

SCOTTISH INDEX OF MULTIPLE DEPRIVATION 2004

TECHNICAL REPORT

Office of the Chief Statistician
Scottish Executive

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Aim

The Scottish Index of Multiple Deprivation (SIMD) 2004 was published on 14th June 2004 through a summary technical report¹. In addition, the Scottish Executive published the underlying data² and presented the results via an interactive website³. The aim of this report is therefore not to comment further on the results but to complement these publications by providing the reader with more detailed information on the construction of the underlying indicators and the technical methodology used to develop the SIMD 2004.

The SIMD 2004 was produced in-house by the Office of the Chief Statistician and was based on the methodology used by the Social Disadvantage Research Centre (SDRC) at Oxford University to create the Scottish Indices of Deprivation (SID) 2003⁴. This report therefore concentrates on describing the processes involved, from data collection to the construction of the overall SIMD scores with references to the SDRC work and other literature where necessary. Due to the nature of this report, there will be some duplication with previous SDRC reports⁵ on the subject. In addition this report concerns the construction of the SIMD 2004 and is not intended to focus on progress against the recommendations of the Executive's long-term strategy for measuring deprivation⁶.

The report begins with a section on the background to the Index, dealing with its conceptualisation and a broad overview of the domains involved. It moves on to a discussion of the geographic unit and then provides a chapter of detailed information on each domain and indicator and the techniques used to construct them. The final chapter describes how these domains are combined to produce the overall SIMD 2004. This information supports the Summary Technical Report by describing the construction of the SIMD 2004 in greater depth.

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¹ www.scotland.gov.uk/SIMD2004Report

² www.scotland.gov.uk/SIMD2004Data

³ www.scotland.gov.uk/SIMD2004Mapping

⁴ *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive. Details can be found at www.scotland.gov.uk/library5/social/siod-00.asp

⁵ As well as producing the SID 2003, Oxford University have produced *The Indices of Deprivation 2000*, the *Welsh Index of Multiple Deprivation 2000* and the *Northern Ireland Multiple Deprivation Measure*. These are referenced at the end of this report.

⁶ More details can be found at www.scotland.gov.uk/about/ASD/CSU/00017814/pubdata.aspx

Chapter 1 : Background

In August 2003 the Scottish Executive published a report from the Scottish Centre for Research on Social Justice (SCRSJ) called '*Measuring Deprivation in Scotland : Developing a Long-Term Strategy*'⁷. The team behind this report had been commissioned by the Executive to:

- provide a clear definition and conceptual basis for measuring deprivation. This should clarify how the terms relate to others used to refer to social need such as poverty, social exclusion or social injustice.
- set out the long-term strategy for measuring area deprivation building on the Scottish Indices of Deprivation (SID) 2003.
- explore approaches to measuring deprivation for individuals. In particular, to recommend whether individual measures should be developed as replacements to area-based measures or as additional to them.

The final report was based on a wide ranging consultation process. Through a steering group, consultation on the interim report and public meetings, the views of central and local government, community groups, academics and the wider general public were sought. The report set out a range of recommendations for the short, medium and long term measurement of deprivation. The Executive welcomed the report as a sound basis for developing its strategy for measuring deprivation in Scotland and accepted all of its recommendations.

The Scottish Index of Multiple Deprivation (SIMD) 2004, is the first output from this long-term strategy and implements the recommendation to produce an area-based measure building on the SID 2003. The starting point for the construction of the SIMD 2004 was therefore the definition of deprivation set out by Townsend:

*"Deprivation takes many different forms in every known society. People can be said to be deprived if they lack the types of diet, clothing, housing, household facilities and fuel, and environmental, educational, working and social conditions, activities and facilities that are customary, or at least widely encouraged and approved, in the societies to which they belong."*⁸

This definition highlights the fact that individuals can be deprived in different ways and that the level of this deprivation is generally assessed in comparison to accepted social standards. On this premise the SIMD 2004 is multi-dimensional and relative. It is therefore conceptualised as a combination of different domains of deprivation, each of which contain relevant and high quality indicators. These domains form individual relative indices for their particular dimension of deprivation. They are combined into an overall index of multiple deprivation using explicit weights, which reflect the academic literature on multiple deprivation and the robustness of the domains.

⁷ *Measuring Deprivation in Scotland: Developing a Long-Term Strategy*, Scottish Centre for Research on Social Justice, Universities of Glasgow and Aberdeen, Edinburgh: Scottish Executive. More details can be found at <http://www.scotland.gov.uk/about/ASD/CSU/00017814/pubdata.aspx>

⁸ P126, Townsend, P. (1987) Deprivation, *Journal of Social Policy*, 16 (1), pp. 125-146.

This is the same basic methodology used in SID 2003. However, the SIMD 2004 also incorporates recommendations made by the SCRSJ and is therefore based on both a strong methodology and is in line with the views of users. It is important to note that the SID 2003 made use of the best available geography and datasets. However, since its publication, there have been advances in both of these areas, particularly through the Scottish Neighbourhood Statistics⁹ project. This has allowed the SIMD 2004 to take significant steps forward in both the updating of data, and the geographic unit of analysis. It is based on the recently introduced small area statistical geography called data zones¹⁰ which will enable users to compare deprivation at a small area level across Scotland.

The six individual domains which combine to produce SIMD 2004 and their reasons for inclusion are:

Current Income domain – indirect measure of a major part of the main cause of deprivation.

Employment domain – direct measure of exclusion from the world of work.

Housing domain – direct measure of material living standards.

Health domain – indirect measure of both causes and consequences of deprivation.

Education, Skills and Training domain - indirect measure of both causes and consequences of deprivation.

Geographic Access and Telecommunications domain – direct measure of area characteristics that impact on individuals.

The SIMD 2004 is a weighted combination of these domains. Across the 6 domains, there are 31 indicators which are used to describe various aspects of deprivation. Taken in total they provide a comprehensive picture of deprivation within each data zone across Scotland. As part of its long-term strategy commitments the Executive is working to ensure that data will be available to update these indicators in late 2006 and on a three year basis thereafter.

Although the underlying methodology is based on the SID 2003, the SIMD 2004 has been produced in-house by the Office of the Chief Statistician (OCS) in the Scottish Executive. The main processes carried out by the OCS in the construction of the Index are outlined below:

- data for the individual indicators was sourced from a range of administrative systems and the Scottish Census. It was essential that the indicators made use of the most up to date information and therefore where possible the data represents 2002 or is taken from the 2001 Scottish Census of Population.
- the indicator data was supplied to the OCS at data zone level and data suppliers ensured that the information they were providing was of sufficient quality for use in the Index.
- each of the individual indicators was constructed by the OCS on a domain by domain basis. For example in the Health domain, the data supplier provided four years worth of counts of emergency admissions to hospital. The final indicator was calculated by presenting this as a proportion based on the total population of the data zone and applying shrinkage. The indicators were then combined to create domain scores and the SIMD

⁹ Further details can be found at www.sns.gov.uk

¹⁰ Data zones were released in February 2004 and are aggregations of Census output areas. The median size of a data zone is 750 people.

2004 was constructed as a weighted combination of these domains. These steps are described in greater detail in chapters 3 and 4.

- Chris Dibben at Oxford Social Disadvantage Research Centre provided valuable advice on the more technical matters regarding the construction of the indices. In addition, Professor Gillian Raab at Napier University helped in quality assuring the SAS programmes and interpreting the shrinkage technique and factor analysis.
- the domains and the overall SIMD were quality assured by the relevant Scottish Executive department and the Index of Deprivation Advisory Group. This advisory group was established through Scottish Neighbourhood Statistics to oversee the SID 2003 and the long term strategy research. It included representatives from the Scottish Executive, local authorities and the health service. Although the group had successfully fulfilled its remit with the publication of the long-term strategy, it agreed to provide this valuable quality assurance of the SIMD 2004 while successor arrangements were considered.
- the final SIMD 2004 was published on 14th June 2004.

The quality assurance carried out at each stage ensured that the construction of the Index was carried out to the highest possible standards. The resulting SIMD 2004 identifies the most deprived areas across Scotland on a consistent basis.

Chapter 2 : Geography

The SIMD 2004 is a measure of relative deprivation at small area (data zone)¹¹ level. In previous indices there has been a compromise between size of geography and how up to date the data is. Typically the Census has been the source of small area data. However, the Census is only updated every ten years and where more recent measures have been produced in non-Census years this has necessarily compromised the geographic unit. Whilst measures based on the 1991 Census were available at Output Area or Enumeration District¹², those produced using non-Census data in 1998 and the 2003 SID were only available at postcode sector and wards respectively¹³.

The new data zone geography became available in early 2004 meaning that it was not possible for the SID 2003 to be presented at this level. Therefore the use of data zones in the SIMD 2004 has been a significant advance, bringing together a small area geographic unit and increasing amounts of non-Census data.

