A national achievement?: Changes in inequalities in risk factors for cardiovascular disease in Australia

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Work in Progress
Structure of the seminar

- Background on inequality measures & Achievement index;
- Main focus on how to represent changes in inequalities and mean health;
- Some examples from self-reported cardiovascular risk factors from Australian National Health Surveys.
Inequality comparisons

Have inequalities:

Decreased?

Remained the same?

Increased?
Case for decreasing inequalities

<table>
<thead>
<tr>
<th>Time 1</th>
<th>Time 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Morbidity</strong></td>
<td><strong>Morbidity</strong></td>
</tr>
<tr>
<td>Poor: 75%</td>
<td>Poor: 25%</td>
</tr>
<tr>
<td>Rich: 50%</td>
<td>Rich: 75%</td>
</tr>
</tbody>
</table>

Ratio = Health of Rich / Health of Poor

Time 1: 50%/25% = 2
Time 2: 75%/50% = 1.5

Inequalities have decreased
Case for no change in inequalities

<table>
<thead>
<tr>
<th>Health</th>
<th>Poor</th>
<th>Rich</th>
<th>Health</th>
<th>Poor</th>
<th>Rich</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1</td>
<td>25%</td>
<td>50%</td>
<td>Time 2</td>
<td>50%</td>
<td>25%</td>
</tr>
<tr>
<td>Time 2</td>
<td>50%</td>
<td>75%</td>
<td>Absolute inequalities in “health”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Time 1: 50% - 25% = 25%

Time 2: 75% - 50% = 25%

Inequalities have remained the same
Case for increasing inequalities

Relative inequalities in “morbidity”

Time 1 75%/50%=1.5
Time 2 50%/25%=2

Inequalities have Increased!
Jim Hacker MP: “So Humphrey are health inequalities rising or declining?”

Sir Humphrey: “Well Minister in terms of measures of morbidity, inequalities are increasing, but in terms of absolute inequalities they remain the same, and if instead we measure inequalities in terms of health they are actually declining.”
Concentration curves

cumulative proportion of morbidity

Cumulative proportion of population ranked by income/socioeconomic status

Concentration index

-L(S1) - L(S2) - L(S3)

-ve indicates Pro-rich Inequality
Concentration curves

Cumulative proportion of population ranked by income/socioeconomic status

+ve indicates Pro-rich Inequality
Generalized concentration curves

Cumulative morbidity

Cumulative proportion of population ranked by income/socioeconomic status

$L(S_1)$  $L(S_2)$  $L(S_3)$

Gen Concentration index
Extended Concentration index

\[ C = 1 - \frac{2}{n\mu} \sum_{i=1}^{n} y_i (1 - R_i) \]

\[ C(\nu) = 1 - \nu(\nu - 1) \int_{0}^{1} (1 - p)^{\nu - 2} L(p) dp, \nu > 1 \]

\[ C(\nu) = 1 - \frac{\nu}{n\mu} \sum_{i=1}^{n} y_i (1 - R_i)^{\nu - 1} \]

Wagstaff (2002) Inequality aversion, health inequalities, health achievement, JHE.
Inequality aversion

Fig 2: Weighting scheme for extended concentration index—eqn (5)

Wagstaff (2002)
How do we make meaningful comparisons across time?

Average health has increased

Absolute and Relative inequalities have declined

Had to argue things are not improving
More difficult case

Average health has increased

Absolute inequalities ↑

Relative inequalities ↑

Hard to say if things are improving
Achievement Index

\[ I(\nu) = \mu(1 - C(\nu)) \]

\[ I_2(\nu) > I_2(\nu) \]

\[ \mu_1 - \mu_1 C_1(\nu) > \mu_2 - \mu_2 C_2(\nu) \]

\[ \mu_2 C_2(\nu) - \mu_1 C_1(\nu) > \mu_2 - \mu_1 \]
Incremental health achievement plane relative to Haiti.
Region of increasing achievement

Kazakhstan

NW

Chad

NE

Madagascar

SW

Egypt

SE
Change in mean health

Increases in absolute inequality
(v=2)

\[
\mu_2 C_2(2) \mu_1 C_1(2)
\]

\[
\mu_2 - \mu_1
\]
Increases in mean health

Increases in absolute inequality (v=8)

\[ \mu_2 C_2(8) - \mu_1 C_1(8) \]

Incremental Cost

Change in mean health

Incremental Cost

Increases in mean health

\[ \mu_2 - \mu_1 \]
Probability of increase in health achievement

Inequality aversion (v)

