Estimating a Country’s Social Distribution of Health
ISPOR Workshop
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Introduction and Estimates from England

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Healthy Years of Life

Why bother doing this?

• Summary measure of health inequality are useful for...
  1. Monitoring progress over time in tackling health inequality
  2. Cross-national comparisons
Where does this fit into DCEA?

Simulating Distributions

Baseline distribution (pre-decision)

Benefits

Opportunity costs

Final distribution (post-decision)

Evaluating Distributions

Dominance tests

Inequality indices

Indirect equity weights

Direct equity weights
Why use QALYs?

- Generic measures of health provide a complete summary
  - Disease-specific measures (e.g. cancer outcomes) are incomplete
  - When evaluating interventions, they also do not allow us to compare the size of health inequality impacts between different disease areas
  - Likewise, life expectancy and morbidity measures are incomplete
- “Disability-free” life expectancy (DFLE) exaggerates inequality
  - DFLE values life with “disability” at zero, as bad as death, and life without “disability” at one, as good as full health. This exaggerates differences and inflates health inequality gaps, as we shall see.
Sensitivity analysis around England estimates

### (b) Adjusted Life expectancy at birth

<table>
<thead>
<tr>
<th></th>
<th>IMD 1 (Most Deprived)</th>
<th>IMD 2</th>
<th>IMD 3</th>
<th>IMD 4</th>
<th>IMD 5 (Least Deprived)</th>
<th>Inequality Gap</th>
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<tbody>
<tr>
<td>Crude Life Expectancy</td>
<td>78.33</td>
<td>80.91</td>
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<td>In good health</td>
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<td>63.96</td>
<td>67.57</td>
<td>69.96</td>
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<td><strong>Love-Koh (2015) estimates</strong></td>
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</table>

### (b) Adjustment for binary measures

<table>
<thead>
<tr>
<th></th>
<th>IMD 1 (Most Deprived)</th>
<th>IMD 2</th>
<th>IMD 3</th>
<th>IMD 4</th>
<th>IMD 5 (Least Deprived)</th>
<th>Inequality Gap</th>
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</thead>
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<tr>
<td>Flat Adjusted disability</td>
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<td>73.28</td>
<td>75.59</td>
<td>77.32</td>
<td>12.41</td>
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<tr>
<td>Flat Adjusted In good health</td>
<td>65.85</td>
<td>69.90</td>
<td>72.50</td>
<td>74.61</td>
<td>77.00</td>
<td>11.15</td>
</tr>
</tbody>
</table>

*Source:* Unpublished work-in-progress, with thanks to Katja Grasic
• Different countries have health inequality concerns about different social status groups

• Examples of Generic Social Status Groups:
  – England: Five quintile groups of neighbourhoods, based on the index of multiple deprivation (IMD)
    • IMD includes income, employment, disability, education and skills, crime, housing and service barriers, living environment
  – USA: Twenty-five groups by race/ethnicity (White, Hispanic, Black, Asian & Pacific Islander, American Indian & Alaska Native) and deprivation (five quintile groups of counties based on the Social Vulnerability Index)
  – Australia: Indigenous status and five quintile groups based on one of the Socio-Economic Indices for Areas
  – A tractably small number of social groups can never cover ALL aspects of social disadvantage, but can be a useful starting point for considering more specific health inequalities
What equity-relevant characteristics (i.e., race and ethnicity, social deprivation, etc) are most important when measuring baseline levels of health inequality in your country/jurisdiction?

Open-ended/short answer responses (displayed as lists)
DISTRIBUTIONAL COST-EFFECTIVENESS ANALYSIS
Quantifying Health Equity Impacts and Trade-Offs

An Oxford University Press Handbook in Health Economic Evaluation

Edited by Richard Cookson, Susan Griffin, Ole F. Norheim, and Anthony J. Culyer

• Flexible methods for any decision context
• Practical spreadsheet training exercises
• Clear overview for decision-makers

‘The definitive guide to equity methods in health economic evaluation - a landmark in the field.’