The Executive developed this small area geography over the last couple of years, including a wide consultation with users. The main reasons for developing this new geography were

- to enable users of Scottish Neighbourhood Statistics to access statistics across a number of policy areas to be readily (and regularly) available on a consistent geography,
- to allow the SIMD 2004 to have a consistent and comprehensive small area geography that would enable small pockets of deprivation to be identified, and
- to provide a common geography to allow aggregated data to be shared and disseminated across the public sector.

The publication of the data zones is a significant milestone in the Scottish Executive and other users' ability to monitor and develop policy at a small area level. Through Scottish Neighbourhood Statistics and the SIMD 2004, data zones will increasingly be the core geography for making available small area statistics across most policy areas including information about benefits, education, health and the labour market. This will allow users to readily bring together information from various sources on a common geography. The SIMD 2004 is a prime example of this functionality.

The data zone geography covers the whole of Scotland and nests within local authority boundaries. Data zones are groups of Census output areas which have populations of between 500 and 1,000 household residents, and some effort has been made to respect physical boundaries. Each data zone is likely to exhibit substantially more homogeneity across the constituent population and households in respect of their socio-economic characteristics than larger geographies such as postcode sectors or wards. This means that the level of deprivation in a data zone is likely to be more similar across the board than in those larger

¹¹ More information on data zones can be found at:

www.scotland.gov.uk/about/ASD/CSU/00017814/pubdata.aspx

¹² On average, Census output areas have a population of approximately 120 and enumeration districts have a population of approximately 320.

¹³ The average ward population is approximately 4,100 though this ranges from just over 650 to around 10,000. Similarly postcode sectors range in population from around 100 to over 35,000 with an average of approximately 5,500.

geographies which may contain groups with varying degrees of deprivation. Since the SIMD 2004 is intended to identify concentrations of area deprivation, this is a particular benefit.

The use of this small area geography in SIMD 2004 enables users to compare relative deprivation at a small area level across Scotland. It also helps to identify 'pockets' of deprivation that may previously have been missed in analyses based on postcode sectors or wards. It will also allow the greater focusing of area based policy initiatives and service delivery strategies.

Chapter 3 : Domains and Indicators

This chapter describes the processes used to construct the indicators and, from these, the domain scores. The methodology is based on that used by SDRC to create the SID 2003 and the techniques have been well documented in their previous work. As such, there may be some overlap with other SDRC reports.

The SIMD 2004 follows the premise of the SID 2003 that multiple deprivation is made up of separate dimensions of deprivation. These dimensions – or domains – measure specific aspects of deprivation that when brought together provide a comprehensive assessment of the level of relative multiple deprivation of an area. The domains included in the SIMD 2004 are Current Income; Employment; Housing; Health; Education, Skills and Training; and Geographic Access and Telecommunications. These are based on the domains of the SID 2003 and incorporate recommendations from the SCRSJ report on a long term strategy for measuring deprivation in Scotland.

Each of these domains forms an index for its own specific aspect of deprivation. For example, the Health domain can be used individually to identify those areas with significant health deprivation.

The indicators contained in each domain are based on those used in the SID 2003. They are:

- ‘domain specific’ and appropriate for the purpose (as direct as possible measures for that type of deprivation)
- measuring major features of that deprivation (not conditions just experienced by a very small number of people or areas)
- up to date
- capable of being updated on a regular basis
- statistically robust
- available for the whole of Scotland at a small area level in a consistent form.¹⁴

Those new indicators introduced in 2004 also conform to these criteria.

The method of combining the indicator data into domain scores is dependent on the quality of the underlying data.

The Current Income, Employment and Housing domains use data which is sufficiently robust as to require no further statistical input. For this reason their domain score is a straight forward sum of the indicators.

The indicators in the three remaining domains are combined using some or all of the following statistical techniques: shrinkage, standardisation and factor analysis. For example, the indicators in the Health and Education domains are shrunk, transformed to a standard normal distribution based on their ranks and combined using weights generated by maximum likelihood factor analysis. These techniques are discussed in greater detail below.

¹⁴ P9 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

Shrinkage

Shrinkage¹⁵ was applied in the domains of Health and Education. This procedure is used to improve the quality of the small area data in indicators where populations are small. For example, the indicator ‘proportion of low birth weight babies’ in the health domain uses the total number of births in a data zone as its population denominator. This population is very small and may fluctuate significantly from year to year. Shrinkage is applied to the indicator data for each data zone in order to address this volatility, avoiding minor changes in the indicator resulting in significant changes in the assessment of deprivation. This involves ‘borrowing strength’ from a more robust value, in this case the Local Authority mean.

Shrinkage is applied to improve the quality of indicator information for all data zones. This does not imply that the indicator is of poor quality and should not be used in the Index. Indicators are included in the Index only if they are suitably robust. However, where populations are small, reliability can be improved further by applying the shrinkage technique.

The full shrinkage procedure is outlined in the SDRC report on the SID 2003¹⁶. However, in its most basic form it can be thought of as a weighted average of the data zone score and the mean of the data zone scores in the same local authority. Thus the shrinkage procedure moves data zone scores towards their local authority mean score. The degree of movement depends on the size of the weight.

The weight is constructed from the standard error of the data zone and the variance among all the data zones in the local authority. It is such that within each local authority, the larger the standard error of the data zone the smaller the weight which the data zone score is assigned. Consequently, the larger the standard error the more weight is given to the local authority mean and the greater the effect of the shrinkage.

However, two data zones with the same standard error but located in different local authorities may not move the same distance towards their local authority mean. This is because the weights are also dependent on the variance within the data zones in the local authority. Where this variance is small, i.e. the local authority is homogeneous and its data zones have similar scores, a data zone with a large standard error will move further towards the local authority mean than a data zone in a (heterogeneous) local authority with a large inter-data zone variance. This is because great variation within a local authority suggests that the local authority mean may not be a good estimate of the data zone score and therefore the local authority mean is given less weight. Thus shrinkage has greatest effect in data zones with small population denominators and large standard errors in homogeneous local authorities.

Shrinkage can have the effect of increasing or decreasing a data zone’s deprivation score depending on its original relationship to the local authority mean. However, in all local authorities, where the standard error of a data zone is small and the score is not considered unreliable, the majority of the weight is given to the original data zone score and the effect of the shrinkage is negligible.

¹⁵ P10 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

¹⁶ P51 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

The decision to apply shrinkage was taken on a domain by domain basis after consideration of the size of the data zone standard errors for each indicator. Large standard errors indicated that shrinkage was necessary. For consistency, if shrinkage was required in one indicator, it was applied to all the indicators in that domain. This is reasonable since the procedure has minimal effect where standard errors in a data zone are small.

In SIMD 2004 indicators are shrunk, where necessary, to the local authority mean. Shrinkage could feasibly be applied using other candidates such as the mean of data zones with similar characteristics. However, this leads to the issue of how these data zones should be defined. For this reason, the local authority mean is felt to be the most reliable procedure. As part of its commitment to ensuring the best techniques are deployed, the Scottish Executive has agreed to commission further research on the shrinkage technique.

Standardisation and Factor Analysis¹⁷

In the domains of Health; Education, Skills and Training; and Geographic Access and Telecommunications each indicator is transformed to a standard normal distribution based on their ranks before factor analysis is applied. The weights generated by the factor analysis are then used to combine the indicators to form a domain score.

The standardisation process is necessary because the indicators in these domains may be measured in different ways and on different scales. For example, it would not be appropriate to simply add an average SQA score to the percentage of pupils who have not successfully applied to higher education because these are on different metrics and the larger SQA score would drive the deprivation analysis (the maximum average SQA score is over 280 whilst, as a percentage, the indicator on higher education can only range between 0 and 100). Converting the ranks to a standard normal distribution ensures that the indicators have identical distributions with the same range and maximum and minimum values. Thus they can be combined without giving any particular indicator undue advantage. The transformation of the ranks also 'prevents outliers, possibly resulting from measurement error, having a disproportionate effect on the overall data zone scores'¹⁸.

Having standardised the indicators, the next step is to combine them into a domain score. However, several issues mean that simply summing the indicators to form a domain score is not appropriate. The indicators may have different levels of accuracy, affect different people at different times and may overlap. A method of combining the indicators which takes these factors into account is required.

SIMD 2004 follows the basic methodological structure of SID 2003 and therefore the technique used to combine the indicators and deal with these issues was maximum likelihood factor analysis. The premise behind this approach is that the deprivation within a domain such as Health is imperfectly measured by each of the individual indicators. However, the indicators which are most highly correlated with the underlying factor will also be highly correlated with the other variables¹⁷. Weights for the indicators are generated by studying the

¹⁷ P53 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

¹⁸ P19 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

correlations between them. A domain score which is representative of the underlying deprivation is produced by applying these weights to the indicators.

