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The use of Spatial Measures for the targeting of Need

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Executive summary

Area based targeting has been used extensively throughout the UK for more than half a century and has generated advocates for and against for almost as long. More recent reviewers have suggested this polarisation is unnecessary and there is an increased recognition that whilst most poverty eradication should be through universal macroeconomic and social policies, area-based interventions may constitute a useful adjunct to these broader programmes. This recognition however, shifts the arguments including how these areas should be defined and the policies assessed. Amongst the calls for more considered theories of agency, better specified objectives and more sophisticated analytic tools, it is evident that one of the most common and overarching themes for most Area Based Initiatives is that area-based targeting can be an effective way of reaching poor people. This suggests that at a fundamental level most area-based policies can be assessed according to their efficiency and effectiveness of reaching those most in need. This has been one of the guiding principles of the current study.

The literature suggests that the spatial unit at which deprivation is identified and measured influences the efficiency of targeting. Most targeting in the UK is currently at Census-based Super Output Area level, but this study also examined aggregates of smaller census-based areas (Census Output Areas) as they are likely to be more homogenous, and also larger areas (District Councils) which might prove easier for policy implementation. The conclusions were that targeting using those District Councils with the greatest concentration of disadvantage would be more inefficient than the current SOA-based approach as most of their populations are not disadvantaged and also that most disadvantaged people do not live in these areas. The study confirms that COAs are more homogenous and do offer an advantage over SOAs in terms of concentration and completeness of targeting but the distinction between the two is not marked. Whether COAs are a practical level upon which to base an area-based intervention is beyond the remit of this study.

The following conclusions can be drawn about the different measures of deprivation:

- Each of the indicators studied in this report identifies areas where there are high concentrations of disadvantage, and there is a reasonable agreement between the measures on where these areas are. However, there are also some differences in the areas that each indicator selects which will have implications for the allocation of funding. Furthermore, as different indicators detect some types of disadvantage better than others this suggests that the choice of indicator could be selected or tailored to better meet the focus of a specific intervention.

- In general the Multiple Deprivation Measure at COA level was more closely related to the basket of demographic, socio-economic and health measures than the other measures studied, though the overall differences between the measures of deprivation studied were modest. It also performed better in terms of both concentration and completeness. The MDM at SOA and the MDM Income Domain at SOA demonstrated the next best fit.

- It is also important to note that although all of the measures studied identify areas where the concentration of disadvantage was highest, they were all fairly inefficient at identifying deprived people.

- None of the variables are particularly good at detecting spatial deprivation in rural areas, and that area-based targeting works maximally (in terms of efficiency) in urban areas. This finding is related to rural areas being more dispersed than their urban counterparts and thus more likely to have a wider variety of people contained within them.

In summary

Area-based interventions are a small but important addition to individual or family-based policies and area based indicators of disadvantage are therefore an invaluable step in this process. They are however not a panacea, and work best when combined with other information sources and, as the documentation for the Welsh index of multiple deprivation states, 'the *index is most useful if it is used in conjunction with other information, either from the index indicators, other published data or local information. This will increase the understanding of the challenges in the local areas*'. The choice of indicator and the spatial unit applied should also perhaps be selected according to the target population.

This report was limited to the measures that are currently available. It is likely that the future availability of other administrative datasets such as house valuation from the Land & Property Services and income returns recorded by HM Revenue & Customs, supplemented perhaps by more detailed modelling of income from larger surveys may provide a more informative picture of the distribution of deprivation in society and enable more efficient targeting of deprived people.

Recommendations:

Users should be cautious of uncritical or blanket use of area indicators of deprivation. The choice of indicator and of the spatial unit of application should be selected according to the specific policy question to be addressed. Area indicators of deprivation should usually be considered in conjunction with other and perhaps more local contextual information. There is little to suggest that the Northern Ireland Multiple Deprivation Measure is not the most appropriate for general use, but it is recommended that this situation is episodically reviewed as newer datasets related to income or disadvantage become available.

Introduction

Whilst most monies to offset deprivation go directly to individuals (or families) in the form of state benefits or tax relief, Government also gives additional funding to areas where there are high concentrations of people who are disadvantaged. Although the amount, duration, and target beneficiaries vary according to the programme, the identification of appropriate areas in the allocation of these resources is central. However, questions about the utility of an area-based approach have persisted for nearly as long as the initiatives themselves. In addition, there are concerns as to whether the current approach in Northern Ireland, that generally uses the Northern Ireland Index of Multiple Deprivation at Super Output Area (SOA), is the most appropriate way to identify areas with high concentrations of deprived people and whether other measure or combination of measures would be more efficient.

The overall aims of this report are to undertake a succinct and accessible review of spatial and non-spatial approaches to targeting need; and to compare a range of possible area-based measures that might be used to identify areas of need.

The report has the following layout: Section one provides a brief summary of the experience of the history and experience of area-based interventions (ABIs) in the UK. It gives a précis of the arguments that have been historically evoked in their favour and by their protractors, concluding with a more recent synthesis that blurs the dichotomous distinction. One of the themes emerging throughout this section is the almost universal rationale for their implementation of identifying and reaching people who are poor. This leads naturally to one robust method for an evaluative framework which is pursued in the following sections. The section also reviews the approaches to targeting in the other UK countries and in the RoI.

Section two looks at how the variation in the efficiency and completeness of a measure varies according to the size of spatial unit by studying levels variation at District Council, SOA and Census Output Area (COA). These levels are also used to study the relationship between targeting and urban-rural orientation. A comparison of the efficiency and completeness of a range of measures is also undertaken.

Section three introduces another raft of possible indicators of deprivation derived from the census, administrative data, processes to model household and various spatial combinations of these. It extends the approach taken in Section two and examines the relationship between these nine possible indicators of deprivation and a basket of demographic, socio-economic and health-related measures. These measures are derived from an analysis of routine census and mortality data, linked census-related data (through the Northern Ireland Longitudinal Study – NILS) and via data relating to dispensed prescriptions (through the Enhanced Prescribing Database – EPD). Section four concludes with a summary of the main findings and recommendations.

Section 1

Overview of literature relating to use of Area-based Initiatives (ABIs)

Area-based targeting of regeneration and social policy have been used in earnest the UK since at least the 1960s and the current debate as to the utility or otherwise of such area-based initiatives (ABIs) has strong echoes with similar debates about area-based policies in GB under Labour and Conservative administrations during the 1960s and 1970s [1, 2]. According to Pattie [3] early initiatives pathologised disadvantage and emphasised the need to break the cycles of disadvantage operating within certain families and neighbourhoods, and it was felt that the careful concentration of resources in deprived areas would lead to a significant improvement in the lives of the most disadvantaged individuals and families, without the need for individual targeting. Many of these initiatives were targeted at urban areas and consequently much of the literature surrounding the utility/futility of such approaches revolves around their effects in urban settings.

Criticisms of these early approaches were that they often failed to reach the poorest individuals in the targeted areas, and the benefits were often taken up by the most affluent residents; that the schemes were inefficient in that most individuals who were deprived did not live in the targeted areas; and that it was necessary to tackle the root causes of inequalities rather than just their spatial manifestations.

Most areas are targeted on the basis of indicators and although, it is generally acknowledged that there is no definitive way of determining which areas are deprived and which are not, a plethora of different indicators have been developed to help identify such areas over the years and especially so over the last few decades [4,5] (see also the Handbook of Inequality and Socioeconomic position: concepts and measures [6] for a useful overview of the strengths and weakness of some of these indicators). These have identified areas as absolutely or relatively deprived, or as containing greater or lesser concentrations of deprived individuals or families/households. They have also used different indicators of deprivation to which different weights have been applied. Few indicators explicitly or directly measure social exclusion.

It is also apparent that although there is often a great overlap between the areas that are identified by the different indicators, there remain differences that would have policy implications when a particular indicator is chosen to inform funding decisions. Different indicators can also emphasise different types of area, either because of the factors contributing to the index or to the statistical processes used to create them. Green [7] and Carstairs and Morris [8] noted that indices at authority level that included overcrowding, non-car ownership and rental accommodation favoured London; these included the earlier version of the DOE index, Jarman, Oxford and Bradford indices [9,10]. By way of contrast the Scotdep, CASE and Index of Multiple Deprivation produced a distribution of deprivation that did not favour London. However, as Tunstall and Lupton [14] point out, the development of the Index of Multiple Deprivation by Prof Mike Noble's team in Oxford broke new ground and since then most of the targeting approaches since then have tended to use local versions of these indices. A brief description of these indices for the home countries and for

the equivalent approaches taken in the RoI and what their stated aims are is given in Appendix A.

A distillation of the literature relating to the history and rationale for area-based initiatives suggests that the main reasons for targeting areas include the following:

1. Because poverty is concentrated in certain areas. The spatial concentration of poverty in Britain has been noted by social commentators such as early as the 19th century [11-13] and it should therefore be a most effective way of reaching poorer individuals. Tunstall & Lupton [14] suggest that while policy makers often state a range of reasons for the area-based targeting, the 'effectiveness' explanation is usually featured strongly amongst their arguments. '*Certainly it would seem a wasteful and unfair use of public money if targeting was very incomplete, so that a tiny proportion of the poor were in areas benefiting, or very inefficient, so that huge proportions of residents in areas benefiting were not poor. This makes [the effectiveness explanation] a particularly important rationale'*. Smith et al [15] suggest that it was arguments about the inefficiency of targeting that probably lead to the demise of the earlier ABI programs in Britain.

2. Because area matters: ie that living in an area of multiple deprivation contributes something above and beyond the characteristics of the individual residents in that area ie '*that concentrations of deprivation give rise to problems greater than the sum of its parts*' [16] or alternatively that concentrated poverty has a cumulative or qualitatively different effect on individuals than in areas where poverty is less concentrated. However, the evidence for the existence of such area-level effects is far from clear. Many studies find unexplained variation at area-level in their analyses but the interpretation of this is difficult as it might represent either true area effects or alternatively unmeasured attributes in the individuals across areas, ie residual confounding. Most researchers have concluded that the additional effects of areas on outcomes (if present at all) are likely to be small. Others have argued that absence of evidence may not be evidence of absence of an effect and that there has been insufficient theoretical underpinning to much of the research so that the wrong outcomes and process have been assessed. [17] Others have argued that the existence of spatial concentrations of deprived people per se must imply area-level causes, for example in the local labour or housing markets [18] and evidence that patterns of disadvantage have remained fairly constant over decades or centuries [19, 20] and persist in some areas despite mainstream policies is further evidence of the need for remedial solutions at an area level. Some argue that the distinction between the individual and area level influences is not as clear-cut as would initially appear, for example employment is an individual characteristic but the geography of unemployment is a combination of an individual's employment (and other) status, their location and the local labour market [21, 22]. Joshi [23] suggests that there is greater chance of finding a link between area-level predictors and individual outcomes if the same variables measured at area level were more than the mere aggregations of the same variables measured on individual characteristics. Features of the natural or build environment climate, pollution, accessibility of shops and services or crime rates would be examples of conditions shared by all inhabitants rather than social

class, unemployment, or employment which would initially be measured at the level of the individual. Therefore the likelihood of finding an area effect will depend on the outcome under consideration, the definition of locality, the duration of residence in the area, and the stability of its disadvantage characteristics.

3. Because some areas have special needs: It could be argued that there is need for ABIs when the spatial concentrations of deprivation arises because of structural problems such as in the employment and housing markets, biased distribution of infrastructure or transport etc, which requires a structural response. Again, some have argued that if mainstream policies are the only answer, why is it that some areas are more resistant to change than others? The persistence of localised spatial patterns of deprivation is therefore seen as an indication of the need for local action (indeed the persistence of high levels of deprivation and unemployment in the northern parts of GB and in NI would also indicate a need for 'local' policy responses).

4. Because of the need to pilot new initiatives: Sometimes the purpose of an ABI is to derive or test new ways of addressing poverty related problems; in such instances the funders might, in addition to measures of disadvantage, be interested in additional area facets such as the ability of the local community to develop innovative models, which if successful might be extended to the rest of the country.

5. Because they may stimulate and/or harness the energy, enthusiasm and ideas of the local community.

6. Because there are some policies that have because of their nature to be area-based. Some examples of this might be educational initiatives which might be targeted at specific schools or child care or issues with local health-care provision.

The opponents of ABIs are as numerous and eloquent as those in favour of them. The following are some of the main arguments proffered against ABIs:

1. That they do not work: The persistence of deprivation in areas despite the decades of localised funding and allied programmes brings into question the effectiveness of ABIs [24]. Burrows & Bradshaw [25] put this rather more bluntly … '*despite the myriads of neighbour-based policy initiatives which have taken place (and the billions of pounds spent on them) there is little in the way of reliable evidence on the efficacy, or otherwise, of area-based approaches to the alleviation of poverty and associated detrimental outcomes'*. There is a distinct dearth of empirical evidence that ABIs will lead to significant health or socio-economic impact [26-28]. Thompson et al [29] summarised the evidence of impacts on health and socioeconomic determinants of health from national programmes of urban regeneration in the UK from 1980-2004 and found the following: health impacts were rarely assessed and conflicting evidence meant that it was impossible to draw any firm conclusions about the health impacts; employment and education were the most commonly reported socio-economic impact and the data were suggestive of a modest positive impact. Impacts on housing and income were rarely assessed making it difficult to generalise about

effectiveness. They also say that even less is known about the social distribution of impacts and the implications for health inequalities. Some of the possible reasons why ABIs have not worked or why a possible positive effect has been missed include the following:

a. The focus of the ABI is usually on poor people and poorer places rather than on neighbourhood dynamics in general, which gives a distorted expectation of what poorer areas in isolation can achieve. For example, because of the intersection of the housing market the fortunes of poor areas are often as much to do with the actions (inactions) of wealthy as of poorer people.

b. The effects of place on outcomes is often more subtle than either conceptualised or captured in routine data.

c. The unit of intervention/analysis is often constrained by administrative boundaries which may have little relationship to functional units such as neighbourhoods.

d. There is a need for careful use of more powerful statistical techniques that adjust for the hierarchies in the data. Others have argued that there is a need for longitudinal data that captures the duration of residence/exposure as well as the perhaps selective migration into and out of deprived areas. The latter is important as it is possible that the observed benefits will be diluted if those who have benefited most leave the deprived areas [30]

e. The timing of the evaluations may be based on administrative requirements but inappropriate to the intervention.

f. There is often a focus on short term changes and therefore often on process issues.

g. It is also possible that some ABIs fail because they do not reach/engage those most in need within the targeted areas.

2. ABI have also been criticized for being short term, unfocused and overly ambitious given their relatively modest budgets [31-35]. Indeed the shifting local, national and political landscape will inevitably reduce the impact that any single intervention can have. Pattie [3] goes further stating *that the symbolic impact of area-based policies in an area-based electoral system should not be underestimated, especially when what is happening in one's area can influence voting preferences* [36].

3. A recurrent theme is that predictions of impacts for ABIs are made with no clear underlying theory. This applies to the processes that give rise to the disadvantage, to the community dynamics that may be influenced by the intervention and of what the possible effects are likely to be and who is most likely to be affected. The limitations of what can be appropriately measured by routine data have been mentioned above.

Thompson therefore suggests that advocates for ABIs have been too ambitious in their expectations of what can be measured by an evaluation [29].

4. They are inefficient. One of the most constant criticisms of ABIs is that they miss most of those who are disadvantaged. As Tunstall & Lupton state, unless areas are segregated according to the particular measure of disadvantage there will always be a degree of population mixing (ie areas will contain a mixture of both disadvantaged and non-disadvantaged people) [14]. This means that some people in the targeted areas will not be disadvantaged; the extent to which this occurs can be described as the efficiency of the targeting approach. This may be problematic as some studies of ABIs have suggested that it is the residents with greater financial and human capital who may be more able to access information about new initiatives, may be better placed to utilize any new services and may have a more positive reaction to new initiative [37, 38]. Stafford et al therefore suggest that ABIs may require more specific targeting to those with the least resources and that programme leaders should consider how to inform and include the least educated groups and design projects with a view to encouraging uptake among those with the lowest education [39]. At the same time, the targeting will be incomplete as many (the majority) of the people who are disadvantaged will live outside the designated areas. Therefore a measure may be inefficient if there are relatively few people inside the designated areas who are disadvantaged and/or incomplete if there are many disadvantaged people living outside the designated areas. The concepts of inefficiency and incompleteness are analogous to those of sensitivity and specificity that are more frequently used to assess the usefulness (or otherwise) of screening tests for selecting individuals for assessments or other health interventions.

5. These problems were recognised by Barnes and Lucas [40] who argued in 1975 that Educational Priority areas were flawed because they were incomplete and that for every two disadvantaged children included in the scheme, there were five outside them. Similarly Townsend [41] building on the earlier work of Holtermann [42] argued that an area based approach should not be central to improving the conditions of people in poverty and in his landmark study of poverty in 1979 stated that ... '*however we care to define economically or socially deprived areas, unless we include over half the areas in the country there will be more poor persons or poor children living outside them than in them*.' More recently McLoone in Scotland using employment from the census and commercially available modelled income data confirmed Townsend's argument that selective targeting of resources on an area basis would miss more deprived people than it would include, and that the poor sensitivity of the area-based approach means that targeted areas would include many people who were not poor [43]. More contemporaneous confirmation has come from Tunstall & Lupton who suggested that further improvements might accrue from the application of smaller and presumably more homogenous spatial unit of analysis [14], though interestingly, McLoone in the study above had already noted that moving from postcode sector to the smaller enumeration district produced only modest improvements in both sensitivity and specificity [43].

6. A further criticism of ABIs is that they can lead to the stigmatisation of areas. Identifying a local area as an ABI publicly labels it as deprived and may further add to the social exclusion of the area and its residents [44-47]. It has also been suggested that labeling fosters the idea of a 'culture of poverty' and an 'urban underclass' who are responsible for the conditions they are surrounded by [48]. On the other hand some have argued that area-based approaches can reduce the stigmatisation associated with poverty reduction interventions that might otherwise be targeted at an individual level [49].

7. Finally it is often stated that ABIs cannot work as most of the causes for the disadvantage lie out-with the deprived areas and the individuals within them [50], and there has been a lively debate over many years as to whether wider 'structural' or more local 'neighbourhood' factors are responsible for the fact that deprivation is an enduring facet of many communities [51] For many earlier commentators ABIs were dismissed as *an inadequate sticking plaster to address the roots of socio-economic deprivation and social exclusion whose roots lie elsewhere* [52, 53]. This echoes Townsend's earlier conclusion that '*an area strategy cannot be the cardinal means of dealing with poverty as areas . . . cannot be treated as autonomous or self-sufficient in terms of either economy or culture. Their functions and distribution of prosperity are in the main decided elsewhere'* [41], and why earlier 19th century thinkers such as Marx, Engels, Booth and Rowntree drew conclusions related to the whole economy rather than to area improvement. Chatterton & Bradley [54] reviewing their evaluation of area-based initiatives in the North of England (mostly under New labour) further argue that the continuing vogue for area-based approaches to regeneration has stifled debate over the causes of deprivation and that such initiatives have led to inadequate understanding of the processes that guide regeneration at a local level.

For many this level of polarisation is now redundant and more recent commentators advocate for combined approaches, and that area-based policies need to be complemented by approaches that target individuals or societies [55]. Smith et al [18] suggest that it is quite consistent to hold the view that the main policy prescription for the eradication of poverty should be through universal macroeconomic and social policies but still see area-based policies as a useful addition to mainstream programmes. Others have pointed out that although the funds going to area-based schemes has increased in recent years they are in reality dwarfed by the bulk of public funding that largely goes to individual households through the benefits system [56]. Joshi, whose research has often been cited as evidence of the absence of an independent area effect (on mortality) [57], concludes … "policies *towards places are not redundant but should operate within a context of policies towards people"* [23]. Whilst acknowledging the dominance of individual-level and structural factors, ABIs may be an effective means of complementing a more general anti-poverty or anti-deprivation strategy and provides some indicators which make this more likely. For example, the more localised the issue the more appropriate is an ABI. Low population mobility is also important as long-term exposure to disadvantage is a greater concern than transient exposure in areas with high population turnover. It could also be argued that if the improvements to the area resulted in gentrification and the displacement of original deprived population this would not be a useful ABI. The nature of the intervention is important and the provision of site-

specific services, such as the location of child-care facilities, schools, transport or other amenities or facilities would make ABIs more attractive. Finally, ABIs may be an efficient way of delivering the program (even if they are not equitable) if there are economies of scale in the provision of services. Again there is the acknowledgement that alternative strategies would be needed to address the needs of the more spatially dispersed but similarly disadvantaged individuals.

