Using models to make the economic case

David McDaid
Associate Professorial Research Fellow
London School of Economics and Political Science
E-mail: d.mcdaid@lse.ac.uk
What Works Centre for Wellbeing Workshop
London School of Economics and Political Science
E-mail: d.mcdaid@lse.ac.uk
Why make use of modelling?
Addressing uncertainty in results of any one study.

- Synthesising data on costs and effects from multiple studies - often with different comparator interventions.
- Assessing costs and effectiveness of different interventions over longer time periods than seen in most empirical studies.
- Creating potential intervention pathways, effectiveness and costs where local empirical evidence is unavailable.
- Looking at implications of differing rates of coverage, uptake and continued engagement to implement wellbeing interventions.

Why make use of modelling?

- Estimating impacts of investing in changes to infrastructure to implement wellbeing interventions.
- In the absence of definitive empirical studies, helping to prioritise where scarce research funds may be invested in empirical trials.
- Why make use of modelling?
Diabetes
Social Isolation
Inactivity
Physical
Depression
Smoking
Potentially modifiable
dementia
35% risk factor
Making use of modelling
Approaches to modelling

- Very complex models, e.g., weather forecasting.
  
- Decision tree modelling
  - Simple linear pathways from intervention to outcome.
  
- Markov modelling
  - Used for long time periods, probabilities of moving between different health states at end of Markov cycle.

- Micro-simulation models
  - Individuals move along model pathway, experiencing changes in outcomes at varying points in time. Model considers likelihood of a further event and when this is likely to occur. This approach can be used to handle very complex models

- Decision tree modelling
  - Simple linear pathways from intervention to outcome.
Modelling Software

• Commercial Packages
  - Treeage Pro - Used extensively in health economics

• Excel for decision modelling and simulation modelling

• R - for simulation modelling

• Bespoke software /models
Examples of actions – work for Public Health England
Simulation models look at potential costs and benefits of investing promotion, prevention, and potential costs and benefits of investing for Public Health England.

Conservative assumptions used for England or local levels.
PHE model designed for England or local levels.
Different timelines and stakeholders/sectors.
Simulation models look at ROI to different levels.
Conservative assumptions used.
Public Health England

Commissioning Cost-Effective Services for Promotion of Mental Health and Wellbeing and Prevention of Mental Ill-Health

From: Public Health England
Published: 30 August 2017

New tool identifies the most cost-effective programmes to help prevent mental ill-health in local communities.

PHE highlights 8 ways for local areas to prevent mental ill-health
Looked at evidence-based interventions (NHS and non-NHS) and other established outcomes. These 15 are not necessarily the priority areas.

For each ... what economic consequences could we measure? Different sectors and over different time periods.

If in doubt, conservative in estimates ... and by year, discounted back. Measured economic impacts by system/budget.

Any 'economic pay-offs' are over and above the health, QOL and wellbeing benefits to individuals.

Our approach: Return on Investment Modelling.
Aim

Rapid reviews for evidence on costs effectiveness & systematic reviews / meta analysis on effects

Look at evidence-based mental health interventions (incl. non-NHS)

must have well-established outcomes

Linear decision analytic modelling

As far as the robust evidence base allows:

- Include promotion and primary prevention
- Include promotion and primary prevention
- Look at widest range of economic impacts
- Estimate impacts over long time periods
- If in doubt, adopt conservative perspective

reviews / meta analysis on effects

Our approach - 1
Examine interventions from different perspectives:
- pay-offs to society as a whole, different public sectors and health sectors and
- pay-offs to different contexts.

Interventions modelled are not necessarily the only ones that are economically attractive.

Need adapting to different contexts:

Findings are not definitive: a platform for discussion.

Please note that:

a. Findings are not definitive: a platform for discussion.
b. Need adapting to different contexts;
c. Our approach - 2.

The wider impacts are important, given the high 'external' costs of up resources.

Over and above the economic pay-offs there are health, QOL and non-health benefits to individuals.

Many MH problems ... even if not always considered in decision-making.
Tackling Loneliness
Target

All community dwelling older adults (aged 65 plus)

Intervention

Signposting service to social activities provided in public locations in England, then participation in social activities and / or volunteering.

Funder

Local Authorities fund cost of signposting & initial participation in activities.

Outcome

Evidence

Impacts on likelihood of being lonely: 9% reduction in loneliness over 5 years through avoidance of severe levels of loneliness over cardiovascular disease & developing dementia.

