Co-development of interactive decision support tools for policy and planning

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Sax Institute

To improve health and wellbeing by driving the use of research in policies, programs and services

- Not for profit, infrastructure funding from NSW Ministry of Health
- Provide policy makers with a gateway to expertise from 46 academic member organisations
- Work with more than 70 policy and program agencies
- Provide systems and services that have been developed and tested over more than 15 years

‘The bridge in curve’ Grace Cossington Smith
Decision Analytics

Latest advances in computer simulation
+ Best research evidence and data
+ Transdisciplinary perspectives & local knowledge
+ Participatory approach

= Interactive decision support tools for policy and practice
Challenges of policy and planning:

1. The complexity of the problem
2. Broad range of options for intervening

Strategies to reduce alcohol related harms
- Differential price by strength
- Social marketing regarding alcohol harms
- Restricted hours/days of sale of alcohol
- Restricted outlet density
- Alcohol taxes
- Advertising bans/sponsorship restrictions (e.g., banned alcohol sponsorship of televised sporting events?)
- Minimum pricing (e.g., Min. Price per Unit [Scotland])
- Enhanced enforcement of liquor laws (e.g., RSA legislation)
- Ban on sales in particular communities or at identified events
- Sale restrictions by alcohol strength
- Minimum legal purchase age
- Bans on drinking in public places
- Responsible service of alcohol training/policies
- Aggression management training for licensed venue staff
- Voluntary codes of practice
- Commercial liquor liability (Hotelier and Server Liability) including license suspensions
- Limits on amount sold on an occasion (including how many drinks can be bought at one time at the bar)
- Late-night lock-outs (no new customers admitted after a designated time)
- Lowered alcohol content of drinks
- High school classroom education on alcohol-related harms
- Product warning labels and messaging
- Brief intervention with risk groups
- Mutual help/self help groups (e.g., AA, online support forums, apps)
- Medication for alcohol problem treatment - antabuse, naltrexone etc
- Mandatory treatment of repeat drink drivers
- Ignition locks (2 or low BAL, to start car) routinely on all new cars or convicted drink drivers
- Required onsite recovery of alcohol use as a condition of probation for drink drivers
- Freezes on liquor licence numbers
- Designated driver programs
- Higher penalties for drink driving
- Zero blood alcohol for young and new drivers
- Automatic Drivers’ licence suspensions for mid-high level drink driving
- Random Breath Testing
- Municipal Alcohol Plans (community-driven management plans with local government enforcement)
- Sobering-up stations/facilities
- BAL definition of “intoxication” (e.g., BAL 0.15) for refusing alcohol sales in licensed venues
- Community impact statement requirements for new liquor licences
- Raising (designated limit, either individual or universal, on how much each person can buy in a month)
- Ban on secondary supply to young drinkers

Strategies to reduce obesity

Intervening at multiple levels of influence

Macro-level Environments (sectors)
- School and Institutional policies (e.g., school wellness programs, Parks and Recreation, Boys and Girls Club)

Physical Environments (Settings)
- Home visitation
- Parenting classes
- Pediatric primary care
- Childcare
- After School Programs (e.g., Soccer)
- Neighborhoods & Community Resources

Social Environment (Networks)
- Lifestyle (Diet, physical activity)
- Skills and behaviors
- Demographics
- Food preferences
- Social media
- Literacy sessions

Individual Factors (personal)
- Family, Friends, Peers (Role modeling, Support, Family classes)

Body Mass Index
3. Geographical variation

Suicide rates across LGAs and unincorporated SLAs, 1996-2000.

Rates of domestic violence, crime and suicide will increase in Adelaide’s north if Holden workers cannot eventually move to other jobs, a Senate inquiry has heard.

The inquiry into income inequality in South Australia has been focusing on the consequences of Holden ending manufacturing at the Elizabeth plant in 2017.

Reverend Peter Sandeman is with Anglicare but is also a member of the State Government's Automotive Transformation Taskforce.

He told the inquiry there was only a short window of opportunity to train workers in other areas.

"If young people don't see a chance of getting employment at the end of school, why stay in school?" he said.
5. Different perspectives and competing views of what should be done
WHAT CAN DYNAMIC SIMULATION MODELLING OFFER HEALTH POLICY AND PLANNING?
Help manage uncertainty

Ask ‘what if’ questions

Inform strategic planning

Adoption of new technology
Helping to address efficiency and safety in health sector
Policy makers at centre of unique approach to test solutions to complex problems

A low-cost, low-risk simulation tool enables decision makers to forecast what will happen when they launch policies in the real world.
Exemplars | Policy and Planning Models
A selection of applications in partnership with policy agencies

• Reducing alcohol related harms – models for New South Wales, ACT, and Tasmania

• Tobacco control models – Queensland and ACT models

• Reducing childhood overweight and obesity – New South Wales and National models

• Diabetes in pregnancy – Australian Capital Territory

• Smoking and Chronic Obstructive Pulmonary Disease – New South Wales model

• Mental Health service planning and suicide prevention – Western Sydney Primary Health Network and National models

• Portfolio management across common lifestyle related chronic disease risk factors – National and ACT models