Turnstall and Lupton point out that while there is often a number of reasons given for particular ABIs most programs include, or have as a central aim, that area-based targeting can be an effective way of reaching poor individuals, and state that although evaluating this is a methodologically easier task than identifying area-level effects this is not often done or in great depth [14]. This section of the report aims to do this using data for Northern Ireland by addressing the following four questions (i) does the level of geography affect the efficiency and completeness of the designated areas; (ii) does targeting favour urban areas; (iii) does the inclusion of an estimated GINI coefficient improve the targeting of areas, and (iv) which indicator provides the best measure for identifying those most in need?

Section2

Efficiency and effectiveness of targeting

The relationship between spatial size and efficiency and completeness

Targeting using District Councils:

Following on from the approach by Tunstall & Lupton [14] the following section examines the utility of using larger geographies, such as the 26 District Councils to target deprived individuals and communities (concentration) and how successful this would be at capturing all those who are deprived. Comparisons are made against the equivalent measures estimated at SOA level. For this analysis the SOA data (working age population and counts of income deprived children and older people) were aggregated up to the coterminous District Council level so that the same data were used to produce the estimates at both District Council and SOA level. Table 1 overleaf, shows the 26 District Councils ranked according to their extent of deprivation. This is a measure of the proportion of a District Councils population living in the most deprived SOAs in the country.

Table 1

Concentration of population and disadvantage at District Council level (ranked by extent of deprivation)

			Percentage of District Council population			
District Council	**Extent**	**% Population**	**Poor (all ages)**	**Poor children**	**Poor older people**	**Emp. Deprived**
Belfast	46	14.9	34.8	42.5	47.3	16.3
Strabane	44	2.2	36.3	37.2	55.7	19.9
Derry	43	6.1	37.9	43.4	50.8	18.2
Craigavon	21	5.2	24.9	26.6	43.0	13.7
Newry &Mourne	19	5.6	28.9	30.0	50.1	13.8
Lisburn	18	6.5	21.4	26.1	30.5	11.1
Limavady	16	1.9	27.9	29.3	45.1	15.3
Newtownabbey	13	4.6	19.1	21.5	31.4	10.3
Ballymena	12	3.5	18.9	21.4	29.3	10.2
Coleraine	12	3.2	23.7	25.7	33.7	12.2
Moyle	12	0.9	27.8	29.6	38.8	14.0
Dungannon	11	3.2	25.2	26.4	46.4	12.3
Larne	11	1.8	20.0	22.6	31.3	11.5
Carrickfergus	10	2.2	17.9	20.0	29.1	10.6
Cookstown	10	2.0	26.6	26.9	47.3	14.1
Down	8	3.9	21.9	23.9	33.9	12.2
Ards	7	4.3	18.1	19.3	29.5	10.8
Omagh	7	2.9	25.5	26.5	42.6	13.9
Antrim	5	3.0	17.5	18.3	30.9	10.6
Armagh	5	3.3	21.8	22.3	36.8	12.3
Castlereagh	5	3.7	15.1	15.9	26.3	9.3
Banbridge	4	2.7	18.6	18.4	35.8	11.7
Fermanagh	4	3.5	23.0	21.9	41.8	10.5
North Down	3	4.4	14.6	17.0	21.5	8.4
Ballymoney	2	1.7	23.8	24.0	39.7	13.1
Magherafelt	2	2.5	21.3	20.7	45.2	11.6
N. Ireland		**100.0**	**24.9**	**27.6**	**38.2**	**13.0**

Note: Extent measures how widespread high levels of deprivation are in a LGD (see http://www.nisra.gov.uk/deprivation/nimdm_2010.htm for a more complete explanation) Belfast is the most deprived District Council with 46% of its people living in the most deprived SOAs, closely followed by Strabane and Derry. These District Councils are some way ahead of Craigavon which is the fourth most deprived and has 21% of its population in the most deprived SOAs. Belfast, Strabane and Derry do represent concentrations of deprivation as over one third of their populations are income deprived (compared to 25% for Northern Ireland as a whole and say 14% for North Down, which is towards the more affluent end of the spectrum). The concentration of poorer children is perhaps even more

concentrated, though the distribution of poor older people, which has a higher overall prevalence, is more uniform across district councils. Unemployment is also higher in these three District Councils though the gradients are not as marked as for income at younger ages; collectively approximately 20% of the working age population in the three most deprived District Councils is employment deprived compared to 13% for Northern Ireland as a whole and 8.4% for North Down.

Concentration: It is however, also apparent that most of the population in these areas are neither income deprived nor unemployed, for although Belfast, Strabane and Derry show the greatest concentration of deprivation, approximately two-thirds of the population in these areas are not income deprived and approximately 80% are not employment deprived (though it is probable that the number of people (dependents) affected by either income or employment deprivation will be greater than these percentages would indicate).

Table 2

Completeness of disadvantage capture at District Council level (ranked by extent of deprivation) according to cut-off point

		Cumulative percentage of Northern Ireland population				
District Council	**Extent**	**% Population**	**Poor (all ages)**	**Poor children**	**Poor older people**	**Emp. Deprived**
Belfast	46	14.9	20.9	20.9	18.9	19.2
Strabane	44	17.2	24.1	24.2	22.0	22.6
Derry	43	23.3	33.4	34.7	28.6	31.3
Craigavon	21	28.5	38.6	39.9	34.1	36.8
Newry &Mourne	19	34.0	45.1	46.7	40.2	42.7
Lisburn	18	40.6	50.7	53.2	45.2	48.3
Limavady	16	42.4	52.8	55.2	47.1	50.6
Newtownabbey	13	47.1	56.4	58.7	51.3	54.2
Ballymena	12	50.6	59.0	61.3	54.4	56.9
Coleraine	12	53.8	62.0	64.1	57.6	59.7
Moyle	12	54.7	63.1	65.1	58.7	60.7
Dungannon	11	57.9	66.3	68.4	62.1	63.8
Larne	11	59.7	67.8	69.7	63.7	65.4
Carrickfergus	10	61.9	69.4	71.2	65.6	67.2
Cookstown	10	63.9	71.5	73.3	67.8	69.4
Down	8	67.9	75.0	76.7	71.3	73.1
Ards	7	72.2	78.2	79.5	75.2	76.7
Omagh	7	75.2	81.2	82.5	78.1	79.9
Antrim	5	78.2	83.3	84.6	80.2	82.3
Armagh	5	81.5	86.2	87.6	83.3	85.4
Castlereagh	5	85.2	88.4	89.5	86.3	88.0
Banbridge	4	87.9	90.4	91.4	88.7	90.4
Fermanagh	4	91.4	93.6	94.1	92.6	93.2
North Down	3	95.8	96.3	96.5	95.8	96.0
Ballymoney	2	97.5	97.9	98.0	97.5	97.7
Magherafelt	2	100.0	100.0	100.0	100.0	100.0

Completeness: Table 2 shows the proportion of those who are disadvantaged who would be captured at any given cut-off point along the distribution. It is evident that there is a trade-off between efficiency (concentration) and completeness. Belfast District Council has 14.9% of the population but 21% of those who are income deprived and 19.2% of those who are unemployed. This yield (in terms of the number of disadvantaged people identified in one area) is a combination of the concentration of disadvantage and the size of the area. This combination is not found elsewhere. If the aim was to 'capture' at least 50% of the income deprived in the targeted areas it is apparent that six District Councils (Belfast – Lisburn inclusive, with 40.6% of the population) would have to be targeted to include at least half of the income deprived and seven District Councils (Belfast – Limavady inclusive, with 42.4% of the population) for unemployment deprived. This is not far removed from Townsend's contention that half of the areas in the country would have to be included to identify half of the poor people in the country.

Targeting using SOAs

Table 3 shows the distribution of population and disadvantage across SOAs ranked by overall MDM index of deprivation. These have been aggregated into vigintiles. (Note: A decile contains approximately 10% of SOA; a vigintile contains approximately 5% of these areas.) The proportion of people disadvantaged has been calculated using the same measures of disadvantage as for the District Councils.

Concentration of deprivation: the most deprived 5% of SOAs are significantly more deprived than the rest of Northern Ireland; 72% of children, 78% older people and 66% of the whole population of these areas are income deprived, and almost 29% are employment deprived, the percentage for Northern Ireland as a whole are 28%, 38%, 25% and 13% respectively. The concentration of disadvantage (the gradients between least and most deprived vigintiles) are more pronounced for income deprived children and less marked for income deprivation at older ages and for employment deprivation.

Table 3

Concentration of disadvantage at SOA (ranked by level of deprivation)

		Percentage of vigintile population			
Vigintile	**% Population**	**Poor (all ages)**	**Poor children**	**Poor Older people**	**Un-employed**
Most deprived	4.5	65.5	71.8	77.5	29.0
2	4.5	52.5	62.7	66.0	22.8
3	4.9	43.0	48.2	59.7	19.8
4	4.8	38.7	44.2	56.4	18.0
5	5.1	34.7	38.7	51.1	16.5
6	4.7	31.1	33.4	47.3	15.8
7	5.3	29.3	31.8	46.3	14.7
8	5.4	27.2	29.1	42.7	13.7
9	5.1	24.1	25.4	40.9	13.3
10	5.1	22.6	23.6	38.4	12.3
11	5.6	19.5	19.8	37.3	11.0
12	5.3	18.9	19.0	35.5	10.9
13	5.4	17.4	17.5	31.8	10.7
14	4.8	17.1	17.3	31.0	10.0
15	5.3	14.0	13.7	27.3	9.3
16	5.1	13.5	14.4	25.2	8.4
17	4.7	10.9	10.0	21.8	7.9
18	4.9	10.3	10.1	20.1	7.1
19	4.5	7.6	7.2	15.2	6.1
Least deprived	4.7	5.7	5.4	11.4	4.8

Efficiency: SOAs are significantly more efficient than District Councils at targeting disadvantage. Belfast, the most disadvantaged District Councils has approximately 15% of the population of whom approximately 35% are income deprived. By comparison, the first three vigintiles of SOA contain a similar proportion of the population but are more deprivation concentrated with 53% of the population income deprived. Nevertheless, the efficiency of the vigintiles falls off rapidly and varies according to the measure of disadvantage. Populations in the third vigintile onwards are more likely to contain non-income deprived children and non-income deprived adults; the efficiency is better for income deprived older people and again worse for employment disadvantaged people.
Completeness: Table 4 below shows that approximately 29% of the population (the top 6 vigintiles) would have to be included so as to include at least 50% of the income deprived children and people in targeted areas; the income deprived older people and employment deprived individuals who are more evenly distributed across areas would require the top 7 and 8 vigintiles (34% and 39% population respectively). This is significantly better than using District Councils which would have required the inclusion of 41-42% of the population to capture more than 50% of income or unemployment deprived people.

Table 4

Completeness of disadvantage capture at SOA level (ranked by extent of deprivation) according to cut-off point

	Cumulative percentage of Northern Ireland population				
Vigintile	% Population	Poor (all ages)	Poor children	Poor Older	Un-employed
Most deprived	4.5	11.9	13.6	8.1	9.9
2	9.1	21.5	24.6	15.2	17.9
3	14.0	30.0	33.5	22.5	25.4
4	18.8	37.5	41.7	29.3	32.0
5	24.0	44.6	48.7	36.5	38.5
6	28.7	50.5	54.4	42.5	44.2
7	33.9	56.7	60.5	48.8	50.2
8	39.4	62.6	66.3	54.8	55.8
9	44.4	67.5	71.0	60.4	61.0
10	49.6	72.2	75.5	65.6	65.8
11	55.2	76.6	79.5	70.5	70.7
12	60.4	80.6	83.1	75.3	75.1
13	65.8	84.3	86.5	79.7	79.6
14	70.6	87.7	89.5	83.6	83.4
15	76.0	90.7	92.2	87.3	87.2
16	81.1	93.5	94.7	90.7	90.6
17	85.8	95.5	96.4	93.7	93.4
18	90.8	97.6	98.1	96.4	96.1
19	95.3	98.9	99.2	98.4	98.3
Least deprived	100.0	100.0	100.0	100.0	100.0

Targeting at Census output level (COA)

Data relating to deprivation have not generally been made available at COA, but are now available as part of the 2010 NIMDM and they are considered to be both valid and reliable. However, neither the range of deprivation measures nor the corresponding population data are as complete at COA as at other levels. Only the income deprivation for the overall (whole) population and the employment deprivation measures are available (both ranks and scores) and, given the difficulty of estimating small area populations, only the whole population estimate is quoted. This causes some difficulty in using the employment deprivation scores to calculate the numbers of people affected in each area as the appropriate denominator (the working age population) is not available. Therefore, the scores have been used in conjunction with the whole population to give an indication of the numbers affected by employment deprivation. This will give a larger estimate but one that will be reasonably unbiased unless there is significant demographic variation between aggregates of small areas. To make these areas comparable across levels of aggregation (SOA and COA) the employment deprivation levels were calculated using the whole population count. All estimates have also been recalculated using the COA data rather than the original SOA or District Council values as this maximises the comparability of the findings.

Tables 5 and 6 show the differences in concentration and completeness using SOA and COA. In each case the overall deprivation rankings have been used to produce the vigintiles so that approximately one-twentieth of the unit areas are in each. It should be noted that the deprived COA areas tend to be a little smaller than those produced from aggregated SOAs; for example the most deprived 20% of SOAs contain 19.1% of the population while the equivalent COAs contain 17.6%.

Table 5

Concentration and completeness using SOA as unit of analysis

		% vigintile pop.			Cumulative % of NI population		
Vigintile	% Population	Poor (all ages)	Emp. deprived		% Population	Poor (all ages)	Emp. deprived
Most deprived	4.6	65.2	29.2		4.6	12.2	10.3
2	4.6	52.3	23.2		9.2	21.9	18.4
3	4.9	42.8	19.9		14.1	30.4	25.9
4	4.8	38.4	18.1		19.0	37.9	32.5
5	5.2	34.4	16.5		24.1	45.1	39.0
6	4.8	30.8	15.8		28.9	51.0	44.7
7	5.3	29.0	14.6		34.1	57.2	50.6
8	5.4	26.9	13.7		39.5	63.0	56.2
9	5.1	23.9	13.3		44.6	67.9	61.3
10	5.1	22.4	12.4		49.7	72.6	66.2
11	5.6	19.4	11.2		55.3	76.9	70.9
12	5.2	18.7	11.1		60.5	80.9	75.3
13	5.3	17.3	10.8		65.8	84.6	79.7
14	4.9	16.9	10.2		70.7	87.9	83.4
15	5.3	13.8	9.4		76.0	90.9	87.3
16	5.1	13.2	8.5		81.1	93.6	90.6
17	4.7	10.6	7.9		85.8	95.6	93.4
18	4.9	10.0	7.1		90.7	97.6	96.1
19	4.5	7.2	6.2		95.2	98.9	98.2
Least deprived	4.8	5.5	4.9		100.0	100.0	100.0

Table 6

Concentration and completeness using COA as unit of analysis

		% vigintile population			Cumulative % of NI population		
Vigintile	% Population	Poor (all ages)	Emp. deprived		% Population	Poor (all ages)	Emp. deprived
Most deprived	4.5	74.7	31.9		4.5	13.5	10.9
2	4.5	58.4	24.6		8.9	24.1	19.3
3	4.3	50.4	22.0		13.2	32.8	26.4
4	4.3	44.6	20.4		17.6	40.7	33.2
5	4.4	40.3	18.6		22.0	47.8	39.4
6	4.6	35.8	17.0		26.6	54.5	45.4
7	4.6	31.6	15.7		31.2	60.4	50.9
8	4.9	28.1	14.6		36.1	66.0	56.3
9	4.8	25.2	13.3		40.9	70.9	61.2
10	5.0	22.5	12.2		46.0	75.5	65.9
11	5.4	19.8	11.6		51.4	79.8	70.6
12	5.5	17.6	10.9		56.9	83.7	75.2
13	5.3	15.8	10.2		62.2	87.2	79.4
14	5.4	13.9	9.4		67.7	90.2	83.3
15	5.4	12.1	8.7		73.1	92.9	86.8
16	5.4	10.3	8.2		78.4	95.1	90.2
17	5.4	8.6	7.6		83.9	97.0	93.4
18	5.2	6.8	6.6		89.0	98.4	96.0
19	5.3	5.0	6.0		94.3	99.5	98.3
Least deprived	5.7	2.3	3.8		100.0	100.0	100.0

Concentration: It is evident that COAs are more homogeneous than SOAs. The gradient in income and employment deprivation across vigintiles is steeper using COAs than SOAs (see Figures 1 & 2) and all three of the most deprived COA vigintiles have more than 50% of their population income deprived compared to only the top two SOA vigintiles.

Figure 1

Percentage of income deprived across vigintiles using SOA and COAs

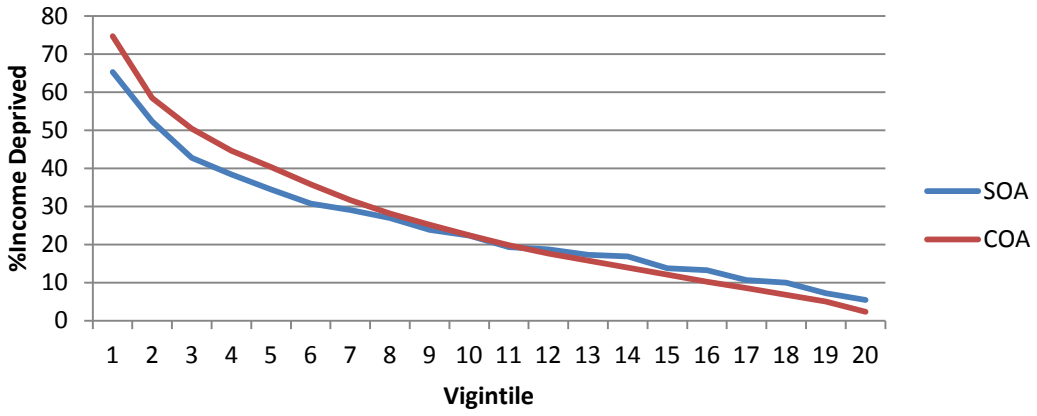
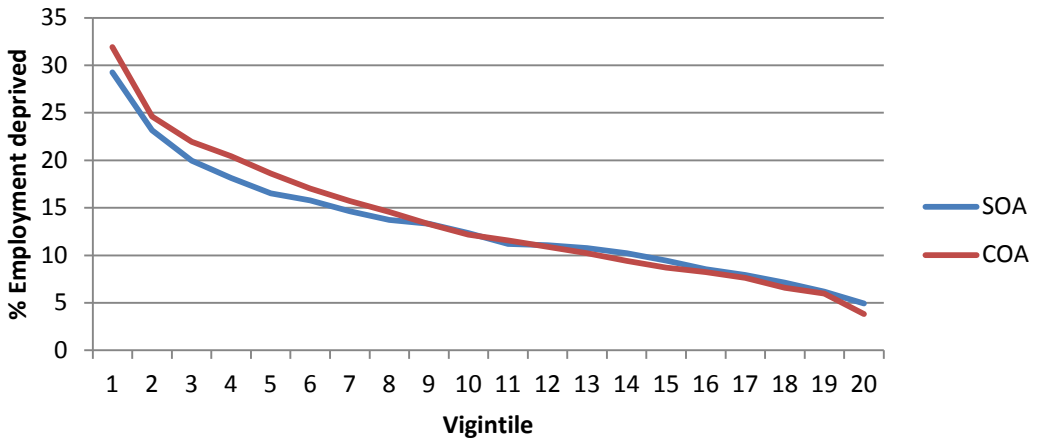


Figure 2

Percentage of employment deprived across vigintiles using SOA and COAs



Completeness: Overall COAs do perform better than SOAs in terms of completeness (see Tables 5 and 6). If COAs were used to define deprived areas then approximately 26% of the population would have to be included to 'capture' 55% of the income deprived individuals (the equivalent figures using SOAs are 29% for 51% of deprived individuals); while 31% of the population would have to be included to capture 51% of employment deprived individuals (compared to 34% for a similar yield using SOAs). This is slightly less than might be expected considering the greater concentration of deprivation using COAs, however this modest improvement is offset by the smaller population coverage in the most deprived COAs.

Summary:

The spatial unit at which deprivation is identified and measured influences the efficiency of targeting. District councils are large and relatively uneven in their distribution of deprivation and whilst targeting those District councils with the greatest concentration of disadvantage has the benefit of simplicity (and perhaps also in the efficiency of the provision and organisation of interventions) it is inefficient in that most of the population in these areas are not disadvantaged and also that most disadvantaged people do not live in these areas.

