Small area synthetic estimation based on the Crime Survey for England and Wales

Joanna Taylor

Supervisors Dr Liz Twigg and Dr Kate Jones (University of Portsmouth) and Prof John Mohan (University of Southampton)

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Today’s presentation...

- The problem
- Multilevel modelling
  Method and results
- Synthetic estimation
  Method and results
- What can synthetic estimates be used for?
The problem

\[
\int \frac{x + 5}{x^2 - 2x - 3} \, dx
= \frac{5}{3} dx = \int \frac{2}{x-3} \, dx - \int \frac{1}{x+1} \, dx
= 2 \ln |x - 3| - \ln |x + 1|
= \ln \frac{(x - 3)^2}{x + 1} + C
\]
Why can’t we use traditional surveys to estimate criminological attitudes at the local level?

The Crime Survey for England and Wales, although one of the largest surveys in England and Wales is still too small to provide reliable neighbourhood statistics.

How have criminological attitudes previously been estimated?

Under the previous Government the Place Survey was conducted biennially by every Local Authority to provide (amongst other findings) attitudes towards various crime and criminal justice issues in the area at a cost of £16.5 million for three sweeps (DCLG 2007).

The Coalition Government abolished Place Surveys in 2010 stating...

“the Place Survey was an example of wasteful municipal spending – which required council officials to ask residents a range of intrusive personal questions” (DCLG 2010).
Response rates achieved by Local Authorities for the 2008 Place Survey

Source: DCLG (2009)
London Borough of Bexley Place Survey’s demographic profile

This corresponds to only 19 respondents
What is the alternative?

Local Surveys such as the Place Survey
- No longer available
- Methodological issues
- Cost implications

Small Area Synthetic Estimation
- Estimates available for all small areas
- Low cost
Crime Survey questions on perceptions towards alcohol and drug related anti-social behaviour

For the following things I read out, can you tell me how much of a problem they are in your area. By your area I mean within 15 minutes walk from here.

.....people being drunk or rowdy in public places?
.....people using or dealing drugs?

Respondents were asked to select their answers from the following response list:
- Very big problem
- Fairly big problem
- Not a very big problem
- Not a problem at all

Those saying either “very big problem” or “fairly big problem” were coded as having negative perceptions of alcohol or drug related ASB.
Why were these two questions chosen?

A review of small area synthetic estimation by the National Centre for Social Research commissioned by the Department of Health (Pickering et al. 2004, 56) identified a number of criteria that should be fulfilled to employ small area synthetic estimation:

- **A prevalence greater than 10%**: the percentages perceiving alcohol / drugs to be a problem were 26% and 28% respectively based on the 2008/09 sweep.

- **Evidence of area-level variation**: previous Government and academic research both in this country and elsewhere has demonstrated strong associations between perceptions of ASB and area-level data.

- **Availability of alternative data sources to check for strong correlations with independent estimates**: Local Authority estimates are available for both questions from the Place Survey.
Data sources
Respondents’ answers to the perceptions of alcohol and drug related ASB questions

Socio-demographic Information about the respondent and their household

ESDS special licence version of the 2008/09 Crime Survey for England and Wales

Super Output Area codes
ESDS special licence version of the 2008/09 Crime Survey for England and Wales

Census
Degree of ethnic heterogeneity
ONS urban and rural classification
Proportion of empty homes from the Empty Homes Agency

Index of Multiple Deprivation
Mid year population estimates
Proportion of young people

www.police.uk
Rate of reported incidents of ASB
**www.police.uk website**

Number of reported incidents of ASB to the police in December 2010

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 16</td>
<td></td>
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<tr>
<td>17 - 32</td>
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<td>33 - 52</td>
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<td>53 - 83</td>
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<td>84 - 140</td>
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<td>141 - 243</td>
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<td>244 - 517</td>
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</tr>
</tbody>
</table>

**Sources:**
1. [www.police.uk](http://www.police.uk)
2. ESRI Community Topographic Basemap
3. ONS, Super Output Area Boundaries.
   Crown copyright material is reproduced with the permission of the Controller of HMSO.
ESDS special licence version of the 2008/09 Crime Survey for England and Wales
Ordnance Survey MasterMap® Address Layer 2

OS MasterMap® Address Layer 2 links any property address to its location on the map. It provides precise coordinates for more than 29 million residential and commercial properties in Great Britain.

From this is it possible to identify the location of licensed premises in England.

Here OS MasterMap® Address Layer 2 is overlaid on OS MasterMap® Topography Layer
Multilevel Small Area Synthetic Estimation
What is Multilevel Small Area Synthetic Estimation?

Multilevel small area synthetic estimation can be summarised as...

