing total EE via “Active Living”?

Active living is a way of life that integrates physical activity into daily routines

Active living …… But not quite what I meant

Active Living in Transportation

Walking
- Almost everyone is capable of walking, anywhere.
- Low cost
- Epidemiologic benefits

Biking
- More than 42 million Americans own bicycles and yet currently less than 1% of trips are made by bike (NIEHS 2004)
- Bicycle sales increasing in Australia, yet rust.

Conclusion

1. The case for “active living” as part of PA related health promotion, and for weight maintenance and obesity prevention, is compelling
2. The challenge is to re-engineer social norms and physical environments to increase population EE
3. Reaching a PAL of 1.75 is a long way off as a public health goal — we aren’t even trying ??
4. LTPA, Sports and recreation participation, while contributing to health, may not help on their own with population obesity prevention

Summary – future roles of workplaces in PA and obesity prevention

- A challenge!
- Stairs use studies
- Sitting reduction measurement and intervention studies
- Active commuting
- Not ‘gym based facilities at work’ ???