Michael Drummond, Professor of Health Economics, University of York, UK

https://www.york.ac.uk/che/publications/books/handbook-dcea/
Readings


Thank you
Estimating the baseline health distribution across socioeconomic status: The case of Chile

Dr. Manuel Espinoza S., MD MSc PhD
Associate Professor - Department of Public Health
Chief – Unit of Health Technology Assessment (ETESA-UC)
Facultad de Medicina - Pontificia Universidad Católica de Chile
Context

- Chile is a high income country in South America
- Suffering pervasive socioeconomic and health inequalities
- Equity became a major principle of the healthcare reform in 2005, which failed in having a significant impact
- Social inequalities are the main reason of a historic social change in the country
- Alongside a process to elaborate a new constitution, health system reform becomes a priority, and equity is a fundamental goal to pursue.
Distribution of what?

**Life expectancy (LE)**
- National mortality rates by sex, age, level of education

**Quality Adjusted LE (QALE)**
- National mortality rates by sex, age, level of education
- Utilities estimated from the 2018 National health Survey (EQ-5D + Chilean value set), by age, sex and educational level

**Health Adjusted LE (HALE)**
- National mortality rates by sex, age, level of education
- Utilities estimated from the 2018 National health Survey (EQ-5D + Chilean value set), by age, sex and educational level

Available public information

Information not available, or with restrictions

Expectancy at birth
- **80.4 years old**
- **69.8 QALYs**
- **62.4 HALYs**

Clear gradient favoring the better-off population

Greater population health inequality than other high income countries

<table>
<thead>
<tr>
<th>Health Indicator</th>
<th>20:20 absolute gap</th>
<th>20:20 relative gap</th>
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</thead>
<tbody>
<tr>
<td>Life expectancy</td>
<td>15.24 years</td>
<td>1.21</td>
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<tr>
<td>QALE</td>
<td>21.92 QALY</td>
<td>1.41</td>
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<tr>
<td>HALE</td>
<td>18.57 HALY</td>
<td>1.38</td>
</tr>
</tbody>
</table>

*socioeconomic status measured as years of education

Q1 (0-3 years, pre-school), Q2 (3-6 years, early years to year 1); Q3 (6-9 years, primary level); Q4 (9-13 years, secondary level); and Q5 (>13, technical or university level)

<table>
<thead>
<tr>
<th>Age interval</th>
<th>SES-1 LE</th>
<th>SES-1 QALE</th>
<th>SES-1 HALE</th>
<th>SES-2 LE</th>
<th>SES-2 QALE</th>
<th>SES-2 HALE</th>
<th>SES-3 LE</th>
<th>SES-3 QALE</th>
<th>SES-3 HALE</th>
<th>SES-4 LE</th>
<th>SES-4 QALE</th>
<th>SES-4 HALE</th>
<th>SES-5 LE</th>
<th>SES-5 QALE</th>
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<td>0-4</td>
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<td>7.5</td>
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<td>4.0</td>
</tr>
</tbody>
</table>

Gaps decrease over the course of people’s lives.
Concluding Remarks

- Population health distribution showed a clear gradient favoring the better-off (educated) population.

- Differences in LE favor women against men contrast with QALE and HALE estimates, which favor men instead. It suggests that policies to address morbidity affecting quality of life should include a gender-informed consideration.

- Higher inequalities observed in Chile than other high income countries can be explained by structural social inequalities as well as inequalities in access to the healthcare system.

- Advantages
  - National consolidated demographic data (mortality and educational level) publicly available
  - Nationally representative health survey providing EQ-5D data to estimate utilities across age, sex and educational level.
Polling Question

Does your country/jurisdiction have publicly available information on baseline levels of health across equity-relevant subgroups in terms of health-adjusted life expectancy (e.g., QALE, HALE)?

• Yes
• No
• I don’t know
Inequities in the Social Distribution of Health Across Race, Ethnicity and Geography in the US

Stacey Kowal
Chair, Health Equity Research Special Interest Group
Principal Researcher, Health Policy and Systems Research
Genentech, Inc
Kowal.Stacey@gene.com

ISPOR Europe 2022 - Virtual Workshop:

Acknowledgements: Dr. Robert Schuldt, Dr. Carmen Ng, Dr. Danny Sheinson, Dr. Kim Jinnett, Dr. Richard Cookson, Dr. Anirban Basu
Given the fragmented nature of the US healthcare system, key information needed to understand current inequities was not readily available.

