

## **Use of Synthetic estimates**

There are problems with synthetic / modelled estimates.

**Research and Modelling Methodology.** The accuracy of any synthetic estimates depend on the quality of the initial research and the modelling itself. If the model is too simple, for example, just containing age and sex as predictors, this means that the resulting estimates will be poor for geographical areas with particularly low or particularly high levels of other factors that influence the estimates, such as deprivation. If the model contains a high number of predictive factors, it is very possible that the model would be “over-fitted”. This is a statistical term meaning that the model is (artificially) a good model using the initial research, but a much poorer model when applied elsewhere.

**Testing.** Even if the modelling has been undertaken by qualified statisticians who understand the numerous problems associated with generating models, it needs to be ‘tested’ and any modelling is still based on initial research. It is very rare for models to be ‘tested’, so generally the accuracy to which the model predicts the true situation is largely unknown.

**Validity and Generalisability.** The quality of the original epidemiological studies could differ substantially, and it is possible that these studies, for any number of reasons, may not be appropriate or of sufficiently high quality to use in modelling. Furthermore, it is possible that a number of different epidemiological studies have been used to generate the model and this has its own complications; combining data from different studies that have used different methodology and definitions, and undertaken at different points in time. It is likely that the initial research was not originally intended to generate such a model, and if different studies have been used it is possible that the factors / variables in the model differ. This means that assumptions need to be made or changes need to be made to the original data to generate a model. For example, it is possible that different measures of deprivation have been used in the original research, but one measure needs to be used in the final model. The time lapse between the original research and the period to which the modelling refers may be long enough to render the model inaccurate under more recent circumstances. It is very possible that the initial research was undertaken in a very specific geographical area, and if this was the case, then there might be very little or no data at the extremes of a highly influential factor, which would result in a very poor model when applied to geographical areas which are substantially different from the geographical area of the initial research. For example, if the original research was undertaken in a geographical area with “average” deprivation and relatively few very or no deprived areas, then there would be very little or no data from the original research to provide good predictions for more deprived areas. The model would generate predictions for much more deprived areas, but it is likely that the predictions could be very poor as the model is generating a prediction outside the range of the original data. This is particularly the case for Hull due to its high level of deprivation. Even where the model is constructed from data drawn from a wide range of situations (eg high/low deprivation), the linear assumptions made by most models may break down at the extremes, and all too often Hull is at the extreme end of either

explanatory or observed variables. This will lead to inappropriate extrapolation and inaccurate and systematically biased estimates.

**Lack of transparency in relation to synthetic estimates:** Most of the time, the details of the model used to create the synthetic estimates is not available. Therefore, it is difficult to assess the quality of the estimate or the quality of the original research used to derive the model. Furthermore, synthetic estimates are sometimes provided without stating where the estimate comes from or even that it is a modelled / synthetic estimate.

**Problems with updating synthetic estimates:** Without knowing the details of the model, it is very difficult to assess how and when the model will change the future (when new data included in the model becomes available). For example, the Index of Multiple Deprivation score was created in 2001 and updated in 2004 and 2007, and if the model included this then it is not likely to change until 2010 or even later (if at all). Some models will use data from the Census, which is updated every ten years with the last Census conducted during 2001. So information from the Census is relatively out of date, and new Census data will not be available until around 2012-2013 once the 2011 Census data is analysed and published.

**Examples.** Synthetic estimates have been derived by the Public Health Observatories (PHO), and are 'factsheets' are available for each Primary Care Trust / Local Authority from the Yorkshire and the Humber PHO (YHPHO)<sup>1</sup>. Historically the synthetic estimates for smoking prevalence in Hull has been considerably higher than local Health and Lifestyle Survey estimates (almost one third higher). The PHO estimate for 2006-2008 is 32.5% for smoking prevalence which is similar to the local surveys conducted in Hull. However, the estimate prior to this (included in the profiles published during 2009) was 41.9%. The table below gives the synthetic estimates and estimates from the local surveys<sup>2</sup> conducted in Hull.

Estimate type	Time period / survey	Prevalence estimate in Hull (%)*				
		Smoking	Binge drink	Healthy eating	Physically active	Obese
Synthetic	2003-2005 (used in 2009 profiles)	40.9	26.2	20.0	12.2	27.3
	2006-2008 (latest)	32.5	28.1	**	**	**
From local surveys	Health & Lifestyle Survey 2007	31.7	21.9	23.0	26.3	20.8
	Prevalence Survey 2009	35.1	19.9	26.1	30.8	24.4
	Social Capital Survey 2009	32.7	**	28.1	39.2	26.3

\*These 'terms' are not defined, so it is difficult to know exactly what is meant by 'physically active' or 'healthy eating'. Locally, 'healthy eating' is defined as eating 5-A-DAY, and exercise was defined based on fulfilling the national exercise recommendations. So definitions may not be comparable.

\*\*Not published or not asked in local survey.

<sup>1</sup> Health Intelligence Practice Profiles and PCT Level Profiles on <http://www.yhpho.org.uk/>

<sup>2</sup> All the local surveys in Hull have used quota sampling so are representative of Hull's population in terms of age, gender and geography (and employment status).