Impacts on use of primary and secondary health services including avoidance of self-harm, social care for dementia, informal care and volunteering.

Economic Pay-offs

Impacts on likelihood of developing depression, loneliness - reduction in risk of depression.
Identifying economic costs of loneliness for model
Review Results

- Rapid literature review across several databases and grey literature
- Examined over 2000 papers looking at different aspects of resource use, cost and loneliness
- Limited discussion of impact on economic cost
- But literature from high income country settings of studies on loneliness as risk factor for health concerns
- Limited resource utilisation used to inform model development
Loneliness associated with poor health & wellbeing

Loneliness
Loss of social networks
Lower wellbeing
GP Consultations
Unplanned hospital admissions
Self-harm
Depression
Coronary Heart Disease
Strokes
Risks to cognitive health

Loneliness associated with poor health & wellbeing

Emergency Accident & Emergency

Networks
Loneliness and Dementia

Meta analysis and European studies provide good evidence on longitudinal risk of dementia in lonely population. Subjects of 19 studies found relative risk of dementia 1.58 times greater in lonely population.


1.64 times greater (1.05 – 2.64) in sample of 2,173 non-demented older people in subset of 19 studies on found relative risk of dementia 1.58 times greater in lonely population.

Loneliness and Dementia
Unplanned Hospital Contacts

- Links between loneliness and increased rates of hospital inpatient admission on the island of Ireland.
- Increased rates of accident and emergency (ER) contact rates from loneliness.
- Valued at rate for English National Tariff for Emergency Medicine Category 2 investigation with Category 3 treatment based on observations in Swedish context.
- Valued at rate of short stay hospital admission using national tariffs on the island of Ireland.
Depression, Stroke, Coronary Heart Disease

- Some evidence in literature that loneliness & depression correlated & some evidence that loneliness increases risk of depression

- Model accounts of increased risk of depression, but also that only 1 in 6 people who are depressed contact health services.

- Recent meta analysis of longitudinal studies also supports associations between poor social relationships and increased risk of incident coronary heart disease (29%) and stroke (32%) (Valtorta et al 2016).

- Modest and conservative costs for CHD (drug therapy), depression (basic time limited psychological therapy) and stroke (outpatient & inpatient costs) used in model
Return on Investment Results
Engagement rate of 6%

Loneeliness risk ~ 9%

Small scale navigation

Excerpt of model structure
ROI: Baseline Scenario for England
ROI: Baseline Scenario Local Area
### Scenario Analysis

**Input your own value if desired**

<table>
<thead>
<tr>
<th>Other parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>£961.00</td>
</tr>
<tr>
<td>£70</td>
</tr>
<tr>
<td>£69</td>
</tr>
<tr>
<td>£31</td>
</tr>
<tr>
<td>£0000</td>
</tr>
<tr>
<td>£0000</td>
</tr>
<tr>
<td>£19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>£2000</td>
</tr>
<tr>
<td>£925</td>
</tr>
</tbody>
</table>

Return to Intervention Choice Menu

Return to Volunteerling Intervention Contents Page

---

**Model Parameters**

**Older Adults : Checking and/or Adjusting Tacking Loneliness and Social Isolation in**

**ROI: Scenario Analysis**
Example: varying effectiveness & cost of navigation

Return on Investment vs. Reduction in relative risk of loneliness

- 0.99
- 0.98
- 0.95
- 0.91
- 0.85
- 0.8

Colors:
- 5
- 9.25
- 15
- 20
- 50

LSE
PSSRU
Importance of local context in models

Access to transport and to volunteers with transport an issue

Cost an issue in rural areas - limited public transport

Access to transport and to volunteers with transport an issue

Capturing all aspects of the impact of loneliness intervention; more than just measurement of changes in recorded levels of loneliness

Recruitment/retention of volunteers who are lifeblood of intervention;

Pay small charges to support group activities;

Challenges in sustainable financing and willingness of participants to pay small charges;

Identifying activities that appeal to men and women;

Cost an issue in rural areas - limited public transport
Bullying
KiVa: evidence-based school-based programme

- Developed in Finland; delivered by teaching staff
- KiVa: evidence-based school-based programme
- KiVa focuses on enhancing empathy, self-efficacy, anti-
- Behaviour of pupils who are neither bullies nor victims can
- Positive changes in bullying attitudes of classroom peers. Positive changes in
- KiVa: evidence-based school-based programme
-Reduce incentitives for bullying
-Reduce rewards that bullies perceive they receive ... and so
-Research shows that it significantly reduces bullying
-Addresses traditional & cyberbullying
-Addresses traditional & cyberbullying
-Victimization & perpetration ... and is strongly cost-effective.
-KiVa: evidence-based school-based programme

Bullying interventions: effects

Karna et al / Consulting & Clinical Psychology 2014; McDaid et al PSSRU/MQ Report 2017
Example of ROI

Term, return on investment
depression. These increase long
terms. Return on investment
for children, work, lower rate of
education. Children who are not bullied:
reported better adult outcomes
for different long term studies.