“modelling nationally...predicting locally”

In other words multilevel models are re-worked for whatever geography is needed e.g., Middle Super Output Areas or Local Authorities.
What is Multilevel Small Area Synthetic Estimation?

Multilevel small area synthetic estimation can be summarised as...

“modelling nationally...predicting locally”

What is a Multilevel Model?

Risk of individual perceiving alcohol related ASB to be a problem in their local area

$F_n[\text{individual factors}] + F_n[\text{area factors}] + \text{Residuals}$
Small area synthetic estimation methodology

Multilevel modelling (1)

- Which people perceive high levels of alcohol and drug related ASB?
  Use the literature and secondary analysis of the Crime Survey to model which people are more likely to perceive high levels of anti-social behaviour.

In any SASE model all individual level variables also have to be available in the Census. Therefore the maximum number of individual characteristics is three...

- Age
- Tenure
- Health status

(1) Candidate variables identified in the literature
(2) Final three variables chosen by the percentage of higher level variation explained
Small area synthetic estimation methodology (continued...)

Multilevel modelling (i)

• *Which people perceive high levels of alcohol and drug related ASB?*
  Use the literature and secondary analysis of the Crime Survey to model which people are more likely to perceive high levels of anti-social behaviour.

Multilevel modelling (ii)

• *Which places perceive high levels of alcohol and drug related ASB?*
  Use geographical codes included in the special license version of the Crime Survey to link external area level data sources such as the Index of Multiple Deprivation and Ordnance Survey’s MasterMap Address Layer 2.
Multilevel modelling results
Multilevel modelling area level results

<table>
<thead>
<tr>
<th></th>
<th>Alcohol related ASB</th>
<th>Drug related ASB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deprivation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population turnover</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnic heterogeneity</td>
<td>Green</td>
<td></td>
</tr>
<tr>
<td>Young people</td>
<td>Grey</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Reported incidents of ASB</td>
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<tr>
<td>Density of pubs and nightclubs</td>
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<td>Proportion of empty homes</td>
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- Positive statistically significant association
- Negative statistically significant association
- No statistically significant association
Small area synthetic estimation methodology (continued...)

- **Multilevel modelling(i)**
  - *Which people perceive high levels of alcohol and drug related ASB?*
  - Use the literature and secondary analysis of the Crime Survey to model which people are more likely to perceive high levels of anti-social behaviour.

- **Multilevel modelling(ii)**
  - *Which places perceive high levels of alcohol and drug related ASB?*
  - Use geographical codes included in the special license version of the Crime Survey to link external area level data sources such as the Index of Multiple Deprivation and Ordnance Survey’s MasterMap Address Layer 2.

- **Synthetic estimation**
  - *Calculate perceptions of alcohol and drug related ASB for every neighbourhood in England*
  - Including those where no respondents were interviewed.
Synthetic estimation results
Percentage of population within MSOA with negative perceptions towards drug-related anti-social behaviour
A Bayesian approach was adopted to assess the precision of the synthetic estimates.

The resulting confidence intervals are too wide to rank the synthetic estimates (for example into quintiles as in the previous map).

An alternative presentational approach is to only report those areas (be it neighbourhoods or Local Authorities) which are statistically significantly above or below the national average.
Neighbourhoods which are expected to have the most negative perceptions towards alcohol related anti-social behaviour are clustered around the urban areas of inner London, the West Midlands, Yorkshire and the North East of England. There are also noteworthy pockets of negative perceptions in coastal towns, a phenomena which is reflected in the literature (Smith 2012).
Why were these two questions chosen?

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- **A prevalence greater than 10%**: the percentages perceiving alcohol / drugs to be a problem were 26% and 28% respectively based on the 2008/09 sweep.

- **Evidence of area-level variation**: previous Government and academic research both in this country and elsewhere has demonstrated strong associations between perceptions of ASB and area-level data.

- **Availability of alternative data sources to check for strong correlations with independent estimates**: Local Authority estimates are available for both questions from the Place Survey.
Strong correlation with independent estimates?

Spearman’s rank correlation between the Place Survey and the synthetic estimates at the Local Authority level...

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<table>
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<tbody>
<tr>
<td>Alcohol related ASB</td>
<td>0.71</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>Drug related ASB</td>
<td>0.75</td>
<td>P&lt;0.01</td>
</tr>
</tbody>
</table>

Availability of alternative data sources to check for strong correlations with independent estimates: Local Authority estimates are available for both questions from the Place Survey.
What can synthetic estimates be used for?

Synthetic estimates are best employed to highlight which neighbourhoods or administrative geographies can be expected to suffer from negative perceptions with a view to allocating resources or targeting interventions.
Small area synthetic estimation based on the Crime Survey for England and Wales

*Thank you and any questions?*


