Obesity prevention in Australia

Modelling cost-effectiveness of interventions: the Assessing Cost Effectiveness (ACE) approach

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WHO Collaborating Centre for Obesity Prevention
Presentation outline

– Obesity in Australia
– ACE-Obesity study
– Logic pathway for modelling interventions
– Future directions for ACE modelling
Presentation outline

- Obesity in Australia
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Obesity prevalence – comparison

Source: International Obesity Taskforce (IOTF) database
Obesity trends in Australia – ADULTS

Source: Australian Social Trends (ABS 2005)
Prevalence of overweight and obesity in the Pacific – ADOLESCENTS

Source: OPIC Study 2005-06
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Project background

– Investment in obesity prevention increasing
– Funding decisions often not underpinned by evidence – limited information on what works and offers value-for-money
– How do you set priorities for obesity prevention?

ACE-Obesity Project
(Assessing Cost Effectiveness in Obesity)
Project overview

– Two year project in Victoria, Australia

– Evidence-based approach to evaluate the cost-effectiveness of interventions for the prevention of unhealthy weight gain in Australian children and adolescents

– Used a standardized methodology to evaluate and prioritize multiple interventions
Key features of ACE approach

- Clear rationale and process for selection of interventions
- Evidence-based (best available evidence)
- Independent research team
- Measurement of benefit based on technical cost-effectiveness results and qualitative analysis with stakeholders
Overview of ACE approach

1. RESEARCH QUESTION
2. Create WORKING GROUP of stakeholders
3. SELECT INTERVENTIONS
4. CONFIRM EVALUATION METHODS
   • Technical analysis ($ cost per DALY)
   • 2nd stage filters (Equity, Acceptability, Feasibility, Sustainability, etc.)
5. UNDERTAKE ANALYSIS
6. AGREE FINDINGS AND DISSEMINATE

Stakeholders involved at all stages of the ACE process
## ACE-Obesity – Selected interventions

<table>
<thead>
<tr>
<th>Category</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Child care</strong></td>
<td>1. Active After-School Communities</td>
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<tr>
<td><strong>Schools</strong></td>
<td>2. Multi-faceted school-based program (- PE)</td>
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<tr>
<td></td>
<td>3. Multi-faceted school-based program (+ PE)</td>
</tr>
<tr>
<td></td>
<td>4. Targeted school-based program</td>
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<tr>
<td></td>
<td>5. Education program to reduce fizzy drinks</td>
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<td></td>
<td>6. Education program to reduce TV viewing</td>
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<tr>
<td><strong>Primary care</strong></td>
<td>7. Family-based GP program for overweight</td>
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<td></td>
<td>8. Family-based targeted program for obese</td>
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<td></td>
<td>9. Orlistat therapy for adolescents</td>
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<tr>
<td><strong>Hospital</strong></td>
<td>10. Gastric banding for morbidly obese</td>
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<tr>
<td><strong>Neighbourhoods &amp; communities</strong></td>
<td>11. TravelSMART Schools</td>
</tr>
<tr>
<td><strong>Media and marketing</strong></td>
<td>12. Walking School Bus</td>
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<td></td>
<td>13. Reduce TV advertising of junk food</td>
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</tbody>
</table>
Overview of ACE-Obesity technical analysis

- Model resource costs of intervention and current practice
- Model disease burden of obesity
- Model change in BMI from intervention
- Model health gain from intervention (DALYs)
- Model cost-offsets from reduction in obesity-related diseases
- Net health gain
- Net cost of intervention

Incremental Cost Eff Ratios
- $ per BMI
- $ per DALY
Study parameters – technical analysis

- Standardised evaluation methods
- A common setting, target group, reference year, perspective, decision context
- Measured against current practice
- Uses Australian data
- Extensive use of probabilistic uncertainty analysis and sensitivity analysis
Economic modelling

- Measuring net costs of intervention
- Pathway analysis – identify all steps in intervention to determine associated resource use
- Costed in steady state – running to full effectiveness potential, no workforce issues, excludes planning and set-up stages
- Time horizon of intervention – reflect real-life application
- Cost-offsets – savings as a result of reduction in obesity related diseases
Assessment of benefit

10% $\Delta$ energy balance $\rightarrow$ 4.5% $\Delta$ body weight

Reference: Swinburn et al AJCN 2006
BMI to DALY modelling (1)

