Excess mortality: developing a coherent understanding and response

Gerry McCartney
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Outline

• Discuss the previous synthesis of the causes of the excess mortality
• Discuss the limitations of the previous synthesis
• Summarise subsequent relevant research
• Propose a framework for updating the synthesis and a prompt for discussion

[Note – I will be presenting lots of others’ work and the credit goes to them and blame for misrepresentation to me]
Previous synthesis

- Search for hypotheses
- Application of Bradford-Hill criteria for causality (Strength of association, Consistency, Specificity, Temporality, Biological gradient, Plausibility, Coherence, Experiment, Analogy)
- Priority and emphasis given to most likely candidate hypotheses
- Periodisation of excess mortality
- Creation of loose diagrams
Identified hypotheses – artefact and ‘downstream’

1. Poverty and material deprivation*
2. Migration
3. Genetic vulnerability
4. Health behaviours

* Only artefactual in relation to the excess mortality
Identified hypotheses – ‘midstream’

5. Different culture of substance misuse
6. Different individual values (time, aspiration)
7. Family, gender or parenting differences
8. Health service supply or demand
9. Greater inequalities
10. Greater concentration of deprivation
11. Deindustrialisation
12. Sectarianism
13. Different culture (boundlessness, alienation)
14. Lower social capital
Identified hypotheses – ‘upstream’

15. Culture of limited social mobility
16. Political attack
17. Climate (sunlight, cold weather)
Number of Bradford-Hill criteria met by each hypothesis for the divergence of Scottish mortality in the mid-20th Century

Hypothesis in relation to the divergence of Scottish mortality pattern from elsewhere in Europe

- Health behaviours
- Greater inequalities
- Deindustrialisation
- Deprivation concentration
- Different individual values (time, aspiration)
- Lower social capital
- Political attack
- Sectarianism
- Migration
- Family and gender differences
- Deprivation and poverty
- Genetic differences
- Climatic differences
- Different culture of substance misuse
- Different culture (boundlessness, alienation)
- Culture of limited social mobility
- Health service supply and demand

Number of Bradford-Hill criteria
Synthesis for the divergence of Scottish mortality from mid-20th Century

Outcomes

- Cardiovascular disease
- Respiratory disease
- Stroke
- Cancer
Synthesis for the divergence of Scottish mortality from mid-20th Century

Possible mechanisms and key factors

- Poverty and inequality
- Instability of industrial employment
- Migration patterns
- Overcrowded city centre housing
- Increased stress
- Gender disharmony
- Substance misuse
- Development of new peripheral housing estates
- Insecurity of employment
- Sectarian divide

Outcomes

- Cardiovascular disease
- Respiratory disease
- Stroke
- Cancer

Scottish culture

Synthesis for the divergence of Scottish mortality from mid-20th Century
Synthesis for the emergence of the ‘Scottish Effect’ and ‘Glasgow Effect’

Outcomes

- Drugs-related
- Alcohol-related
- Suicide
- Road-traffic accidents
- Cardiovascular disease
- Respiratory disease
- Stroke
- Cancer
Synthesis for the emergence of the ‘Scottish Effect’ and ‘Glasgow Effect’

Mechanisms:
- Individuation and competition
- Breakdown in confidence of working class communities
- Reduced self-esteem & self-efficacy
- Increased stress
- Disempowerment and hopelessness
- Rise in inequality and poverty
- Deindustrialisation

Outcomes:
- Drugs-related
- Alcohol-related
- Suicide
- Road-traffic accidents
- Cardiovascular disease
- Respiratory disease
- Stroke
- Cancer

Scottish culture
Greater poverty and inequality
Industrial dependence
Sectarian divide
Scottish climate
Genetic factors
Road-traffic accidents
Alcohol-related diseases
Drugs-related diseases
Cardiovascular disease
Respiratory disease
Stroke
Cancer

Synthesis for the emergence of the ‘Scottish Effect’ and ‘Glasgow Effect’.
Synthesis for the emergence of the ‘Scottish Effect’ and ‘Glasgow Effect’

Trigger

- Political attack by the Thatcher government post 1979

Mechanisms

- Individuation and competition
- Reduced well-being
- Increased stress
- Disempowerment and hopelessness
- Rise in inequality and poverty
- Deindustrialisation

- Reduced self-esteem & self-efficacy
- Increased violence
- Family breakdown
- Substance misuse