• Integrated service planning across the health system – Queensland model

• Food policy – ACT model
Dynamic simulation modelling methods

System Dynamics
Jay Forrester, 1950s

Process-centric (Discrete Event)
Geoffrey Gordon, 1960s

The System

1990s Agent Based

Source: Borshchev & Filippov 2004
NSW model of alcohol related harms
- Agent based model -

- Academic alcohol experts
- Clinical experts
- Policy and program experts
  - NSW Health
    - Centre for Population Health
    - Centre for Epidemiology and Evidence
    - Drug & Alcohol Directors
    - Local Health District Directors
    - Office of Preventive Health
  - NSW Treasury

Modellers: Dylan Knowles, Ante Prodan, Geoff McDonnell
Physical Context

AtWorkOrSchool

AtSocialDrinkingOpportunity

PreloadingForPubClubOrBar

AtPubClubOrBar

AtPeerEvent

AtBottleShop

AtHomeAloneOrWithFamily

Social Context

socialContext

WithCoworkers

WithFriends

WithFamilyOrAlone
Rules govern the behaviour of individuals
Drinking episodes

The model keeps track of each individuals’ blood alcohol concentration
### Chronic harms simulated:

<table>
<thead>
<tr>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lip, oral and pharyngeal cancer</td>
</tr>
<tr>
<td>Oesophageal cancer</td>
</tr>
<tr>
<td>Liver cancer</td>
</tr>
<tr>
<td>Breast cancer (female)</td>
</tr>
<tr>
<td>Colorectal cancer</td>
</tr>
<tr>
<td>Hypertensive diseases</td>
</tr>
<tr>
<td>Ischaemic heart disease</td>
</tr>
<tr>
<td>Haemorrhagic stroke</td>
</tr>
<tr>
<td>Cirrhosis of liver</td>
</tr>
</tbody>
</table>

### Acute harms simulated:

<table>
<thead>
<tr>
<th>Harm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Violence</td>
</tr>
<tr>
<td>Road traffic accidents</td>
</tr>
<tr>
<td>Alcohol poisoning</td>
</tr>
<tr>
<td>Accidental injuries</td>
</tr>
<tr>
<td>(e.g. falls, fire, drowning)</td>
</tr>
<tr>
<td>Acute presentations resulting from chronic alcohol use disorder</td>
</tr>
</tbody>
</table>
Test whether model is able to reproduce historic data pattern across a range of indicators.
### Model interventions:

<table>
<thead>
<tr>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brief interventions (delivered by health professionals)</td>
</tr>
<tr>
<td>Improved access to alcohol treatment services</td>
</tr>
<tr>
<td>Restriction of hours of sale of alcohol</td>
</tr>
<tr>
<td>‘Lock outs’</td>
</tr>
<tr>
<td>Limiting the density of licensed venues</td>
</tr>
<tr>
<td>Advertising bans</td>
</tr>
<tr>
<td>Minimum pricing</td>
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<tr>
<td>Enhanced enforcement of RSA</td>
</tr>
</tbody>
</table>
The effects of combining multiple interventions are not necessarily additive.
Some interventions can have unintended consequences.
The effect of interventions can grow stronger over time with impacts not seen within a policy cycle.
NEW SOUTH WALES HEALTH
- CHILDHOOD OVERWEIGHT AND OBESITY-
How to achieve the premier’s target for reducing childhood overweight and obesity?

Policy partners and collaborators:
- NSW Health
- Centre for Population Health
- Office of Preventive Health
- NSW Department of Premier and Cabinet
- Multidisciplinary academic and clinical stakeholders

**Modelling the Premier's Priority**
Reducing Childhood Overweight and Obesity

Modellers: Mark Heffernan, Geoff McDonnell, Ante Prodan

Detailed model
Modelling the Premier's Priority
Reducing Childhood Overweight and Obesity

Detailed model

Achieved Reduction OwO %: 1 - 2 - 3 -

- Achieved reduction in % children overweight and obese over time

Year to start programs

Built environment infrastructure On/Off
Sport & active transport On/Off
Unhealthy food ad restrictions On/Off
Sugar sweetened beverage tax On/Off
Subsidise Healthy Food On/Off

Modify Built Env
Modify Sport & Active Transport
Modify Adv bans
Modify SSB Tax

NSW Health intervention switches
Targeted at [Age 0 up to 2]
Targeted at [Age 2 up to 5]
Targeted at [Age 5 up to 12]
Targeted at [Age 12 up to 17]
Modify programs

Modify

Run Pause Stop Reset
ACT HEALTH

- DIABETES IN PREGNANCY -
ACT Health – Diabetes in pregnancy tripartite model

Project aim:

- To develop a dynamic simulation model to inform the best investments for prevention and management of diabetes in pregnancy
- To be able to test both clinical and population health interventions

Modellers: Nate Osgood, Geoff McDonnell, Yang Qin, Anahita Safarishahrbijari, Allan McLean, Winchell Qian
- Spans the continuum from primary prevention to service delivery / alternative models of care
- Explores intergenerational effects of DIP

An individual

- Weight status
- Individual characteristics
- Dysglycemia / diabetes status
- Diagnostic status
- Pregnancy status