In every domain, considerable testing pointed to a robust single factor solution explaining a large proportion of the variance. These tests included the latent root criterion (i.e. that only the first factor has an eigen value greater than 1) and the scree test criterion (i.e. that in a scree plot of the eigen values for all possible factors, only the first factor appears before the change of gradient). If a meaningful second factor had emerged this would have suggested the need for an additional domain.

There are other possible methods for combining these indicators such as selecting the weights. However, it was felt that maximum likelihood factor analysis was the most appropriate. Whilst at the domain level there is academic evidence to determine which dimensions of deprivation are most important to the overall concept of multiple deprivation and which domains are most robust, this is significantly more difficult at the indicator level. There is no evidence to suggest, for example, that the average SQA tariff score should carry more weight than the absence rates in terms of Education deprivation. Therefore, selecting indicator weights would rely on an agreement being reached as to the importance of each individual indicator

The Scottish Executive is working to ensure that the Index continues to use the most appropriate statistical techniques and is therefore in the process of commissioning research to investigate factor analysis further. However, it is satisfied that factor analysis was the most appropriate method of deriving indicator weights in the SIMD 2004.

Current Income Deprivation

Indicators

- Adults in Income Support households (Department for Work and Pensions (DWP) April 2002)
- Children in Income Support households (DWP April 2002)
- Adults in Income Based Job Seekers Allowance households (DWP August 2001)
- Children in Income Based Job Seekers Allowance households (DWP August 2001)
- Adults in Working Families Tax Credit households below a low income threshold (DWP/Inland Revenue (IR) April 2002)
- Children in Working Families Tax Credit households below a low income threshold (DWP/IR April 2002)
- Adults in Disability Tax Credit households below a low income threshold (DWP/IR April 2002)
- Children in Disability Tax Credit households below a low income threshold (DWP/IR April 2002)

Population Denominator

- total population (2001 Scottish Census of Population)

Domain Aim

Low income is a key cause of deprivation and as such, the domain is concerned with measuring the proportion of people on low incomes.

Background

The Scottish Centre for Research on Social Justice recommended that rather than creating a single domain focusing on financial resources, the SE should produce the separate domains of Current Income and Other Financial Resources. In this way the Index can separately focus on current income and on additional factors which determine an individual's level of financial resource. Due to current data limitations it has not been possible to introduce an Other Financial Resources domain in SIMD 2004.

The domain is an update of the income domain in SID 2003¹⁹. As such, it is constructed from means tested social security benefits and tax credits which are comparatively robust and give valuable insights into low income.

Domain Score

The domain contains benefits available to those who are out of work (Income Based Job Seekers Allowance and Income Support) and tax credits which are available to those in employment (Working Families Tax Credit and Disability Tax Credit). The aim of this domain is to focus on individuals in low income and, in SID 2003, research from SDRC and

¹⁹ P11 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

DWP concluded that an income cut off should be applied to the tax credits data to retain this focus. This has been maintained in the SIMD 2004. The cut off used was that determined by SDRC in SID 2003²⁰ i.e. only the population of those benefits units below 60% median income before housing costs were included. The base line income level applied was £159.60 per week. It was appropriate to retain this cut off in 2004 since there is only a year's time difference between the two domains. However the SE will approach the DWP Households Below Average Income Unit to run a new national profile and re-determine the cut off level for future measures of deprivation.

The domain is constructed by summing the indicator counts for each data zone and calculating a percentage based on the data zone's 2001 Census total population. The benefits indicators used in this domain do not overlap and the domain score can therefore be presented as the percentage of the population of a data zone who are income deprived.

Future Development

As part of its long term strategy for measuring deprivation²¹ the SE has agreed to monitor developments in estimating local income distributions as a potential replacement for benefits data in the longer term. In addition, it has agreed to explore benefit take-up rates with the Department for Work and Pensions and the Inland Revenue.

²⁰ P12 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre, Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

²¹ *Measuring Deprivation in Scotland: Developing a Long-Term Strategy*, Scottish Centre for Research on Social Justice, Universities of Glasgow and Aberdeen, Edinburgh: Scottish Executive

Employment Deprivation

Indicators

- Unemployment Claimant Count averaged over 12 months of those men aged under 65 and women aged under 60 (Office for National Statistics (ONS), 2002)
- Incapacity Benefit recipients, men aged under 65 and women aged under 60 (DWP April 2002)
- Severe Disablement Allowance recipients, men aged under 65 and women aged under 60 (DWP April 2002)
- Compulsory New Deal participants – New Deal for the under 25s and New Deal for the 25+ not included in the unemployment claimant count (DWP April 2002).

Population Denominator

- Working age population - men aged under 65 and women aged under 60 (2001 Scottish Census of Population)

Domain Aim

The domain is intended as a measure of ‘enforced exclusion from the world of work’²² and as such concerns the proportion of working age people who want to work but due to unemployment, ill health or disability are excluded from the labour market.

Background

The approach to measuring employment deprivation applied in the SID 2003 has been retained²². Here it was noted that the claimant count is the traditional measure of employment deprivation. However there may be certain groups of people who want to work, are available for work and are actively seeking work but are not included on the unemployment claimant count for a variety of reasons. Examples are people who are on sickness related benefits or have taken early retirement. The employment domain therefore includes benefits relating to ill-health, disability and compulsory New Deal as well as the traditional claimant count.

Domain Score

The employment domain of SIMD 2004 is a straight forward update of the SDRC’s employment domain in SID 2003 with two changes. Firstly, the definition of working age is extended to include those men aged 60-64, and the claimant count is averaged over 12 months to address problems of seasonal fluctuation.

The domain is constructed by summing the indicator counts for each data zone and calculating a percentage based on the data zone’s 2001 Census working age population. The indicators used in this domain are non-overlapping and the domain score can therefore be presented as the percentage of the working age population of a data who are employment deprived.

²² P14 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre, Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

Health Deprivation

Indicators

- a. Comparative Mortality Factor (CMF) (Information and Statistics Division (ISD) of NHS Scotland, 1998-2002)
- b. Hospital episodes related to alcohol use (ISD, 1998-2002)
- c. Hospital episodes related to drug use (ISD, 1998-2002)
- d. Comparative Illness Factor (based on 2001 Census data for General Health and Limiting Long Term Illness)
- e. Emergency admissions to hospital (ISD, 1998-2002)
- f. Proportion of population being prescribed drugs for anxiety or depression or psychosis (ISD, 2002)
- g. Proportion of live singleton births of low birth weight (<2,500g) (ISD 1998-2002)

Denominators

- a. Total population by sex and five year age bands (2001 Scottish Census of Population)
- b. Total population (2001 Scottish Census of Population)
- c. Total population (2001 Scottish Census of Population)
- d. Total (household) population by sex and five year age bands (2001 Scottish Census of Population)
- e. Total population (2001 Scottish Census of Population)
- f. Total population derived from CHI extract (ISD, 2002)
- g. All live singleton births (ISD, 1998-2002)

Aim

The domain is intended to identify areas with higher than expected levels of ill health or mortality given the age / sex profile of the population. There is currently no source available which can directly measure ill-health at the small area level and can be regularly updated. The concept is therefore measured indirectly by indicators which are correlated with or are risk factors for ill-health.

Background

In SID 2003 this domain was called 'Health Deprivation and Disability'. However, it has been renamed 'health' to reflect the focus on mortality and morbidity, rather than disability. The key justification for this domain is that it measures health inequalities associated with low income and deprivation.

SCRSJ concluded that the Health domain of SID 2003 was well developed and for this reason there are only minor changes in the calculation of the indicators between 2003 and 2004.

Indicators

Comparative Mortality Factor (CMF)

The CMF is a measure of mortality and morbidity for the whole population. It is based on the CMF indicator in the health domain of SID 2003²³ which focussed on the under 75 population. This extension of the indicator is on the basis of the SCRSJ long-term strategy recommendations and is intended to give better coverage of the whole population.

The indicator is calculated based on counts of deaths per data zone which were provided by the Information and Statistics Division (ISD) of NHS Scotland. These counts were supplied broken down by sex and by five year age bands for the years April 1998 – March 2002. The counts were summed over the four year period to form the numerator. This was necessary due to the small size of the data zones. By aggregating over this four year period a more reliable rate is produced, allowing for better discrimination between the small areas. The denominator for the rate was four times the total population of the data zone (2001 Census) to match the four years of deaths data. Direct age and sex standardisation was applied to the rates using the SDRC²⁴ methodology to avoid simply reflecting local demographic profiles. Despite using the aggregate of four years data, data zone standard errors can still be high since the populations within the five year age and sex bands are small. Shrinkage was therefore applied to the rates for each five year age group by sex as part of this age and sex standardisation process.