Outcomes

- Drugs-related
- Alcohol-related
- Suicide
- Road-traffic accidents
- Cardiovascular disease
- Respiratory disease
- Stroke
- Cancer
Synthesis for the emergence of the ‘Scottish Effect’ and ‘Glasgow Effect’

**Vulnerability**
- Greater poverty and inequality
- Scottish culture
- Industrial dependence
- Sectarian divide
- Genetic factors
- Scottish climate

**Trigger**
- Political attack by the Thatcher government post 1979

**Mechanisms**
- Individuation and competition
- Decreased well-being
- Increased stress
- Disempowerment and hopelessness
- Rise in inequality and poverty
- Deindustrialisation

**Outcomes**
- Drugs-related
- Alcohol-related
- Suicide
- Road-traffic accidents
- Cardiovascular disease
- Respiratory disease
- Stroke
- Cancer

Rise in inequality and poverty -> Individuation and competition -> Decreased well-being -> Increased stress -> Disempowerment and hopelessness -> Increased violence -> Reduced community cohesion

Breakdown in confidence of working class communities -> Reduced self-esteem & self-efficacy

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Limitations of existing synthesis

1. Lots of new research has been published
Limitations of existing synthesis

1. Lots of new research has been published

And more are currently underway...
Limitations of existing synthesis

1. Lots of new research has been published
2. Non-systematic searches of the literature
3. Reductionist to consider individual hypotheses for causality rather than groups or pathways
4. Synthesis does not clearly explain all observed phenomena
5. Limited description of lagged or historical effects
Summary of subsequent & planned research (1)

1. Early years and parenting
Poverty, parenting and poor health: comparing early years' experiences in Scotland, England and three city regions

Martin Taubut
David Walsh
Glasgow Centre for Population Health
April 2013
Summary of subsequent & planned research (1)

1. Early years and parenting
2. 3 cities survey – social capital, sense of coherence, psychological outlook
Exploring potential reasons for Glasgow’s ‘excess’ mortality:
Results of a three-city survey of Glasgow, Liverpool and Manchester

David Walsh, Gerry McCartney, Sarah McDillough, Marjon van der Pol, Duncan Buchanan, Russell Jones
June 2013
Social capital - reciprocity
Reciprocity: exchanging favours with people who live nearby.

<table>
<thead>
<tr>
<th>Location</th>
<th>Exchange Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glasgow</td>
<td>2.3</td>
</tr>
<tr>
<td>Liverpool</td>
<td>2.9</td>
</tr>
<tr>
<td>Manchester</td>
<td>2.1</td>
</tr>
</tbody>
</table>

How many people exchange favours with? (mean)
Social capital - trust
Trust: % saying most people in neighbourhood can be trusted

And same overall pattern by age and sex as well
Unpaid help: at least one example in previous 12 months

- **Glasgow**
  - A & B (higher and intermed managerial/admin/prof): 10.5%
  - C1 (supervisory, clerical, junior managerial/admin/prof): 10.9%
  - C2 (skilled manual): 5.4%
  - D (semi-skilled/unskilled manual): 4.5%
  - E (on state benefit/unemployed/lowest grade workers): 4.2%

- **Liverpool**
  - A & B (higher and intermed managerial/admin/prof): 32.6%
  - C1 (supervisory, clerical, junior managerial/admin/prof): 20.0%
  - C2 (skilled manual): 11.5%
  - D (semi-skilled/unskilled manual): 4.7%
  - E (on state benefit/unemployed/lowest grade workers): 4.2%

- **Manchester**
  - A & B (higher and intermed managerial/admin/prof): 31.7%
  - C1 (supervisory, clerical, junior managerial/admin/prof): 26.9%
  - C2 (skilled manual): 9.4%
  - D (semi-skilled/unskilled manual): 9.0%
  - E (on state benefit/unemployed/lowest grade workers): 14.3%
Social capital - summary

• Views of local area, civic participation, social networks/support all similar (or better)
• But lower reciprocity, trust and social participation (e.g. volunteering)
• Some of clearest differences in comparison of those of high SES...
Sense of Coherence
Mean Sense of Coherence (soc-13) score (13-91)