Dynamics of glycemic regulation
INTERACTIVE INTERFACES
Interactive user interfaces

Modelling strategies to address smoking in Queensland

A decision-support tool for reducing smoking-related harm

Model sectors
- Population
- Smoking prevalence
- Initiation
- Cessation and relapse
- Mental health
- E-cigarettes
- Smoking-related disease
- Release notes

Simulation results
Number of smokers, 18+ years, males

- Number of smokers over years
- pg 5

Accessibility and acceptability of tobacco
- Tobacco licensing
  - Tobacco licensing start
    - 2017
    - 2027
    - 2037

- Smoke-free environments
  - Smoke-free environments start
    - 2017
    - 2027
    - 2037

- Age of supply increase
  - Age of supply increase start
    - 2017
    - 2027
    - 2037

- Smoke-free generation
  - Smoke-free generation start
    - 2017
    - 2027
    - 2037

Affordability of tobacco
- Real cost increase start
  - 2021
  - 2029
  - 2037

- Real cost increase duration (years)
  - 0
  - 10
  - 20

- Real cost increase per year
  - 0

Appeal of tobacco
- Mass media campaign start
  - 2017
  - 2027
  - 2037

- Campaign duration (years)
  - 0
  - 10
  - 20

- Mass media campaign exposure
  - 1

Agency to quit tobacco
- Brief cessation interventions
- Quit support programs
- Quit support target (per year)
  - 5k

Qid Smoking v1.01, December 2017
Modelling the NSW Premier's Priority
Reducing Childhood Overweight and Obesity

The Nature of the Problem
Population Structure
Prevention interventions
Weight loss interventions
Key model assumptions
Cost interface
Start Stella Live
Stop Stella Live
Export data from graphs

Achieved reduction in % children overweight and obese over time

Cost $M - net present value

NSW Health intervention switches

- Programs targeted at ages 2 to 5
- Programs targeted at ages 5 to 12
- Programs targeted at ages 12 to 17

Max % mothers reached

Broader policy intervention switches

- Built environment infrastructure
- Active Kids program
- Water fountains
- Sugar sweetened beverage tax
- Active transport and sports
- Unhealthy food ad restrictions
- Subsidies for healthy food

Energy intake alone
Energy expenditure alone

Release Notes
OandO V878 TAPPC 22 Dec 2017
Model transparency important

Interventions in the model (red) act to modify the flows between the stocks.
Interactive user interfaces

Western Sydney suicide prevention decision support tool

**Background**
- The Magnitude of the Problem
- Key question model aims to address
- Indicative Model Structure
- Trans-diagnostic stepped care
- Unfurl the model
- Intervention mechanisms
- Start Stella Live
- Stop Stella Live
- Export data from graphs

**Specific suicide prevention interventions**
- Post suicide attempt assertive aftercare: On/Off
- GP / Gatekeeper training

**Mental health interventions**
- Mental Health Hospital to Home Service
- Modify community infrastructure spend per annum
- Community Support
- Sub-acute community Mx of severe mental disorder
- Headspace
- New intervention to re-engage those lost to services

**Mental health service planning**
- Modify secondary MH service capacity
- Modify hospital staffing and training
- Extra beds pa
- Staff increase % pa
- Annual training units
- Extra non-sec practitioners pa

**Grow assessment capacity**
- % increase pa

**Charts**
- Annual suicide attempts
- Annual suicide deaths
Intervention control panel

GP and gatekeeper training control panel

- Increase in referrals due to GP training %
  - 0.0
  - 50.0
  - 100.0

- Years to Complete GP training
  - 1.0
  - 3.0
  - 5.0

- Week to Start GP Interventions
  - 0
  - 260
  - 520

Graph: Population with known mental disorder over weeks (Run 1 and Run 2)
GP and gatekeeper training is aimed at reducing suicidal ideation through referral to services. This includes people who may be thinking about suicide for the first time or have survived a previous attempt.

In the model, this intervention acts to improve mental disorder diagnosis and referral to appropriate care.

The mechanism and estimates of effect for this intervention are informed by expert and local knowledge and:


ADVANTAGES OF THE PARTICIPATORY APPROACH
‘I think you should be more explicit here in step 2.’
Our Approach | Participatory

Integrated modelling techniques with best available evidence, data and expert knowledge

- Improved validity, robustness and utility of the final decision support tool
- Consensus building for action
- Improved understanding of the complex problem
- Potential for policy coherence across jurisdictions
- Better alignment of cross-sectoral agendas to support implementation
- Pro-bono inputs from leading experts in the field
- Access to key data sources in abridged timeframes
Use of our models | Driving Change

- To support recommendations in ministerial briefs.

- To inform investment decisions by health and government departments and program commissioning decisions in the primary care setting.

- To facilitate the engagement of broader stakeholders in strategy dialogues and consensus building for action.

- Help set realistic targets for impact / manage expectations regarding progress towards targets set.

- Use as advocacy tools and to add strength to business cases for longer term funding.

- Demonstrate the consequences of disinvestment in programs.

- Help identify priorities for data collection / research.
Thank you

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