Hospital episodes related to alcohol use

This indicator is intended to focus on alcohol abuse. As in SID 2003, this is measured by extracting from hospital episode statistics, counts of acute and psychiatric hospital discharges that can be specifically linked to alcohol²⁵.

Counts of these discharges linked to data zone were supplied by ISD for the period April 1998 to March 2002. These excluded discharges relating to transfers within hospitals and to other hospitals. The cases covered are noted in appendix A and include, for example, mental and behavioural disorders due to the use of alcohol, intentional self poisoning and exposure to alcohol and alcoholic liver disease. There may be differences in recording of alcohol misuse from hospital to hospital due to variations in coding practice and service provision. However the cases which are recorded by the hospital episode statistics will focus on the seriously ill users and therefore the aim of the indicator will not be affected.

The data zone counts of discharges were summed over the four years to form the numerator. Due to the small size of the geography, this improves the reliability of the rate to discriminate between areas. The rate was calculated based on the total data zone population (2001 Census) multiplied by four to match the four years of admissions data. Shrinkage was then applied to the indicator.

²³ P16 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

²⁴ P55 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

²⁵ P17 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

The final indicator represents the ‘average rate of alcohol related hospital episodes per person in the data zone’.

Hospital episodes related to drug use

This indicator is intended to focus on drug abuse. As noted in SID 2003, ‘drug abuse has a significant physical and psychological impact on individuals. It is an especially significant health hazard for younger people and a major cause of premature death (General Register Office for Scotland, 2001; Jackson, 2002)’²⁶.

Drug abuse can be measured by extracting from hospital episode statistics, counts of acute and psychiatric hospital discharges that can be specifically linked to drugs. These counts were provided by ISD and excluded discharges relating to transfers within hospitals and to other hospitals. The cases covered are listed in Appendix B and include acute intoxication, harmful use and dependence syndrome. Similarly to the alcohol related episodes, there may be differences in recording of drug misuse from hospital to hospital due to variations in coding practice and service provision. However the cases which are recorded by the hospital episode statistics will focus on the seriously ill users and therefore the aim of the indicator will not be affected.

ISD linked the discharges to data zone and provided the data zone level counts for the years April 1998 to March 2002. This data was summed over the four years to form the numerator. A rate was calculated using four times the total population of the data zone (Census 2001) as the denominator to match the four years of numerator data. Shrinkage was then applied.

The final indicator represents the ‘average rate of drug related hospital episodes per person in the data zone’.

Comparative Illness Factor

The CIF is a measure of chronic health conditions and is based on 2001 Census data on limiting long term illness and general health.

In 2003, the CIF was produced from data on claimants of Disability Living Allowance (DLA), Attendance Allowance (AA), Incapacity Benefit (IB) and Severe Disablement Allowance (SDA). However, the SCRSJ long term strategy report recommended that the SE ‘adopt Census data on limiting long-term illness and general health as the basis of the CIF in the short term.’²⁷ The Executive agreed to implement this recommendation and to consider how this might be updated in future years.

The suitability of these indicators for use in the CIF was investigated and consideration was given to the Healthy Life Expectancy Measurement in Scotland Steering Group report ‘Measures of Healthy Life Expectancy for Scotland’²⁸. However, the investigations

²⁶ P17 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

²⁷ P26 of *Measuring Deprivation in Scotland: Developing a Long-Term Strategy*, Scottish Centre for Research on Social Justice, Universities of Glasgow and Aberdeen, Edinburgh: Scottish Executive

²⁸ Clark, D., A. McKeon, M. Sutton, R. Wood (2004) on behalf of the HLE Measurement in Scotland Steering Group, *Healthy Life Expectancy in Scotland*.

concluded that there was evidence in favour of both general health and limiting long term illness.

Two indicators were therefore created. The general health indicator was defined as the 'proportion of the population with poor general health' while the limiting long term illness indicator was the 'proportion of the population with a limiting long term illness'. The numerator and denominator in both cases were taken from the 2001 Census. These indicators were combined using equal weights. The combined indicator was then direct age and sex standardised using the SDRC methodology²⁹ to avoid simply reflecting local demographic profiles. As part of this process, shrinkage was applied to the rate for each five year age and sex band to deal with the small populations involved.

Emergency Admissions to Hospital

In SID 2003, SDRC noted that this indicator captures 'two important aspects of health deprivation: externally caused injuries (e.g. accidents or violence) and poorly responding or untreated conditions which are important aspects of health deprivation. The fact that they are emergency admissions is an indicator of their immediate severity.'³⁰

ISD extracted counts of discharges relating to emergency admissions from hospital episode statistics. Discharges relating to transfers within hospitals and to other hospitals were excluded. These counts were supplied at data zone level for the period April 1998 to March 2002. The data was summed over the four years to form the numerator. A rate was calculated using four times the total population of the data zone (Census 2001) as the denominator to match the four years of numerator data. Shrinkage was then applied.

The final indicator represents the 'average rate of emergency admissions per person in the data zone'.

Proportion of population being prescribed drugs for anxiety, depression or psychosis

Mental ill health is an important aspect of health deprivation to measure. To calculate the indicator, ISD provided estimates of the number of patients being prescribed hypnotic, antipsychotic or antidepressant drugs in 2002. ISD used the methodology outlined by SDRC in SID 2003³¹ to derive this information from prescriptions data at practice level and Community Health Index (CHI) populations. ISD also provided an estimate of data zone level total populations derived from the CHI extract.

The final indicator is calculated by summing the estimated number of patients being prescribed the various drugs and presenting this as a proportion of the data zone population estimated from the CHI extract.

²⁹ P55 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

³⁰ P18 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

³¹ P18 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

Proportion of live singleton births of low birth weight

A singleton birth is defined as being a baby from a pregnancy resulting in only one live or still birth. ISD provided counts of all live singleton births and of those live singleton births of low birth weight (less than 2,500 grammes). The data was supplied at data zone level for the period April 1998 to March 2002. The birth figures excluded home births and births at non-NHS hospitals.

The numerator was the sum of all low birth weight live singleton births over the four year period. A rate was calculated based on the total number of live singleton births in that period. Shrinkage was then applied to the indicator.

Calculating the Domain Score

The ‘Shrinkage’ technique was applied to all indicators in the Health domain with the exception of the Comparative Mortality Factor (CMF) and the Comparative Illness Factor (CIF), where it forms a part of the age and sex standardisation procedure.

The indicators were transformed to a standard normal distribution based on their ranks, before factor analysis was applied. A robust single factor was generated and the indicators were combined using the weights this derived. These are shown in the table below:

CMF	0.09
Alcohol use	0.22
Drug use	0.13
CIF	0.25
Emergency admissions	0.19
Depression, anxiety and psychosis	0.07
Low Birth Weight	0.05

These weights represent a change from those generated in SID 2003. This is due to the advances made in the indicators for SIMD 2004. Not only is the data more up to date but it has been presented on a much smaller area geography. A change of this nature is therefore not unexpected. In factor analysis, the data itself shows the extent to which the indicators are relevant to the underlying deprivation and this objective analysis of the information determines the weights.

Future Developments

As part of its long-term strategy for measuring deprivation the Scottish Executive will continue to improve the information in the Health domain. In future years it aims to explore whether it is necessary to apply direct age and sex standardisation to all the health indicators; monitor the availability of data on smoking rates; and monitor the development of small area data on life expectancy and healthy life expectancy as alternatives to existing mortality and morbidity indicators. It is likely that the age and sex standardisation could be implemented if necessary in 2006. However, a longer timescale may be more realistic for the other changes.

Education, Skills and Training Deprivation

Indicators

- a. Pupil Performance on SQA at Stage 4 (Scottish Qualifications Authority (SQA) 2001-2002)
- b. Pupils aged 16+ who are not in full time education (DWP 2002)
- c. Proportions of the 17+ population who have not successfully applied to Higher Education (University and Colleges Admissions Service (UCAS) 2000-2002)
- d. Working age adults with no qualifications (2001 Scottish Census of Population)
- e. Secondary Level Absences (Scottish Executive (SE) 2001/2002)

Population Denominators

- a. Average pupil performance scores at S4, based on those pupils who sat exams adjusted to account for non-exam pupils. Non exam adjustment based on data from the 2003 pupil level Education Census.
- b. 15-17 year old household population (2001 Scottish Census of Population).
- c. 16-18 year old household population (2001 Scottish Census of Population).
- d. Adults aged 25-64 for men and aged 25-59 for women (2001 Scottish Census of Population).
- e. Total possible number of attendance days.

Aim

The Education, Skills and Training domain focuses on low educational achievement as both an outcome and a cause of poverty and deprivation.

Background

The domain makes use of 5 indicators to directly measure lack of educational qualifications in children and adults, absenteeism and lack of progression to Further or Higher education. It is based on the Education, Skills and Training domain of SID 2003³² with developments in the indicators on the basis of the SCRSJ report on a long term strategy for measuring deprivation in Scotland.