<table>
<thead>
<tr>
<th></th>
<th>Glas</th>
<th>Liv</th>
<th>Man</th>
<th>Glas</th>
<th>Liv</th>
<th>Man</th>
<th>Glas</th>
<th>Liv</th>
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<th>Glas</th>
<th>Liv</th>
<th>Man</th>
<th>Glas</th>
<th>Liv</th>
<th>Man</th>
</tr>
</thead>
<tbody>
<tr>
<td>A &amp; B (higher and intermed managerial/admin/prof)</td>
<td>72.2</td>
<td>67.8</td>
<td>65.1</td>
<td>69.7</td>
<td>64.6</td>
<td>63.3</td>
<td>69.2</td>
<td>63.8</td>
<td>58.7</td>
<td>65.9</td>
<td>63.2</td>
<td>58.3</td>
<td>61.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1 (supervisory, clerical, junior managerial/admin/prof)</td>
<td>72.2</td>
<td>67.8</td>
<td>65.1</td>
<td>69.7</td>
<td>64.6</td>
<td>63.3</td>
<td>69.2</td>
<td>63.8</td>
<td>58.7</td>
<td>65.9</td>
<td>63.2</td>
<td>58.3</td>
<td>61.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C2 (skilled manual)</td>
<td>69.7</td>
<td>64.6</td>
<td>63.3</td>
<td>69.2</td>
<td>63.8</td>
<td>58.7</td>
<td>65.9</td>
<td>63.2</td>
<td>58.3</td>
<td>61.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D (semi-skilled/unskilled manual)</td>
<td>69.7</td>
<td>64.6</td>
<td>63.3</td>
<td>69.2</td>
<td>63.8</td>
<td>58.7</td>
<td>65.9</td>
<td>63.2</td>
<td>58.3</td>
<td>61.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E (on state benefit/unemployed/lowest grade workers)</td>
<td>69.7</td>
<td>64.6</td>
<td>63.3</td>
<td>69.2</td>
<td>63.8</td>
<td>58.7</td>
<td>65.9</td>
<td>63.2</td>
<td>58.3</td>
<td>61.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Psychological outlook
Life Orientation Test (revised) (LOT-R) mean score (possible score range: 0-24)

- **Glasgow**:
  - 16-29: 15.4
  - 30-44: 14.3
  - 45-64: 13.5
  - 65+: 14.3

- **Liverpool**:
  - 16-29: 15.3
  - 30-44: 14.4
  - 45-64: 14.3
  - 65+: 14.1

- **Manchester**:
  - 16-29: 15.1
  - 30-44: 15.2
  - 45-64: 14.8
  - 65+: 15.1

The chart shows the mean scores for different age groups in Glasgow, Liverpool, and Manchester.

- Age Group: 16-29, 30-44, 45-64, 65+
Summary of subsequent & planned research (1)

1. Early years and parenting
2. 3 cities survey - social capital, sense of coherence, psychological outlook
3. Vitamin D
Vitamin D and subsequent all-age and premature mortality: a systematic review

Lynne Rush, Geety McCartney, David Walsh and Daniel MacKay

Abstract
Background: All-cause mortality in the population <65 years is 30% higher in Glasgow than in equally deprived Liverpool and Manchester. We investigated a hypothesis that low vitamin D in this population may be associated with premature mortality via a systematic review and meta-analysis.

Methods: Embase, Web of Science, the Cochrane Library and grey literature sources were searched until February 2012 for relevant studies. Summary statistics were combined in an age-stratified meta-analysis.

Results: Nine studies were included in the meta-analysis, representing 34,297 participants, 5,324 of whom died during follow-up. The pooled hazard ratio for low compared to high vitamin D demonstrated a significant inverse association (HR 1.19, 95% CI 1.12-1.27) between vitamin D levels and all-cause mortality after adjustment for available confounders. In an age-stratified meta-analysis, the hazard ratio for older participants was 1.25 (95% CI 1.14-1.36) and for younger participants 1.12 (95% CI 1.01-1.24).

Conclusions: Low vitamin D status is inversely associated with all-cause mortality but the risk is higher amongst older individuals and the relationship is prone to residual confounding. Further studies investigating the association between vitamin D deficiency and all-cause mortality in younger adults with adjustment for all important confounders (or using randomised trials of supplementation) are required to clarify this relationship.

Keywords: Vitamin D, 25OHD, Premature mortality, Systematic review, Meta-analysis.