Conservative analysis: several

Bedford

Area Selected:
Estimating long term ROI of bullying intervention

- Expanded PHE model to link with new evidence on the long term wider economic impacts of bullying to age 50
- Potential very long term return of £146:1
- Early 1970s, but need to be cautious as long term data for children in the early 1970s
- Bullying associated with adverse outcomes in more recent child cohorts

New research shows the benefit of bullying interventions in schools
Hypothetical cohort of 200 children aged 7 to 8 followed over four years

<table>
<thead>
<tr>
<th>Age 0</th>
<th>Age 1-11</th>
<th>Age 18</th>
<th>Age 50</th>
<th>Overall Net Return per Pound Invested</th>
<th>Total Cost (saving if negative value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>£4.618</td>
<td>£4.41</td>
<td>£4.18</td>
<td>£4.00</td>
<td>£0.19</td>
<td>£4.19</td>
</tr>
<tr>
<td>£4.92</td>
<td>£4.12</td>
<td>£4.00</td>
<td>£3.92</td>
<td>£0.00</td>
<td>£3.92</td>
</tr>
<tr>
<td>£3.32</td>
<td>£2.29</td>
<td>£2.17</td>
<td>£2.09</td>
<td>£0.00</td>
<td>£2.09</td>
</tr>
<tr>
<td>£0.00</td>
<td>£0.00</td>
<td>£0.00</td>
<td>£0.00</td>
<td>£0.00</td>
<td>£0.00</td>
</tr>
</tbody>
</table>

Potential long term impacts of bullying intervention
Debt
Debt and mental health

Estimated that 16.1% of UK adults (8.25 million people) were over-indebted – regularly missing monthly payments in at least three of the last six months or finding meeting commitments a heavy burden. (Money Advice Service 2016).

Unmanageable debt associated with increased risk of common mental health problems, relative risk 1.33 compared to general population.

Further 9% where such difficulties contributed a lot to the suicide.

The recession, employment or financial-related difficulties and a relative risk 1.33 compared to suicides entirely related to England in 2010 and 2011 revealed ‘4% of suicides entirely related to unmanageable debt associated with increased risk of common mental health problems, relative risk 1.33 compared to general population.

Analysis of coroner records of 300 people who died by suicide in England in 2010 and 2011 revealed ‘4% of suicides entirely related to unmanageable debt associated with increased risk of common mental health problems, relative risk 1.33 compared to general population.

Coope 2015.
Debt and welfare advice services

Target
General population without mental health problems at risk of unmangeable debt or welfare problems

Intervention
Debt advice services, provided on face to face, telephone or internet basis; including GP practice training to increase referral to debt advice services

Funder
Complex: Subsidies from finance industry (Fair Share), Debt Advice Levy, Creditors, Local Authorities & CCGs

Outcome
Evidence trial based and observational evidence on value of debt and welfare advice services. Avoidance of costs to health and social care services; legal system; productivity losses; local economy; reduction in suicidal behaviour

Economic pay-offs
Avoidance of costs to health and social care services; legal system; productivity losses; local economy; reduction in suicidal behaviour
### Example of ROI

**McDaid, Park, Knapp et al forthcoming 2017**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Cost / Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>£650.858</td>
</tr>
<tr>
<td>2</td>
<td>£650.858</td>
</tr>
<tr>
<td>3</td>
<td>£650.858</td>
</tr>
<tr>
<td>4</td>
<td>£650.858</td>
</tr>
<tr>
<td>5</td>
<td>£650.858</td>
</tr>
</tbody>
</table>

Cumulative QALYs Gained

<table>
<thead>
<tr>
<th>Year</th>
<th>£2.55</th>
<th>£2.75</th>
<th>£2.85</th>
<th>£2.95</th>
<th>£3.14</th>
<th>£3.79</th>
<th>£6.17</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
</tr>
<tr>
<td>2</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
</tr>
<tr>
<td>3</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
</tr>
<tr>
<td>4</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
</tr>
<tr>
<td>5</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
<td>-£520.0</td>
</tr>
</tbody>
</table>