Indicators

Pupil Performance on SQA at Stage 4

The Scottish Executive obtained Scottish Qualifications Authority data on the postcode and points tariff score of each person sitting exams at S4 in Scotland in 2001 or 2002. Aggregating over the two years is intended to reduce the impact of fluctuations from one year to the next. In the future it is intended that the indicator will be an aggregate of three years data. However, this was not possible in SIMD 2004 because the SQA data from 2000 was not of sufficient quality for use in the Index.

³² P20 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

Since the SQA data is very well postcoded, it can be aggregated to data zone level so that for each data zone there is information on i) the total SQA S4 points tariff accrued by pupils in that data zone in 2001 and 2002 and ii) the total number of pupils sitting S4 exams in that data zone in 2001 and 2002. However this does not take into account the pupils who did not sit any exams. On examination of the data it was felt necessary to account for this ‘non-exam’³³ group. This was made possible by the 2003 pupil level Education Census which includes information on the postcodes of school pupils in 2003. By comparing this with the 2003 SQA data it is possible to work out how many pupils in each data zone in 2003 did not sit exams. It is assumed that the proportions are the same for 2001 and 2002. These proportions can then be applied to the numbers of pupils sitting exams in 2001 and 2002 to give a final population denominator which takes into account those ‘non-exam’ pupils. The 2003 proportion has been applied to the 2001 and 2002 data because the 2003 pupil level Census was the first of its kind. However in the future it will be possible to match the pupil level Census information to the year of the SQA data and determine the proportion of non-exam pupils directly.

As noted in the SID 2003, a proportion of pupils from special schools take SQA qualifications. However, these pupils generally have comparatively low scores and the number of such pupils being entered for SQA exams at this stage is often low. Consequently, although exam results for special school pupils are included, special schools are excluded from the non-exam weighting. A similar issue is noted in independent schools. In several of these schools, pupils sit other examinations (e.g. GCSE’s etc) instead of SQA Stage 4. It was therefore necessary to exclude those schools where no or very few of their pupils sat SQA exams and those with high take up rates but low results. Where the exam results for independent schools were included in the analysis, no account was taken of their non-exam pupils. This is the same procedure as applied in the SID 2003.

The final data zone score for this indicator is calculated by dividing the total tariff points score for the data zone, by the weighted number of pupils in the data zone. This results in the average SQA points score for the data zone weighted to take account of the non-exam pupils. Shrinkage was then applied to the indicator scores.

*Pupils aged 16+ who are not in full time education*³⁴

This indicator is based on data from the Child Benefit system. Child Benefit is paid to carers of all children under the age of 16. However, it will continue to be paid to carers of young people aged 16-18 who are still in full time non-advanced education. This means that, in an area, the difference between the number of young people aged 16-18 and the number claiming Child Benefit is an indication of the number of 16-18 year olds who are *not* staying on in full time education.

The indicator was constructed as follows. The percentage of those *staying on* in full time education was calculated. The numerator was the count of 16-18 year olds on child benefit (DWP, 2002) and the denominator was the household population of 15-17 year olds (2001 Census). Since the numerator data is from 2002 and the denominator data from 2001, the 15-17 year old household population was designed to match the 16-18 year old population in the

³³ P22 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

³⁴ P21 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

later year. The final indicator is the negative of the above measure and provides an estimate of the percentage of the 16-18 year old population who are *not* in full time education. Shrinkage was applied to this indicator.

Proportion of the 17+ population who have not successfully applied to Higher Education

The University and Colleges Admissions Service (UCAS) provided individual level data on all those applicants to Higher Education from postcodes in Scotland in the years 2000-2002. This aggregate of three years data was intended to remove the impact of fluctuations from one year to the next. This postcode level information was successfully matched to data zones with only 2% of postcodes each year being incomplete, missing. Pupils applying from institutional postcodes were removed to avoid unduly boosting the index score in areas around residential schools. The dataset was then restricted to the 17-19 year old population to focus on those applying to Higher Education after school. An evaluation of the data concluded that the upper age limit of 19 successfully captured the majority of such entrants and that most individuals who took a gap year would have finished it and entered higher education by that age.

Once aggregated to data zone level, the UCAS data provided for each area the number of successful 17-19 year old applicants to higher education over the three year period. The first stage in calculating the indicator was therefore to calculate the proportion who *successfully* applied to higher education. To do so the number of acceptances was summed over the three year period to form the numerator. The rate is then based on the Census 2001 16-18 year old household population. This provides the proportion being accepted into Higher Education. The final indicator is the negative of this measure, representing the proportion who have **not** applied successfully to Higher Education. Shrinkage was then applied.

Working age adults with no qualifications

In SID 2003, the indicator on working age adults with no qualifications was modelled from Labour Force Survey data. However, the SCRSJ report recommended that the SE 'replace the indicator on qualifications for working age adults by direct figures from the Census'³⁵. The indicator is therefore the percentage of the working age population who have no qualifications. The numerator data is data zone level counts of those aged 25-64 for men and 25-59 for women who recorded in the 2001 Scottish Census of Population that they had no qualifications. The denominator is the Census population of men aged 25-64 and women aged 25-59 for the data zone. The numerator and denominator data were split into five year age bands by sex and rates were calculated. The rate was direct age and sex standardised using the SDRC³⁶ methodology to avoid simply reflecting local demographic profiles. Since numbers in each of the five year age and sex bands are small, shrinkage was applied to the rates for these groups as part of the standardisation process.

Secondary Level Absences

Scottish Executive Education Statistics provided data on absences in S1 to S5 for all publicly funded Scottish secondary schools in the academic year 2001/2002. This did not include

³⁵ P28 of *Measuring Deprivation in Scotland: Developing a Long-Term Strategy*, Scottish Centre for Research on Social Justice, Universities of Glasgow and Aberdeen, Edinburgh: Scottish Executive

³⁶ P55 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre, Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

independent or special schools. For each school, the total number of possible half day attendances and the total number of half day absences accrued by its S1 to S5 pupils were known. The data included both 'authorised' and 'unauthorised' absences and could be expressed as the average number of half day absences per pupil.³⁷

Since this data was presented at school level, the pupil level September 2002 School Census data was used to disaggregate the information to data zone level. This School Census data provided the home postcode of pupils in every publicly funded school in Scotland. It was therefore possible to determine for each school, the number of pupils living in each data zone. The total number of attendances and absences for each school were allocated pro-rata to the data zones in which the pupils lived. The data zone level score was created by aggregating these values and calculating the absences as a percentage of the total possible number of attendances in that data zone. Shrinkage was applied to the indicator.

This pro-rata approach of allocating absences to data zones is not ideal. However, the long-term strategy report recommended that the indicator on absence rates be improved by taking advantage of new pupil level data in this area. The first such collection was in the 2003/2004 school session and was not available in time for the 2004 Index. Pupil level data will be available for use in the 2006 index and will provide greater accuracy for this indicator.

Combining the indicators

Shrinkage was applied to all the indicators in the Education domain with the exception of 'working age adults with no qualifications' where the data was 'shrunk' as part of the direct age and sex standardisation process.

The indicators were transformed to a standard normal distribution based on their ranks and factor analysis was applied. This generated a robust single factor model with no evidence of a meaningful second factor. The normalised indicators were therefore combined using the weights generated by factor analysis:

Pupil Performance on SQA at Stage 4	0.21
Proportion of 17+ population not applying successfully to HE	0.32
Pupils aged 16+ not in full time education	0.08
Working age adults with no qualifications	0.34
Secondary level absences	0.05

In SID 2003, the 'proportion of the 17+ population who have not applied successfully to higher education' and 'pupils aged 16+ who are not in full time education' indicators were combined prior to factor analysis. This was because these indicators had amongst the highest correlations and made use of the same denominator. In 2004, there is less correlation between these variables at data zone level and the indicators use different denominators. For this reason they were not combined in the 2004 domain.

³⁷ The publication 'Attendance & Absence in Scottish Schools, 2001/02' (<http://www.scotland.gov.uk/stats/bulletins/00218-00.asp>) provides further information on the definitions of absence.

As with the health domain, there are significant differences between these weightings and those generated in SID 2003. The improvements in the indicator data, the move to a data zone geography, and the decision not to combine the two indicators noted above are all contributing factors and therefore this change is not unexpected. In factor analysis, the data itself determines how important particular indicators are to the underlying deprivation and the weights are generated on this basis.

Future Development

The Scottish Executive has agreed to consider how indicators which estimate the proportion of adults with poor literacy or numeracy can be included to improve coverage of the working age population. However it is unlikely that this information will be available until after 2006.