- Start with BMI distribution (mean, SD) by 5 yr age and gender

- Outcome: DALYs saved due to intervention = difference in future mortality and morbidity outcomes between baseline (current practice) and intervention

- These differences based on changes in age-specific BMI distribution of target population over their remaining life

- Use historical BMI data to develop regression equation – then move cohort through life in 5 yr cycles
EAT WELL!
STAY FIT!
DIE ANYWAY!
BMI to DALY modelling (2)

- Calculate Potential Impact Fractions (PIFs) – proportional change in expected disease or death attributable to change in exposure to risk factor

- The diseases for which PIFs were calculated are:
  - Ischaemic heart disease
  - Ischaemic stroke
  - Hypertensive heart disease
  - Type 2 diabetes
  - Osteoarthritis
  - Cancers (endometrial, colon, kidney, post-menopausal breast)
Results: Effectiveness

Total DALYs saved

- Walking School Bus
- TravelSMART
- Active After School
- Orlistat in adolescents
- GP intervention
- Multi-faceted school-based - PE
- Gastric banding
- TV viewing
- Multi-faceted school-based + PE
- Fizzy drinks
- Family-based targeted
- Targeted multi-faceted school-based
- TV advertising
Results: Affordability

Total intervention cost

- Walking School Bus
- TravelSMART
- Active After School
- Orlistat in adolescents
- GP intervention
- Multi-faceted school-based - PE
- Gastric banding
- TV viewing
- Multi-faceted school-based + PE
- Fizzy drinks
- Family-based targeted
- Targeted multi-faceted school-based
- TV advertising

Millions
Results: Cost-effectiveness

Incremental cost-effectiveness of interventions (net $ per DALY saved)

Walking School Bus
TravelSMART
Active After School
Orlistat in adolescents
GP intervention
Multi-faceted school-based - PE
Gastric banding
TV viewing
Multi-faceted school-based + PE
Fizzy drinks
Family-based targeted
Targeted multi-faceted school-based
TV advertising

Thousands

> $0.23M
> $0.11M
2nd stage filter analysis – issues

• Contrary to known government policy (regulation of TV advertising)
• Potential for side-effects (gastric banding, Orlistat)
• Acceptability (gastric banding, Orlistat)
• Affordability (gastric banding)
• Sustainability (Walking School Bus, Active After-School Communities program)
• Important implications for other areas of government eg. Dept of Education (school-based interventions)
• Strength of evidence (GP intervention)
Conclusions and implications

- Policy interventions often inexpensive
- Energy intake interventions more potent than physical activity – but both are needed
- Reach is a big determinant of total costs and health benefits
- Packaging interventions complicated by broad factors (qualitative considerations, joint costs, cumulative impact of multiple interventions, targeted vs non-targeted interventions)
- Need multiple strategies in multiple settings with multiple partners
- Better evaluations of interventions required
- ACE process provides useful information for policy-makers, despite limitations
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Logic pathway for obesity modelling

Δ Policy / Program

Δ Environment and Δ Behaviour

Δ Energy balance

Δ Weight / BMI

Δ Population Health
Logic pathway: Change in food and physical activity policy to change in health outcomes

Δ Policy → Δ Food environment → Δ Eating behaviour

Δ Food environment → Δ Physical activity environment

Δ Physical activity environment → Δ Physical activity behaviour

Δ Physical activity behaviour → Other effects

Δ Physical activity behaviour → Δ Energy expenditure

Δ Energy expenditure → Δ Level of physical activity

Δ Level of physical activity → Δ Sedentariness

Δ Dietary intake

Δ Diet composition (non energy-related)

Δ Fruit and Vegetable intake
Δ Fish intake
Δ Fat intake
Δ Salt intake
Δ Fibre intake
Δ Calcium intake

Δ Energy intake

Δ Amount (g) of food consumed
Δ Amount (g) of beverages consumed
Δ Energy density of food consumed
Δ Energy density of beverages consumed

Δ Energy balance

Δ Energy balance → Δ Weight / BMI

Δ Intermediates: risk factors

Δ Blood pressure
Δ Blood lipids
...
Logic pathway for obesity modelling

1. Δ Policy / Program
2. Δ Environment and Δ Behaviour
3. Δ Energy balance
4. Δ Weight / BMI
5. Δ Population Health
Obesity law and regulation project

