A New National Deprivation Index
for
Health and Health Services Research

Short Report

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Summary of key points

Background

- SAHRU was commissioned in early 1997 by the Directors of Public Health in Ireland to produce the 1st national deprivation index for health and health services research. The index and report was subsequently placed in the public domain. This version was based on the 1991 Census. In 1998 the index was updated to reflect the then newly released 1996 Census results. The present report does the same for the 2002 national Irish Census.
- A suitable index of deprivation must be based - in the first instance - on an appreciation of the functional role of the index. This requires that a distinction be made between an index of material deprivation and other potential *at risk* indices. A firm conceptual basis allows for the selection of the relevant individual indicators (subject to their availability in the CSO's Small Area Population Statistics or SAPS).
- The SAHRU index is similar in design to the widely regarded Carstairs and Townsend indices employed in the UK, with certain modifications in view of differences in definition and scope between census variables in the UK and Ireland.
- Important changes in the way the index is derived and presented have been introduced in the current version reflecting, amongst other considerations, technical developments in index generation in recent years. In view of this, the 1991 index has been re-computed to facilitate comparisons with that for 2002.

Methods
- Principal components analysis (PCA) was employed to construct a weighted combination of indicators of unemployment, social class, type of housing tenure, car ownership and overcrowding, available in the Small Area Population Statistics for 3,422 Electoral Divisions (or EDs) in Ireland during the census year 2002. PCA objectively determines the weights (hence the influence) of individual indicators in the index.
- The 1st Principal Component provides a score for each ED that is the basis for the index. The scale (or Principal Component score) is ranked from low (least deprived) to high (most deprived) and then simply divided into 10 classes or deciles. The last decile therefore comprises the most deprived EDs (N=343) in the country.

Main findings

- Maps 1 & 2 (frontispiece) display the index for 2002 and 1991, respectively. Inspection of these maps points to selected coastal areas, particularly in the North-West and West of the country, as experiencing high levels of deprivation. The pattern of deprivations is seen to be broadly similar for both years. Less obvious – due to the scale of these maps – is the fact that many urban centres – with large populations - also experience high levels of deprivation, most notably in the cities of Dublin, Cork and Limerick. Conversely, many of the highly deprived (yet highly visible) rural areas are sparsely populated.
- Comparisons between regions indicates that the bulk of the most deprived EDs (i.e. the top decile with 343 EDs) are located in the Eastern Region (Dublin, Kildare & Wicklow) region (with 30% of the top decile) followed by the North Western (Donegal, Sligo and Leitrim) with 16% of the top decile.
- In terms of numbers of individuals living in deprived EDs, in 2002 just under 18% of the national population lived in the 343 most deprived EDs. This corresponds to 692,023