Using SOAs, which are smaller, of uniform population size and more homogenous in composition, offers distinct benefits over District Councils in terms of both efficiency and completeness. However, going to the next smallest geographical units does not produce gains in efficiency and completeness of the same magnitude. COAs are the smallest spatial size for which NIMDM scores and ranks are available. These areas have been constructed so as to be reasonably homogenous (at least in terms of housing and tenure) and should therefore offer a further advantage over SOAs. However, whilst there is an improvement in both concentration and completeness the distinction between the two is not marked.

Tunstall & Lupton [14] had suggested that both completeness and efficiency might be improved by targeting smaller spatial areas, and that the availability of '*deprivation indices at sub-ward scale would allow significant gains in potential completeness and efficiency...though the administrative costs of such detailed targeting would need to be considered*'. They were not aware that McLoone had reported in an earlier paper that moving from postcode sector to the smaller enumeration district produced only modest improvements in sensitivity and specificity [43]. The current examination tends to confirm McLoone's analysis.

The relationship between targeting and urban-rural orientation

One of the themes emerging from the literature review (and especially the CASE analyses [7, 14]) is that the process of designating deprived areas may favour urban over rural areas. This is quite separate from any argument as to whether the specific indicators of disadvantage have an inherently urban bias (as might be suggested for car ownership or housing tenure), but whether the deprived in rural areas get hidden by the averaging of deprivation scores over their larger spatial areas [58, 59]. This section will examine (i) the extent to which this happens in Northern Ireland and (ii) determine if using differing levels of geography or an augmentation of the current geography would improve or worsen any imbalance.

Methodology: The designation of urban or rural residence is acknowledged to be difficult but the current approach uses the NISRA Classification of Settlements [60], which recognises eight bands (A-H) where A represents the Belfast Metropolitan Urban Area and H is the most rural (small villages, hamlets and open countryside with less than 1000 residents). For the purpose of this report these eight bands have been aggregated into three groups; Urban (Bands A and B, representing Belfast and Derry); Intermediate (Bands C- G inclusive), and Rural (Band H only). The full classification is only available at COA level and so the NIMDM data at COA have been used to generate the numbers of income and employment deprived individuals in each COA. These data can then be aggregated into SOA and DCs.

Table 7

Concentration of income and employment deprived across urban-rural areas

	Income deprived	**Employment deprived**
Urban	28.3	14.4
Intermediate	25.8	13.4
Rural	18.5	11.1
Northern Ireland	**24.7**	**13.1**

Tables 7 and 8 show that there is a greater concentration of deprivation in urban than in rural areas. Urban areas contain 43% of income deprived and 42% of employment deprived people but only 38% of the population; the equivalent proportions in rural areas are less than the 28% of the population. Intermediate areas have approximately their population share of the deprivation groups.

Table 8

Distribution of population and income and employment deprived across urban-rural areas

	Population	Income deprived	Employment deprived
Urban	37.9	43.4	41.5
Intermediate	34.2	35.7	34.8
Rural	28.0	20.9	23.7

The same data also demonstrate that although the concentration of disadvantage is greater in urban areas, most of the people who are deprived do not live in urban areas and that approximately one in four employment-deprived and one in five income-deprived people live in the most rural areas.

Targeting at District Council level

In keeping with previous sections, the first level of geography to be examined will be District Council and the three DCs with the greatest extent of deprivation (Belfast, Strabane and Derry) will be used to illustrate the effects of using DCs to identify deprived areas. The distribution of income and employment deprived individuals within these DCs is shown in Tables 9 and 10 below.

Table 9

Distribution of income deprived across District Councils and Settlement bands

District Council	Rank	Urban	Intermediate	Rural	Total
Belfast	1	21.1	0.0	0.0	21.1
Strabane	2	0.0	1.9	1.3	3.3
Derry	3	8.5	0.3	0.6	9.4
Craigavon	4	0.0	4.5	0.7	5.1
Newry & Mourne	5	0.0	3.6	2.8	6.4
Lisburn	6	4.8	0.3	0.6	5.6
Limavady	7	0.0	1.5	0.7	2.2
Newtownabbey	8	2.9	0.5	0.1	3.6
Moyle	9	0.0	0.6	0.5	1.1
Coleraine	10	0.0	2.5	0.6	3.1
Ballymena	11	0.0	2.1	0.6	2.7
Dungannon	12	0.0	1.6	1.6	3.2
Larne	13	0.0	1.1	0.3	1.4
Carrickfergus	14	1.4	0.1	0.0	1.6
Cookstown	15	0.0	0.9	1.3	2.2
Down	16	0.0	2.4	1.1	3.4
Omagh	17	0.0	1.6	1.4	3.0
Ards	18	0.0	2.6	0.5	3.1
Armagh	19	0.0	1.6	1.3	2.9
Antrim	20	0.0	1.7	0.4	2.1
Castlereagh	21	2.2	0.0	0.1	2.2
Fermanagh	22	0.0	1.3	1.9	3.2
Banbridge	23	0.0	1.3	0.7	2.0
North Down	24	2.5	0.0	0.0	2.6
Ballymoney	25	0.0	0.8	0.8	1.6
Magherafelt	26	0.0	1.1	1.1	2.1
N. Ireland		**43.4**	**35.7**	**20.9**	**100.0**

Table 10

Distribution of employment deprived across District Councils and Settlement bands

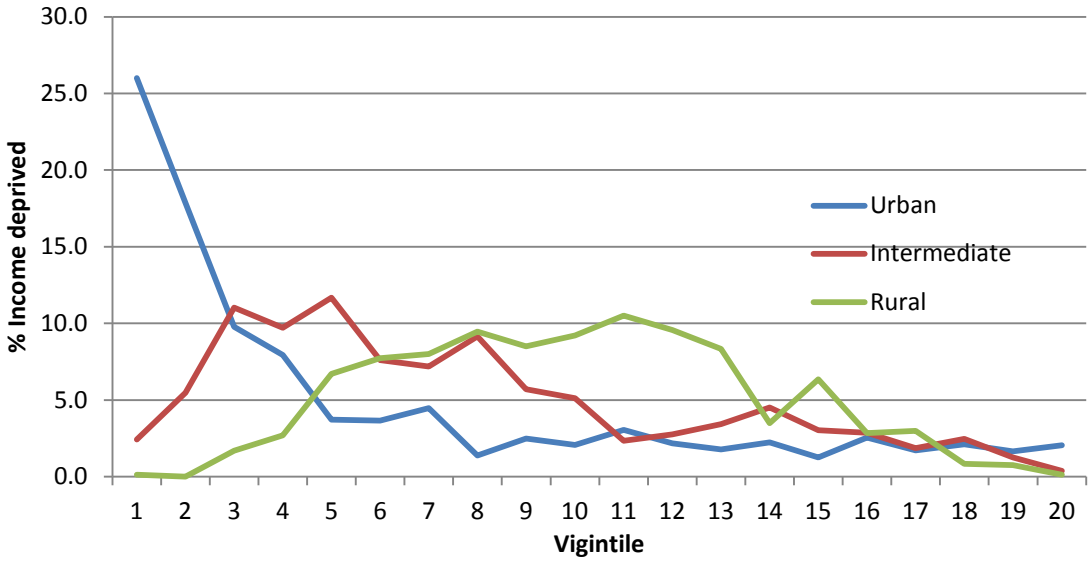
District Council	Rank	Urban	Intermediate	Rural	Total
Antrim	20	0.0	1.8	0.7	2.5
Ards	18	0.0	2.9	0.7	3.6
Armagh	19	0.0	1.5	1.6	3.1
Ballymena	11	0.0	2.0	0.8	2.8
Ballymoney	25	0.0	0.8	0.9	1.7
Banbridge	23	0.0	1.4	1.0	2.4
Belfast	1	19.4	0.0	0.0	19.4
Carrickfergus	14	1.7	0.2	0.1	1.9
Castlereagh	21	2.5	0.0	0.1	2.6
Coleraine	10	0.0	2.3	0.7	3.0
Cookstown	15	0.0	0.8	1.3	2.2
Craigavon	4	0.0	4.5	0.9	5.4
Derry	3	7.6	0.3	0.6	8.6
Down	16	0.0	2.4	1.3	3.7
Dungannon	12	0.0	1.3	1.6	2.9
Fermanagh	22	0.0	1.1	1.7	2.8
Larne	13	0.0	1.1	0.4	1.6
Limavady	7	0.0	1.5	0.8	2.3
Lisburn	6	4.4	0.3	0.8	5.6
Magherafelt	26	0.0	0.9	1.2	2.2
Moyle	9	0.0	0.5	0.5	1.0
Newry & Mourne	5	0.0	3.2	2.6	5.7
Newtownabbey	8	3.1	0.5	0.2	3.7
North Down	24	2.8	0.0	0.1	2.9
Omagh	17	0.0	1.5	1.6	3.1
Strabane	2	0.0	1.9	1.5	3.4
N.Ireland		**41.5**	**34.8**	**23.7**	**100.0**

Urban-rural differences ... Targeting at SOA level:

The second level of geography is SOA and the graph below shows the distribution of income deprived individuals across vigintiles using the overall deprivation rank at SOA to categorise areas. The graph represents concentration of deprived individuals across vigintiles within each of the three settlement bands. If the SOA rank was of no use then approximately 5% of deprived individuals would be in each vigintile; the more efficient the measure is at identifying deprived individuals the higher percentage will be towards the vigintiles 1 and 2.

Figure 3

Distribution of income deprived individuals within vigintile according to settlement band using SOA as building blocks



It is evident that the NIMDM at SOA is very efficient at detecting deprivation in urban areas (more than 25% of the urban deprived are in the most deprived 5% of SOAs (vigintile 1). By contrast, the largest concentration of deprived individuals in rural areas are scattered in a broad range centred on the middle; practically no deprived people in rural areas are in the most deprived SOAs. Although deprived individuals in intermediate areas tend to be in the more deprived half of the range, few are in the most deprived SOA and therefore unlikely to be identified in any high-level cut-off.
Completeness: Table 11 below shows the cumulative percentage of deprived individuals included across the deprived spectrum. As before, we see that six vigintiles would have to be targeted to ensure that 50% or more of income deprived individuals are included in designated areas. However, this level of efficiency varies markedly by settlement band. Targeting the most deprived 15% of SOAs (the top three vigintiles) would be sufficient to identify at least 50% of deprived individuals in urban areas but it would take seven vigintiles to give an equivalent yield in intermediate areas. The inefficiency of NIMDM at SOA level in identifying rural disadvantage is apparent as half of the SOAs would have to be targeted to ensure that at least 50% of deprived people in rural areas are included.

Table 11

Cumulative percentage of the income deprived in each settlement band within SOA deprivation cut-off point.

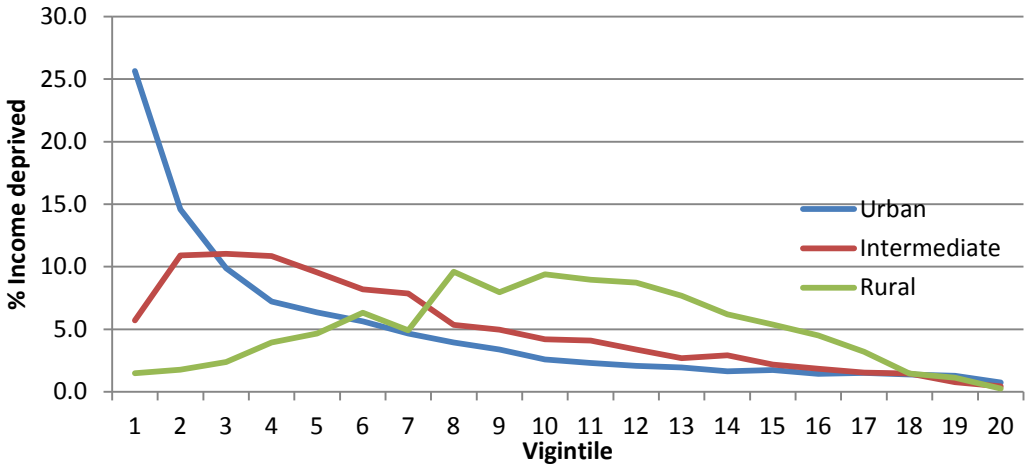
Vigintile	Urban	Intermediate	Rural	Total
Most deprived	26.0	2.4	0.1	12.2
2	43.9	7.9	0.1	21.9
3	53.6	18.9	1.8	30.4
4	61.6	28.7	4.5	37.9
5	65.3	40.3	11.2	45.1
6	69.0	47.9	19.0	51.0
7	73.4	55.1	27.0	57.2
8	74.8	64.3	36.4	63.0
9	77.3	70.0	44.9	67.9
10	79.4	75.1	54.2	72.6
11	82.4	77.4	64.7	76.9
12	84.6	80.2	74.2	80.9
13	86.4	83.6	82.6	84.6
14	88.6	88.1	86.1	87.9
15	89.9	91.2	92.4	90.9
16	92.5	94.0	95.3	93.6
17	94.2	95.9	98.3	95.6
18	96.3	98.4	99.1	97.6
19	97.9	99.6	99.9	98.9
Least deprived	100.0	100.0	100.0	100.0

Targeting at COA level

Figure 4 below shows distribution of income deprived individuals across vigintiles using the overall deprivation rank at the smaller COA to categorise areas. The graph is the equivalent to the SOA level one above and represents concentration of deprived individuals across vigintiles within each of the three settlement bands. A comparison of Figures 3 and 4 suggests that there are only modest differences between the two spatial levels in their ability to detect deprivation in intermediate and rural areas. The most noticeable difference is a slightly greater number of deprived rural dwellers evident in the most deprived COA vigintiles.

Figure 4

Distribution of income deprived individuals within vigintile according to settlement band using COA as building blocks



Completeness: Table 12 shows the ability of the vigintiles defined at COA level to capture deprived individuals overall and within each of the three settlement bands. The SOA defined vigintiles are shown alongside for ease of comparison. As before, the COA defined vigintiles capture a slightly greater proportion of deprived individuals overall if the cut-off point is towards the deprived end of the spectrum. Once again though, the urban-rural difference in completeness is evident. Inclusion of the urban deprived is still good, though only the first three vigintiles (15% of the distribution) includes more than 50% of urban deprived. The level of coverage in the most deprived 10% of areas is approximately twice as good for intermediate residents using COAs, though overall this is still quite poor as six vigintile would have to be targeted so that 50% or more of the deprived people in these areas could be included. Although the use of COAs would increase the inclusion of rural dwellers in relative terms the absolute differences are small and whether SOAs or COAs are used, at least half of the areas would have to be targeted to ensure than at least 50% of deprived people are included in the designated areas.

Table 12

Cumulative percentage of income deprived people within each settlement band across deprivation vigintiles using SOA and COA as building block

	SOA based					COA based			
Vigintile	**Urban**	**Inter.**	**Rural**	**All areas**		**Urban**	**Inter.**	**Rural**	**All areas**
Most deprived	26.0	2.4	0.1	12.2		25.7	5.7	1.5	13.5
2	43.9	7.9	0.1	21.9		40.3	16.6	3.2	24.1
3	53.6	18.9	1.8	30.4		50.1	27.7	5.6	32.8
4	61.6	28.7	4.5	37.9		57.4	38.5	9.6	40.7
5	65.3	40.3	11.2	45.1		63.7	48.1	14.3	47.8
6	69.0	47.9	19.0	51.0		69.3	56.3	20.6	54.5
7	73.4	55.1	27.0	57.2		74.0	64.2	25.5	60.4
8	74.8	64.3	36.4	63.0		77.9	69.5	35.1	66.0
9	77.3	70.0	44.9	67.9		81.3	74.5	43.1	70.9
10	79.4	75.1	54.2	72.6		83.9	78.7	52.5	75.5
11	82.4	77.4	64.7	76.9		86.2	82.7	61.4	79.8
12	84.6	80.2	74.2	80.9		88.3	86.1	70.2	83.7
13	86.4	83.6	82.6	84.6		90.3	88.8	77.9	87.2
14	88.6	88.1	86.1	87.9		91.9	91.8	84.1	90.2
15	89.9	91.2	92.4	90.9		93.6	93.9	89.4	92.9
16	92.5	94.0	95.3	93.6		95.1	95.8	93.9	95.1
17	94.2	95.9	98.3	95.6		96.6	97.3	97.1	97.0
18	96.3	98.4	99.1	97.6		98.0	98.8	98.6	98.4
19	97.9	99.6	99.9	98.9		99.3	99.6	99.8	99.5
Least deprived	100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0

Conclusions:

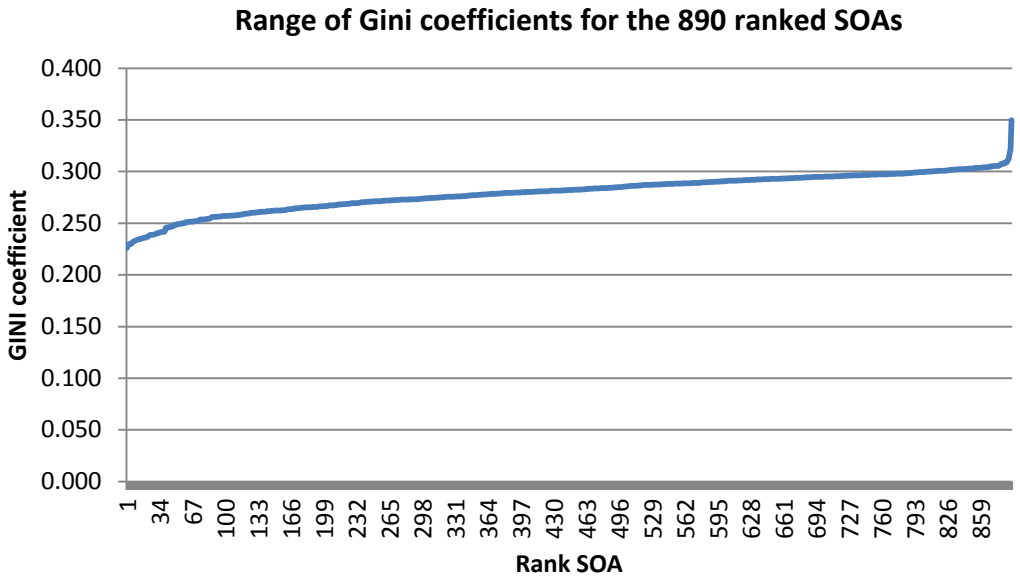
Approximately one-quarter of the Northern Ireland population lives in the most rural areas (Band H- classification of settlements) and these areas contain about one in five of those who are income deprived and one in four of the employment deprived. However, because the concentration of deprivation is much lower in rural than in more densely inhabited areas, they will rarely be identified using any of the common cut-off points in the NIMDM scale. None of the variables are particularly good at detecting spatial deprivation in rural areas, and that area-based targeting works maximally (in terms of efficiency) in urban areas. This finding is related to rural areas being more dispersed than their urban counterparts and thus more likely to have a wider variety of people contained within them.

The effect of the addition of the GINI coefficient on efficiency and effectiveness

Anderson, as part of the exercise to develop models of households of low income also developed a Gini coefficient [61]. This is a measure of the degree of inequality in the distribution of household income within an area. The Gini coefficient has a range from 0 to 1; 0 means that there is no inequality in income distribution (all households have the same income), a score of 1 means that one household has all the income.

Figure 5 shows the range of Gini coefficient scores across SOAs in Northern Ireland. The lower the score, the more homogenous the composition of the area in terms of modelled income, the higher scores denotes more mixed communities. There is little variation apparent and 746 of the SOAs (comprising 83% of the total population) are constrained between 2.500 and 2.999. For most of the population there is no clear evidence of a natural cut-off and, given the shallowness of the incline, SOAs on opposing sides of any arbitrary cut-off would be remarkably similar. The steeper incline above 0.300 on the right of the curve is largely due to a small number of areas such as the University area of Botanic which are known to comprise unusually mixed and transient populations in mostly privately rented accommodation.

Figure 5



The effect of the Gini coefficient on the concentration of deprivation

The primary aspiration for the Gini was that it could be used in conjunction with other measures such as the NIMDM to identify a group of SOAs that are pervasively deprived ie that the addition of GINI would improve the efficiency of NIMDM and select out those areas where the concentration of deprivation is particularly high.