Background
The extent to which vitamin D deficiency may be important in explaining morbidity and mortality has recently been a focus for research. The importance of vitamin D for bone health and the prevention of rickets is well-established; however, observational data suggest that low levels are also associated with increased incidence of chronic diseases including cardiovascular disease, cancer, type II diabetes and multiple sclerosis [1-8]. Four meta-analyses of observational studies have also found an association with increased all-cause mortality [9-12]. Most of the populations in the included studies were elderly, limiting applicability to the wider population. It is also possible that the associations between vitamin D and negative health outcomes. In addition, observational associations may be due to reverse causality, whereby vitamin D is reduced as a consequence of disease processes. Those randomised controlled trials of vitamin D supplementation that are available are largely confined to elderly populations with pre-existing morbidity, for example, following hip fractures and are therefore not generalisable to either younger or pre-morbidity populations.

The potential for vitamin D deficiency to explain higher mortality, and in particular premature mortality, is particularly relevant in Scotland. Vitamin D-deficiency has been postulated as one of many explanations for the ‘excess’ mortality that is, the higher levels of mortality not explained in terms of socio-economic circumstances.

Conclusions: Low vitamin D status is inversely associated with all-cause mortality but the risk is higher amongst older individuals and the relationship is prone to residual confounding. Further studies investigating the association between vitamin D deficiency and all-cause mortality in younger adults with adjustment for all important confounders (or using randomised trials of supplementation) are required to clarify this relationship.
SMR of Glasgow relative to Belfast
(indirectly standardised to two-city deprivation deciles, age and gender)
Summary of subsequent & planned research (1)

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4. Health behaviours
## Hazard ratios for all-cause mortality: Scotland relative to England

<table>
<thead>
<tr>
<th>Model</th>
<th>Deaths</th>
<th>N</th>
<th>England HR</th>
<th>Scotland HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age- &amp; sex-adjusted (basic model)</td>
<td>21,345</td>
<td>193,873</td>
<td>1</td>
<td>1.40 (1.34 to 1.47)</td>
</tr>
<tr>
<td>+ Occupational social class</td>
<td>20,410</td>
<td>183,043</td>
<td>1</td>
<td>1.39 (1.33 to 1.46)</td>
</tr>
<tr>
<td>+ Educational attainment</td>
<td>21,318</td>
<td>193,733</td>
<td>1</td>
<td>1.39 (1.32 to 1.45)</td>
</tr>
<tr>
<td>+ Smoking status</td>
<td>21,309</td>
<td>193,068</td>
<td>1</td>
<td>1.31 (1.25 to 1.37)</td>
</tr>
<tr>
<td>+ Frequency of alcohol consumption</td>
<td>21,311</td>
<td>191,531</td>
<td>1</td>
<td>1.39 (1.33 to 1.45)</td>
</tr>
<tr>
<td>+ Self-assessed general health</td>
<td>21,339</td>
<td>193,835</td>
<td>1</td>
<td>1.39 (1.33 to 1.46)</td>
</tr>
<tr>
<td>+ Longstanding illness</td>
<td>21,341</td>
<td>193,829</td>
<td>1</td>
<td>1.41 (1.35 to 1.48)</td>
</tr>
<tr>
<td>Multiply adjusted</td>
<td>20,330</td>
<td>181,560</td>
<td>1</td>
<td>1.29 (1.23 to 1.36)</td>
</tr>
</tbody>
</table>

Summary of subsequent & planned research (1)

1. Early years and parenting
2. 3 cities survey - social capital, sense of coherence, psychological outlook
3. Vitamin D
4. Health behaviours
5. Spatial patterning of deprivation
Figure 4. Income deprivation in Glasgow (ranked within three cities).

Figure 3. Income deprivation Liverpool
Summary of subsequent & planned research (1)

1. Early years and parenting
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3. Vitamin D
4. Health behaviours
5. Spatial patterning of deprivation
6. Historical, political and economic influences on mortality across deindustrialised areas in Europe
Box plots of spatial variation in female life expectancy
(showing maximum, minimum, upper and lower quartile data within each region)

Box plots of spatial variation in male life expectancy
(showing maximum, minimum, upper and lower quartile data within each region)

Underlying influences across deindustrialised areas in Europe

- Transition from an industrial region and diversification was more problematic in West Central Scotland (WCS)
- Other areas emphasised social protection and social cohesion whilst WCS focussed on economic growth
- The deprivation and inequality in WCS have resulted from the social and economic policy pursued
- Other deindustrialising areas have made a successful social, economic and health transition

Summary of subsequent & planned research (1)