persons. [NB: clearly not everyone living in deprived EDs are themselves deprived and *vice versa*.]
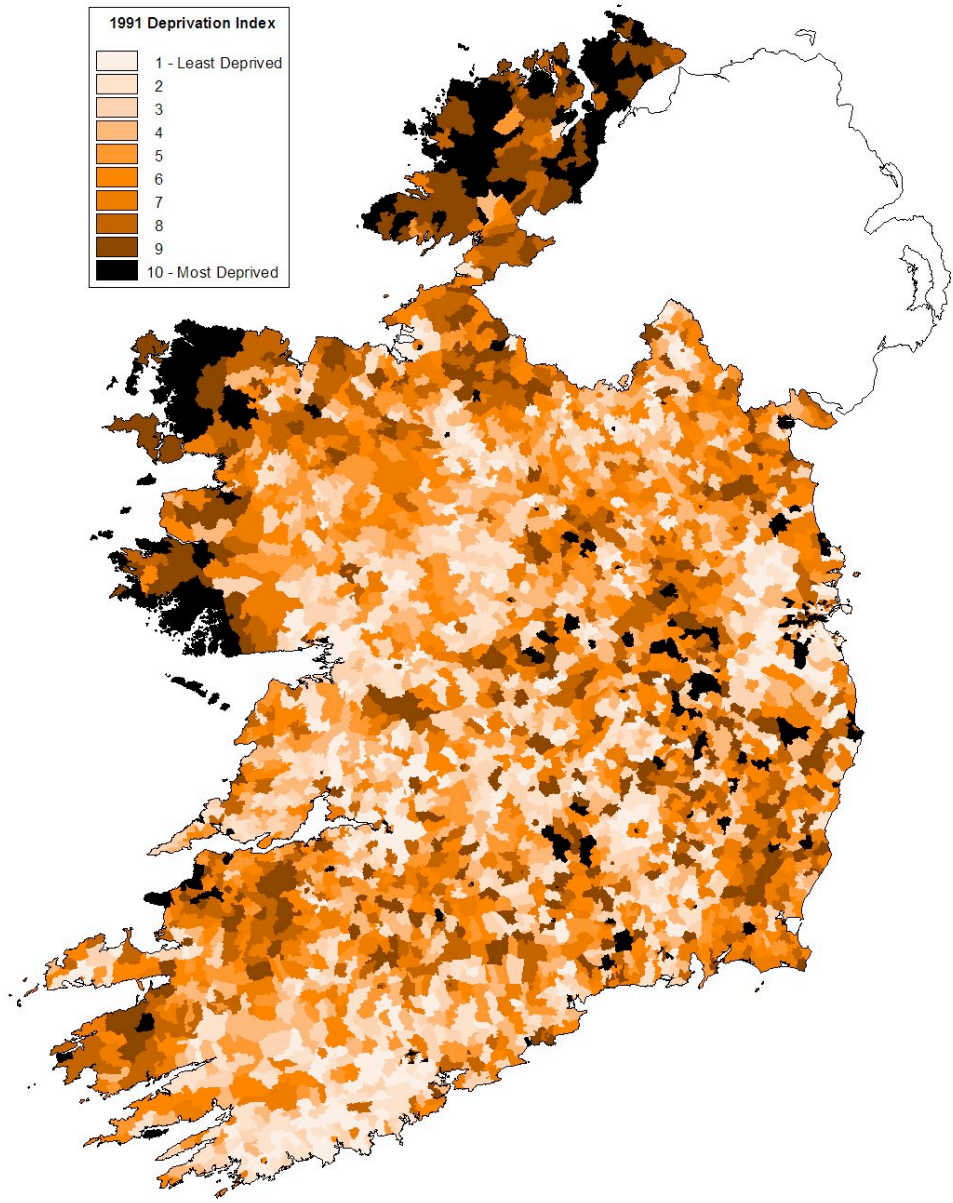
- Forty eight percent (48%) of the 692,023 persons living in the most deprived EDs (top decile) are in the ERHA region. The regional breakdown follows:

Region	Proportion of persons (N=692,023) living in most deprived EDs by region
ERHA	0.48
SEHB	0.11
SHB	0.10
NWHB	0.08
NEHB	0.07
MWHB	0.06
WHB	0.06
MHB	0.04

- For purposes of comparisons between 1991 and 2002 (pre and post "Celtic Tiger") only 3411 EDs may be considered due to some restructuring of EDs between the two time periods. Such comparisons must be treated very cautiously due to the relative nature of the index. Given that, about one third of all EDs retain the same index level; nearly two thirds of all EDs retain the same index level or move up or down by just one level (i.e. by one decile) with the remaining one third of EDs experienced more pronounced shifts in deprivation levels, some moving up or down the scale by 4 to 6 deciles. These latter EDs tend, by and large, to have small populations and are thus more susceptible to relatively large swings in percentages unemployed, in low social class, etc.
- Only 3401 EDs are directly comparable in terms of how the population is attributed to neighbouring urban and rural EDs. In 1991, just under 19% of the population in these EDs was located in the most deprived EDs; this had dropped slightly to just under 17% by 2002. [Recall the relative nature of the index, which makes direct comparisons problematic, as already noted.] The pattern of change differs markedly by region.