Table 13 shows a cross-classification of SOAs ranked by NIMDM 2010 and Gini; the data represent the number of SOAs in each cell. The NIMDM has been divided into vigintiles based on the ranking of the overall measure, the Gini into deciles (this being a compromise so as to give a reasonable range of divisions whilst at the same time reducing the number of empty cells), though there are still some cells with no match between NIMDM and Gini, for example the most deprived SOAs tend to be also relatively homogenous according to the Gini index and there are not many deprived SOAs that can also be considered mixed in terms of income deprivation. Overall, 34 (76%) of SOAs in the most deprived vigintile are also in the decile with the lowest Gini coefficient scores, and 70% of those in the most deprived 15% of SOAs are also in the most homogenous quintile; only two SOAs are not in the most homogenous half of the distribution. SOAs towards the midpoint in the affluent-deprived spectrum tend to have higher Gini coefficient scores indicating less homogeneity but the least deprived SOAs exhibit an array of Gini scores.

Table 13

NIMDM- Gini cross-classification; number of SOAs in each cell

	Gini coefficients in deciles										
Vigintile	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
Most deprived	34	8		1	1		1				45
2	18	10	6	6	3				1		44
3	14	10	12	1	4	1	1	1		1	45
4	5	16	4	4	6	3	4	1		1	44
5	4	5	6	6	5	5	2	7	3	2	45
6	2	5	5	11	2	4	2	3	5	5	44
7	4	6	6	2	6	4	4	3	3	7	45
8	1		3	5	4	3	4	7	11	6	44
9	1	3	6	4	2	5	11	3	6	4	45
10		3	4	8	2	2	5	8	7	5	44
11	1	2	3	3	5	3	7	3	9	9	45
12	2	4		5	2	3	2	9	7	10	44
13			3	5	3	8	4	9	10	3	45
14	1	2	5	1	4	11	7	4	5	4	44
15	1	1	6	2	6	7	5	3	8	6	45
16		1	6	4	10	7	4	6	3	3	44
17		4	4	4	5	4	7	6	6	5	45
18		2	3	8	7	9	6	3	1	5	44
19		3	3	5	9	5	8	4	2	6	45
Least deprived	1	4	4	4	3	5	5	9	2	7	44
All SOAs	**89**	**89**	**89**	**89**	**89**	**89**	**89**	**89**	**89**	**89**	**890**

Table 14 shows a further cross-classification of SOA by NIMDM 2010 and Gini, this time the cells show the concentration of income deprivation in the SOAs for a given NIMDM-Gini combination. If the Gini coefficient scores are correctly identifying areas where deprivation is more pervasive then the concentration of income deprivation within each NIMDM vigintile (row) should be greatest for Gini decile 1 and get progressively less as the Gini score (decile) increases (moving from left to right within a row). This is not apparent. There appears to be little difference in levels of concentration of deprivation within a NIMDM level suggesting that Gini would not improve the targeting of disadvantaged areas. If Gini was to be used to refine the selection of SOAs while keeping the number of SOAs targeted constant, then those with higher Gini scores (deciles) would be excluded to be replaced other SOAs from the next NIMDM category (assuming they also met the Gini criteria). However, it is not clear that this would be an improvement as the sharp decline in concentration of deprivation across NIMDM vigintiles is much greater than any change across Gini deciles. For example the SOA in the most deprived vigintile with the highest Gini coefficient score (Gini decile 7, representing the least homogenous in the row) has a greater concentration of income deprivation than the more homogenous SOAs from the next most deprived vigintile.

Table 14

Concentration of income deprivation within a NIMDM- Gini cross-classification

	Gini coefficients in deciles										
Vigintile	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
Most deprived	66.2	64.1		60.0	59.0		63.0				**65.5**
2	53.3	51.8	51.3	52.5	54.0				49.0		**52.5**
3	42.2	42.3	42.8	48.0	46.0	39.0	52.0	44.0		39.0	**43.0**
4	36.8	38.6	39.3	35.8	40.8	38.9	41.8	32.0		39.0	**38.7**
5	31.5	34.3	34.1	33.7	36.0	37.6	35.1	36.3	30.4	35.2	**34.7**
6	26.9	31.9	30.0	32.7	37.0	31.2	32.5	28.2	31.7	28.0	**31.1**
7	31.0	27.5	29.2	30.4	28.0	29.9	32.4	30.1	29.1	28.2	**29.3**
8	24.0		28.3	25.3	28.7	28.2	25.3	28.4	28.2	25.5	**27.2**
9	23.0	24.3	26.3	25.8	24.0	27.6	23.5	22.2	20.1	23.6	**24.1**
10		22.0	24.2	24.2	22.1	22.4	23.3	22.8	20.4	22.0	**22.6**
11	9.0	21.6	18.7	22.6	20.7	21.0	21.7	18.0	19.3	17.7	**19.5**
12	20.4	18.3		19.6	21.0	21.0	19.6	18.9	19.1	17.5	**18.9**
13			20.1	17.6	18.3	18.1	19.8	16.9	16.3	15.8	**17.4**
14	16.0	18.0	16.4	20.0	17.3	17.5	19.1	15.7	14.0	18.5	**17.1**
15	11.0	17.0	15.4	15.4	15.9	13.2	13.9	15.5	13.6	11.3	**14.0**
16		13.0	15.6	11.1	13.6	14.6	15.3	11.6	11.3	13.7	**13.5**
17		11.8	10.9	9.8	12.0	12.9	11.0	11.9	9.6	8.5	**10.9**
18		9.6	9.5	11.2	10.0	10.8	10.7	8.0	13.0	9.2	**10.3**
19		4.9	7.0	6.8	8.0	7.6	8.0	9.4	7.8	7.0	**7.6**
Least deprived	4.0	5.5	4.8	7.1	4.9	5.7	7.2	5.7	4.5	4.8	**5.7**
All SOAs	**50.0**	**33.7**	**26.5**	**24.5**	**22.2**	**19.8**	**20.2**	**19.5**	**19.6**	**18.4**	**24.9**

Relationship between Gini and rurality.

Anderson further suggested that there might be an urban orientation associated with Gini coefficient scores, though this was not formally examined [61]. SOAs are generally considered an improvement over electoral wards, which were the more usual census output, not least because they are more uniform in terms of population size. However, populations of circa 2000 can be easily defined by small spatial units in big conurbations but requires larger catchment areas in rural areas. Rural SOAs are therefore likely to include a much more geographically dispersed and socio-economically divergent array of communities [58, 59]. This means that the more homogenous urban SOAs will tend to have lower Gini coefficients. This is confirmed in the following tables and diagrams.

Table 15

Gini coefficients of the SOAs within District Councils (ranked in ascending order by average Gini coefficient)

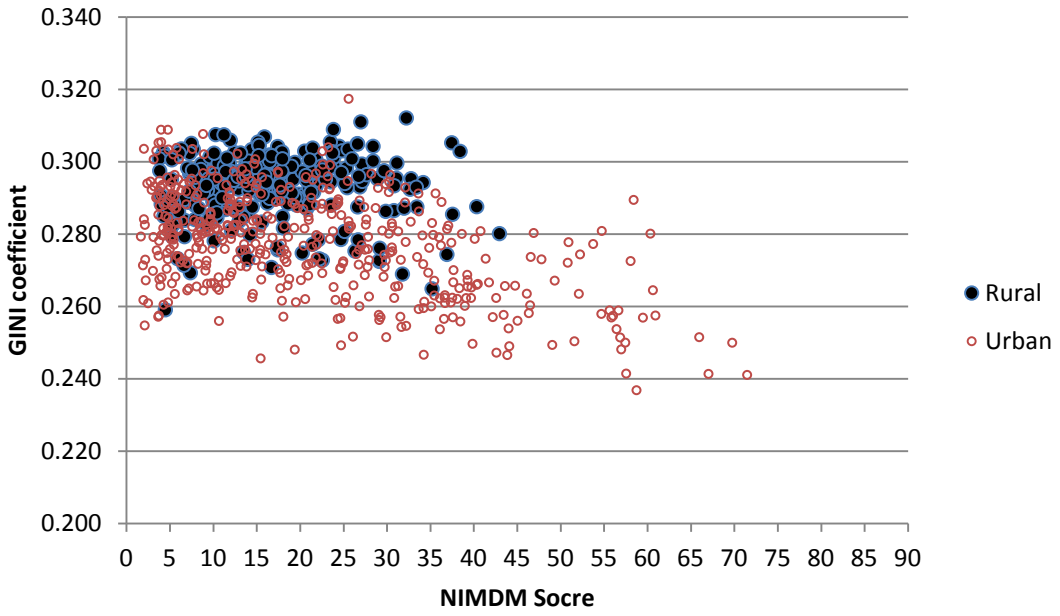
		Gini coefficients		
District Council	**SOAs (nos.)**	**Min**	**Max**	**Average**
Belfast	150	0.227	0.350	0.262
Derry	57	0.241	0.303	0.274
Craigavon	44	0.237	0.302	0.275
Castlereagh	33	0.255	0.294	0.276
Carrickfergus	20	0.247	0.303	0.276
Newtownabbey	47	0.246	0.317	0.277
Larne	16	0.248	0.297	0.277
Lisburn	58	0.241	0.309	0.279
Ards	46	0.247	0.308	0.282
Ballymena	29	0.262	0.298	0.282
North Down	40	0.257	0.309	0.283
Antrim	25	0.255	0.304	0.283
Limavady	18	0.254	0.301	0.285
Banbridge	19	0.263	0.301	0.287
Strabane	18	0.250	0.305	0.287
Newry and Mourne	47	0.249	0.312	0.288
Magherafelt	21	0.272	0.298	0.288
Ballymoney	16	0.271	0.297	0.288
Coleraine	29	0.250	0.305	0.289
Armagh	25	0.269	0.304	0.290
Down	36	0.264	0.304	0.290
Dungannon	22	0.271	0.305	0.291
Omagh	24	0.279	0.305	0.294
Cookstown	16	0.281	0.311	0.295
Fermanagh	25	0.260	0.309	0.295
Moyle	9	0.286	0.303	0.296

Most of the DCs comprising SOAs with the lowest Gini coefficients (such as Belfast, Derry, Craigavon, Castlereagh and Carrickfergus) are entirely or predominantly urban; while those with SOAs with higher average coefficient are more rural in character. Employing a cut-off of say 0.261 (which defines the most homogeneous 15% of SOAs) would rule out all DCs where none of their SOAs had a coefficient of more than this. This would rule out Ballymena, Bambridge, Down, Armagh, Dungannon, Ballymoney, Magherafelt, Omagh, Cookstown and Moyle.

The urban-rural differences in Gini coefficients are seen more clearly in Figure 6 below, which also demonstrates the relationship between deprivation as measured by NIMDM at SOA level and rural residence. If a cut-off score of 37.5 is used on the NIMDM (equating to approximately 15% of SOAs) this will include four rural SOAs, but if a Gini-coefficient is added only urban SOAs would be included.
Figure 7 below develops the point by showing that the addition of a Gini coefficient would further increase the proportion of deprived SOAs that would be selected from Belfast District Council.

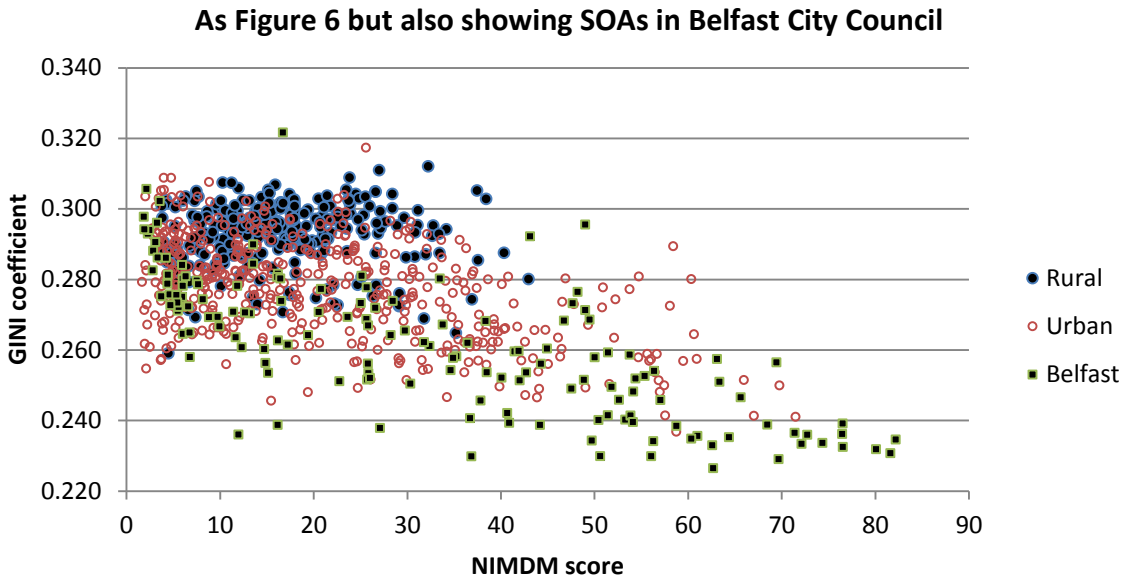
Figure 6

The relationship between Gini coefficient scores and NIMDM scores for SOAs classified by urban-rural character



Note: NIMDM scores are used here as this figure is for illustrative purposes only

Figure 7



Conclusions:

It is evident that there is little inherent variation in the Gini coefficient scores at small area level within Northern Ireland. This may have arisen because the lack of precision in the estimation of the household income levels has introduced a significant level of noise in the system reducing measured variability between areas. The Gini coefficient scores do not appear to add significantly to NIMDM in selecting out areas that have a greater concentration of deprivation. In addition, homogeneity as measured by the Gini coefficient appears to have a significant urban orientation and the addition of a Gini component would further increase the targeting of urban areas.

There may also be further concerns related to the use of the Gini coefficient scores that are derived from these household estimations given the known caveats with the modelled household income data and the recommendation not to apply it directly to households [62]. One concern already mentioned is that random misclassification in the estimation of household incomes may have reduced the apparent variability within areas reducing the measure's intrinsic ability to disaggregate areas. A further problem relates to non-random biases; McClelland & Donnelly list some of the difficulties associated with the modelling of household income namely, an underestimation the proportion of (i) people and (ii) children in low income households and (iii) the impact of increasing children on household income, and (iv) an underestimation of low income amongst home owners, and (v) a probably gross under- or over-estimation of poverty amongst older people. Presumably these biases (along with other factors such as the selective non-response bias to the FRS surveys used for the modelling exercise) may also be carried through into the Gini coefficient estimations if the distribution of any of these factors is spatially concentrated.

Variations in effectiveness and efficiency between indicators of deprivation

Four indicators of disadvantage were picked to illustrate the differences amongst the range of possible indicators. These were the overall NIMDM 2010 ranks; the NIMDM 2010 Income domain ranks; Anderson's modelled income scores [61]; and the percentage of social renting (from the 2001 census). The ideal would have been to gather data that was as contemporaneous as possible but the 2010 NIMDM was chosen instead of the 2005 version as it offered a more detailed description of disadvantage such as deprivation at finer levels of geographical aggregation. In essence as the character of areas remains fairly constant over relatively short periods of time, so the choice of NIMDM version is not likely to significantly affect the findings. The last, percentage in social renting, was chosen as it has face validity as an indicator of where people who are disadvantaged might be found and if confirmed would represent a relatively easy way of targeting areas and people in need.

Tables 16 A-C show the overlap in the distribution of SOAs ranked in vigintiles according to the different indicators. There is obviously a close correspondence between the overall MDM rankings and those of the Income Domain. 41 (91%) of the 45 SOAs that each would classify as being in the most deprived 5% of areas are common to both classifications; this drops a little to 89% concordance for the most deprived 10% and 89% for the most deprived 15% of areas.

There is less agreement between MDM and the modelled income indicator (Table 16B); there is only 67% overlap in the SOA in the most deprived 5% of areas and 80% for the most deprived 15%. There is even less agreement between MDM and social renting (Table 16C) where the equivalent overlaps are 56% and 65% respectively. Interestingly, the overall MDM rankings identify disadvantage in areas that have approximately the average levels of social renting, and alternatively there are areas with high levels of social renting that do not have high levels of deprivation according to the overall MDM classification.

Table 17 shows the percentage of people who are income deprived or employment deprived who would be included in targeted areas according to different cut-offs on the distribution for each of the four indicators of disadvantage. Table 18 shows the same equivalent data for children and older people who are income deprived. It is apparent that each of the indicators 'capture' some aspects of deprivation better than others specifically they are each better at identifying income deprivation amongst children than amongst older people. Employment deprivation is also relatively poorly identified.

In terms of completeness, both the overall MDM and the income deprivation domains are very similar (which is not surprising considering their derivation), over 21% of income deprived people would be identified within the most 10% of SOAs using either as the measure of deprivation and just over 50% of deprived people would be indentified within the most deprived 30% of SOAs. Both modelled income and the percentage social renting do not perform as well and would for example have to employ a 35% cut-off to include more than half of all income deprived people. However, it is worth emphasising two points (i) that the difference between the four indicators is modest and (ii) that all of the indicators are relatively poor in terms of completeness and, except at high cut-off points, would miss most deprived individuals.

Table 16

A. Distribution of SOAs according to both NIMDM vigintiles (rows) and Income domain vigintiles (columns).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	41	4																		
2	4	35	5																	
3		4	26	14	1															
4		1	12	18	10	3														
5			2	9	20	9	4	1												
6				3	9	18	5	7	2											
7					3	8	20	10	4											
8					2	4	11	14	6	7										
9						2	5	4	18	7	6		2					1		
10								8	10	9	4	8	4	1						
11									5	9	10	6	8	1	3	1	1	1		
12										7	9	14	8	3	2				1	
13										3	6	10	7	12	2	3	2			
14										2	8	4	8	14	5	1	1	1		
15											1	1	4	7	13	9	9	1		
16											1	1	4	5	12	13	3	3	1	1
17														1	6	7	12	15	3	1
18															2	9	13	11	8	1
19																1	3	9	18	14
20																	1	2	14	27

B: NIMDM (rows) and Modelled Income (columns)

1	30	11	4																	
2	11	15	12	6																
3	1	11	12	7	11	3														
4	3	2	6	11	7	4	6	3	1			1								
5		3	6	11	9	7	5	4												
6			3	6	3	10	1	8	6	4	2	1								
7		1		2	5	9	6	8	8	2	1	3								
8			1	1	6	6	10	6	5		4	4	1							
9		1			2	1	5	3	7	8	4	5	3	1		2	2		1	
10			1			2	2	5	3	3	9	5	5	3	3	3				
11					1	1	3	1	1	8	6	4	4	8	6	2				
12							3	1	6	5	8	3	9	5	1	2	1			
13							3	4	1	4	5	2	3	6	5	5	3	2	2	
14						1		1	2	7	3	4	5	4	5	5	4	3		
15									2	1	1	2	4	3	7	10	7	6		2
16							1				2	5	4	6	2	5	2	5	9	3
17										1		2	1	1	8	4	7	6	10	5
18									1			1	3	4	4	1	5	9	7	9
19							1		1	1		2	1	1	2	1	5	10	8	12
20									1				2	2	2	4	9	3	8	13

C: NIMDM (rows) and social renting (columns)

1	28	8	4	4	1															
2	11	12	7	4	7		1	1	1											
3	3	9	6	9	7	4	4	1		2										
4	3	7	9	2	10	2	4	5	1				1							
5		3	8	5	5	7	7	2	1	2	2	1	1	1						
6		3	5	3	3	6	4	1	4	4	2	1	2	1	3	1	1			
7		1	1	8	1	7	4	7	3	1	6	2	1		1	2				
8			1	3	5	4	5	6	4	5	6	1	3				1			
9			3	1	3	2	3	5	2	4	3	4	3	5	1	4		2		
10				2	1	2	2	5	3	7	5	4	3	3	2	3	1	1		
11				2	1	2	3	4	2	3	2	4	5	4	8	1	2	1		1
12				1	1	3	2	2	4	3	2	6	5	1	3	6	3	2		
13		1				2		1	6	6	3	4	4	4	2	4	5	1		2
14			1			2	4	1	8	5	3	2	2	4	1	3	5	2	1	
15							1	2	1	1	4	3	1	6	5	4	4	6	5	2
16							1	1	3		3	5	2	6	3	5	4	7	3	1
17									1	1	1	3	5	3	7	3	5	4	6	6
18									1		2	3	4	3	2	4	5	7	7	6
19						1					1	1	1	1	5	1	7	6	12	9
20													2	2	2	3	2	5	11	17

Table 17

Cumulative percentage of income and employment deprived people across vigintiles of deprivation defined by the full MDM2010 rank (MDM), income domain rank (IncDom), modelled income (Modincome), and social renting (Renting).