<table>
<thead>
<tr>
<th>Life Expectancy (LE)</th>
<th>Disability-Free LE (DFLE)</th>
<th>Quality-Adjusted LE (QALE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>National life expectancy by sex, age and race &amp; ethnicity</td>
<td>Disability-free life expectancy by sex, age and race and ethnicity</td>
<td>Dated general population utility by sex and age OR race and ethnicity</td>
</tr>
<tr>
<td>Life tables for White, Black and Hispanic populations</td>
<td>Disaggregated disability data by race and ethnicity or sex/age</td>
<td>National QALE by race and ethnicity, sex and age and SDOH</td>
</tr>
<tr>
<td>Life tables for Asian and Pacific Islander, American Indian or Alaska Native</td>
<td>National DFLE by race and ethnicity, sex and age and SDOH</td>
<td>Sub-national QALE by race and ethnicity, sex and age and SDOH</td>
</tr>
<tr>
<td>Representative mortality data below national level by race and ethnicity</td>
<td>Sub-national DFLE by race and ethnicity, sex and age and SDOH</td>
<td>Contemporary QALY data by race and ethnicity, sex and age and SDOH</td>
</tr>
<tr>
<td>Mortality data that considers race and ethnicity and social determinants of health (SDOH)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
We developed a nationally-representative dataset of health drivers and health outcomes at the county level by linking several sources.

**Deprivation Measures**

Many countries rely on composite deprivation measures to capture broader social determinants of health.

Reviewed 9 indexes based on:
- Included metrics
- Validation across geographic levels
- Comparability to ex-US indices

Selected measure validated at the county level:
- Social vulnerability index (SVI)

**Disaggregated County-Level Data on Deprivation**

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Community Survey</td>
<td>CDC WONDER Mortality Files</td>
</tr>
<tr>
<td>Area Health Resource Use File</td>
<td>Dartmouth Atlas of Healthcare</td>
</tr>
<tr>
<td>Disability Statistics Compendium</td>
<td>SSI Disability Recipients File</td>
</tr>
<tr>
<td>CDC WONDER Mortality Files</td>
<td>IHME Global Burden of Disease</td>
</tr>
<tr>
<td>CMS Chronic Conditions File</td>
<td>County Health Rankings</td>
</tr>
</tbody>
</table>

Full inventory of data available across sex, race & ethnicity and/or age for SDOH based on County Health Rankings Outcomes model (data anchored to newest available national mortality data (2016)).

**Health Behaviors**
- (e.g., Tobacco use, alcohol use)

**Clinical Care & Access**
- (e.g., quality of care, available care)

**Social & Environmental**
- (e.g., income, education, employment)

**Physical Environment**
- (e.g., transit, pollution)

Despite linking numerous datasets, high levels of data suppression hampered our ability to capture county-level information on LE, DFLE and QALE.

**Challenge**
- US mortality data is suppressed for deaths less than 10
- High level of data suppression for small counties and smaller racial and ethnic subgroups
- Available data sources dropped counties in aggregate data given suppression

**Example:**
Availability of mortality data in County Health Rankings Data

- Starting number of counties in our sample: 3,014
- Counties with mortality data on 3 most populous racial and ethnic subgroups: 810
- Counties with data on all 5 racial & ethnic subgroups: 34

**Solution**
- Imputation with Bayesian small area models
Given the large size of our minimum geographic unit of analysis, we created racial and ethnic subgroups within counties to better reveal current inequities.

**Geographic Unit of Analysis**

<table>
<thead>
<tr>
<th></th>
<th>United States</th>
<th>United Kingdom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deprivation measure</td>
<td>Social vulnerability index (SVI)</td>
<td>Index of multiple deprivation (IMD)</td>
</tr>
<tr>
<td>Geographic unit of analysis</td>
<td>County</td>
<td>Small areas</td>
</tr>
<tr>
<td>Number of units</td>
<td>3,014</td>
<td>32,844</td>
</tr>
<tr>
<td>Mean population size per unit</td>
<td>106,988</td>
<td>1,500</td>
</tr>
</tbody>
</table>

**Challenge:**
- US counties were the smallest unit of analysis that allowed us to link mortality data to needed demographic and risk factor data.

**Solution**
- United States health compared across **25 subgroups** instead of 5 quintiles (per the UK research).
- Increased number of equity-relevant subgroups better captures underlying heterogeneity.
  - In addition to SVI quintiles, we examined outcomes for 5 racial and ethnic groups within counties: non-Hispanic White, non-Hispanic Black, Hispanic, Asian and Pacific Islander (PI) & American Indian & Alaska Native (AI/AN).
Increasing our number of equity subgroups allowed us to capture more of the underlying inequities within counties

Observed gaps in life expectancy at birth between the ‘best off’ and ‘worst off’ subgroups across subgroup definition

- 5 subgroups based on county-level SVI
- 5 subgroups based on race/ethnicity
- 25 subgroups based on county level SVI & race/ethnicity
Overall health gaps for the US are larger than the UK, though limited and dated QALY information may underestimate current quality of life gaps.