2002 Deprivation Index

- 1 - Least Deprived
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 - Most Deprived
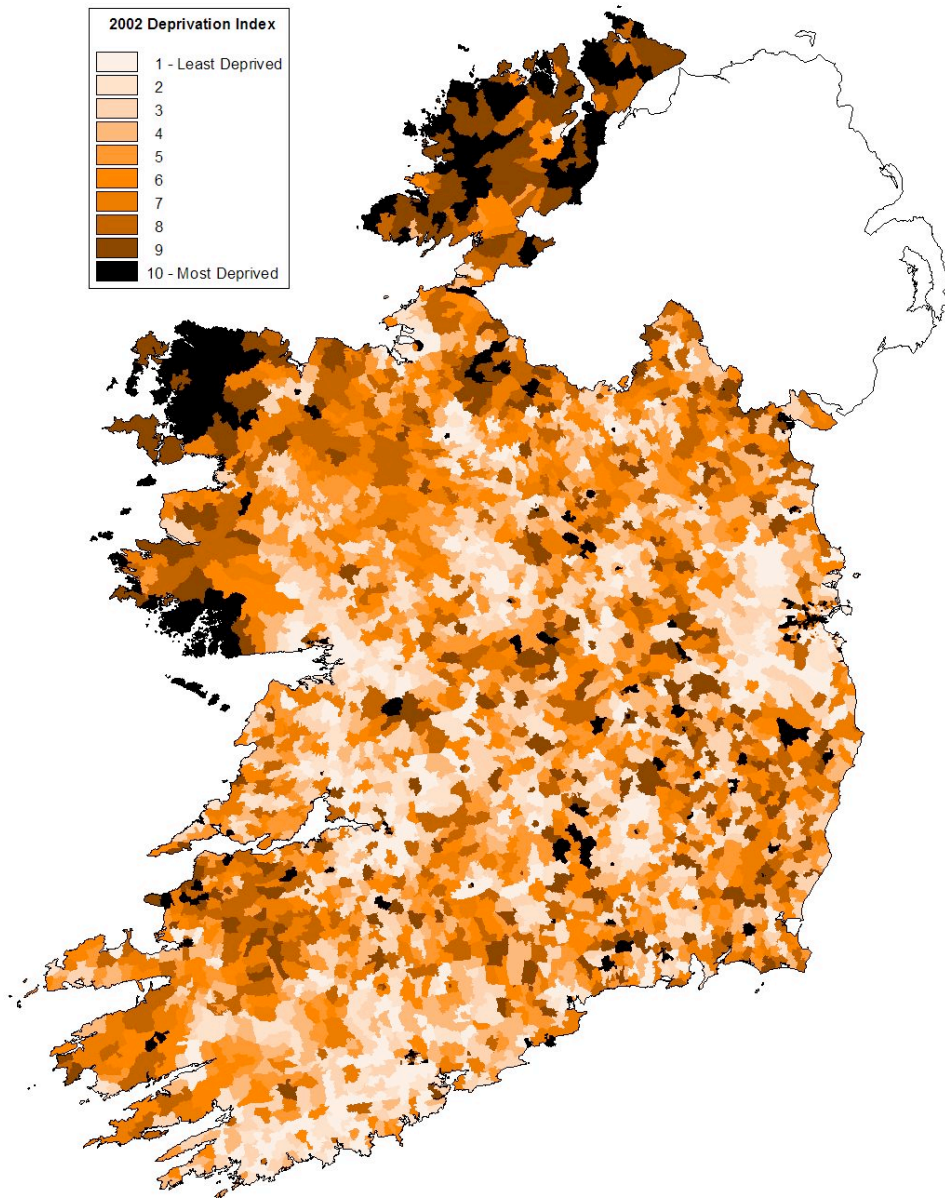
Map 1 SAHRU National Deprivation Index 2002

1991 Deprivation Index

1 - Least Deprived
2
3
4
5
6
7
8
9
10 - Most Deprived

Map 2 SAHRU National Deprivation Index 1991

Foreword

This short report summarises the development of a national (material) deprivation index for health and health services research in Ireland based on the 2002 Census conducted by the Central Statistics Office (CSO). The findings updated a similar report based on the 1991 census (SAHRU, 1997) and a subsequent update of that index based on the 1996 Census (SAHRU, 1998). Each of these indices has been made freely available - as is the present version, which may be downloaded from the web site (address below) as a tab-delimited text file.

Whilst the current index is based on the same set of 5 census variables as formerly, it is important to note that changes have occurred in the method of index construction and, more obviously, in its presentation. The 1991 and 1996 indices were presented on a 5-point scale. The scale was non-linear by choice; the rationale for this was explained in the 1997 report. In deriving the 2002 index, it was recognised that comparisons would inevitably be made with the 1991 index, yet, having regard to the choice of cut-off points associated with the original 5-point scale, it proved impossible to ensure that such comparisons could validly be made. For this reason, a simpler 10-point decile scale – similar to that used by Townsend and also by Carstairs in the UK – has had to be developed. As this precluded any direct comparison with the previous index, the 1991 index has been re-generated using the same method of construction as that for the 2002 index for the 3411 (out of 3422) Electoral Divisions (EDs) that are strictly comparable to the 1991 census. Direct comparisons are now facilitated and some are presented in this report along with due cautions in the interpretation of such temporal comparisons. Note that there is no simple link between the elements of the previous 5-point scale and the current 10-point scale.