	Income deprived people					Employment deprived people			
Vigintile	MDM	IncDom	ModIncome	Renting		MDM	IncDom	ModIncome	Renting
Most deprived	11.9	11.9	10.9	11.2		9.9	9.8	8.8	8.8
2	21.5	21.8	20.8	19.3		17.9	18.1	17.3	15.7
3	30.0	30.6	29.1	27.0		25.4	25.5	24.3	22.4
4	37.5	38.0	36.7	34.2		32.0	32.0	30.9	29.0
5	44.6	45.0	43.9	41.3		38.5	38.4	37.4	35.5
6	50.5	51.2	49.7	47.3		44.2	44.2	43.1	41.1
7	56.7	57.2	55.5	53.7		50.2	50.1	48.8	47.2
8	62.6	62.9	61.0	59.3		55.8	55.7	54.2	52.7
9	67.5	67.9	66.1	64.0		61.0	60.8	59.2	57.5
10	72.2	72.4	70.5	68.6		65.8	65.4	63.7	62.5
11	76.6	77.0	75.0	73.0		70.7	70.1	68.5	66.8
12	80.6	80.8	79.0	76.9		75.1	74.5	72.8	71.4
13	84.3	84.6	82.8	80.9		79.6	78.9	77.1	75.7
14	87.7	88.2	86.2	84.6		83.4	83.2	81.2	79.9
15	90.7	91.0	89.2	88.2		87.2	86.8	84.7	84.3
16	93.5	93.7	91.9	91.6		90.6	90.3	88.4	88.2
17	95.5	95.9	94.3	94.7		93.4	93.3	91.4	92.0
18	97.6	97.7	96.4	96.9		96.1	96.2	94.4	95.2
19	98.9	99.1	98.3	98.4		98.3	98.4	97.3	97.5
Least deprived	100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0

Table 18

Cumulative percentage of children and older people income deprived across vigintiles

	Income deprived children					Income deprived older people			
Vigintile	MDM	IncDom	ModIncome	Renting		MDM	IncDom	ModIncome	Renting
Most deprived	13.6	13.7	13.5	13.4		8.1	8.0	6.5	7.6
2	24.6	25.1	24.2	22.3		15.2	15.3	14.3	14.4
3	33.5	35.3	32.9	30.6		22.5	22.3	21.4	21.2
4	41.7	42.6	40.7	37.7		29.3	29.5	28.5	27.8
5	48.7	49.6	47.7	44.9		36.5	36.1	35.6	34.7
6	54.4	55.6	53.4	51.2		42.5	42.6	41.3	40.3
7	60.5	61.4	58.8	57.2		48.8	49.1	47.6	46.8
8	66.3	67.2	64.1	62.6		54.8	54.6	53.8	52.7
9	71.0	72.0	68.9	67.3		60.4	60.2	59.5	57.8
10	75.5	76.2	72.7	71.4		65.6	65.5	65.0	62.9
11	79.5	80.5	76.9	75.4		70.5	70.6	70.1	67.9
12	83.1	83.9	80.7	79.0		75.3	75.2	75.0	72.6
13	86.5	87.1	84.2	82.5		79.7	79.9	79.5	77.2
14	89.5	90.2	87.3	86.1		83.6	84.2	83.4	81.3
15	92.2	92.8	89.8	89.5		87.3	87.7	87.2	85.6
16	94.7	95.1	92.3	92.4		90.7	91.2	90.4	89.8
17	96.4	96.8	94.5	95.2		93.7	94.4	93.3	93.5
18	98.1	98.3	96.3	97.2		96.4	96.7	96.1	96.3
19	99.2	99.4	98.2	98.3		98.4	98.7	98.3	98.2
Least deprived	100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0

Tables 19 (A-C) show how well the different indicators of disadvantage identify concentrations of income deprived people. Here the data are presented as a comparison against the overall MDM rankings using deciles to define cut-off thresholds. The data should also be compared to those in Table 16 which shows the number of SOAs in each cell. A comparison of the ability of the indicator to identify concentrated disadvantage can be seen in the gradients in the 'totals' rows and columns of the table. The slightly steeper gradient across deciles in the income domain rankings suggests that it is very slightly better at discriminating in the levels of income deprived people between areas, which is to be expected given its purpose. The shaded cells in the diagonal represent collections of SOAs where both indicators agree on the decile of rank and generally where most of the SOAs and the population in that row/column will be found. Table 19 shows that although there are some differences in the selection of SOAs that each indicator identifies as being in the most deprived decile or quintile, the overall concentration for each indicator is very similar. The reason for this is two-fold, (a) because most of the SOAs and population is common to both indicators and (b) because at each cut-off both indicators include SOAs with a range of levels of concentrations which tend to even out.

Table 19 A

Average concentration of income deprived people according to a cross-classification of MSM and MDM Income Domain deciles

		Income domain scores in deciles										
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
MDM in deciles	**Most deprived**	59.7	45.8									59.0
	2	50.7	41.4	34.1								40.9
	3		38.7	33.3	27.9	24.0						33.0
	4			32.4	28.2	23.8						28.2
	5			32.6	27.2	23.9	20.2	17.7		10.0		23.3
	6					22.9	19.8	17.4	14.5	10.0	6.0	19.2
	7					22.4	19.8	16.8	13.7	10.2		17.3
	8						19.1	16.6	13.6	10.5	7.0	13.8
	9							16.0	13.0	10.1	7.1	10.6
	Least deprived								12.0	9.6	5.9	6.6
	Total	59.1	41.2	33.2	28.0	23.6	19.9	17.0	13.5	10.1	6.1	24.9

Table 19 B

Average concentration of income deprived people according to a cross-classification of MSM and Modelled Income deciles

		Modelled Income in deciles										
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
MDM in deciles	**Most deprived**	60.8	53.6									59.0
	2	44.4	40.7	40.6	35.0	34.0	45.0					40.9
	3	39.4	34.5	33.4	31.3	29.0	31.8					33.0
	4	29.0	31.3	28.4	28.8	27.3	26.4	26.0				28.2
	5	32.0	23.0	26.0	24.4	24.9	21.9	21.7	19.0	29.3	28.0	23.3
	6			16.6	21.7	20.5	19.3	18.6	17.7	17.0		19.2
	7			17.0	19.3	17.9	17.9	17.3	16.5	15.6	20.8	17.3
	8				12.0	14.0	14.6	15.3	13.5	12.8	13.2	13.8
	9					14.0	11.9	10.9	11.6	10.2	9.9	10.6
	Least deprived			0.0		8.4	11.0	6.1	6.3	7.2	6.2	6.6
	Total	55.9	41.4	32.3	27.8	22.7	20.7	16.7	14.1	11.2	9.3	24.9

Table 19 C

Average concentration of income deprived people according to a cross-classification of MSM and social renting deciles

		Social renting in deciles										
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
	Most deprived	61.6	56.0	49.6	53.6	53.0						59.0
MDM in deciles	2	42.6	40.1	41.2	39.4	40.7		39.0				40.9
	3	32.7	33.4	34.0	34.5	31.2	33.3	32.0	28.2	27.0		33.0
	4	34.0	28.5	29.1	28.4	26.0	28.2	28.3	29.8	25.0		28.2
	5		27.0	24.4	24.7	23.4	22.8	22.4	21.9	20.6		23.3
	6		21.1	20.9	20.8	19.2	18.7	18.4	18.5	19.2	23.0	19.2
	7	20.0	22.0	19.5	17.7	18.5	18.3	15.7	15.2	16.3	18.3	17.3
	8				15.7	17.2	13.8	14.8	13.3	12.8	12.5	13.8
	9					14.2	12.0	10.9	10.4	10.1	10.0	10.6
	Least deprived			12.0			9.5	7.7	7.3	6.7	6.0	6.6
	Total	54.1	38.7	33.4	28.5	23.2	20.3	17.9	16.0	12.6	8.5	24.9

The following conclusions can therefore be drawn about the different measures of deprivation:

1. Each indicator identifies areas where there are high concentrations of disadvantage, and there is a reasonable agreement on where these areas are.

2. However, there are some differences in the areas that each indicator selects and this will have implications when a specific indicator is selected to allocate funding.

3. Furthermore, each of the indicators detects some type of disadvantage better than others; this suggests that the choice of indicator may need to be tailored to best meet the focus of the specific intervention.

4. In general the overall MDM and associated income domain ranks performed better than either the modelled income or social tenure indicators in terms of both concentration and completeness, though the differences were not great.

5. All of the indicators are fairly inefficient at identifying deprived people and in terms of completeness the differences between the indicators are very modest.

Section 3

Association of deprivation measures and demographic, socio-economic and health factors.

Different measures of deprivation

As detailed in Section 2, a central problem with the current approach is that it is not particularly effective or efficient at identifying areas where there are large concentrations of mainly deprived individuals. It is possible that other measures of deprivation may be able to select suitable areas with more success. In the previous sections five different measures of deprivation were introduced and analysed; the summary MDM scores at SOA level (MDM), the income domain scores of the MDM measure, again at SOA level (IncDom); the modelled income score (MODIncome), and summary MDM score at COA level (MDMCOA), and GINI coefficient scores derived from the modelled income analyses (GINI). To these another group of deprivation measures are added, which are (i) households that are multiply deprived, (ii) the concentration of poverty, (iii) the spatial concentration of poverty, and finally a measure of urban deprivation. These are described below.

Multiply deprived households

Wathan et al [63] make the case that while census data are often used at area and at individual level with the development of appropriate measures and classifications, there have been relatively few standardised household classifications that are routinely produced and this is at a time when policy initiatives are increasingly focused on the unit of household or on families. They suggest a classification that is able to identify the coincidence of different dimensions of deprivation at the household level and would constitute a useful addition to the Index of Multiple Deprivation. They are however, at pains to point out that the indicators described are '*not offered as a competing definition of deprivation and should not be used as such; indeed the classification as released contains an explicit statement to this effect'*. It was hoped that the additional information might be used to '*finesse local area deprivation counts*'.

The household deprivation measures were chosen to cover the same dimensions of deprivation as the Index of Multiple Deprivation but were limited by census data availability to the four dimensions of employment, health, housing, and education (see Box 1 below for the definitions). It is interesting to note that socially rented accommodation was considered as a possible dimension of deprivation but eventually dropped on the advice of consultees.

The authors state that the criteria used do not necessarily imply deprivation per se; rather each dimension is designed to capture additional information associated with deprivation.

Box 1

Definitions of household deprivation dimensions

Dimension	A household is deprived if …
Employment:	Any member of the household (aged 16-74) who is not in full-time education and is either unemployed or permanently sick
Education	No member of the household (aged 19-59/64) has at least 5GCSEs (A-C) or equivalent
Health & disability	Any member of the household has poor health or has a limiting long-term illness
Housing	Where the household accommodation is either (i) overcrowded,(ii) does not sole use of toilet or bath/shower, (iii) is not self-contained or (iv) has no central heating

Wathan et al then compared their measure against the 1991 Poverty and Social Exclusion (PSE) survey and the 1991 Samples of Annonymised Records(SARs) data and found that, only 31% of households in the 1998 General Household Survey did not have at least one indicator of deprivation, with education deprivation being the most common dimension affected. The measure was also related to equivalised household income, though interestingly neither sickness nor education dimensions were predictors of PSE defined poverty, and the predictive effects of housing and employment deprivation were less than for social housing, which is not part of the measure.

The following additional observations on Wathan et al's household deprivation measure may be added:

1. The measure misses out on the dimension of income deprivation (for the very understandable reason that it is difficult to operationalise based on census data); however, this could be considered a serious omission given its acknowledged importance to deprivation measurement and the weighting attributed to this dimension by each of the different Indices of Multiple Deprivation.

2. There are some households that are going to have difficulty registering on this household deprivation scale, for example single person households (unless that person is exhibiting multiply dimensions of deprivation), and older households which cannot score on the education and employment scales (as these are not recorded in the census output).

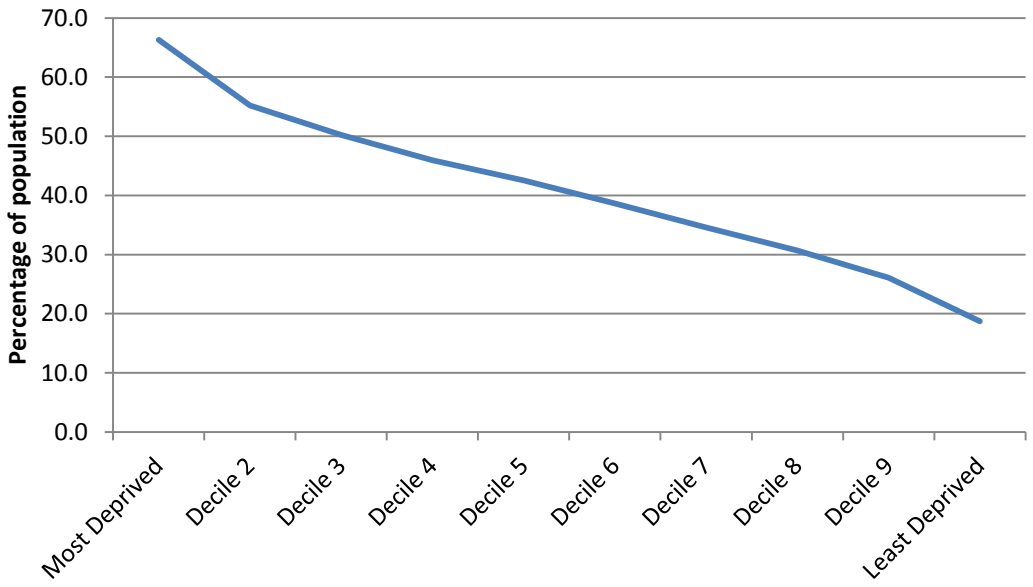
3. On the other hand, there is an element of double counting involved as almost 100% of those who are permanently ill will have a LLTI; thus a household with one 'permanently sick' person would automatically be doubly deprived!

4. It could also be argued that the associated legal standards would prevent most residents in social housing from registering on the housing scale, irrespective of the quality of the wider housing environment.

5. The different Indices of Multiple Deprivation introduce an arbitrary weight to the different dimensions in recognition of their perceived relative importance; the household measure does not do this and as it is a simple count of dimensions affected gives equal weight to each.

Figure 8

Percentage of population per SOA living in households with multiple deprivation.



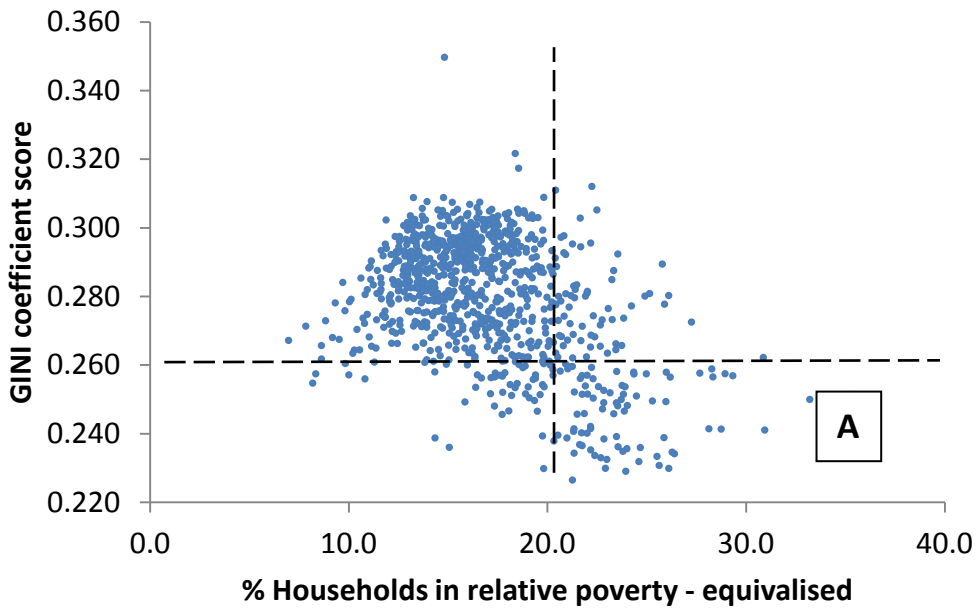
The 2001 census in NILS was used to define households which were multiply deprived. Overall, 20% of households had no indicators of deprivation, 39% had only one indicator, 22% had only two and 19% had three or four. In keeping with Wathan et al, a level of two or more was used to define multiply deprived households (41% of household in Northern Ireland) and the percentage of people per SOA living in households of multiply deprivation was calculated, and deciles determined. Figure 8 shows the average percentage of population in SOAs living in deprived households across the deciles. In the most deprived decile the most deprived SOA has approximately 86% of its population living in households with two or more indicators of deprivation, the least deprived SOA in this decile has 59% of its population thus deprived.

Concentration of poverty

This deprivation measure follows on from the income modelling by Anderson and the subsequent validation analyses of McClelland and Donnelly [62] which introduced the potential of combining the modelled income and the GINI coefficients as a novel approach to identifying deprived areas such that areas exhibiting relatively high rates of low household income and also low GINI coefficient scores (meaning that there is relatively little variation in the levels of income), should identify areas where there is a concentration of deprivation (defined here as poverty). The original graph is reproduced below.

Figure 9

Relationship between modelled GINI coefficient scores and modelled household low income estimates for 890 SOAs



Again it is evident from the graph that there is no definitive cut-off on either of the scales but further discussions indicated that the definition that should be used was: SOAs with a Gini coefficient score of 0.26 or less and having 20% or more of households in relative income poverty (where equivalised net income before housing costs was less than 60% of the UK median equivalised net income). This is represented by the lower right quadrant in Figure 9 marked [A]. Although this is an arbitrary cut-off, it gives a number of SOAs (n=80) roughly equivalent to the number of SOAs used in the other deprivation measures. Unlike the other deprivation measures, the concentration of poverty measure identifies only one 'deprived' area (decile equivalent), and is not therefore informative at the more affluent end of the scale, though this is not a problem as the focus of the exercise is to identify the most deprived areas. The 80 SOAs defined by this approach will then be compared en masse against the (usually) 89 SOAs defined by the other more traditional NIMDM approaches. The slightly smaller number of SOAs included in this measure should therefore represent a slightly more select group and, all other things being equal, perform slightly better in terms of associations with other indicators of deprivation and need.

Spatial concentration of deprivation

Another suggested improvement on current methodologies was to see whether the residents of SOAs in which all or most of the constituent COAs are deprived are 'in greater need' than those in which the deprivation is more evenly spread out. In this context 'greater need' might imply more people who are deprived or alternatively that they have worse outcomes in the future for example in employment, educational attainment or health.

However, while this is easy to conceptualise there are similar difficulties in operationalisation as with poverty concentration as there is no definitive definition or threshold of deprivation at either SOA or COA level nor a clear understanding what 'pervasively deprived SOAs' might mean, though a range of most-to-all has been suggested.

There are 5022 COAs within the 890 SOAs, giving an average of 5.6 COAs per SOA (range 1-11) with 54.3% comprising either 5 or 6 COAs. This relatively small number of COAs per SOA renders the concepts of all-or-most less robust. Therefore some exploratory analysis was undertaken that involved examining a cross-classification of SOAs by COAs to determine what levels of cut-off might be feasible. SOAs were divided into deciles based on the overall MDM rankings as were the COAs.

Table 20

Cross tabulation of SOA and COA deciles: showing the number of COAs in each cell

	COA deciles										
SOA deciles	Most Deprived	2	3	4	5	6	7	8	9	Least deprived	total
Most Deprived	320	118	46	22	18	2	1	1	0	2	530
2	93	149	123	82	44	25	12	6	3	1	538
3	41	89	124	108	68	39	34	13	10	6	532
4	29	59	87	98	80	78	41	34	16	11	533
5	13	32	57	58	92	93	70	42	21	13	491
6	4	22	33	48	69	91	85	85	41	20	498
7	1	24	20	44	59	73	88	77	64	38	488
8	1	7	9	29	35	56	94	110	99	48	488
9	0	0	3	12	27	30	51	92	139	110	464
Least deprived	0	2	1	1	10	15	26	43	109	253	460
	502	502	503	502	502	502	502	503	502	502	5022

As can be seen (Table 20) there is a reasonable correspondence between the deprivation deciles for SOAs and COAs. There was however more COAs in the deprived SOAs than in the less deprived SOA, probably reflecting their inherent tendency to be in more densely populated urban areas. Overall, 64% of COAs in the most deprived decile were also in the most deprived decile according to SOA classification. Alternatively, 60% of COAs in the most deprived SOAs were also in the most deprived COA decile and 80% were in the most deprived quintile (according to COA classification). The table does however also suggest a degree of mismatch with some less deprived COAs within deprived SOAs.

