The Bio-Psycho-Social Determinants of Health: A Nautical Journey (to Scotland!)

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Key Questions for the Scottish Collaboration for Public Health Research and Policy:

• What are the key public health and primary care interventions that can efficiently improve population health status in a setting like Scotland?

• How capable are these interventions of also reducing socio-economic disparities in health, and over what time-frame?

The answers are illuminated by some fundamental “nautical” observations...
Observation #1

- Your health is a function of much more than the health care you receive...

[i.e. on the “ship of life,” a good ship’s doctor alone is not enough...]
Most Public Health Interventions

Health Outcomes

Most Health Care

Biological Endowment

Physical & Social Environmental Exposures

Gene-Environment Interactions

Lifecourse of Individuals

Families / Couples / Households

Neighborhoods / Communities

(Urban Entities)

Nation-States

Forces

Political
Social
Cultural
Economic
Spiritual
Ecological
Technological

CIHR- IPPH Population Health Framework
Observation #2

“The ship you sail on in life – i.e. the society you live in – has enormous influence on your lifelong health and function, no matter how competent and healthy your personal habits are.

(But the lag-time from societal change to health effects – i.e. between “turning the ship’s wheel” and “changing the ship’s course” -- can be very long, even decades.)
Life expectancy and income per capita for selected countries and periods

Japan’s IMR over the previous century:


**Figure 2** Trends in the infant mortality rate in selected OECD countries, 1900–96

Source: OECD 1999.
One generation earlier, a social policy watershed:

On the other hand...

- What if the ship –i.e. the society -- founders?

[When this happens, do all health outcomes behave the same way?]
All-Cause Mortality, USSR, 1984-94

All Cancer Mortality, USSR, 1984-94

Observation #3

While the ship you sail on – i.e. the society you are born into – matters greatly, it matters even more what rank you have, among the crew...

“I’ve been richer, and I’ve been poorer, and richer’s better...”

-Mae West
Health Inequalities: Generic Features Across Settings

- Social epidemiological axiom: socioeconomic inequalities, in mortality and morbidity, typically exhibit continuous gradients, no matter where they occur, characterized by:
  - “fractal” tendencies to show the same monotonic pattern (slope-sign) of risk, by SES level, no matter how many quantiles of rank-ordered SES are used in the analysis
  - protean (spanning diverse disease-processes) – i.e. biologically non-specific -- manifestations
  - remarkable resistance to change in overall magnitude over time, even though the predominant, specific diseases and traumas may change a great deal
Gradients in Mortality by Deprivation Category
Scotland, 1980-85

Standard Mortality Ratio

- All ages
- 0-64
- 65+

Affluent
Deprivation Category
Deprived
Gradients in Mortality by Cause
Scotland, 1980-85

- all infectious diseases
- ca. oesophagus
- chronic rheumatic heart disease
- ischaemic heart disease (ISH)
- ISH, age 0-64
- pulmonary heart disease
- stomach ulcers
- non-road traffic accidents
- suicide/undetermined

0 20 40 60 80 100 120 140 160 180
SMR

most affluent
most deprived
Time-Trends in Health Inequalities: The Example of Modern Scotland

- Some important inequalities are stubbornly resistant to policy/program and practice efforts to reduce them – it is as if lower socioeconomic status confers the same sort of health risks across different eras, even when the specific causes of illness and death change.

- How are Scottish health inequalities doing recently, given that many policies have been aimed at reducing them in the last decade?
Scottish Health Inequalities by SES

Steepest in Western Europe - and largely not declining (even in absolute terms) since devolution began 15 years ago.

Last 30 years: rise in inequalities in in teens/young adults, due to “external causes”:

- drugs/alcohol/
- violence/ self-harm
(i.e. conditions related to mental health & strongly influenced by local culture/social env’t) - initially in males, then in females
Age specific contribution to inequalities of specific causes of death, across SIMD quintiles (Scots men 2000-02): “2 Paupers’ Graveyards”

One, growing for the young poor, dying of “external causes”

The other, stable in size for the older poor, dying of chronic disease

Absolute Range: Healthy Life Expectancy (Males)

Absolute Range: Healthy Life Expectancy (Females)

Scottish HI Indicators in Current Use

- Recent Scottish analyses of health inequalities’ time-trends and patterns, by SES, over the last decade or more, are among the most statistically sophisticated in the world – BUT...

- The rich-poor gaps in about a dozen key Scottish health outcomes appear, over the last dozen years, to be frozen in time (virtually static)...