- **Gaps in Life Expectancy at Birth**
  - UK Gap: 7.4 years

- **Gaps in DFLE at Birth**
  - UK Gap: 12.5 DFLYs

- **Gaps in QALE at Birth**
  - UK Gap: 14.7 QALYs
In addition to supporting DCEA applications, our dataset can be used to generate a variety of useful measures on aggregate health.

<table>
<thead>
<tr>
<th>Life Expectancy (LE)</th>
<th>Disability-Free LE (DFLE)</th>
<th>Quality-Adjusted LE (QALE)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What we had before the study</strong></td>
<td><strong>What we have now</strong></td>
<td><strong>What is still missing</strong></td>
</tr>
<tr>
<td>National life expectancy by sex, age and race &amp; ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life tables for White, Black and Hispanic populations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life tables for Asian, American Indian or Alaska Native</td>
<td>National DFLE by race &amp; ethnicity, sex and age and SDOH</td>
<td>National QALE by race &amp; ethnicity, sex and age and SDOH</td>
</tr>
<tr>
<td>Representative mortality data below national level</td>
<td>Sub-national DFLE by race &amp; ethnicity, sex and age and SDOH</td>
<td>Sub-national QALE by race &amp; ethnicity, sex and age and SDOH</td>
</tr>
<tr>
<td>Mortality data that considers race and ethnicity and SDOH</td>
<td></td>
<td>Contemporary QALY data by race &amp; ethnicity, sex and age and SDOH</td>
</tr>
</tbody>
</table>

DCEA: distributional cost-effectiveness analysis
Polling Question

What data sources would you use in your country/jurisdiction to produce these types of estimates?

- Brainstorming poll – open field entry with the audience upvoting their favorite responses
Health equity research in Australia

Natalie Carvalho
Senior Research Fellow, Health Economics Unit, School of Population and Global Health
On behalf of Marie-Anne Boujaoude, PhD student
<table>
<thead>
<tr>
<th>What could be done in Australia?</th>
<th>Status</th>
<th>Examples</th>
</tr>
</thead>
</table>
| Describe pre-decision health inequalities | ✓ | • Targeted disease-specific or geography-specific studies  
• Routine Australian Institute for Health and Welfare (AIHW) data on health outcomes, risk factors, and access to care, by subgroup |
| Evaluate **intervention** impacts on inequalities in Health Benefits | ✓ | • CEAs largely applied to public health programs, by subgroup based on socio-economic index $^1$ and remoteness $^2$  
• Ongoing work to disaggregate Australian GBD estimates by subgroup using AIHW risk factor data, to evaluate differences in intervention impacts by subgroup$^3$, $^4$ |
| Evaluate equity-efficiency trade-offs between reducing health inequalities and improving health | ✓ | • Ongoing study surveying Australian general public looking across indigeneity, SES, geographic area$^5$ |
| Evaluate equity-equity conflicts between prioritising the severely ill and reducing health inequalities | ✗ | • General discussion based on expert opinion |

5. Boujaoude M, Devlin N, Dalziel K, Carvalho N. Understanding the Australian general population level of health inequality aversion. Manuscript under development
Different subgroups of interest in Australia

Different health experiences of certain population groups in Australia affect their health status and health outcomes.

The subgroups often considered are¹:

• Socioeconomic groups
• Rural and remote populations
• Culturally and linguistically diverse populations
• Aboriginal and Torres Strait Islander people
• People with disability

Different subgroups of interest in Australia

Studies suggest the establishment of a new, regularly collected, good quality data source on the distribution of health and social determinants of health that will enable monitoring of social determinants of health inequities in Australia in line with international best practice.