Further analysis shows that the number of SOAs with a large proportion of their COAs in the most deprived decile of SOA is rather small; only 15 SOAs have all of their constituent COAs in the most deprived decile of SOA, 37 SOAs have 75% or more of their COAs deprived and 66 have 50% or more COAs deprived. This is obviously less than the usual 89 SOAs in a decile and the threshold must drop to 40% of COAs deprived, representing 84 SOAs, to get to close to this number. It is possible to get larger numbers by defining COA deprivation as being in the most deprived quintile (for example 38 SOAs would then have all of their COAs so deprived and 145 would have at least half of their COAs in the most deprived quintile). However, it has already been shown that the most deprived 10% of COAs are similar in terms of the concentration of deprivation to the most deprived 10% of SOAs and therefore using COAs in the most deprived decile seems a reasonably approach to defining deprivation.

As with the concentration of poverty measure this approach again produces two categories of deprivation; deprived (most deprived decile equivalent) and the rest of Northern Ireland.

GINI Coefficient:

This was also included as a possible indicator of deprivation. It has been described previously in the report. For this further analysis, the 890 deciles were divided into ten groups with 89 SOAs in each.

Urban deprivation:

It has been demonstrated in Section II that (i) many of the most deprived areas are in larger conurbations and (ii) that many of the deprivation indicators are inherently better at detecting deprivation in urban than in rural areas. It could also be argued that as urban deprivation is more concentrated it is therefore more easily targeted for policy interventions.

In recognition of this, a further deprivation measure was calculated that identified only disadvantaged areas in the Belfast and Derry District Councils. Therefore the first and second most deprived groups of 89 SOAs in these District Councils were categorised as the equivalent of the top two deciles in the other deprivation measures.

Relationship between deprivation and demographic characteristics

In the following section the relationship between the different indicators of deprivation and an array of demographic characteristics is explored. The characteristics are age, sex, marital status, single parent households and denomination (community background). As these (and the socio-economic and self-reported health measures) are all derived from the 2001 census from an analysis of NILS 454,017 members, the caveats associated with NILS data which are primarily related to differential non-enumeration in the 2001 census should be noted [64].

Demography

Age differences

Table 21 shows the relationship between deprivation and the age and sex distribution in the most deprived decile of equivalent of the nine deprivation measures. For ease of presentation age has been aggregated into three age-groups; 0-15, 16-64, 65 and over. The distribution for the population as a whole was 22.3%, 64.3% and 13.5% respectively. More deprived areas tend to have a profile that is younger than that of the least deprived areas, with about 5-6 percentage points more in the 0-15 age-group. Although the more deprived areas tend to have proportionately fewer older people the relationship between the percentages aged over 65 and deprivation is less clear.

Table 21

A comparison of the age distributions in the most deprived decile (or equivalent) of each of the deprivation measures. Data represent the percentage of the population in each decile.

Deprivation indicator	0-15	16-64	65+
MDM	27.3	60.1	12.6
MDM Income domain	27.7	60.0	12.3
Modelled Income	28.6	60.2	11.1
MDM at COA	28.7	59.3	12.0
Multiply deprived households	27.8	60.6	11.7
Concentrated poverty	26.7	59.8	13.5
Gini	24.6	60.2	15.2
Spatial concentration	23.2	63.2	13.6
Urban deprivation	25.7	60.4	13.9

The proportion of the population in deprived deciles who are younger is slightly greater for the MDM at COA and the Modelled Income measures. The GINI, spatial concentration and urban deprivation measures have population distributions that are most similar to the Northern Ireland average.

Sex differences

The slight overall excess of females to males (51.6% to 48.4% respectively) is increased in the more deprived areas to approximately 53% female. This is not unexpected given the greater effect of deprivation on male than female mortality and the consequently greater longevity of females in less deprived areas; though perhaps a greater degree of under-enumeration amongst men would have contributed.

Table 22

A comparison of the gender distribution in the most deprived decile (or equivalent) of each of the deprivation measures. Data represent the percentage of the population in each decile.

Deprivation indicator	Male	Female
MDM	46.9	53.1
MDM Income domain	46.7	53.1
Modelled Income	47.2	52.8
MDM at COA	46.6	53.4
Multiply deprived households	47.3	52.7
Concentrated poverty	46.4	53.6
Gini	46.2	53.8
Spatial concentration	48.5	51.5
Urban deprivation	46.8	53.2

As Table 22 shows, there is relatively little difference between the deprivation measures, though perhaps the Modelled Income and Spatial Concentration have distributions more akin to the rest of Northern Ireland.

Marital status

Marital status was categorised into three groups, never married, married, and a third group comprising the widowed, separated and divorced. The distribution for the population as a whole was 48.4%, 39.9% and 11.7% respectively.

Table 23 shows the marital status of people in the most deprived decile (or equivalent). It should be noted that these data do not adjust for age and that the data above describing the tendency towards younger age profiles in more deprived areas should be borne in mind.

Against this background the greater proportion of the population in more deprived areas who were never married (58% in the most deprived decile compared to approximately 42% for the least deprived areas) should not be too surprising; there is little difference in the proportion never married across the measures. On the other had there is an almost two-fold gradient in the proportion who are widowed, separated or divorced across deciles of deprivation; for example 17.1% in the most deprived areas compared to 8.8% in the least deprived areas according to the MDM measure. This would not be expected given the age distribution. The higher widowhood is undoubtedly related to the higher mortality risk in deprived areas but the greater proportion separated or divorced may be related to either the deleterious effects of poverty or possibly to selective migration into disadvantaged areas following marital breakdown.

Table 23

Variation in marital status in the most deprived decile (or equivalent) of each of the deprivation measures. Data represent the percentage of the population in each decile.

Deprivation indicator	Never married	Married	Sep/Widow/Divorce
MDM	57.7	25.2	17.1
MDM Income domain	57.9	25.3	16.9
Modelled Income	58.4	25.8	15.8
MDM at COA	58.0	24.7	17.3
Multiply deprived households	57.9	27.0	15.1
Concentrated poverty	56.8	25.6	17.7
Gini	54.4	27.8	17.8
Spatial concentration	57.5	26.0	16.6
Urban deprivation	56.4	26.2	17.4

The MDM at COA has the smallest proportion of population who are currently married; the GINI-based measure has the greatest proportion. Higher levels of widow(er)hood, separation and divorce are found in the GINI and the Concentrated Poverty measures, and Modelled Income and Multiply deprived households have the lowest levels, but there are only 2-3 percentage points between the highest and lowest.

Single parent families

An additional indicator of hardship, the proportion of people living in single parent families, was added. The overall proportion for Northern Ireland was 12.7% but this ranged from 28.0% in the most deprived areas to 5.7% in the least deprived areas.

The MDM at COA measures identified a slightly greater proportion than the other measures (Table 24); the measure based on the GINI scores identified the least.

Table 24

Variation in proportion in each decile or equivalent living in single parent household

	Living in single parent household	
Deprivation indicator	**No**	**Yes**
MDM	71.2	28.8
MDM Income domain	71.1	28.9
Modelled Income	71.4	28.7
MDM at COA	69.6	30.4
Multiply deprived households	73.4	26.6
Concentrated poverty	71.5	28.5
Gini	74.2	25.8
Spatial concentration	71.7	28.3
Urban deprivation	72.7	27.3

Community background

The assignment of community background was determined by two questions included in the 2001 Census: the first on current religious affiliation, and a supplementary, to be answered if the respondent declined to provide a definitive answer to the first, asking the religious background the person had been brought up in. This was used to assign affiliation for approximately 14% of respondents who did not answer or said none to the initial question. Collectively this is considered to represent community background. From this three groups were defined: Roman Catholics, Protestants, and a smallest group comprising individuals espousing ‘other philosophies’ and those who responded ‘none’ to both questions (called

'Other/none' in the text). The overall proportions for Northern Ireland were 42.0%; 51.6%; and 6.5% respectively.

Approximately 66% of residents in the most deprived deciles are Catholic and 23% are Protestant, compared to 20% and 60% respectively in the least deprived areas (according to the MDM measure). The proportion of those who are in the Other/none group increases from just less than 7% in the most deprived decile to just under 9% in the least deprived decile. This may reflect (a) a greater concentration of deprived Catholics in urban areas; (b) that deprived Catholics tend to live in more segregated areas, or alternatively that deprived Protestants live in more rural areas or may be more dispersed amongst more affluent others. This could be tested further using NILS.

Table 25

Distribution of the population in the most deprived decile (or equivalent) of each of the deprivation measures according to Community Background. Data represent the percentage of the population in each decile.

Deprivation indicator	Catholic	Protestant	Other/none
MDM	67.8	25.7	6.6
MDM Income domain	70.6	23.0	6.5
Modelled Income	75.4	18.6	6.1
MDM at COA	67.8	25.5	6.7
Multiply deprived households	80.3	14.0	5.8
Concentrated poverty	62.5	30.7	6.7
Gini	49.4	43.1	7.5
Spatial concentration	71.2	22.6	6.3
Urban deprivation	63.1	30.1	6.8

Table 25 shows that unlike the other socio-demographic measures examined in this report, there are marked differences in the community background according to the measure of deprivation used. The Multiply Deprived Households measures produces the greatest imbalance, while the GINI based measure produces a Community background distribution that is nearly balanced.

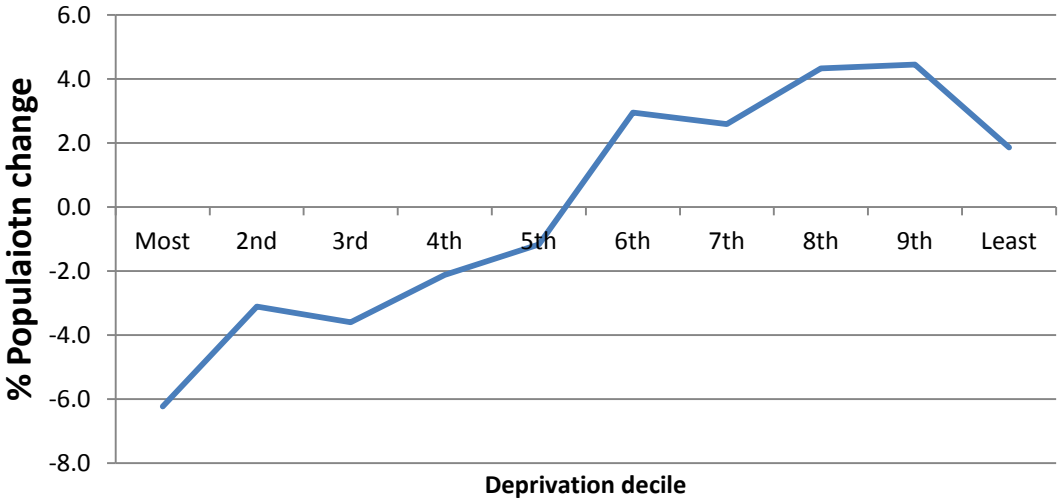
Migration

The final demographic feature examined is migration and it is closely linked with disadvantage in different ways. Over the last few decades it is evident that one of the responses to increasing deprivation in an area is population movement. This takes two forms; on one hand it is recognised that most deprived areas have seen reductions in population as a result of a net outmigration [65-67]; in addition, there is some evidence to suggest that this migration has been selective, ie that proportionately it has been the more affluent who have been leaving the deprived areas. Migration may therefore act as a proxy indicator of the less desirable areas and hasten the downward social and socio-economic spiral in these areas. Depopulation threatens the viability of support services and social infra-structure and any derelict housing adversely affects an area's desirability as well as its social capital and physical environment. In recent years however the effects of gentrification may have started to reverse this trend. Migration may also be important when targeting social interventions at areas; on one hand it could be argued that stable populations will ensure that those most in need will get exposed to the intervention, on the other hand it could also be argued that rapid population turnover ensures that a greater proportion of the total population in need will get exposure to any area-based interventions.

NILS records the location of the cohort member at the time of the census but unlike the other UK Longitudinal Studies it also updates their location during the intercensal period with six monthly downloads from the BSO health-card registration database. It is therefore possible to see where people have migrated to and also to see which types of area have gained and lost population. One notable caveat here is the reliance on the updating of addresses in the BSO database; this relies on contact with the GP and an address change being recorded at the surgery. It is known that there are delays in the system [68] which may produce an undercount in migration and it is likely that this will not occur to the same extent across the deprivation spectrum. A further caveat is that this methodology assumes a closed system and ignores immigrants from outside Northern Ireland. It should also be remembered that migration is also age-related and populations with greater proportions of younger adults will have a greater degree of population movement.

Figure 10

% change in population between 2001 and 2009 according to deprivation decile



Between 2001 and 2009 most people (about 80%) do not change address, those that do mostly relocate to deprivation deciles that are relatively similar to the one they left; very few make extreme moves eg from the least to the most deprived or vice versa. The figure above uses the population changes in the MDM measure to illustrate how net population change is generally related to deprivation. Over the approximately nine years, 18.4% of the most deprived decile moved to other deciles (55% of these were to the next three most deprived deciles); while new residents amounted to only 12.1% of the original amount moved back in; the result was a loss of 6.2% of its original population. This pattern is replicated to a lesser extent for the other deprived deciles with the least deprived areas gaining in equal proportion.

Table 26

Change in population between 2001 and 2009 in the most deprived decile (or equivalent) of each of the deprivation measures

Deprivation indicator	% outflow	% inflow	Net loss
MDM	18.5	12.3	6.2%
MDM Income domain	18.4	12.1	6.2%
Modelled Income	19.4	12.7	6.8%
MDM at COA	N/A	N/A	N/A
Multiply deprived households	17.7	11.3	6.4%
Concentrated poverty	19.9	13.2	6.7%
Gini	21.6	14.9	6.7%
Spatial concentration	19.1	13.4	5.7%
Urban deprivation	14.8	11.5	3.3%

Note: updating the addresses at COA level was not feasible at NILS

As the table above shows the deprived deciles or equivalents all record a population loss over the study period. There are only modest differences between them with modelled income detecting a slightly greater degree of depopulation over the period. The urban deprivation recorded the lowest degree of depopulation and perhaps this is due to either the pressure for residential accommodation in deprived areas and/or some gentrification of more disadvantaged urban areas.

Relationship between deprivation and indicators of socio-economic status

In the following section each of the measures of deprivation is assessed to see how well it identifies areas that comprise a concentration of people who are disadvantaged across a range of deprivation indicators. There were five indicators of deprivation measured, household tenure, car availability, educational attainment, economic activity, and social class. All were measured at the time of the 2001 census and the results are based on analysis undertaken using NILS. The relationship between the measures of deprivation and urban residence that was established in Section II is relevant here as the correspondence between some of the socio-economic indicators (for example car availability and social renting) and disadvantage is known to vary across the urban-rural spectrum.

Social housing

All measures of deprivation demonstrate that they can delineate concentrations of deprivation as indicated by the percentage of the population in those areas living in social rented accommodation. For this analysis, those living in communal establishment have been excluded.

Most people (76%) were living in owner occupied accommodation at the time of the 2001 census; 17% were living in social-rented accommodation and the remainder were living in privately rented accommodation. There was little variation in private rented residence across the deprivation spectrum, but large differences in the proportions in social renting; this ranged from just less than 2% in the least deprived decile (according to MDM) to almost 54% in the most deprived decile. Even with this gradient it should also be noted that the most deprived decile 'only' accounts for 30% of all people in social renting.

Table 27

Variation in housing tenure for the population in the most deprived decile (or equivalent) of each of the deprivation measures. Data represent the percentage of the population in each decile.

Deprivation indicator	Owner	Private renting	Social renting
MDM	40.7	5.5	53.8
MDM Income domain	41.0	5.2	53.8
Modelled Income	42.8	5.4	51.8
MDM at COA	34.6	4.1	61.3
Multiply deprived households	46.7	5.3	47.9
Concentrated poverty	41.2	6.6	52.2
Gini	46.8	8.5	44.7
Spatial concentration	41.7	4.8	53.5
Urban deprivation	44.7	6.7	48.6

Table 27 shows the distribution of social renting, private renting and owner occupancy for the most deprived decile (or equivalent) each of the nine measures of deprivation. There is little difference between MDM, the MDM income domain and spatial concentration of deprivation. However, MDM at COA is the most discriminating measure, and the GINI, Multiply deprived households and urban discriminating measure the least. It is noted that social housing is not one of the defining features of the deprived household indicator.

Car availability

Not having access to a car has a long pedigree as a measure of disadvantage. However the earlier studies (related to the 1971 census) used lack of access to one car and, given the general increase in car ownership since, it is arguable whether this cut-off is as discriminating as it once was. For this analysis car availability has been categorised into none, one, or two or more cars and Table 28 shows the variation in car availability across the deprivation measures. Again, it should be recalled that the availability of public transport may meet many of the transport needs of disadvantaged people in the city, and car access could be considered of greater importance in rural areas.

Table 28

Variation in car availability for the population in the most deprived decile (or equivalent) of each of the deprivation measures. Data represent the percentage of the population.

Deprivation indicator	Two or more cars	One car	No car
MDM	9.6	41.5	48.9
MDM Income domain	10.3	41.8	48.0
Modelled Income	12.0	42.1	45.9
MDM at COA	9.1	41.4	49.5
Multiply deprived households	14.4	42.8	42.9
Concentrated poverty	8.3	41.1	50.6
Gini	10.8	42.0	47.2
Spatial concentration	11.2	41.8	47.0
Urban deprivation	9.5	41.8	48.7

This variable demonstrated the greatest gradient across deciles of deprivation with a 10-fold variation in the percentage of people living in households without access to a car (5-49% for the MDM measure). Though again only 27% of those without access to a car are in the most deprived decile. Less than 10% of people in the most deprived decile of the MDM measure have access to two or more cars compared to over 60% of those living in the least deprived decile.

Table 28 shows how car availability in the most deprived decile for each of the deprivation measures compares. It is clear that each of the measures identifies areas with high levels of concentrated deprivation as assessed by car availability. There is relatively little to choose between the measures, with MDM at COA and Concentrated Poverty performing slightly better and Multiply deprived households and Modelled Income the worst. The improvement of concentrated poverty over modelled income may be because the addition of the GINI is identifying more urban SOAs.

Social class

Social class is also a traditional measure of disadvantage, though it was not included as one of the indicators in Townsend's composite measure of deprivation [41]. The older version has now been replaced by the National Statistics Socio-economic Classification (NS-SEC), which incorporates elements of work pressure and control (lack of), as well as the more usual social class hierarchy [69]. For these analyses, the age range has been restricted to 16-74, as

this covers the availability of census data. NS-SEC has been divided into the seven categories shown in the Table below. Overall 25% of the Northern Ireland population were in professional classes (range least: most deprived deciles 45%: 12%), 32% were in routine occupations (range 16-46%), and 6% were not working (range 2-15%).

Table 29

Variation in social class across the population in the most deprived decile (or equivalent) of each of the deprivation measures. Data represent the percentage of the population.

	Social class						
Deprivation indicator	**Prof.**	**Intermed**	**Own**	**Lower Super.**	**Routine**	**Not working**	**Student**
MDM	11.7	7.7	3.5	8.8	46.1	14.9	7.3
MDM Income domain	11.6	7.7	3.7	8.7	45.6	15.3	7.4
Modelled Income	11.6	7.7	4.2	8.7	44.7	15.5	7.7
MDM at COA	9.7	7.1	3.6	8.0	47.7	15.7	7.2
Multiply deprived households	11.9	7.6	5.1	9.2	44.1	15.0	7.9
Concentrated poverty	11.3	7.8	3.3	9.2	47.1	14.4	6.9
Gini	13.5	9.0	3.5	9.7	45.3	12.1	6.9
Spatial concentration	12.0	7.7	3.9	8.7	45.3	14.8	7.6
Urban deprivation	13.0	8.4	3.5	9.1	44.8	14.0	7.3

It is difficult with seven categories to produce a definitive ranking (Table 29), but MDM at COA identified a slightly greater proportion of those not working or in routine occupations and less people in professional occupations. By the same measure, the GINI coefficient in isolation and urban deprivation measures perform less well.

Educational attainment

Although education is often used to indicate disadvantage, it has sometimes been excluded from some of the composite indicators on the basis that it does not represent deprivation per se though it may shape future employment success and earning potential. This variable also needs to make some adjustment for the age of the respondent: On one hand the educational attainment question was not asked of respondents aged 75 and over; alternatively many younger people will not have had an opportunity to complete their education. So the analysis was therefore restricted to people aged 16-74 inclusive. The emphasis perhaps should therefore be placed on those without any formal qualifications but the percentage with a degree is shown by way of contrast.

