Using 2011 Census data to estimate future elderly health care

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Policy Context

- “The ageing of the population is inevitable, and affects us all.” and
- “The NHS is facing a major increase in demand and cost consequent on ageing and will have to transform to deal with this. Because of this rising demand, [...], needs will remain unmet and cost pressures will rise inexorably.”

Ready for Ageing, House of Lords, March 2013.
• Health care costs rising
• Demand increasing
• Foresight needed so that the correct level of resources are available at the right time in the right place, so that:
  – Needs are met
  – Resources not wasted
• Estimate to 2031 the prevalence of specific morbidities in English Local Authority Districts
• Health questions
  – Presence & degree of a long term limiting illness
  – General health

• Related questions
  – Away from work, ill
  – Long-term sick or disabled
  – Carer responsibilities

• Socio-demographic
Ethnicity plays a role in health outcomes
  – Lifestyle
  – Socio-economic
  – Access to health services / guidance
  – Genetics

Asian increased Coronary Heart Disease (CHD) risk;
Black/Afro-Caribbean increased stroke risk;
White increased cancer risk;

The health of minority ethnic groups, Volume 1, 2005. Edited by Sproston, K and Mindell, J, Health and Social Care Information Centre
Spatial Microsimulation (2011)

Gender x Age x Ethnicity

Gender x Age x Illness

Gender x Age x NSSEC

Gender x Age x Car ownership

ETHPOP 2011 to 2031 Projections

Adjusted Projections

Gender x Age x Ethnicity

Spatial Microsimulation (2011)

Hybrid Microsimulation (2011 to 2031)

CHD; stroke; diabetes; cancer; respiratory illness; arthritis and depression

ELSA Wave 5

ELSA Waves 1 to 6

Hazard Model

Take account of future ethnic composition of the local authority population

• **Model:** a cohort-component population projection model using 355 population pairs of a zone, UK minus zone (i.e. macro-simulation)

• **Populations:** Projects for 16 ethnic groups (2001 Census), 2 sexes and ages 0 to 100+

• **Inputs:**
  – Population base 2001 Census
  – Component rates estimated by ethnicity for 2001-2006
  – Component rates aligned to assumptions in NPP2008 for 2006 to 2051

• **Outputs**
  – Projection aligned to NPP2008 (TREND)
  – Projection with alternative method for handling international migration (UPTAPER)
  – Projections that generate estimates of which component assumptions drive projections (Geographical Journal 2013)
In each LAD

- Calculate absolute differences between 2011 Census counts and 2011 ETHPOP (mid-year) projections for each of five broad ethnic groups
- Both genders
- Eight age bands (starting at 50-54)
- Express the sum of these 16 differences as a % of total 50 years and older population for each ethnic group
• Best performance for white ethnicities

• Looking at non-absolute differences confirms over prediction of white and under prediction of BME
<table>
<thead>
<tr>
<th></th>
<th>White</th>
<th>Mixed</th>
<th>Asian</th>
<th>Black</th>
<th>Other</th>
<th>ALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 South Gloucs</td>
<td>3%</td>
<td>11%</td>
<td>6%</td>
<td>5%</td>
<td>12%</td>
<td>South Gloucs 3%</td>
</tr>
<tr>
<td>2 Huntingdonsh</td>
<td>3%</td>
<td>12%</td>
<td>6%</td>
<td>6%</td>
<td>12%</td>
<td>Huntingdonsh 3%</td>
</tr>
<tr>
<td>3 Erewash</td>
<td>4%</td>
<td>12%</td>
<td>6%</td>
<td>6%</td>
<td>16%</td>
<td>Erewash 3%</td>
</tr>
<tr>
<td>4 Swindon</td>
<td>4%</td>
<td>14%</td>
<td>6%</td>
<td>7%</td>
<td>16%</td>
<td>Waverley 4%</td>
</tr>
<tr>
<td>5 Waverley</td>
<td>4%</td>
<td>15%</td>
<td>7%</td>
<td>8%</td>
<td>16%</td>
<td>Waverley 4%</td>
</tr>
<tr>
<td>6 North Somers</td>
<td>4%</td>
<td>15%</td>
<td>7%</td>
<td>8%</td>
<td>18%</td>
<td>Winchester 5%</td>
</tr>
<tr>
<td>7 Woking</td>
<td>5%</td>
<td>16%</td>
<td>7%</td>
<td>8%</td>
<td>18%</td>
<td>North Somers 4%</td>
</tr>
<tr>
<td>8 North Somers</td>
<td>5%</td>
<td>16%</td>
<td>7%</td>
<td>8%</td>
<td>19%</td>
<td>Winchester 5%</td>
</tr>
<tr>
<td>9 Basildon</td>
<td>5%</td>
<td>16%</td>
<td>7%</td>
<td>8%</td>
<td>19%</td>
<td>Winchester 5%</td>
</tr>
<tr>
<td>10 Rushcliffe</td>
<td>5%</td>
<td>16%</td>
<td>7%</td>
<td>9%</td>
<td>19%</td>
<td>North Somers 4%</td>
</tr>
</tbody>
</table>

**ETHPOP over projection of white ethnicity**

- Lewisham 35%
- Tower Hamlet 38%
- Newham 38%
- Islington 39%
- Slough 39%
- Southwark 42%
- Hammersmith 42%
- Wandsworth 50%
- Hackney 58%
- Lambeth 65%