Housing Deprivation

Indicators

- Percentage of people living in households which are overcrowded (Census 2001)
- Percentage of people living in households without central heating (Census 2001)

Denominators

- Total household population (2001 Census of population)

Aim

The domain is intended as a direct measure of material living standards. It is currently in the early stages of development but it is intended that in the long term, it should focus on direct measures of inadequacy of housing, covering physical conditions, suitability and security of tenure.

Background

This is a new domain for SIMD 2004 and is included in response to recommendations in the long term strategy paper. SDRC had hoped to include a Housing domain in the SID 2003 but this was eventually ruled out because the indicators they derived from the Scottish House Condition Survey were not sufficiently robust. However, with the availability of 2001 Census data, it was possible to include this Housing domain in the SIMD 2004. Although Census data cannot be updated directly, the SE is committed to sourcing more and better data on Housing conditions for future updates.

Constructing the Domain Score

The data for these indicators was taken from the 2001 Census at Census output area level and aggregated to data zone level. The numerators were therefore the number of people living in overcrowded households and the number of people living in households without central heating, while the denominator was the total household population of the data zone.

The Census defines overcrowding based on its occupancy rating. This compares the actual number of rooms in the house to the number of rooms which are required by the household, based on the relationships between the people living in the household and their ages. The room requirement is calculated on the basis that a one person household is assumed to require three rooms – two common rooms and a bedroom. Where there are two or more residents it is assumed that they require a minimum of two common rooms plus one bedroom for:

- i) each couple;
- ii) each lone parent;
- iii) any other person aged 16 or over;
- iv) each pair aged 10 to 15 of the same sex;
- v) each pair formed from a remaining person aged 10 to 15 with a child aged under 10 of the same sex;
- vi) each pair of children aged under 10 remaining;

vii) each remaining person (either aged 10 to 15 or under 10)³⁸.

Overcrowding is defined to mean households with an occupancy rating of -1 or -2 i.e. that there is either 1 or 2 rooms too few in the household.

Shrinkage was not found to be necessary for this domain and therefore the indicators were simply added together to produce a final score. The premise being that a household with both these attributes is more deprived than a household with one attribute.

Future Development and Other Issues

An indicator concerning the 'Percentage of people living in households without the sole use of a bath/shower and toilet' was considered for inclusion in the domain. However, since only 0.2% of people in Scotland are affected by this type of deprivation, it was excluded.

Based on the long-term strategy recommendations, an indicator on homelessness was investigated. However it was ruled out for several reasons. In order that the homelessness indicator provides an accurate picture at small area level it is necessary to collect full post-code information on the applicant's last known address. The SE currently collects this information through electronic data capture of case based HL1 returns but unfortunately the post-code data is incomplete for around 30 percent of the records. It was considered that the amount of missing data made it problematic to include the homelessness indicator in the SIMD. During 2004, the SE is planning to carry out a comprehensive review of the homelessness recording system including whether to make the post-code field a mandatory data item. Depending on the result of the review the inclusion of homelessness data will be considered for future versions of the Index.

³⁸ <http://www.scrol.gov.uk/scrol/metadata/glossary.htm#OccupancyRating>

Geographic Access and Telecommunications

Indicators

- Drive time to a GP
- Drive time to a Petrol Station
- Drive time to a Post Office
- Drive time to a Primary School
- Drive time to a Supermarket

Sources of Data

- Road network – generalised from Ordnance Survey’s OSCAR Route Manager dataset to a scale of 1:50,000 to provide street level mapping. It includes motorways, trunk roads, A roads, B roads and the majority of minor and unclassified roads, the exceptions are cul-de-sacs less than 200 metres in length, pedestrianised streets, private roads and ferry routes.
- Ferry route data – Ordnance Survey Strategy 2003.
- Service locations: GP, supermarket, petrol station, primary school and post offices – PointX Data 2003.
- Census output area population weighted grid references - General Register Office for Scotland 2001.

Aim and Background

This domain is intended to capture a set of problems which operate at area level and which are seen by many as important in their own right. These are the problems (financial cost, time and inconvenience) of having to travel a relatively long distance to access basic services³⁹.

The domain measures aspects of access deprivation that are relevant to all people since it is important to be able to access key local services in both rural and urban areas. The inclusion of ‘telecommunications’ in the domain title indicates the Executive’s intent to develop the domain further and include measures of the availability of the telecommunications infrastructure in future indices as small area level data becomes available.

Domains and Indicators

In SID 2003 this domain was based on road distances to the following services: GP surgery or health centre; general stores or supermarket; primary school; petrol station; bank or building society; and community internet facilities. The SIMD 2004 moves to measuring drive times on the recommendation of the SCRSJ long-term strategy report. Their recommendation was based on feedback from the consultation process where it was suggested that drive times would provide a better reflection of difficulties in accessing services, particularly where ferry journeys were involved. The move should also show improvements where new services are located closer to residents and where improvements in roads or transport services have reduced travel times. The list of services have also been

³⁹ P32 of *Measuring Deprivation in Scotland: Developing a Long-Term Strategy*, Scottish Centre for Research on Social Justice, Universities of Glasgow and Aberdeen, Edinburgh: Scottish Executive

changed to focus on those which are visited regularly. Post offices have replaced banks and building societies because they are used by the majority of people and are an essential local service. Access to community internet facilities has been dropped because they are used by such a small proportion of the population and many alternative sources of internet access exist.

The drive times to the nearest service were calculated from the population weighted grid reference of each Census output area. Drive time calculations are based on average travel speeds. Each of the road classes (e.g. A roads or B roads) in the road network have an assigned speed, this speed is the average for that class. The average travel speeds on the different classes of roads are based on figures provided by the Department of Environment, Transport and the Regions. There is currently no way of modelling for a reduced or lower than average speed at morning and evening peak periods.

Data zone level indicators were created by averaging the drive times from each Census output area within a data zone to a particular service.

For islands which do not have a particular service, ferry times were incorporated into the drive times. The drive times to the island's harbour were calculated from the population weighted grid reference of each data zone on the island. The ferry times from the harbour to the mainland were taken from ferry route data supplied by Ordnance Survey. Then the drive time from this harbour to the data zone the service is located in was calculated. These figures were added to arrive at the total drive time from a data zone to the nearest service. It was not possible to include ferry waiting times.

The indicators were transformed to a standard normal distribution based on their ranks. Factor analysis was then applied, generating a single factor model with the following weights:

Drive time to a GP	0.26
Drive time to a Petrol Station	0.14
Drive time to a Post Office	0.22
Drive time to a Primary School	0.17
Drive time to a Supermarket	0.21

These weights were applied to the normalised indicator scores to compute the overall Access Domain. The weights in SIMD 2004 cannot be compared with those in SID 2003 since the domain makes use of different indicators.

Chapter 4 : Creating a data zone level overall Scottish Index of Multiple Deprivation

Once the individual domain scores are calculated they are combined into the overall Scottish Index of Multiple Deprivation (SIMD 2004). The methodology⁴⁰ is based on that used by SDRC to create the SID 2003 and as with the domains and indicators, the techniques have been well documented in their previous work. As such, there may be some overlap with other SDRC reports.

The exponential transformation is used to prepare the domains for this combination. Each domain is first standardised by ranking the scores. This is necessary because the domains are measured on different scales and by ranking the domains it is ensured that they have identical distributions with the same range and maximum and minimum values. However, using the ranks alone would result in distributions which were symmetrical and deprivation in one domain could be fully ‘cancelled out’ by lack of deprivation in another. This does not reflect the prior distribution of domain scores and gives undue weight to the least deprived scores. Prior to standardisation the domain scores are such that the most deprived scores are spread out, while the least deprived scores are very similar. Thus simply using the symmetrical ranks is inappropriate given that low scores signify less deprivation and do not imply well-being. A transformation is required to address these issues and, in line with the SDRC methodology in SID 2003, the exponential transformation of the ranks was chosen as the most appropriate method.

The exponential transformation deals with this question of cancellation. It has the advantage that every domain is converted to an identical distribution with the same maximum and minimum values, whilst emphasising the most deprived ‘tail’ of the distribution. The transformation ‘draws out’ the ranks of the most deprived data zones so that spaces are introduced between data zones that reflect the actual distributions. The formula for the calculation is that used by SDRC in SID 2003⁴¹:

$$X = -23 * \log\{1 - R * [1 - \exp(-100/23)]\}$$

where R is the rank (with the least deprived data zone ranked 1) transformed to the range [0,1], log is the natural logarithm and exp the exponential transformation.

The constant -23 gives a 10% cancellation property. To illustrate why this property is desirable, suppose two domains were equally weighted and cancellation was not applied. A data zone which was most deprived on one of the domains and least deprived on the other would be ranked at the 50th percentile. However, it does not seem appropriate to suggest that lack of deprivation in one domain should exactly cancel out an entirely different dimension of deprivation in another. Using the 10% cancellation property, the data zone would be ranked within the 10% most deprived data zones. This was considered to be more appropriate.