Table 30

Levels of educational attainment in the most deprived decile (or equivalent) of each of the deprivation measures. Data represent the percentage of the population.

Deprivation indicator	Degree or equivalent	Intermediate	No formal qualifications
MDM	6.5	34.9	58.6
MDM Income domain	6.5	35.0	58.4
Modelled Income	6.5	36.2	57.3
MDM at COA	4.9	34.4	60.7
Multiply deprived households	6.8	36.4	56.9
Concentrated poverty	6.0	34.4	59.5
Gini	7.9	35.4	56.7
Spatial concentration	6.8	35.1	58.1
Urban deprivation	7.5	35.0	57.4

The proportion in the whole population who had attained a degree (or equivalent) was 16% (range least: most deprived decile 30-7%); intermediate levels, 42% (range 45-35%); no formal qualifications (range 25-59%). Again the differences between the measures are relatively modest (Table 30), though perhaps MDM at COA identifies a greater proportion without formal qualifications and a smaller proportion with a degree. The GINI coefficient and urban deprivation perform less well than the others. Interestingly the Multiply deprived households measure did not do as well despite education being one of its defining characteristics.

Economic activity

As with the analysis relating to social class, this variable was restricted to people aged 16-74 years, though age continues to influence the findings to some extent as younger populations will (all other things being equal) have a greater proportion of people who are students, and older population will have a greater proportion who are retired.

Overall, 56% of the Northern Ireland population were employed though this ranged from 64% in the least deprived decile (for the MDM measure) to 36% in the most deprived decile. Unemployment at the time of the 2001 census was uncharacteristically low in Northern Ireland with only 4% so classified, though this ranged from less than 2% to over 8%, (least to most deprived deciles respectively). As with other parts of the UK, about twice as many people were registered as 'permanently sick' as were unemployed, and this ranged from 4 – 18% across the deprivation spectrum. There was relatively little variation across the deprivation spectrum in the proportion who were students or retired.

Table 31

Variation in levels of economic activity across the population aged 16-74 in the most deprived decile (or equivalent) of each of the deprivation measures. Data represent the percentage of the population.

	Economic activity					
Deprivation indicator	**Employed**	**U/E**	**Student**	**Retired**	**Perm. sick**	**Inactive**
MDM	36.2	8.5	7.5	10.5	17.6	19.6
IncDom	36.0	8.5	7.6	10.3	17.6	20.0
MDM Income domain	36.2	8.6	7.9	9.5	17.5	20.3
MDM at COA	34.2	8.7	7.4	9.9	18.3	21.5
Multiply deprived households	37.2	8.2	8.2	9.7	17.2	19.5
Concentrated poverty	36.7	8.3	7.1	11.1	17.6	19.3
Gini	41.1	6.9	7.1	12.0	15.9	17.0
Spatial concentration	36.7	8.5	7.8	9.9	17.6	19.6
Urban deprivation	37.9	8.1	7.5	11.0	17.2	18.3

There is relatively little difference between the measures (Table 31), though MDM at COA identifies areas where a smaller proportion is employed and greater proportions are either unemployed or permanently sick. The GINI measure performs least well.

Relationship between deprivation and indicators of health status

The following section details the relationship between an array of health indicators and the various deprivation measures. These include the self-reported health indicators in the census, the use of antibiotics and antidepressants, infant mortality and mortality at older ages. Deaths and births close to the 2001 census were chosen so as to match and make a fair comparison to the other demographic, socio-economic and health information from the 2001 census.

Self-reported health status

The 2001 census included two self defined measures of morbidity; the first asked about the perception of general health in the year preceding the census - this allowed three responses (good, fairly good and not good); the second, the limiting long term illness (LLTI) question which asked about the presence of any long-term illness, health problem or disability which limits daily activities or the work the respondent could do. The following tables that present the percentages of people with differing levels of health status are not adjusted for age and sex and again the demographic differences should be kept in mind.

All measures of deprivation identify areas with marked concentrations of ill-health, and in many cases the differences are more marked than for those for mortality (see below). Table 32 shows that almost 30% of those in the most deprived decile report an LLTI, which is twice the level reported in the least deprived decile (14%)(using MDM as an example), with a smooth gradient over the spectrum.

Table 32

A comparison of the morbidity level in the most deprived decile (or equivalent) of each of the deprivation measures. Data represent the percentage of the population in each decile.

	Limiting long-term illness			General health in last year		
Deprivation indicator	**No**	**Yes**		**Good**	**Fair**	**Not good**
MDM	70.7	29.3		61.0	21.0	18.0
MDM Income domain	71.1	28.9		61.5	20.7	17.8
Modelled Income	72.2	27.8		62.9	20.1	17.0
MDM at COA	70.7	29.3		61.1	21.1	17.9
Multiply deprived households	72.0	28.0		62.7	20.3	17.0
Concentrated poverty	70.4	29.6		60.1	21.4	18.5
Gini	71.0	29.0		60.4	21.6	18.0
Spatial concentration	71.3	28.7		61.7	20.6	17.7
Urban deprivation	70.4	29.6		60.6	21.1	18.4

In terms of concentration of people with poor health there is little to choose between the MDM and MDMIncome measures; the slightly greater proportion of sick people identified by the former is to be expected given that its construction includes health. The MDM at COA does not do better than the MDM at SOA level. The concentrated poverty and urban deprivation perform slightly better than these measures, whilst the modelled income does slightly worse. The variation in levels of General Health, describes a very similar picture. There is an almost three-fold variation across the deprivation spectrum in the proportion of people who say that their health in the last year was not good (about 18% in the most deprived decile compared to 6-7% in the least). Again the concentrated poverty and urban deprivation identify a slightly greater proportion of sick people than the other measures, though the GINI identifies the areas with the second smallest percentage with good health.

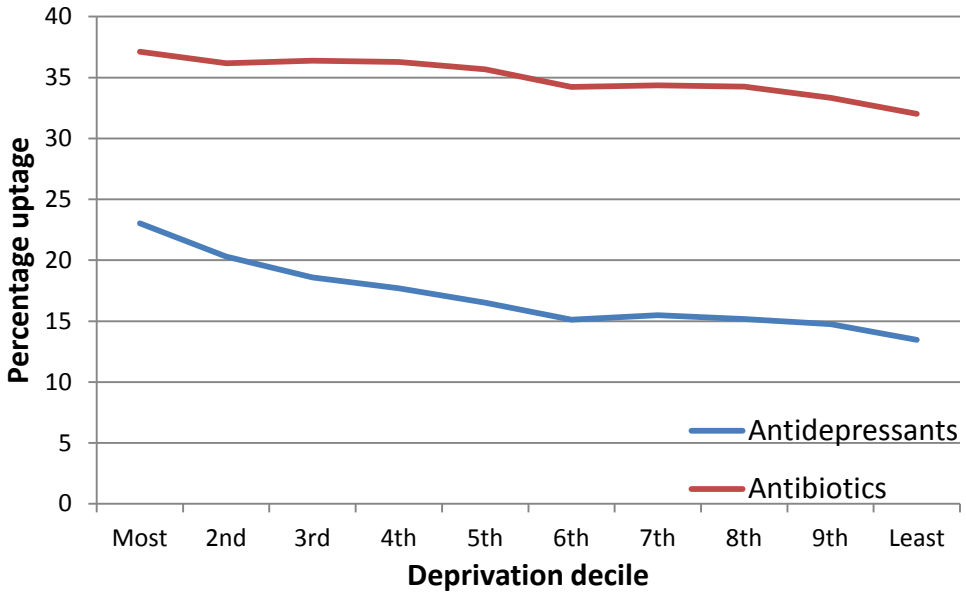
Prescription data

The following section offers another perspective on health ie an examination of variation in usage of antibiotics and antidepressants. These data are held by in the Enhanced Prescribing Database (EPD) at the BSO. These data are relatively unique in the UK and have the additional benefit of relating to prescriptions cashed by the patient and not to those dispensed by the GP. There are also some caveats that should also be borne in mind if they are to be used as proxies for poor health; namely that they rely on patients attending the doctor, having their symptoms recognised and acted upon and there being no systematic variation in adherence rates amongst patients. It is possible that most of these factors vary across the deprivation spectrum, and if they also vary by different facets of deprivation, this might cause an additional independent variation between the deprivation measures.

As prescription for antibiotics is a relatively frequent event and mental ill-health requiring medication is a relatively common illness in Northern Ireland, one year's worth of prescribing data was sufficient to provide robust estimates at decile level. As no differentiation between antibiotics was specified, the British National Formulary (BNF) category 5.1 (all antibacterial drugs) was used to specify antibiotics, and the BNF category 4.3 was used to identify all antidepressants. Again, there is no acknowledged method to specify usage so a dichotomous any/none was used for both types of medication. In addition the utility of age and sex standardisation is questionable in this context so a crude percentage is used, all ages for antibiotics and 16 and over for anti-depressants.

Figure 11

Percentage of the population on medications (all ages for antibiotics; 16 and over for antidepressants)



The figure above shows the levels of uptake of antibiotic and antidepressants and the variation across the deprivation deciles, as measured by the MDM measure. Over one in three of all people in Northern Ireland (37%) had at least one prescription for an antibiotic and about half of this (17%) had a prescription for an antidepressant. Although there is a socio-economic gradient in the uptake for both antibiotics and antidepressants, both the absolute and relative differences were greater for the latter. It is likely that a steeper gradient may become evident using different categories for antibiotic use, eg more than one prescription or for different classes of medication.

Table 33 shows the percentage uptake for the most deprived deciles of the various deprivation measures. There is a reasonable correspondence between the rankings for the two groups of medication, with the exception of the Multiply Deprived Households variable which has the second highest uptake of antibiotic but the lowest for antidepressants. The MDM at COA performs better than the other measures for both medications; the MDM and Concentrated Poverty are second best for antidepressants. The Modelled Income and GINI do not perform quite as well as the other measures.

Table 33

The percentage of the population who cashed at least one prescription for antibiotics or for antidepressants in the most deprived decile of the different deprivation deciles (or equivalent).

	Percentage of the population with one or more prescriptions for …	
Deprivation indicator	**Antibiotic**	**Antidepressant**
MDM	37.1	23.0
MDM Income domain	36.9	22.8
Modelled Income	36.0	21.9
MDM at COA	37.9	24.0
Multiply deprived households	37.4	21.7
Concentrated poverty	36.9	23.0
Gini	36.5	22.3
Spatial concentration	37.1	22.7
Urban deprivation	37.1	22.4

Mortality analysis

This section examines the variation in mortality according to deprivation decile. Three measures of mortality are used. The first is infant mortality and includes a section on teenage motherhood, and is described below. The second is premature mortality, which like infant mortality, has also historically been used as a powerful indicator of the effects of deprivation. The third mortality-related measure is life expectancy at birth.

Births to teenage mothers

Teenage motherhood is included in the current analysis as it is both a strong marker of disadvantage and a potent driver for the perpetuation of disadvantage as it often disrupts both the educational and employment potential of young women. GRO births from 1999-2003 inclusive (n = 110,236) were analysed. During this period there were 7,855 births to teenage mothers representing 7.1% of the total, though as the table below shows this was strongly related to area deprivation. In the most deprived deciles approximately one in six babies was born to a teenage mother; this compares to approximately one in 50 in the least deprived areas. The most deprived deciles comprise 27-28% of all births to teenage mothers in Northern Ireland compared to approximately 12% of all births.

Table 34

Percentage of births in areas to teenage mothers according to deprivation measure.

			Level of disadvantage							
Deprivation indicator	Most	2nd	3rd	4th	5th	6th	7th	8th	9th	Least
MDM	16.1%	10.8%	8.2%	7.1%	6.4%	4.8%	4.7%	4.0%	2.9%	2.1%
MDM Income domain	16.0%	10.4%	8.5%	7.6%	6.3%	4.7%	4.5%	3.7%	3.0%	2.1%
Modelled Income	14.6%	11.2%	9.1%	6.9%	6.3%	5.8%	4.4%	3.8%	3.5%	2.4%
MDM at COA	16.4%	13.2%	10.5%	7.1%	5.9%	4.4%	3.7%	2.9%	2.7%	1.8%
Multiply deprived households	14.6%	8.2%	8.7%	7.3%	6.3%	6.6%	6.0%	4.3%	3.5%	2.3%
Concentrated poverty	15.5%									
Gini	15.2%	9.8%	7.2%	7.4%	6.4%	5.6%	4.9%	5.4%	4.7%	3.8%
Spatial concentration	15.9%									
Urban deprivation	15.1%	7.2%								

Note: where only one or two categories of disadvantage are identified, the data are presented only for the most deprived categories.

There is again little difference between the MDM measures (Table 34), though the MDM measured at COA level has the highest concentration of teenage births and the steepest gradient (differentiation) between most and least deprived areas. The modelled income and the multiply deprived households perform least well.

Infant mortality by deprivation

Historically, infant mortality was one of the principle indicators of poor health and one that was strongly related to deprivation. It was widely used in research related to inequalities in health in the Northern Regions of England [71], in Scotland [8]and in Northern Ireland [70]. However, infant mortality rates have continued to improve markedly in recent years, for example from 9.2 per 1,000 births in 1980 to 4.1 in 2010, and arguably, the relatively small number of events therefore makes it a less robust measure of health now than in previous years.

Table 35

Estimated infant mortality by deprivation measure.

			Level of disadvantage							
Deprivation indicator	Most	2nd	3rd	4th	5th	6th	7th	8th	9th	Least
MDM	7.22	6.42	5.91	5.57	4.79	5.18	4.71	4.96	4.79	3.75
MDM Income domain	6.97	6.22	6.10	5.67	4.45	6.15	4.50	5.15	4.22	3.76
Modelled Income	7.12	6.60	5.84	5.69	4.30	5.56	4.68	4.92	4.38	4.44
MDM at COA	7.60	6.16	6.18	4.87	3.84	6.02	4.33	5.42	4.94	4.11
Multiply deprived households	7.58	5.36	7.51	5.74	4.41	5.25	5.03	4.55	3.36	4.35
Concentrated poverty	7.02									
Gini	6.97	6.46	4.60	6.01	4.62	6.09	5.41	3.91	4.78	5.21
Spatial concentration	7.27									
Urban deprivation	6.93	5.43	5.20							

In this analysis, all registered births occurring between 1999 and 2003 inclusive were used to give the number of births to Northern Ireland mothers in each of the deprivation areas. These were linked to infant deaths (aged less than 1 year old) for the years 1999-2003, to estimate infant mortality rates per 1000 live births. A total of 606 infant deaths were recorded, of which 596 were to Northern Ireland residents. The overall infant mortality rate for the period was 5.42 per 1000 live births.

It is notable in Table 35 above that while there is generally higher infant mortality in more deprived areas its relationship with deprivation is not as clear as with other measures of ill-health. This is especially true for the less deprived areas where the smaller number of births and lower risk of mortality event makes estimates of infant mortality less robust. It is difficult therefore to determine which indicator of deprivation performs better, though urban deprivation and GINI do not appear to discriminate quite as well as the others.

Premature mortality

Five years of registered death data (1999-2003 inclusive) were used for both this analysis and the calculation of life expectancy with the census, which was approximately at the midway point, providing the demographic base. Over this period there were a total of 74,127 deaths of which 710 (<1%) could not be assigned an appropriate decile or equivalent and a further 426 were non-NI residents. This left 72,991 deaths for analysis. Life expectancy was calculated according to the spreadsheets made available at the ONS.

Table 36

The percentage of deaths in each of the most deprived decile or equivalent that is to people aged under 65 and under 75 years old.

	Percentage of deaths	
	65 years	**75 years**
Deprivation indicator		
MDM	26.7	51.1
MDM Income domain	27.1	51.6
Modelled Income	27.7	51.4
MDM at COA	27.6	51.9
Multiply deprived households	26.6	51.2
Concentrated poverty	25.5	50.4
Gini	24.1	49.0
Spatial concentration	27.7	51.8
Urban deprivation	25.6	50.6

Traditionally, prematurity was defined as death occurring before 65, but given the lengthening of life expectancy an additional cut-off of 75 has also been employed. Between 1999 and 2003 19.4% of deaths to residents of Northern Ireland were to people aged less than 65 and 37.8% were to people aged less than 75 years. The proportion is evidently greater in the more deprived areas reaching more than 25% and 50% respectively. However, while this undoubtedly reflects the detrimental effects of deprivation on health, it may also reflect the younger population within these areas as well as their higher mortality rates. For this reason, the variations in life expectancy probably give a better indication of the relative mortality risk in each area.

Life expectancy at birth:

Over the last 80 years life expectancy for people born in Northern Ireland has been increasing at a rate of approximately 3 years every decade (slightly more than this for females and slightly less for males, though the difference between men and women has been reducing in more recent years). However, given the strong relationship between disadvantage and mortality risk it is not surprising that this is reflected in marked variation in life expectancy across the deprived spectrum. Some of this variation across the deciles of deprivation is shown in the graphs at the end of this section to demonstrate the relationship between deprivation and life expectancy as well as the size of the variation across the deprivation spectrum.

Against the general pattern of increasing life expectancy with reducing deprivation there are some additional points of interest: the first is the relatively little variation in life expectancy across the deciles in the centre of the distribution and the gradual increase towards the least deprived deciles, though not with the modelled income measure. The large reduction in life expectancy in the most deprived decile (and sometimes also the most deprived quintile) suggests that these are really identifying areas with significantly poorer health status, and reflect the fact that the measures are designed to measure deprivation, and therefore not necessarily reflect affluence.

Table 37

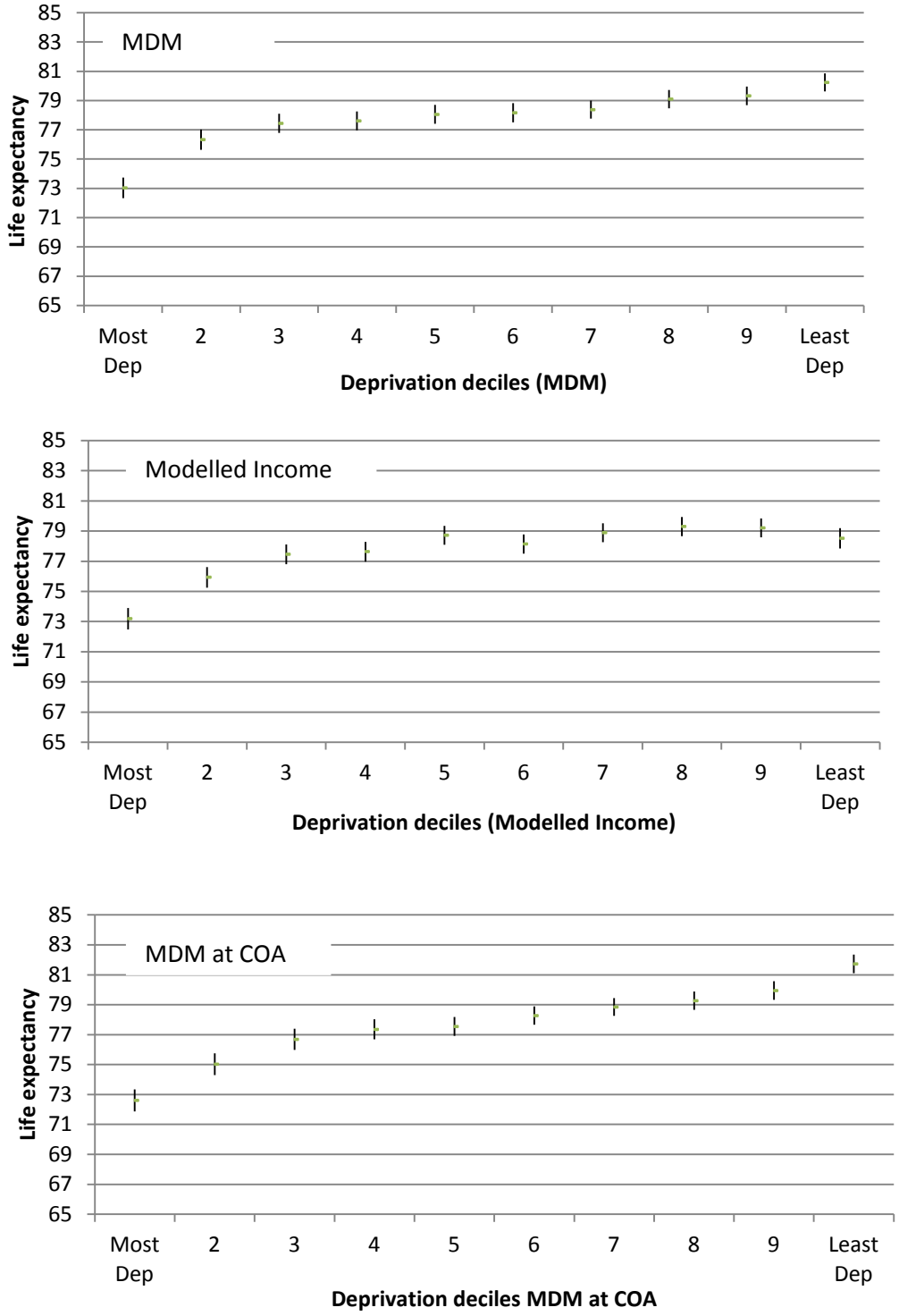
A comparison of life expectancy at birth for residents in the most deprived areas as defined by different deprivation measures.