It has not been possible to revisit the 1996 index, as this was derived from a 'light' census, that is, only two of the 5 key variables were recorded in the 1996 census and it was necessary – at that time - to employ a sophisticated neural net algorithm to predict the index as distinct from deriving it as we did for 1991 and 2002.

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Introduction

SAHRU was commissioned in early 1997 by the Directors of Public Health in Ireland to produce the 1st national deprivation index for health and health services research. The index and report were subsequently placed in the public domain. That version was based on the 1991 Census. In 1998 the index was updated to reflect the then newly released 1996 Census results. [1] The present report does the same for the 2002 Census.

A suitable index of deprivation must be based - in the first instance - on an appreciation of the functional role of the index. This requires that a distinction be made between an index of material deprivation and other potential *at risk* indices. A firm conceptual basis allows for the selection of the relevant individual indicators (subject to their availability in the CSO's Small Area Population Statistics or SAPS).
The SAHRU index is similar in design to the widely regarded Carstairs and Townsend indices employed in the UK, with certain modifications in view of differences in definition and scope between census variables in the UK and Ireland.

In the original SAHRU reports (SAHRU, 1997; Kelly & Sinclair, 1997) on the development of the national deprivation index we set out a rationale for the choice of 5 variables from the SAPS data on which to base the index. The following are extracts from that report describing the constituent variables. It should be noted that minor, but not necessarily unimportant changes have occurred in the way the CSO provide information in relation to two of these variables, i.e. 'unemployment' and 'overcrowding'. The past definition is presented alongside the current for clarity.

Unemployment

Unemployment reflects lack of access to earned income and the facilities of employment. Moreover it may impose other pressures on individuals through loss of self-esteem, and on families through problems and tensions generated.

The 'unemployment' indicator is:

> Proportion of the economically active population (15 years or older) unemployed or seeking a first time job.
> [NB: Previously this read: Proportion of the economically active population (15 – 64 years of age) unemployed or seeking a first time job.]

Low social class.

The Irish Social Class Scale is an ordinal scale from 1 (higher professional) to 6 (unskilled manual). It is based on the concept of groups whose members possess capacities for the generation of income through their occupations, not the status/prestige associated with particular occupations. A social class code of seven is assigned to people who can not be

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[1] The 1996 national census did not record the same level of detail as did the full censuses of 1991 and 2002. In fact only 2 of the 5 key indicators for the construction of the index was recorded in 1996. The index could not therefore be derived in the usual manner; instead, following considerable demand, we employed a neural network to *predict* the deprivation status of all DEDs using the 2 variables that did appear in the 1996 census (% unemployment and low social class) and the known form of relationship between these two variables and the index based on all 5 indicators in 1991. This was a reasonably compromise, but there is therefore no point in revisiting the 1996 census for the present exercise.

assigned to any of the other six groups. Being in a low social class — i.e. Class 5: semi-skilled manual occupations (including farmers farming less than 30 acres) and Class 6: unskilled manual occupations — reflects earnings at the lower end of the income scale. Low income limits access to material resources and the ability to make choices in life.

The 'low social class' indicator is:

> Proportion of population (social classes 1 to 6 only) in social class 5 or 6.

No car

Car ownership has been suggested as a surrogate for current disposable income. Apart from the cost of purchasing a car there are the necessary licensing, insurance, maintenance and repair costs, as well as day-to-day running expenses. Car ownership also confers benefits in terms of access to other resources. It might be argued that in city areas, with good access to public transport services, owning a car is not a necessity. Nevertheless despite the availability of public transport ownership of a car appears to be something that many households do wish to achieve. This may be a reflection of the inconvenience and/or limited scope of public transport as well as the prestige associated with owning a car. In rural areas car ownership is more of a necessity and its value as a discriminator between affluent and deprived areas may be diminished.

The following 'no car' indicator has been used:

> Proportion of permanent private households with no car.