Following the exponential transformation, the data zones have scores ranging between 0 (least deprived) and 100 (most deprived) on each domain. In addition, the scores increase

⁴⁰ P34 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

⁴¹ P59 of *Scottish Indices of Deprivation 2003*, Social Disadvantage Research Centre (SDRC), Department of Social Policy and Social Work, University of Oxford, Edinburgh: Scottish Executive

exponentially so that the most deprived data zones have more prominence. The 10% cancellation factor means that the most deprived 10% of data zones are emphasised with scores between 50 and 100 whilst the remaining 90% of data zones have scores between 0 and 50. Thus the exponential transformation successfully deals with the issues of cancellation and symmetry.

The overall SIMD 2004 score is then constructed by combining the exponentially transformed domains using the ratios 6 : 6 : 3 : 3 : 2 : 1 in the following order:

- Current Income
- Employment
- Health
- Education, Skills and Training
- Geographic Access and Telecommunications
- Housing

The weights are those used in the SID 2003, adjusted to allow the inclusion of the new Housing domain. The SDRC chose a theoretical approach to deriving the domain weights over other possibilities such as weights chosen empirically, by consensus, for policy relevance or arbitrarily. They concluded that the Current Income and Employment domains should carry the most weight in the overall Index. This was partly due to the fact that these domains were the most robust and partly since this was in line with the academic literature of multiple deprivation. In the SIMD 2004 these conclusions are still relevant and therefore the weights have remained similar with a slight adjustment to incorporate the Housing domain. The relatively small weight of the Housing domain is a reflection of the current limited amount of relevant data available for inclusion in the domain. As more and better data on poor housing conditions is developed the relative weight is likely to increase.

The larger the SIMD 2004 score the more deprived the data zone. However in order to compare data zones it is important to use the relative order of the ranks. It is not correct for example to say that data zone X is twice as deprived as data zone Y because the SIMD score for X is 50 and that for Y is 25. This is due to the transformation of the data that takes place to enable a domain score to be produced. It is equally not true to say that a data zone of rank 50 is twice as deprived as a data zone with rank 100. However a data zone of rank 75 is more deprived than a data zone of rank 125.

APPENDICES

APPENDIX A : ALCOHOL USE CASE INDICATORS

APPENDIX B : DRUG USE CASE INDICATORS

APPENDIX C : CONTACT POINTS

Appendix A – Hospital episodes related to alcohol use: full list of case indicators

Acute and psychiatric discharges excluding transfers (ICD-10 codes)			
E52X	Niacin deficiency [pellagra]	F100	Mental & behavioural disorders due to use of alcohol: acute intoxication
F101	Mental & behavioural disorders due to use of alcohol: harmful use	F102	Mental & behavioural disorders due to use of alcohol: dependence syndrome
F103	Mental & behavioural disorders due to use of alcohol: withdrawal state	F104	Mental & behavioural disorders due to use of alcohol: withdrawal state with delirium
F105	Mental & behavioural disorders due to use of alcohol: psychotic disorder	F106	Mental & behavioural disorders due to use of alcohol: amnesic syndrome
F107	Mental & behavioural disorders due to use of alcohol: residual & late-onset psychotic disorder	F108	Mental & behavioural disorders due to use of alcohol: other mental & behavioural disorders
F109	Mental & behavioural disorders due to use of alcohol: unspecified mental & behavioural disorders	G312	Degeneration of nervous system due to alcohol
G621	Alcoholic polyneuropathy	G721	Alcoholic myopathy
I426	Alcoholic cardiomyopathy	K292	Alcoholic gastritis
K700	Alcoholic fatty liver	K701	Alcoholic hepatitis
K702	Alcoholic fibrosis and sclerosis of liver	K703	Alcoholic cirrhosis of liver
K704	Alcoholic hepatic failure	K709	Alcoholic liver disease, unspecified
K860	Alcohol-induced chronic pancreatitis	O354	Maternal care for (suspected) damage to fetus from alcohol
P043	Fetus and newborn affected by maternal use of alcohol	Q860	Fetal alcohol syndrome (dysmorphic)
R780	Finding of alcohol in blood	T506	Poisoning by antidotes and chelating agents, not elsewhere classified
T510	Toxic effect of ethanol	T519	Toxic effect of alcohol, unspecified
X450	Accidental poisoning by & exposure to alcohol, occurrence at home	X452	Accidental poisoning by & exposure to alcohol, occurrence at school other institution/pub admin area
X454	Accidental poisoning by & exposure to alcohol, occurrence on street/highway	X455	Accidental poisoning by & exposure to alcohol, occurrence at trade/service area
X458	Accidental poisoning by & exposure to alcohol, occurrence at other specified place	X459	Accidental poisoning by & exposure to alcohol, occurrence at unspecified place
X650	Intentional self poisoning by &	X651	Intentional self poisoning by &

	exposure to alcohol, occurrence at home		exposure to alcohol, occurrence in residential institution
X652	Intentional self poisoning by & exposure to alcohol, occurrence at school other institution/pub admin area	X654	Intentional self poisoning by & exposure to alcohol, occurrence on street/highway
X655	Intentional self poisoning by & exposure to alcohol, occurrence at trade/service area	X658	Intentional self poisoning by & exposure to alcohol, occurrence at other specified place
X659	Intentional self poisoning by & exposure to alcohol, occurrence at unspecified place	Y150	Poisoning by and exposure to alcohol: occurrence at home
Y159	Poisoning by and exposure to alcohol: occurrence at unspecified place	Y573	Alcohol deterrents
Y901	Blood alcohol level of 20-39 mg/100 ml	Y902	Blood alcohol level of 40-59 mg/100 ml
Y903	Blood alcohol level of 60-79 mg/100 ml	Y904	Blood alcohol level of 80-99 mg/100 ml
Y905	Blood alcohol level of 100-119 mg/100 ml	Y906	Blood alcohol level of 120-199 mg/100 ml
Y907	Blood alcohol level of 200-239 mg/100 ml	Y908	Blood alcohol level of 240 mg/100 ml or more
Y909	Presence of alcohol in blood, level not specified	Y910	Mild alcohol intoxication
Y911	Moderate alcohol intoxication	Y912	Severe alcohol intoxication
Y913	Very severe alcohol intoxication	Y919	Alcohol involvement, not otherwise specified
Z133	Special screening exam for mental and behavioural disorders	Z502	Alcohol rehabilitation
Z637	Other stressful life events affecting family and household	Z714	Alcohol abuse counselling and surveillance
Z721	Alcohol use	Z811	Family history of alcohol abuse
Z864	Personal history of psychoactive substance abuse		

Appendix B – Hospital episodes related to drug use: full list of case indicators

Acute and psychiatric discharges excluding transfers (ICD-10 codes)			
F110	Mental & behavioural disorders due to use of opioids; acute intoxication	F155	Mental & behavioural disorders due to other stimulants including caffeine: psychotic disorders
F111	Mental & behavioural disorders due to use of opioids; harmful use	F156	Mental & behavioural disorders due to other stimulants including caffeine: amnesic syndrome
F112	Mental & behavioural disorders due to use of opioids; dependence syndrome	F157	Mental & behavioural disorders due to other stimulants including caffeine : residual & late-onset psychotic disorder
F113	Mental & behavioural disorders due to use of opioids; withdrawal state	F158	Mental & behavioural disorders due to other stimulants including caffeine : other mental & behavioural disorders
F114	Mental & behavioural disorders due to use of opioids; withdrawal state with delirium	F159	Mental & behavioural disorders due to other stimulants including caffeine: unspecified mental & behavioural disorders
F115	Mental & behavioural disorders due to use of opioids; psychotic disorder	F160	Mental & behavioural disorders due to use of hallucinogens: acute intoxication
F116	Mental & behavioural disorders due to use of opioids; amnesic syndrome	F161	Mental & behavioural disorders due to use of hallucinogens: harmful use
F117	Mental & behavioural disorders due to use of opioids; residual & late-onset psychotic disorder	F162	Mental & behavioural disorders due to use of hallucinogens: dependence syndrome
F118	Mental & behavioural disorders due to use of opioids; other mental & behavioural disorders	F163	Mental & behavioural disorders due to use of hallucinogens: withdrawal state
F119	Mental & behavioural disorders due to use of opioids; unspecified mental & behavioural disorders	F164	Mental & behavioural disorders due to use of hallucinogens: withdraw stat + delir
F120	Mental & behavioural disorders due to use of cannabinoids; acute intoxication	F165	Mental & behavioural disorders due to use of hallucinogens: psychotic disorder
F121	Mental & behavioural disorders due to use of cannabinoids; harmful use	F166	Mental & behavioural disorders due to use of hallucinogens: amnesic syndrome
F122	Mental & behavioural disorders due to use of cannabinoids; dependence syndrome	F167	Mental & behavioural disorders due to use of hallucinogens: residual & late-onset psychotic disorder
F123	Mental & behavioural disorders due to use of cannabinoids; withdrawal state	F168	Mental & behavioural disorders due to use of hallucinogens: other mental & behavioural disorders
F124	Mental & behavioural disorders due	F169	Mental & behavioural disorders due