Cumulative Return on Pound Invested

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Cost</th>
<th>Total Cost consequences (Saving if negative value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>£2.55</td>
<td>-£520.0</td>
</tr>
<tr>
<td>2</td>
<td>£2.75</td>
<td>-£520.0</td>
</tr>
<tr>
<td>3</td>
<td>£2.85</td>
<td>-£520.0</td>
</tr>
<tr>
<td>4</td>
<td>£2.95</td>
<td>-£520.0</td>
</tr>
<tr>
<td>5</td>
<td>£3.14</td>
<td>-£520.0</td>
</tr>
</tbody>
</table>

Depression Productivity Losses

<table>
<thead>
<tr>
<th>Year</th>
<th>Workplace Stress Absence due to Debt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>£23.787</td>
</tr>
<tr>
<td>2</td>
<td>£23.787</td>
</tr>
<tr>
<td>3</td>
<td>£23.787</td>
</tr>
<tr>
<td>4</td>
<td>£23.787</td>
</tr>
<tr>
<td>5</td>
<td>£23.787</td>
</tr>
</tbody>
</table>

Legal and Debtor Administration

<table>
<thead>
<tr>
<th>Year</th>
<th>£32.012</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

GP Visits

<table>
<thead>
<tr>
<th>Year</th>
<th>£31.952</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Total Net Costs / Payoffs (Default values 2015 prices)

**Total Cost Information**

Return to Intervention Choice Menu

Return to Debt Advice Contents Page

**Bedford**

**Area Selected:**

**In debt**

**ROI: Providing support for people**
Economic pay-offs per £1 invested

<table>
<thead>
<tr>
<th>Programmes</th>
<th>NHS</th>
<th>Other public sector</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suicide prevention</td>
<td>0.97</td>
<td>0.31</td>
<td>0.68</td>
<td>1.96</td>
</tr>
<tr>
<td>Debt and welfare advice</td>
<td>0.81</td>
<td>0.02</td>
<td>1.57</td>
<td>2.40</td>
</tr>
<tr>
<td>Loneliness alleviation for older people</td>
<td>0.09</td>
<td>0.95</td>
<td>0.35</td>
<td>1.39</td>
</tr>
<tr>
<td>Collaborative care for physical health problems</td>
<td>0.26</td>
<td>2.31</td>
<td>1.26</td>
<td>3.83</td>
</tr>
<tr>
<td>Workplace stress alleviation</td>
<td>0.18</td>
<td>0.05</td>
<td>0.30</td>
<td>0.53</td>
</tr>
<tr>
<td>Workplace wellbeing</td>
<td>0.30</td>
<td>0.27</td>
<td>1.52</td>
<td>2.09</td>
</tr>
<tr>
<td>Collaborative care for physical health (impacts on depression only)</td>
<td>0.02</td>
<td>0.35</td>
<td>0.32</td>
<td>0.67</td>
</tr>
<tr>
<td>School social and emotional learning</td>
<td>0.90</td>
<td>-</td>
<td>0.08</td>
<td>0.98</td>
</tr>
</tbody>
</table>

Not all long term impacts or non-mental health impacts included in analysis.

Very conservative analysis.

Programmes in yellow not funded outside of NHS.
Social Return on Investment Modelling

The impact map below outlines the first three stages of the SROI analysis.
Other considerations when modelling
Intersectoral activities

- Many actions take place across sectors
- Multiple sectors may pay, multiple sector may benefit
- Focus on specific issues around making an economic case inlanguage relevant to other sectors
- Help inform discussions re implementation of
- Intersectoral activities
Speaking the right language

- Make arguments using the language of the sector in question e.g. workplaces, schools

- Performance at work, absenteeism, reduction in work accidents,
  - For workplaces: creativity, innovation,

- Absenteeism rates, reputation, performance outcomes, classroom disruption, teacher
  - For school based programmes: truancy rates, exam education outcomes and impacts on

Speaking the right language
Linking to registries and datasets

Look for opportunities to use registries to identify long-term effects.

Ongoing evaluation to assess exposure to loneliness alleviation in UK and use of health, social and long-term care services

Understanding Society Data on arts and sports engagement used to help determine monetary value of wellbeing
To summarise, modelling can play an important role in making the economic case for wellbeing promoting interventions. Particularly in showing long term impacts across sectors. Important to be transparent and conservative in assumptions made. Modelling can play an important role in making the economic case for wellbeing promoting interventions.