– 5 year National Health and Medical Research Council (NHMRC) project grant

– Joint Deakin University and Monash University (public health lawyers)

– Identifying promising legal interventions (interviews with government and stakeholders at all levels)

– Ultimately will model ‘best buys’
## Obesity prevention policy framework

<table>
<thead>
<tr>
<th>Process</th>
<th>Output</th>
<th>Impact</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>Strategic policy and leadership</td>
<td>Policy instruments</td>
<td>Supportive envmts</td>
<td>Health</td>
</tr>
<tr>
<td>- Laws &amp; regulations</td>
<td>- Govt spending &amp; taxing</td>
<td>- Service delivery</td>
<td>Economic</td>
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<td>- Advocacy</td>
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<td>Social</td>
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<td></td>
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<td>Behav change</td>
<td>Environmental</td>
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<td></td>
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<td>Health services</td>
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Sacks et al *Obesity Reviews* 2009 (Adapted from WHO Global Strategy for Diet & Physical Activity Framework)
Integrating different public health approaches

Socio-ecological (upstream) approach
- Policies that shape the economic, social and physical environment
  - Influence underlying determinants of health

Lifestyle (midstream) approach
- Policies that directly influence behaviour
  - Influence food environments

Medical (downstream) approach
- Policies that support health services and clinical interventions
  - Influence physical activity environments

Strategic policy and leadership
- Supportive environment
- Strategic policy and leadership
- Behaviour change
- Policy instruments
  - Service delivery
  - Spending & taxing
  - Advocacy
  - Laws & regulations
- Monitoring, evaluation, and research

Health services
- Environmental
- Economic
- Social
- Health
## Policy areas that influence food environments

<table>
<thead>
<tr>
<th>LEVEL OF GOVERNANCE</th>
<th>LOCAL GOVERNMENT</th>
<th>STATE GOVERNMENT</th>
<th>NATIONAL GOVERNMENT</th>
<th>INTERNATIONAL</th>
<th>ORGANISATION</th>
</tr>
</thead>
</table>
| PRIMARY PRODUCTION  | • Land-use management (zoning)  
• Community gardens | • Agricultural subsidies | • Taxes on primary production  
• Agricultural subsidies  
• Research and development in agriculture | • Wealthy countries (e.g. USA, EU) agriculture subsidies | |
| FOOD PROCESSING     | • Farmers markets | • Food safety | • Food composition standards  
• Food composition monitoring | | |
| DISTRIBUTION        | • Marketing to children (billboards and signage)  
• Marketing to children  
• Marketing practices in schools | • Food transport  
• Access of fresh foods in remote areas | • Import tariffs  
• Import restrictions / restrictions on supply | • Trade arrangements between countries | |
| MARKETING           | • Land-use management (zoning)  
• Number of fast food outlets  
• Food handling | • Products sold in schools | • Nutrition labelling  
• Health claims on food products | • School food policies  
• Standards for food served in  
• Food procurement policies | |
| RETAIL              | • Community kitchens  
• Nutrition information in restaurants | | | | |
| CATERING / FOOD SERVICE | • Nutrition information in restaurants | | | | |
Logic pathway for obesity modelling

Δ Policy / Program

Δ Environment and Δ Behaviour

Δ Energy balance

Δ Weight / BMI

Δ Population Health
Energy gap concepts

‘Energy Imbalance Gap’ = the average difference between daily TEI (top line) and TEE (bottom line) needed to produce weight gain over a period of time.

‘Energy Flux Gap’ = the average difference in energy flux (TEI ≈ TEE) between two points in time.

Period of weight gain

Time A
(Settling point A, lower mean weight)

Time B
(Settling point B, higher mean weight)
Relationship between energy & weight

- Children
- Adults
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Other ACE-related work

– ACE Prevention project – 100 preventive, 50 treatment options across a range of chronic diseases

– Internationalization of ACE-Obesity (USA, Malaysia, New Zealand)

– Another round of ACE linking obesity and climate change – Raises methodological issues around measuring and health and environmental outcomes in a way meaningful to policymakers
Results: Cost-effectiveness plane

Results shown for alcohol prevention interventions
Results: Intervention pathway

Results shown for alcohol prevention interventions
Acknowledgements

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References (ACE process)


• Haby MM et al. *Int. J Obesity* 2006; 30; 1463-75.


Thank you!