Data to be collected should include¹

- Representative samples for each state and territory, nationally and by remoteness
- Health data that capture distribution of health of individuals
- Data on social determinants of health: income, wealth, housing, education, employment, social inclusion/exclusion
- Data on disability, Indigenous status, and migrant status
- Data on ethnicity, culture and language, and social support to complement measures of socio-economic status/position
- Neighbourhood characteristics: socio-economic status of area of residence
- Data on gender, including non-binary and transgender categories as well as female/male

Available data on distribution of health in Australia

Life tables, published by the Australian Bureau of Statistics, are available detailed by subgroups:

- Life tables, states, territories, and Australia
- Life tables by remoteness
- Life tables by index of relative socioeconomic disadvantage (IRSD)

They were used to derive many measures including:

- LE at birth
- HALE
- Mortality rates
- Infant mortality rate

Available data in Australia

In the Australian Burden of Disease Study 2018\(^1\), HALE was calculated for 2011, 2015, and 2018 at the national level and for sub-national populations:

- state and territory,
- remoteness areas by sex
- socioeconomic groups by sex

<table>
<thead>
<tr>
<th>Year 2011</th>
<th>HALE</th>
<th>Life Expectancy at birth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Major cities</td>
<td>75</td>
<td>71.7</td>
</tr>
<tr>
<td>Remote &amp; very remote</td>
<td>68.1</td>
<td>66.2</td>
</tr>
</tbody>
</table>

As previously mentioned, life table data were sourced from published and customised life tables published by the Australian Bureau of Statistics.

---

Indigenous estimates

HALE for indigenous and non-Indigenous Australians was also estimated at the national level, for 4 states and territories (New South Wales, Queensland, Western Australia and the Northern Territory) and by remoteness area\(^1\).

*Estimates for Indigenous Australians were not derived by socioeconomic group* as life expectancy data were not available using the same socioeconomic index used for deriving YLD.

HALE for Indigenous and non-Indigenous Australians was estimated for 2018 only, as comparable life expectancy estimates for other reference years were not available.

<table>
<thead>
<tr>
<th>Year 2018</th>
<th>HALE</th>
<th>Life Expectancy at birth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Indigenous</td>
<td>58.8</td>
<td>56</td>
</tr>
<tr>
<td>Non-Indigenous</td>
<td>73.5</td>
<td>71.5</td>
</tr>
<tr>
<td>GAP</td>
<td><strong>14.7</strong></td>
<td><strong>15.5</strong></td>
</tr>
</tbody>
</table>

Female 74.4  Male 70
Female 83.5  Male 80.2

Current state of use

Project: Eliciting health inequality aversion parameters (Atkinson and Kolm indices) and comparing the social judgments of the Australian general public through a benefit trade-off exercise using previously-established methods

Trade-off between different subgroups:
• Richest fifth and poorest fifth of the society
• Indigenous and non-indigenous individuals
• People living in major cities and those living in remote areas

Measure chosen: LE at birth

Reasons:
Measure available to all subgroups
Easy for the public to understand

Example of the benefit trade-off exercise

Which program would you choose?

Program A

Program A and Program B are equally good

Program B

Program A

<table>
<thead>
<tr>
<th>Richest fifth</th>
<th>Poorest fifth</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>80</td>
</tr>
<tr>
<td>+6</td>
<td>+2</td>
</tr>
</tbody>
</table>

Program B

<table>
<thead>
<tr>
<th>Richest fifth</th>
<th>Poorest fifth</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>80</td>
</tr>
<tr>
<td>+2</td>
<td>+5</td>
</tr>
</tbody>
</table>

Richest fifth: 91 years
Poorest fifth: 82 years
Total gain: 8 years
Gap: 9 years

Richest fifth: 87 years
Poorest fifth: 85 years
Total gain: 7 years
Gap: 2 years
Benefit trade-off exercise

By Indigenous status

Which program would you choose?

Program A

Program A and Program B are equally good

Program B

**Program A**

- Non Indigenous: 82 years
- Indigenous: 74 years
- Life expectancy gain: 7 years
- Total gain: 10 years
- Gap: 12 years

**Program B**

- Non Indigenous: 82 years
- Indigenous: 74 years
- Life expectancy gain: 3 years
- Total gain: 10 years
- Gap: 4 years
Audience Poll

Beyond equity-informative cost-effectiveness analysis, how would you/your organization use information on baseline health inequality?

- Brainstorming poll – open field entry with the audience upvoting their favorite responses
Final Poll

What topic would you most like to learn more about in the future: (choose one)

• Methods and application for small area estimation models
• How – and where - to use information on baseline health inequality in healthcare decision-making
• Summary information on how baseline health inequality varies across countries/jurisdictions
• More information on how to use different types of underlying data to generate your own estimates of inequality aversion
• Overall methods for equity-informative cost-effectiveness analysis (like distributional cost-effectiveness analysis)