**ETHPOP under projection of BME**

- Lewes 53%
- Halton 54%
- South Kesteven 54%
- Rother 54%
- Wirral 55%
- Chichester 55%
- Blackpool 57%
- Test Valley 58%
- East Lindsey 59%
- Barnsley 59%
• **Comparison:** 2011 Census versus 2011 projected populations
• **White British:** over-projected because we were too optimistic about survival probabilities
• **BME groups:** under-projected because mortality too high, immigration assumptions too low (we believed the official view)
• **South Asian** groups under-projected by 8%; **Black** groups by 12%, **Mixed** groups by 17% and **Other Ethnic** Groups by 45% (higher immigration from Rest of World and much switching into this group, we think)
• **First revision:** rebase to 2011 Census; update trajectories based on error ratios from comparison described below; constrain to SNPP
• **Second revision:** using 2011 Census and component information for 2006-2013, new assumptions and new estimation and projection models, we will revise the projections 2015-2016, with ESRC funding to create a NewETHPOP data set
• **Link:** [www.ethpop.org](http://www.ethpop.org) holds database and links to publications and reports
Interim Correction

• Comparison of national outcomes: average TREND and UPTAPER projections
• Establish the “normal” ETHPOP growth/decline between 2011 and the projection year
• Apply this to the 2011 Census counts; BUT
• Adjust this change by a factor that adjusts for discrepancies in the projection between 2001 and 2011
• Constrain to ONS 2012-SNPP
ETHPOP adjustments

• Establish ethnicity and local authority specific factor needed to adjust the ratio of 2001 Census/2011 Census to 2011 ETHPOP/2011 ETHPOP counts

\[
\text{raw projection correction} = \left[ \frac{2011 \text{ Census}}{2001 \text{ Census}} \right] \frac{1}{10} \left[ \frac{2011 \text{ ETHPOP}}{2001 \text{ ETHPOP}} \right]
\]

• Assume that this adjustment factor applies yearly after 2011
• To reproduce the observed growth between the 2001 and 2011 Census, need to adjust by −0.61% the ETHPOP projections each year.
To reproduce the observed growth between the 2001 and 2011 Census, need to adjust by +7.0% the ETHPOP projections each year!

Small numbers have a big (unsustainable) impact

<table>
<thead>
<tr>
<th>Asian in Plymouth</th>
<th>2001</th>
<th>2011</th>
<th>growth</th>
<th>Raw projection correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Census</td>
<td>208</td>
<td>666</td>
<td>(\frac{666}{208} = 3.202)</td>
<td>(\left[\frac{3.202}{1.620}\right]^{\frac{1}{10}} = 1.070)</td>
</tr>
<tr>
<td>ETHPOP</td>
<td>258</td>
<td>418</td>
<td>(\frac{418}{258} = 1.620)</td>
<td></td>
</tr>
</tbody>
</table>
Example : Solution

- Classify each LAD into one of seven ONS Supergroup clusters
- Establish ethnicity specific 10% to 90% percentiles on these adjustment factors for each Supergroup
- Constrain each LAD to be within its Supergroup range – thus eliminating outliers
- Range for Asian in Cities and Services type LADs is [0.997, 1.045]. Therefore actual adjustment factor reset from +7.0% down to +4.5%. Still large!
## Worked Example: White Males in Plymouth aged 50 to 54

<table>
<thead>
<tr>
<th>2011 Census</th>
<th>ETHPOP Growth</th>
<th>Correction factor</th>
<th>ETHPOP population share</th>
<th>Revised estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total white ethnic population for the LAD</td>
<td>Apportion to the ethnic gender and age band</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White people aged 40 and older in Plymouth</td>
<td>White people aged 40 and older in Plymouth from 2011 to 2015</td>
<td>As previous</td>
<td>White males aged 50 to 54 relative to all white people aged 40 and over</td>
<td></td>
</tr>
<tr>
<td>120,221 *</td>
<td>133,697 (\frac{133,697}{128,000})</td>
<td>0.9939⁴ *</td>
<td>(\frac{9,112}{133,697}) = 8,352 (\text{was } 9,112)</td>
<td></td>
</tr>
</tbody>
</table>
Final Step

- Make consistent with the ONS 2012-SNPP
- Only available by gender and age (hence need for ETHPOP!)
- In each gender and age category combination aggregate ETHPOP revised estimates across all five ethnic groups
- Establish a factor to make this sum consistent with ONS 2012-SNPP specific LAD, gender and age group projection
- $8,352 \times 0.9749 = 8,143$
• Microsimulation consists of a collection of individuals taken to represent a LAD
• For future years, adapt the population at the previous time step so it matches the adjusted ETHPOP projections
• Examine the microsimulated population for presence of morbidities
• Future population is an important driver of service provision
  – Health care for the elderly is an acute example
    • Dependencies include age, gender, socio-economic status, ethnicity and lifestyle
    • ONS forecasts limited to age and gender; ethnicity an important extension
• ETHPOP a powerful framework for projection
  – But scope for refinement against 2011 benchmarks
  – We have demonstrated a method for realignment of both baseline and future projections
  – Further enhancements are ongoing...