- While one might conclude – and there is some truth in this – that insufficient policy and program effort has gone into actually reducing the “rich-poor” and “educated-uneducated” gaps in Scottish society, there are compelling reasons to believe that the population health indicators currently in use in Scotland aren’t very responsive (at least within a half-decade) to any feasible PH interventions likely to be actually carried out.

Absolute Range: Cancer Incidence (all sites) <75y – Scotland 1996-2007

Figure 9: Absolute range: Cancer incidence <75y, Scotland 1996-2009
(European age-standardised rates per 100,000)

NO PROGRESS OVERALL -- Footnote: DOES IT MAKE SENSE TO COMBINE ALL CANCERS IN ONE STATISTIC, WHEN THEY DIFFER SO WIDELY IN THEIR SES GRADIENTS’ DIRECTION AND SHAPE?

WHY NOT TO EXPECT REDUCTIONS IN SMOKING-RELATED HEALTH INEQUALITIES: SMOKING IS NOW VERY UNEQUAL!

Local Scottish data now show 5-fold+ gaps across SES extremes.

Figure 3: Cigarette smoking among women aged 16 and over by socio-economic group 1958-2000, Britain

Source: Wald and Nicolaides – Bouman, 1993; Bridgewood et al, 2000

Smoking among the proportion of women who smoke has declined sharply but the gap in prevalence between poorer and better off groups is widening.

ESRC Seminar Series Mapping the public policy landscape
Developing the evidence base for tackling health inequalities and differential effects

Source: http://www.esrcsocietytoday.ac.uk/ESRCInfoCentre
Why are major causes of mortality – and many other routinely collected health outcomes -- are no longer very sensitive to societal changes, in the short run?

- Many epidemiologists now believe: “Improved medical care – and indeed most deliberate health policies and programs – at least in developed countries, now only reduce broad categories of mortality rather slowly, and all-cause mortality very slowly,” because:
  - Life expectancy, and even all-cause mortality rates, appear to be subject to “epidemiological momentum / inertia:” they are hard to shift quickly, largely because deaths occur mostly among the elderly, where chronic disease with lifelong roots, and competing risks, matter!
  - The consequences of early life deprivation are deeply embedded in a person’s mind and body very early on in life – so they are difficult to shift in less than a human generation.
### Scottish Inequalities in Health Outcomes and Risk Factors in Pregnancy and at Birth

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>% Least Deprived</th>
<th>% Most Deprived</th>
<th>Relative Risk *</th>
<th>Risk Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unplanned pregnancy</td>
<td>8</td>
<td>39</td>
<td>4.8</td>
<td>31</td>
</tr>
<tr>
<td>Smoked in pregnancy</td>
<td>9</td>
<td>43</td>
<td>4.9</td>
<td>34</td>
</tr>
<tr>
<td>Planned to bottle feed</td>
<td>15</td>
<td>46</td>
<td>3.1</td>
<td>31</td>
</tr>
<tr>
<td>Never breast fed</td>
<td>21</td>
<td>60</td>
<td>2.8</td>
<td>38</td>
</tr>
</tbody>
</table>

**Health Outcome**

| Low birth weight           | 5                | 8                | 1.6             | 3               |

* Prevalence in most deprived divided by prevalence in least deprived

Bromley & Cunningham-Burley, 2010
Observation #4

- Your experience on the ship in early life is more important than the rest of the journey, for it sets much of your status, the health and functional effects of which track you for life...

[i.e. be nice to the cabin boy...and favour early-life interventions in general, if you want to reduce inequalities...]
Cognitive Development* (7-16y) & Social Origins in the 1958 British Birth Cohort – How Ordinary Schooling Makes The Gradient Worse*

Registrar-General’s SES category:
- I & II
- IV & V

(*Because it starts too late in childhood, when privileged children already have a huge head-start! Should we blame the schools?)

Jefferis et al, 2002

*Stand’d Maths test-scores (excl LBW)
`Sensitive periods’ in early brain development

Graph developed by Council for Early Child Development (ref: Nash, 1997; Early Years Study, 1999; Shonkoff, 2000.)
HOW EARLY IN LIFE CAN WE SEE OTHER BIG SES-GAPS IN THE U.K./SCOTLAND?

WHERE YOU’RE BORN ONLY MATTERS IF YOUR PARENTS ARE LOW-SES – in which case...