Rented accommodation

Non-owner occupation has been suggested as a surrogate for income in the long term. Taken together with car ownership these two indicators are likely to provide a fairly good reflection of income levels in different areas.

The 'rented accommodation' indicator is:

> Proportion of permanent private households rented from a local authority, or in the process of being acquired from a local authority

Overcrowding

Overcrowded accommodation reflects living circumstances and housing conditions. It may also reflect wealth as people in overcrowded circumstances are likely to wish to improve their circumstances provided financial resources are available.

The following 'overcrowding' indicator has been used:

> Ratio of the total number of persons divided by the total number of rooms in permanent private households.

> [NB: Previously this read: The average number of persons per room in permanent private housing units.] This variable is no longer reported in the 2002 SAPS.

Index construction

The basis for the index is the first principal component derived from the matrix of the 5 variables by the 3,422 EDs. (The methodology is discussed in our original 1997 report and a copy of the relevant sections is available on our web site www.sahru.tcd.ie if needed.)

In our previous report on deprivation we employed a population weighted Principal Components Analysis (PCA), that is, the contribution of each ED to the PC model was weighted by the population size of the ED. This practice is typical in the statistical analysis of areal (i.e. geographically aggregated) data. An obvious consequence is that EDs with larger populations (i.e. urban areas) are inevitably more influential in the formation of the model. On this occasion, and having regard to recent developments in the construction of deprivation indices for England & Wales, Scotland and Northern Ireland (Oxford Social Disadvantage Research Centre, 2000 & 2001), an alternative approach was employed, namely 'shrinkage' (Longford, 1999). This latter technique is intended to reduce the impact (on the model parameters) of EDs with quite small populations prone to exceptionally large swings in levels of unemployment, or low social class, etc. In such populations, a very slight change in absolute numbers (for example, in numbers unemployment) can result is a very large shift in the corresponding proportion. To remedy this, we computed an adjusted estimate for all EDs for each constituent indicator such that EDs with small populations had their proportions 'shrunk' towards the respective county average.

Table 1 lists the correlation coefficient between each pair of indicators following shrinkage. It will be noted that these are all positive and range from a low of 0.18 (between No Car and Overcrowding) to a high of 0.64 (between No Car and LA Rent or Purchase).

Table 1 Correlations between each pair of indicators

	Unemployment	Low SC	No Car	LA Rent or Purchase	Overcrowding
Unemployment	1.00	0.60	0.61	0.61	0.37
Low SC		1.00	0.41	0.51	0.41
No Car			1.00	0.64	0.18
LA Rent or Purchase				1.00	0.44
Overcrowding					1.00

It is useful to back translate the coefficients associated with the scaled variables as employed in the PCA to the original units as reported in the SAPS but after shrinkage. These coefficients follow.

Equation of the 1st PC for the 'raw' (i.e. unstandardised) variables (after shrinkage):

> 21.42 (Proportion Unemployed)
> + 5.94 (Proportion Low SC)
> + 3.87 (Proportion No Car)
> + 5.50 (Proportion LA Rent or Purchase)
> + 7.60 (Overcrowding)
> - 7.52

It will be seen that proportion 'Unemployed' carries the highest coefficient (21.42) while

proportion 'No Car' carries the lowest coefficient (3.87).