Deprivation indicator	Life expectancy (95% confidence intervals)
MDM	72.91 (72.21, 73.62)
MDM Income domain	73.04 (72.33, 73.74)
Modelled Income	73.19 (72.48, 73.90)
MDM at COA	72.61 (71.88, 73.35)
Multiply deprived households	73.07 (72.37, 73.76)
Concentrated poverty	73.36 (72.64, 74.07)
Gini	74.49 (73.78, 75.20)
Spatial concentration	73.21 (72.48, 73.93)
Urban deprivation	73.60 (72.90, 74.30)

There is not much variation in life expectation according to the different deprivation measures. The MDM measures identified the areas with the lowest average life expectancy, with the variation measured at COA level doing a little better than the equivalent SOA probably because of the ability to pick out more homogenous areas. Again, there was little difference between the MDM and the MDM income domain measures, interestingly the Multiply Deprived Households measure did not do quite as well despite the weighting due to LLTI. The worst performing measures were the GINI, Urban deprivation and Concentrated poverty. However, a further inspection shows that the confidence intervals for the estimates of life expectancy for each deprivation measure overlap and a reasonable interpretation is therefore that there is no significant difference between any of them.

Figure 12

Variation in life expectancy across deciles of multiple deprivation according to (a) MDM, (b) MDM income domain and (c) MDM at COA level



Section Conclusions:

The aim of this section was to provide an overview of the association between a range of indicators of deprivation (both established and suggested alternatives) and a wide array of measures of demographic variation, and socio-economic and health status. Some of these, such as the measures of socio-economic status are indicators of disadvantage and a close correspondence with the formal measures of deprivation was to be expected. Others such as the health variables can be viewed as either health deprivation (in which case the correspondence to material deprivation should be sufficiently distinct as to warrant health a separate deprivation class), or as an outcome, albeit indirect, of deprivation but not a direct measure of such per se. Many of the demography variables are possibly best considered in a quasi-equity framework. It might therefore be argued that a greater emphasis might be placed on the associations with the socio-economic variables when concluding which were the better performing deprivation measures.

Judging by their relationship to these other demographic SES and health variables, most of the measures of deprivation seem to identify areas in which there is a concentration of people who are either materially disadvantaged or who have poor health and health outcomes. In many cases there is little to choose between them. Interestingly, and one of the other major findings of the study is the great similarity between the deprivation measures in their ability to identify areas with higher concentrations of people who are deprived or in need. This should perhaps not be too surprising when it is realised that many of the measures are selecting the same areas for inclusion. For example, of the eight measures that use SOAs, 25 (31%) of these are common to each measure, and ignoring the urban deprivation measure, which restricts selection to Belfast and Derry, this increases to 33 (41%) with much of the remaining disagreement around the SOAs that are usually in the second decile. Reducing the number of measures increases the degree of overlap for example MDM, MDM Income, Modelled income and Multiply Deprived Households have 53 (60%) of SOAs in common.

Given the variety of variables tested there were bound to be some differences between the deprivation measures, though in general these differences were small. It should also be noted that where there were a range of 'outcomes' for a single measure (such as general health or social class) a judgement was made as to which the deprivation measure performed best. The results are shown in Table 38. On a straight count the MDM at COA level is most closely associated with 11 (69%) of the 16 health, demographic and socioeconomic measures it was assessed against (it was not assessed in the migration). This is, of course, a combination of both the indicator and the smaller spatial unit of analysis, which was shown in Section 2 to be associated with more homogenous populations. When MDMCOA was ignored, a total of 7 (64%) of the 17 positions were taken by either the MDM at SOA level or the MDMInc measure.

Table 38

Comparison of the main indicators of deprivation: Markers represent the indicator of deprivation that is most closely associated with the demographic, socio-economic or health measure indicated.

	Indicator of deprivation								
	MDM	MDMInc	ModInc	MDM COA	Multi Dep HH	Conc Poverty	GINI	Spatial Dep	Urban
Young profile				X					
Sep, Widow, Divorced							X		
Single person Household				X					
%Catholic					X				
Out Migration			X						
Social Renting				X					
No Car						X			
Low Social class				X					
No Education				X					
Not Employed				X					
LLTI						X			X
Gen Health Not Good						X			X
Antibiotics				X					
Anti-Depressants				X					
Teen mother				X					
Infant mortality				X					
Life expectancy				X					

Section 4

Overall conclusions and recommendations

Area based targeting has been used extensively throughout the UK for more than half a century and has generated advocates for and against for almost as long. More recent reviewers have suggested this polarisation is unnecessary and there is an increased recognition that whilst most poverty eradication should be through universal macroeconomic and social policies, area-based interventions may constitute a useful adjuvant to these broader programmes. This recognition however, shifts the arguments including how these areas should be defined and the policies assessed. Amongst the calls for more considered theories of agency, better specified objectives and more sophisticated analytic tools, it is evident that one of the most common and overarching themes for most ABIs is that area-based targeting can be an effective way of reaching poor people. This suggests that at a fundamental level most area-based policies can be assessed according to their efficiency and effectiveness of reaching those most in need. This has been one of the guiding principles of the current study.

The literature suggests that the spatial unit at which deprivation is identified and measured influences the efficiency of targeting. Most targeting in the UK is currently at SOA level, but this study also examined aggregates of smaller census-based areas (COAs) as they are likely to be more homogenous, and also larger areas (District Councils) which might prove easier for policy implementation. The conclusions were that targeting using those District councils with the greatest concentration of disadvantage would be less efficient than the current SOA-based approach as most of their populations are not disadvantaged and also that most disadvantaged people do not live in these areas. The study confirms that COAs are more homogenous and do offer an advantage over SOAs in terms of concentration and completeness of targeting but the distinction between the two is not marked. Whether COAs are a practical level upon which to base an area-based intervention is beyond the remit of this study.

The following conclusions can be drawn about the different measures of deprivation:

- Each of the indicators studied in this report identifies areas where there are high concentrations of disadvantage, and there is a reasonable agreement between the measures on where these areas are. However, there are also some differences in the areas that each indicator selects which will have implications for the allocation of funding. Furthermore, as different indicators detect some types of disadvantage better than others this suggests that the choice of indicator could be tailored to meet the focus of a specific intervention.

- In general the MDM at COA level was more closely related to the basket of demographic, socio-economic and health measures than the other measures studied, though the overall differences between the measures of deprivation studied were modest. It also performed better in terms of both concentration and completeness. The MDM at SOA and the MDM Income Domain at SOA were probably the next best.

- It is also important to note that although all of the measures studied identify areas where the concentration of disadvantage was highest, they were all fairly inefficient at identifying deprived people.

None of the variables are particularly good at detecting spatial deprivation in rural areas, and that area-based targeting works maximally (in terms of efficiency) in urban areas. This finding is related to rural areas being more dispersed than their urban counterparts and thus more likely to have a wider variety of people contained within them.

In summary

Area-based interventions are a small but important addition to individual or family-based policies and area based indicators of disadvantage are therefore an invaluable step in this process. They are however not a panacea, and work best when combined with other information sources and as the documentation for the Welsh index of multiple deprivation says 'the *index is most useful if it is used in conjunction with other information, either from the index indicators, other published data or local information. This will increase the understanding of the challenges in the local areas*'. The choice of indicator and the spatial unit it is applied at should also perhaps be selected according to the target population.

This report was limited to the measures that are currently available. It is likely that the future availability of other administrative datasets such as house valuation from the Land & Property Services and income returns recorded by HM Revenue & Customs, supplemented perhaps by more detailed modelling of income from larger surveys may provide a more informative picture of the distribution of deprivation in society and enable more efficient targeting of deprived people.

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Appendix A:

Identifying areas of multiple deprivation in other countries

Each of the four Home Countries now has its own index of multiple deprivation (see below for brief overview). This has developed from the original work by Professor Mike Noble from Oxford University [1], which is considered a significant advance on previous methodologies as it recognises that deprivation (a general lack of resources and opportunities) is more than poverty (insufficient money to get by); that people can be deprived in different ways and therefore that different domains of deprivation are needed to reflect this variety (in general each of the indicators of multiple deprivation recognises seven aspects (domains) of deprivation: income, employment, health, education, access to services, crime, and housing, though the terminology for some indicators varies a little and Wales has a separate domain (physical environment)); that disadvantage is better captured by administrative data (though occasionally supplemented by census data); and that while summary measures can be produced for areas, it is also possible to examine domain ranks to understand the drivers for deprivation in individual areas. Most countries are however at pains to point out that absence of deprivation is not an indicator of affluence.

On the negative side the construction of these indicators is not immediately apparent and each country has dedicated websites and associated documentation instructing potential users in how to use and interpret the indicator ranks and scores. A further caveat is that ranks and scores cannot generally be used to compare/monitor change over time though there is now detailed documentation to show how this can be best achieved. Each of the Home Countries produces its own index of multiple deprivation but these are not directly comparable for a range of reasons though again, guidance is available on how this can best be achieved.

The stated purposes of the English Indices of Deprivation [2] 2010 include the following:

- *to identify small areas of England which are experiencing multiple aspects of deprivation (though it is acknowledged that the data cannot determine if individuals in these areas suffer from multiple deprivation or if different individuals are suffering different types of deprivation),*

- *[to increase] the evidence base for regeneration policy in England and help target limited resources appropriately.*

- *To encourage a holistic approach to developing local services (the composite index), though individual domains can be used to look at specific issues such as health or education.*

- *To be used by local communities to address local priorities and by local residents to compare their area with similar areas using nationally consistent measures*.

The English index points out that areas themselves are not deprived and that 'it is the circumstances and *lifestyle* (?) of the people living there that affects its deprivation score'; although the presence of a concentration of people experiencing deprivation in an area may

give rise to a compounding deprivation effect, this is still measured by reference to those individuals.

The English Indices of Deprivation 2010 combines 38 separate indicators into seven distinct domains of deprivation which can be combined (using weights reflecting each domains perceived contribution to overall deprivation) to calculate the Index of Multiple Deprivation 2010 (EIMD2010). The EID2010 introduced Lower Super Output Areas as the new spatial geography. These are 32,482 homogenous small areas of relatively even size (around 1,500 people) and are considered to be an improvement on the previous ward geography used in the EID2000, which were larger and subject to frequent change. Although the documentation notes that 98 per cent of the most deprived LSOAs are in urban areas there are no specific recommendations related to rural deprivation. Cut-off of 10% are often taken to represent deprived areas but the accompanying advice suggested that cut offs other than the 10% most deprived may also be appropriate depending on the use being made of the summary.

Some examples of how previous versions of the Indices have been used by central Government include as a criteria for allocating resources efficiently for programmes such as regeneration, neighbourhood renewal, identify disadvantaged pupils for additional support or allocate grants to community groups. Key users of the Indices are local authorities where the Indices are used to identify the local areas with the greatest level of need for support or intervention. Examples include analysing community safety data to evaluate neighbourhood policing and partnerships, using the Indices as local measures of community cohesion, investigating patterns of 'risk of youth offending', identifying the greatest health inequalities between the most and least deprived populations or for context in community safety strategic assessments.

The Welsh Index of Multiple Deprivation (WIMD) [3] is very similar to the English indicator above, with the exception of the additional physical environment domain (that includes air quality and flood risk). Its stated aim is [to function as] *a tool to identify and understand deprivation in Wales, so that funding, policy and programmes can be effectively focussed on the most disadvantaged communities*. *This is important when developing area-based policies, programmes and funding*.

The latest (2011) version has scores and ranks calculated for each of the 1896 lower layer super output areas (LSOAs – with an average population of 1,500) in Wales. Again, the Welsh documentation does not specify a recommended cut-off though 10% is frequently mentioned, instead it suggests that ... ' *the index is most useful if it is used in conjunction with other information, either from the index indicators, other published data or local information. This will increase the understanding of the challenges in the local areas*'. Although it is acknowledged that urban rural authorities tend to be more deprived than those which are largely rural the Welsh documentation gives no specific recognition is given of the difficulties in identifying rural deprivation other than to enhance the indicators with reference to the DEFRA rural urban classification.

The stated function of the Scottish Index of Multiple Deprivation (SIMD) [4] is to ... '*identify small area concentrations of multiple deprivation across all of Scotland in a consistent way.*

It allows effective targeting of policies and funding where the aim is to wholly or partly tackle or take account of area concentrations of multiple deprivation'. There have been three version of the SIMD (2004, 2006 and 2009), each constructed in a manner similar to those in the other Home Countries. The latest version the SIMD2009 is available for 6,505 data zones, which have a median population size of 769.

Unlike the other parts of the UK, the focus in Scotland is usually on the 975 (15%) most deprived datazones, though the recommendation is that funders also consider alternative approaches (such as looking at the individual domains) and consider alternative cut-offs that best suit their purpose. It also offers clear guidance on using the indicator that best suits the needs of the user ... '*If the focus is on areas with high levels of multiple deprivation, then the SIMD can be used. If however, the focus is on all deprived people, then a different approach needs to be taken. In this case, it may be possible to use the underlying data from one of the domains rather than the overall index* as *not all deprived people live in deprived areas even when looking at individual domains*.'

Scotland has perhaps gone further in specifically acknowledging the difficulties of identifying deprivation in rural communities (for example noting that neither Orkney nor Shetland Islands have any datazones in the 30% of the most datazones in the country) , though it has robustly defended the ability SIMD to identify and target rural as well as urban areas ... ' *In fact the SIMD does what it was designed to do and the indicators which make up the SIMD have been chosen because they are measures of deprivation regardless of the geographic area where a person lives... and identifies small area concentrations of multiple deprivation irrespective of whether they are found in urban or rural areas'*... It has produced a document designed to help users identify the most income, employment and access deprived rural datazones in their area [5], though responses to the consultation on the planned 2011 revision have asked for further/updated analysis of deprivation in rural areas and analysis of mixed urban/rural areas.

The 2010 Northern Ireland Index of Multiple Deprivation (NIMDM [5]) is the latest in a long series of measures that have been used to define and identify spatial deprivation here. The current measure is the third incarnation of work that was initially carried out by the Social Disadvantage Research Centre at the University of Oxford in 2001 and repeated in 2005.

The purpose of a spatial indicator of deprivation is to produce spatial measures of deprivation that can be used '*to inform policy and target areas of need in Northern Ireland*'. Current uses of deprivation measures include the Neighbourhood Renewal Strategy and in the Acute Hospitals Resource Allocation Formula. (Note: although the NIMDM, and its sister indicators in the other home countries, has been used to allocate many different types of central government funds, resource allocation for health and social services in the UK generally uses an entirely different approach. The 'York' methodology [7] recognises that need for services is primarily dependent on the number of people in that area, the age and sex composition, but that there is also some additional variation due to relative healthiness of the population and perhaps also the cost of the provision of these services (as either an additional rural weighting or (in England) to compensate for the higher salaries in London). Healthiness is derived from econometric models using a wide array of health and socio-

economic factors. Different models have been derived for different types of service. The portion of funds areas receive for these services is determined by these models).

The derivation of the NIMDM by a team within NISRA involves the aggregation of 52 indicators into seven domains of deprivation in a similar manner to that of the other Home Countries. Super Output Areas (SOAs) are the main geography for the NIMDM2010, which, being more even in population size (average 2,000 persons), are preferable to electoral wards (population range c700-9,500) that were used previously. One of the innovations of the 2010 version was the production of scores and ranks at Census Output Area (COA – average population c300).

The issue of identifying deprived areas in rural areas has been clearly acknowledged in the Northern Ireland documentation; a problem that is only partially addressed by using the more homogenous SOAs ... '*It is notable that at rank 97 the most deprived rural SOA is outside the most deprived decile when all SOAs in Northern Ireland are considered*.' Users are warned that SOAs are more homogenous in urban than in rural areas with the result that '*small area concentrations of deprivation are more readily identified in urban areas than rural areas*', which is important when comparing deprivation measures in urban and rural areas. Users are also advised to consider scores and ranks at COA level which may be more appropriate when assessing deprivation in rural areas.

The approaches in the Republic of Ireland differ substantially from those in the UK, though they are again divided approximately into those indicators used in the health-related fields and those used for other government agencies/departments. The Small Area Health Research Unit (SAHRU) index [8], as with the Townsend and Carstairs Indices [9, 10] uses census variables, but applies principal component analysis to produce 'appropriate' weights for these variables. Another formal attempt to derive a formula for allocating funds for health services used synthetic estimation from survey data to model need at small areas [11], though, to my knowledge, this has not yet used to allocate funds.

On the other hand, many of the non-health related agencies use the Pobal-Haase Deprivation Index [12]. The aims of this index are:

(i) to provide a reliable tool for targeting funds at the objectively most disadvantaged areas, and
(ii) to assist in creating the political consensus necessary to allow funding to be distributed in this way.

The most recent model builds upon the earlier development work in the Haase Index of Relative affluence and Deprivation [13]. The overall approach has been lead by theory of what constitutes deprivation and to some of the structural factors contributing to disadvantaged status rather than being 'driven by data availability' as with other deprivation indices, and although this aim is common to most other indicators the end result is quite different. It recognises three underlying dimensions of relative affluence and deprivation; demographic profile, social class and labour market situation though these are rather wide descriptors as the demography profile includes two educational attainment indicators (as does the social class, which also includes household density) and the labour market situation includes a

single parenthood related indicator. The population change variable (depopulation) is of particular interest as it is used as a proxy indicator of economic decline in rural areas. The authors make the case that the use of indicators such as unemployment are inappropriate in rural areas as population outmigration of unemployed people is the most common response to a weak rural labour market.

Scores are estimated for each dimension and then combined using structural equation modelling to form a measure of overall affluence and deprivation. Absolute and relative index scores can be calculated at different levels of geography; positive scores represent affluence, negative scores deprivation. The absolute index score has a mean of zero and a standard deviation of 10 in 1991, with a varying mean and standard deviation in later censuses that reflects the underlying trends in subsequent years. Maps are extensively used to display these findings with eight standard deviate-based cut-offs points that the authors argue, better represents the underlying distribution of affluence and deprivation. The relative index scores for each year are identical to the 'detrended' absolute scores.

The team have used the same model structure and measurement techniques for the 1991, 1996, 2002 and the 2006 waves of census data, which allows comparisons of areas over time. This the authors suggest is a particular strength of the Pobal-Haase Deprivation index, enabling it to monitor and quantify the level of observed disadvantage within specific areas and across the country as a whole.

The most recent version of the index also incorporates the newer census-based Small Area Population Statistics which had been produced at Small Area level. These SAs have a mean of 92 households (range 65 - ~900) and are thought to be more homogenous in size and composition than Electoral Districts (electoral ward equivalents in the UK) that were the smallest geographical units previously available, and are considered to be better able to identify localised pockets of deprivation. Some of these smaller areas had to be combined or aggregated to maintain the levels of confidentiality defined by the CSO, though surprisingly aggregated small areas were not necessarily contiguous.

Interestingly, in an earlier report, [13] the authors state that although the deprivation indices are presented at finer levels of spatial units (such as electoral districts) they are '*intended primarily for use at higher levels of spatial aggregation. They are not intended to 'count the number of poor people in a given area' but to identify underlying structural strengths and weaknesses*.' They suggest areas with at least 20,000 residents are needed to formulate the appropriate policy responses and this was approximately the threshold for the designation of Partnership Areas under Local Development Partnerships. The use of the smaller geographic units however, should help the development agencies target their resources at the most disadvantaged locations within their respective target areas. However, echoing some of the UK reports the authors of the Pobal-Haase Deprivation Index stress that '*local knowledge should be used as a complement when interpreting scores at lower levels of spatial definition*'.

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