Literacy Scores for Youth Aged 16-25 years (Statistics Canada & the OECD, 1995). Source: Sloat E, Willms JD. The International Adult Literacy Survey.
“Fifth of Scots have poor literacy”
- The BBC: http://news.bbc.co.uk/1/hi/scotland/8393805.stm

“Literacy report shows Russell there really is a crisis in education”
- The Scotsman: http://news.scotsman.com/opinion/Literacy-report--shows-Russell.5883656.jp

“Zero-tolerance approach to poor literacy needed, experts say”
Determinants of School Outcomes in Scotland – Why Schools Are Not to Blame

• “While individuals may defy this trend, no school in a deprived area is able to record a similar level of success to that achieved by almost all schools in the most affluent areas.”¹

• “...but the gaps between them (schools) are far less important than differences between students. In Scotland, who you are is far more important than what school you attend.”²

SCPHRP Knowledge Synthesis & Translation

- Reviews international early years’ intervention evaluations
- Assesses evidence-quality for what works
- Considers local Scottish context
- Recommends particular evidence-based programmes / proportionate universalism
- Recognition that early years’ outcome measures across Scotland are lacking/needed

[Go to www.scphrp.ac.uk download a free copy]

New outcome measures for child development

• Bewilderingly large number of early childhood measures from which to choose, even on school entry!
• Difficult for policy-makers to distinguish between:
  A. Medical screening/diagnostic tools for specific developmental disorders, for specialist referral;
  B. Baseline version of individual-level measures of student’s educational progress in school;
  C. Public Health measures which can inform community ECD interventions, before school begins
• Licensed individual-child measures (B above) are most attractive to schools, who usually do not see C (above) as “part of their job;” e.g. Durham University’s PIPS tests (Performance Indicators in Primary Schools)
IN MIRRABOOKA (PERTH) AUSTRALIA, INTENSIVE LOCAL ECD PROGRAM DEVELOPMENT REDUCED EDI VULNERABILITY BY 25% WITHIN A HALF-DECADE (A RAPIDLY RESPONSIVE MEASURE)
A Pilot Study in East Lothian
Results/Conclusions from Phase 1

- The Canadian EDI required only minor language and terminology changes for local use
- “Floor” and “ceiling” effects on just 4 of 104 items
- Majority of teachers found EDI easy to complete & appropriate for context
- But no direct benefit for teachers or pupils - training day must emphasize bigger picture and ECD goals for future birth cohorts in that community
- Training half day can be CPD (in-service)
- Completion day – funds needed for supply teachers
- Paper based system time-consuming and ++ cleaning of data and led to missing information – for countrywide roll-out, online entry system required
PHASE 2: Overall “developmental vulnerability” of school enterers (N=1172), Scotland, January 2012

Overall: 27.3% “vulnerable” (= “in bottom 10% of all scores, on at least 1 domain”)

<table>
<thead>
<tr>
<th>Sex</th>
<th>All children</th>
<th>male</th>
<th>female</th>
<th>&lt;5.2 years</th>
<th>&gt;=5.2 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>% overall vulnerability</td>
<td>25</td>
<td>30</td>
<td>15</td>
<td>&lt;5.2 years</td>
<td>&gt;=5.2 years</td>
</tr>
</tbody>
</table>

Measurement tool: Early Development Instrument (EDI)
‘Overall developmental vulnerability’ (% children low on at least one/two EDI domains of development) of Scottish school enterers by parental postcode Scottish Index of Multiple Deprivation in Jan 2012

<table>
<thead>
<tr>
<th>Socioeconomic Status Quintile</th>
<th>Vulnerable in 1 or more Domains</th>
<th>Vulnerable in Two or more Domains</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Lothian</td>
<td>27.3</td>
<td>15.4</td>
</tr>
<tr>
<td>1</td>
<td>38.5</td>
<td>25.6</td>
</tr>
<tr>
<td>2</td>
<td>38.4</td>
<td>23.7</td>
</tr>
<tr>
<td>3</td>
<td>30.5</td>
<td>16.4</td>
</tr>
<tr>
<td>4</td>
<td>23.2</td>
<td>12.8</td>
</tr>
<tr>
<td>5</td>
<td>16.7</td>
<td>7.2</td>
</tr>
</tbody>
</table>

Note: Imprecise estimate
Percentage of children who score low on one or more domains of development by cluster area

Legend
- North Berwick Cluster
- Tranent Cluster
- Haddington Cluster
- Dunbar Cluster
- Prestonpans Cluster
- Musselburgh Cluster
Findings (1)