	to use of cannabinoids; withdrawal state with delirium		to use of hallucinogens: unspecified mental & behavioural disorders
F125	Mental & behavioural disorders due to use of cannabinoids; psychotic disorder	F170	Mental & behavioural disorders due to use of tobacco: acute intoxication
F126	Mental & behavioural disorders due to use of cannabinoids; amnesic syndrome	F171	Mental & behavioural disorders due to use of tobacco: harmful use
F127	Mental & behavioural disorders due to use of cannabinoids; residual & late-onset psychotic disorder	F172	Mental & behavioural disorders due to use of tobacco: dependence syndrome
F128	Mental & behavioural disorders due to use of cannabinoids; other mental and behavioural disorders	F173	Mental & behavioural disorders due to use of tobacco: withdrawal state
F129	Mental & behavioural disorders due to use of cannabinoids; unspecified mental & behavioural disorders	F174	Mental & behavioural disorders due to use of tobacco: withdrawal state + delirium
F130	Mental & behavioural disorders due to use of sedatives/hypnotics: acute intoxication	F175	Mental & behavioural disorders due to use of tobacco: psychotic disorder
F131	Mental & behavioural disorders due to use of sedatives/hypnotics: harmful use	F176	Mental & behavioural disorders due to use of tobacco: amnesic syndrome
F132	Mental & behavioural disorders due to use of sedatives/hypnotics: dependence syndrome	F177	Mental & behavioural disorders due to use of tobacco: residual & late-onset psychotic disorders
F133	Mental & behavioural disorders due to use of sedatives/hypnotics: withdrawal state	F178	Mental & behavioural disorders due to use of tobacco: other mental & behavioural disorders
F134	Mental & behavioural disorders due to use of sedatives/hypnotics: withdrawal state with delirium	F179	Mental & behavioural disorders due to use of tobacco: unspecified mental & behavioural disorders
F135	Mental & behavioural disorders due to use of sedatives/hypnotics: psychotic disorder	F180	Mental & behavioural disorders due to use of volatil solvents: acute intoxication
F136	Mental & behavioural disorders due to use of sedatives/hypnotics: amnesic syndrome	F181	Mental & behavioural disorders due to use of volatil solvents: harmful use
F137	Mental & behavioural disorders due to use of sedatives/hypnotics: residual & late-onset psychotic disorder	F182	Mental & behavioural disorders due to use of volatil solvents: dependence syndrome
F138	Mental & behavioural disorders due to use of sedatives/hypnotics: other mental & behavioural disorders	F183	Mental & behavioural disorders due to use of volatil solvents: withdrawal state
F139	Mental & behavioural disorders due to use of sedatives/hypnotics: unspecified mental & behavioural	F184	Mental & behavioural disorders due to use of volatil solvents: withdrawal state with delirium

	disorders		
F140	Mental & behavioural disorders due to use of cocaine: acute intoxication	F185	Mental & behavioural disorders due to use of volatile solvents: psychotic disorder
F141	Mental & behavioural disorders due to use of cocaine: harmful use	F186	Mental & behavioural disorders due to use of volatile solvents: amnesic syndrome
F142	Mental & behavioural disorders due to use of cocaine: dependence syndrome	F187	Mental & behavioural disorders due to use of volatile solvents: residual & late-onset psychotic disorder
F143	Mental & behavioural disorders due to use of cocaine: withdrawal state	F188	Mental & behavioural disorders due to use of volatile solvents: other mental & behavioural disorders
F144	Mental & behavioural disorders due to use of cocaine: withdrawal state with delirium	F189	Mental & behavioural disorders due to use of volatile solvents: unspecified mental & behavioural disorders
F145	Mental & behavioural disorders due to use of cocaine: psychotic disorder	F190	Mental & behavioural disorders due to multiple/psychoactive drug: acute intoxication
F146	Mental & behavioural disorders due to use of cocaine: amnesic syndrome	F191	Mental & behavioural disorders due to multiple/psychoactive drug: harmful use
F147	Mental & behavioural disorders due to use of cocaine: residual & late-onset psychotic disorders	F192	Mental & behavioural disorders due to multiple/psychoactive drug: dependence syndrome
F148	Mental & behavioural disorders due to use of cocaine: other mental & behavioural disorders	F193	Mental & behavioural disorders due to multiple/psychoactive drug: withdrawal state
F149	Mental & behavioural disorders due to use of cocaine: unspecified mental & behavioural disorders	F194	Mental & behavioural disorders due to multiple/psychoactive drug: withdrawal state with delirium
F150	Mental & behavioural disorders due to other stimulants including caffeine: acute intoxication	F195	Mental & behavioural disorders due to multiple/psychoactive drug: psychotic disorder
F151	Mental & behavioural disorders due to use of other stimulants including caffeine: harmful use	F196	Mental & behavioural disorders due to multiple/psychoactive drug: amnesic syndrome
F152	Mental & behavioural disorders due to other stimulants including caffeine: dependence syndrome	F197	Mental & behavioural disorders due to multiple/psychoactive drug: residual & late-onset psychotic disorder
F153	Mental & behavioural disorders due to other stimulants including caffeine: withdrawal state	F198	Mental & behavioural disorders due to multiple/psychoactive drug: other mental & behavioural disorders
F154	Mental & behavioural disorders due to other stimulants including caffeine: withdrawal state with delirium	F199	Mental & behavioural disorders due to multiple/psychoactive drug: unspecified mental & behavioural disorders

Appendix C : Contact Points and References

If you have a question on the Index regarding

- Methodological approach
- Geographic unit
- Data
- Results
- Presentation of results

then please contact either

Ailie Clarkson (Assistant Statistician) on

Ailie.Clarkson@scotland.gov.uk, or

Robert Williams (Statistician) on

Robert.Williams@scotland.gov.uk.

If you have a more general question regarding Scottish Executive statistics then please e-mail the statistics enquiry e-mail at statistics.enquiries@scotland.gov.uk, or write to

Office of the Chief Statistician
Room 3 WR
St Andrew's House
Regent Road
Edinburgh
EH1 3DG
Tel : 0131 244 0442

References

The methodology of the SIMD 2004 is based on the work developed by the Social Disadvantage Research Centre (SDRC) at the University of Oxford. The 2003 SID for Scotland can be accessed at

<http://www.scotland.gov.uk/library5/social/siod-00.asp>

The SDRC have also developed multiple deprivation indices for England, Wales and Northern Ireland. These include:

- Noble, M., G. Smith, B. Penhale, G. Wright, C. Dibben, T. Owen and M. Lloyd (2000), *Measuring Multiple Deprivation at the Local Level: The Indices of Deprivation 2000*, DETR
- Noble, M., G. Smith, B. Penhale, G. Wright, C. Dibben, T. Owen and M. Lloyd (2000), *Response to the Formal Consultation on the Indices of Deprivation 2000*, DETR
- Noble, M., G. Smith, G. Wright, C. Dibben, M. Lloyd, and B. Penhale (2000), *Welsh Index of Multiple Deprivation 2000*, The National Assembly for Wales
- Noble, M., G. Smith, G. Wright, C. Dibben and M. Lloyd (2001), *The Northern Ireland Multiple Deprivation Measure*, NISRA

The reports on these measures and their associated papers provided valuable information on the technicalities of the methodology.

The SIMD 2004 is the first output from the ‘long term strategy for measuring deprivation’ which was developed in partnership with the Scottish Centre for Research on Social Justice. This report can be found at

<http://www.scotland.gov.uk/library5/social/mdis-00.asp>

The SIMD 2004 has been developed as part of the Scottish Neighbourhood Statistics Project. More information about this project can be found at

www.sns.gov.uk

More information about Scottish Executive Statistics can be found at

www.scotland.gov.uk/stats

Other papers referenced in this work are:

- Clark, D., A. McKeon, M. Sutton, R. Wood (2004) on behalf of the HLE Measurement in Scotland Steering Group, *Healthy Life Expectancy in Scotland*.
- General Register Office for Scotland (2001), *Vital Events Reference Tables 2001 : Section 6 : Deaths – causes*, General Register Office for Scotland.
- Jackson, G.W.L. (2002), *Drug – Related Deaths in Scotland in 2001*, Occasional Paper No 8, General Register Office for Scotland.
- Townsend, P. (1987) Deprivation, *Journal of Social Policy*, 16 (1), pp. 125-146.