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5. Spatial patterning of deprivation
6. Historical, political and economic influences on mortality across deindustrialised areas in Europe
7. Qualitative work comparing Glasgow-Liverpool-Manchester
Summary of subsequent & planned research (2)

1. Was the scale of urban change experienced historically in the cities different?
2. Was there a difference in ‘vulnerability’ of the cities to national and local political decisions?
3. Were there differences in housing quality and provision?
4. Were there differences in diet?
5. Were there differences in the nature of employment?
6. Systematic review of hypotheses
7. ...then update the synthesis
Trends in overcrowding

% population living in overcrowded households, 1981-2001

Source: Census

- Glasgow
- Manchester
- Liverpool
Distribution of overcrowding (households > 1 person per room) across city-specific deciles, 1971

City-specific decile

- Glasgow
- Liverpool
- Manchester

% of households

1 (highest) 2 3 4 5 6 7 8 9 10 (lowest)
Housing built by/for* Glasgow, Liverpool and Manchester council and predecessors

* Liverpool and (especially) Manchester built extensively outside city boundaries
Demolitions or closures as percentage of 1951 housing stock, 1955-1985

<table>
<thead>
<tr>
<th>City</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bristol</td>
<td>7</td>
</tr>
<tr>
<td>Birmingham</td>
<td>19</td>
</tr>
<tr>
<td>Liverpool</td>
<td>25</td>
</tr>
<tr>
<td>Leeds</td>
<td>27</td>
</tr>
<tr>
<td>Sheffield</td>
<td>30</td>
</tr>
<tr>
<td>Manchester</td>
<td>37</td>
</tr>
<tr>
<td>Glasgow</td>
<td>40</td>
</tr>
</tbody>
</table>
Destinations of emigrants from the three cities, 1961-1971

- Glasgow
- Liverpool
- Manchester

<table>
<thead>
<tr>
<th>Location</th>
<th>Glasgow</th>
<th>Liverpool</th>
<th>Manchester</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Towns</td>
<td>14</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Outside city, within sub-region</td>
<td>29</td>
<td>37</td>
<td>48</td>
</tr>
<tr>
<td>Beyond sub-region, still in</td>
<td>12</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Scotland or North West</td>
<td>46</td>
<td>44</td>
<td>43</td>
</tr>
<tr>
<td>Elsewhere in Britain</td>
<td>46</td>
<td>44</td>
<td>43</td>
</tr>
</tbody>
</table>
Proposed method for synthesis

1. Review and update hypotheses and evidence for these
2. Create causal models using the more plausible hypotheses
3. Test and iterate causal models against ability to explain all observed phenomena
4. Identify assumptions and remaining research questions
Early thoughts on updated synthesis
European comparisons

Poverty, deprivation & deindustrialisation → Worse health within countries

e.g. Silesia
Nor-pas-de-Calais
Merseyside
West Central Scotland
Poverty, deprivation & deindustrialisation

Neoliberal economic policy from 1980s

Worse health within countries

e.g. Silesia
Nor-pas-de-Calais
Merseyside
West Central Scotland

UK areas improve more slowly and inequalities are wider
Poverty, deprivation & deindustrialisation → Excess mortality in Glasgow
UK comparisons

Poverty, deprivation & deindustrialisation

Excess mortality in Glasgow

? greater vulnerability to neoliberalism

? greater scale of urban change

? political influences
Summary

- Poverty, deprivation and deindustrialisation are all important causes of high mortality and health inequalities.
- The combination of this with a neoliberal economic policy from the 1980s is likely to be part of the explanation for the worse health emerging in the UK.
- There is some emerging evidence that Glasgow may have been more vulnerable to the changing political context (e.g. disinvestment in council housing) and experienced greater urban change.
- There is some emerging evidence that urban change in Glasgow both greater in scale than other cities and that the nature of this change may have more detrimental to population health (e.g. Liverpool encourages growth of suburbs within city, migrants to New Towns less skewed towards the more affluent population).
- Work is ongoing to understand the political influences on the different outcomes across Glasgow, Liverpool and Manchester.
Discussion and task:

1. Have any important factors/plausible explanations not been mentioned in the presentations/discussion?

2. Do you agree with the proposed method for synthesising the evidence? Or are there other ways of looking at this?

3. In the light of evidence amassed to date, can your table construct plausible causal pathways to explain the excess mortality seen among different populations in Glasgow and Scotland?
Thank you for listening/heckling*
*delete as appropriate

Contact: gmccartney@nhs.net