- Overall developmental vulnerability in East Lothian (27.3%) similar to other populations e.g. British Columbia 29%; Canada 27.9%; Australia 23.5%
- Developmental vulnerability not just concentrated in the poorest segment of the population (by SIMD)
- Across all SES groups, East Lothian 5 yr olds:
  - do quite well in physical health & well-being and cognitive/language development domains
  - score ‘average’ in social competency
  - score less well in emotional maturity and communications & general knowledge domains
Findings (2)

• 4% of children are *already* identified as having additional needs
• A further 9.5% are recognised as having *problems needing further assessment* by teachers, parents or other professionals— most of these are “normal” children with sub-optimal developmental /“home learning” environments since birth: *inadequate stimulation*
• Girls less likely to be developmentally vulnerable than boys (consistent with other research)
• Older children, even by a few months, less likely to be developmentally vulnerable than younger children (ditto) – read Malcolm Gladwell’s book “Outliers”
Findings (3)

• Few children in East Lothian (4%) fall in the lowest socioeconomic category: full SES gradient in EDI scores imprecisely (under-?) estimated

• Greatest ‘gaps’ between the most and least affluent groups are in the Communication & General Knowledge, and the Language & Cognitive Development domains

• Large geographic differences exist in the level of child development at school entry, even within a rather small Local Authority – and they are not precisely predicted by local SIMD, because they reflect the SES of families with children currently entering school at the time of assessment, not the SES of the whole community
Key Conclusions of First EDI pilot in Scotland

• EDI is acceptable, appropriate, affordable (£20 per student, mostly for teacher buy-out, ~ 1% of population, every 3 years): feasible for wide use in Scotland with minimal language adaptation

• All five domains of the EDI exhibited good internal consistency (Cronbach’s alpha higher than .76)

• LARGE developmental differences between socioeconomic and geographic groups can be detected with EDI in Scotland, even within a local population of just over 130,000 (~1200 P1 students) in East Lothian – just as found in other countries

• The local parent/EY teachers /LA officials LOVE it, and can be given all the data, since it is anonymized, and releasable down to the school level! [This feature also allows only passive parental consent to participate, leading to an >98% response rate.]
What the global scientific community thinks is **good** about the EDI

- Comprehensive/global assessment of child development, for >98% of P1’s, at community level, efficiently done
- Population-level measure for summarizing effects of ALL early years services/programs/env’ts
- NOT for screening / diagnosing / categorising / labelling of individual children: no referral burden
- If rolled out, provides rich dataset of centralised information for needs assessment and, potentially, better ECD resource allocation, by need
- The amortized cost, at £6.66 annually per child (7p per capita p.a.), is well within the realistic affordable range for Local Authorities – cheaper than a home visit (and much more reliable, due to extensive teacher experience with each child)
What makes the EDI less acceptable to some policy-makers

• Not for individual-level use -- thus difficult to ‘sell’ to teachers and the education sector (analogous to clinician versus public-health perspectives in health?)
• If rolled out, which level of government should pay for teacher-time buyout (main cost for collecting data)?
• Scotland: model/culture of devolved decision-making and budgets (now deeply cut) so central government seems to feel it’s not in a position to “recommend” to LAs how they should measure child development outcomes

NOTE: The Australian federal authorities’ decision some years ago, to fully pay for EDI data-collection costs, and centralized the data analysis, with a strong public health perspective was a very prescient decision, in view of our Scottish experience!
Summary of the EDI’s Future in Scotland

- Many if not most current population health indicators -- based mostly on natality, mortality, self-reported morbidity and hospitalization data -- seem inadequately “sensitive”/responsive to feasible 5-year policy initiatives to reduce health inequalities -- they are just “tombstone” indicators

- Child development indicators have the most promise for rapid and large effects on inequalities, from relatively efficient and acceptable early child development programmes.

- The EDI fits the bill – to a tee, BUT it faces major hurdles in Scotland, in terms of:
  - complex inter-governmental relations, in a deep recession
  - differing views of (pre-)primary education stakeholders, compared to public health experts, as to what is required in order to improve Scottish children’s developmental status
Useful websites & references

- Scottish Collaboration for Public Health Research and Policy: [www.scphrp.ac.uk](http://www.scphrp.ac.uk) – see EDI Project Report under “Publications”
- British Columbia ECD mapping portal [http://www.ecdportal.help.ubc.ca/archive/faq.htm](http://www.ecdportal.help.ubc.ca/archive/faq.htm)
Useful websites & references