Series 2
Cardiovascular risk in Australia
NHS survey population

- Individuals participating in the last four ABS National Health Surveys, conducted in:
  - N=54,241, 53,828, 26,862, 25,906
- Expanded surveys available on-line from 2001 via the remote access data laboratory (RADL)
- Urban and rural areas throughout all states and territories
- Non-institutionalized residential population;
- Collects self-reported information on health status, health behavior, health use (mainly over previous 2 weeks)
- Demographic and socio-economic factors, e.g. self-reported household income
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>34,078</td>
<td>15,713</td>
<td>13,167</td>
<td>15,004</td>
</tr>
<tr>
<td>% female</td>
<td>50.9</td>
<td>50.4</td>
<td>52.8</td>
<td>51.2</td>
</tr>
<tr>
<td>% over 50 years</td>
<td>33.9</td>
<td>32.7</td>
<td>40.2</td>
<td>39.9</td>
</tr>
<tr>
<td><strong>Risk factors %</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High blood pressure</td>
<td>20.4 (20.5)</td>
<td>15.0 (14.5)</td>
<td>14.8 (12.9)</td>
<td>15.4 (13.8)</td>
</tr>
<tr>
<td>No exercise</td>
<td>35.9 (35.7)</td>
<td>33.1 (32.4)</td>
<td>29.6 (29.2)</td>
<td>(33.7)</td>
</tr>
<tr>
<td>Smoker</td>
<td>28.2 (29.1)</td>
<td>24.1 (25.0)</td>
<td>22.5 (24.5)</td>
<td>22.8 (25.6)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.5 (2.3)</td>
<td>3.0 (3.0)</td>
<td>4.7 (4.2)</td>
<td>5.1 (4.6)</td>
</tr>
<tr>
<td>High cholesterol</td>
<td>10.9 (10.9)</td>
<td>7.3 (7.7)</td>
<td>9.4 (7.8)</td>
<td>10.2 (9.1)</td>
</tr>
<tr>
<td>Previous heart disease</td>
<td>5.0 (4.8)</td>
<td>4.2 (4.6)</td>
<td>2.8 (2.2)</td>
<td>2.1 (1.8)</td>
</tr>
<tr>
<td>Overweight or obese</td>
<td>39.0 (38.4)</td>
<td>44.9 (43.5)</td>
<td>52.2 (49.8)</td>
<td>55.0 (53.2)</td>
</tr>
</tbody>
</table>
Vigorous Exercize

Prevalence of vigorous exercise

- 1989
- 1995
- 2001
- 2005
Overweight, or obese

prevalence of overweight or obese by income decile

BMI

1989
1995
2001

Income decile
Obese

Age and sex standardised prevalence of obesity by income quintile

- 1989
- 1995
- 2001
- 2005
Smoking status

Age and sex standardised prevalence of smoking by income decile

- 1989
- 1995
- 2001
- 2005
Diabetes (Type I & II)
High cholesterol

Age and sex standardised high cholesterol

- 1989
- 1995
- 2001
High blood pressure

Age and sex standardised prevalence of high blood pressure

1989
1995
2001
Increases in absolute inequality ($v=2$)

Change in absolute inequality

Change in mean health

- 1995
- 2001
- 2005

- Normal weight
- Vig. Exercise
- Non Smokers
Increases in absolute inequality (v=2)

Change in mean health

Change in absolute inequality

Diabetes
Cholesterol
Blood pressure

Smoking status

Age and sex standardised prevalence of smoking by income decile

- 1989
- 1995
- 2001
- 2005
## Measuring achievement: smoking

<table>
<thead>
<tr>
<th>Survey year</th>
<th>Mean</th>
<th>Cl_m</th>
<th>Cl_h</th>
<th>μCl_m</th>
<th>μCl_h</th>
<th>Al_h</th>
<th>Al_m</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>0.291</td>
<td>-0.098</td>
<td>0.04</td>
<td>-0.0285</td>
<td>0.0285</td>
<td>0.6805</td>
<td>0.3195</td>
</tr>
<tr>
<td>1995</td>
<td>0.25</td>
<td>-0.152</td>
<td>0.051</td>
<td>-0.038</td>
<td>0.038</td>
<td>0.712</td>
<td>0.288</td>
</tr>
<tr>
<td>2001</td>
<td>0.245</td>
<td>-0.148</td>
<td>0.048</td>
<td>-0.0363</td>
<td>0.0363</td>
<td>0.7187</td>
<td>0.2813</td>
</tr>
<tr>
<td>2005</td>
<td>0.256</td>
<td>-0.14</td>
<td>0.048</td>
<td>-0.0358</td>
<td>0.0358</td>
<td>0.7082</td>
<td>0.2918</td>
</tr>
</tbody>
</table>
Measuring achievement

AI vs \( \psi \) parameter for smoker
Overweight, or obese

prevalence of overweight or obese by income decile
## Overweight & obese

<table>
<thead>
<tr>
<th>Survey year</th>
<th>Mean</th>
<th>$C_{l_m}$</th>
<th>$C_{l_h}$</th>
<th>$\mu C_{l_m}$ (v=2)</th>
<th>$\mu C_{l_h}$ (v=2)</th>
<th>$A_{l_h}$ (v=2)</th>
<th>$A_{l_m}(v=2)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>0.384</td>
<td>-0.046</td>
<td>0.029</td>
<td>0.0177</td>
<td>0.0177</td>
<td>0.5984</td>
<td>0.4016</td>
</tr>
<tr>
<td>1995</td>
<td>0.435</td>
<td>-0.023</td>
<td>0.018</td>
<td>-0.01</td>
<td>0.01</td>
<td>0.555</td>
<td>0.445</td>
</tr>
<tr>
<td>2001</td>
<td>0.498</td>
<td>0.003</td>
<td>-0.003</td>
<td>0.0015</td>
<td>-0.0015</td>
<td>0.5035</td>
<td>0.4965</td>
</tr>
<tr>
<td>2005</td>
<td>0.532</td>
<td>-0.0157</td>
<td>0.018</td>
<td>-0.0084</td>
<td>0.0084</td>
<td>0.4596</td>
<td>0.4404</td>
</tr>
</tbody>
</table>