The distribution of the Index for 2002 as a raw score derived from the 1st PC (prior to grouping) is graphed in Fig. 1. The summary statistics (below the figure) show that the score ranges from –3.34 to + 11.13; the median score is slightly less than zero at –0.36. Negative score values correspond to more affluent EDs, while the more positive the score the more deprived the ED.
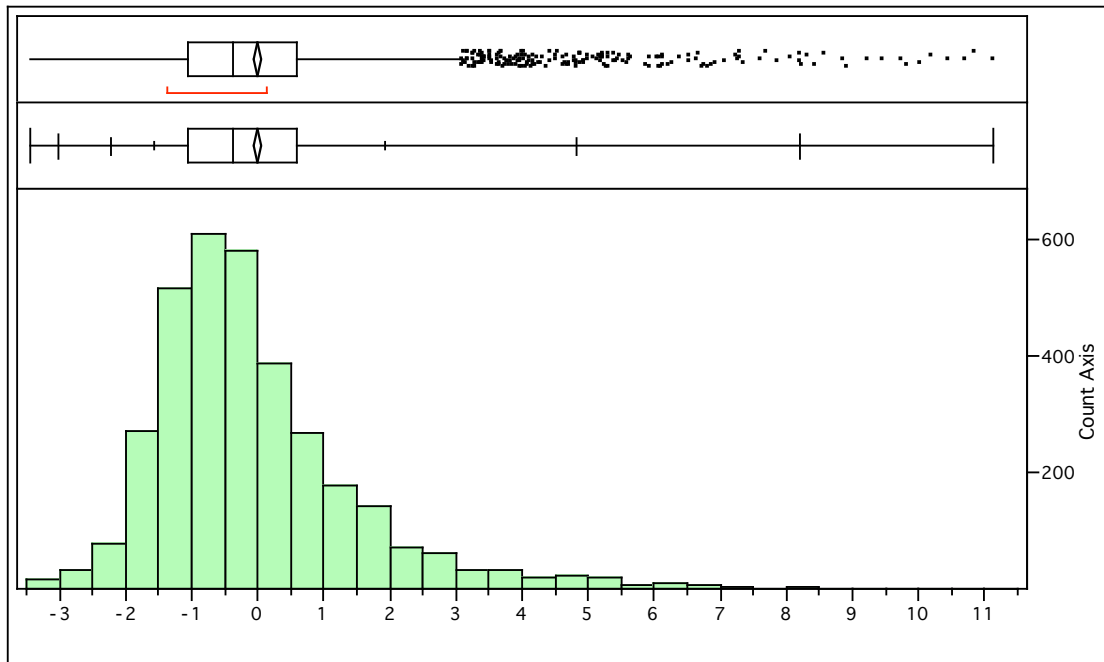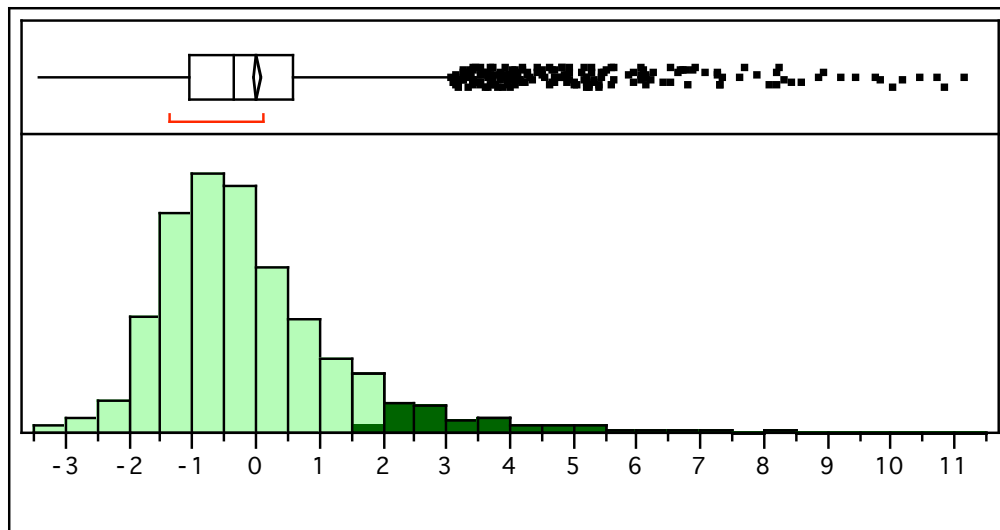

Figure 1 – Distribution of Raw Score for Index (2002)

Summary statistics for deprivation score:

Quantiles	Score value
Maximum	11.13
Upper quartile	0.59
Median	-0.36
Lower quartile	-1.07
Minimum	-3.43
N	3422

Selection of cut-off points

In the previous versions of the SAHRU index (for 1991 and 1996), we employed a 5-point scale (1 = least deprived, 5 = most deprived). The considerations in choosing the cut-off points were explained in the 1997 report. Unfortunately, after due consideration, it proved impossible to continue this format – in spite of its advantages – in that this would preclude a valid comparison between the new (2002) index and the original index for 1991. For this reason we have chosen (as with similar indices in the UK) to simply express the index as deciles (i.e. tenths) of the distribution of the ranked raw scores. This is illustrated in Fig. 2.

The index is now scaled from 1 to 10 with approximately equal numbers of EDs per decile (i.e. 3422/10 to give either 342 or 343 EDs per decile).
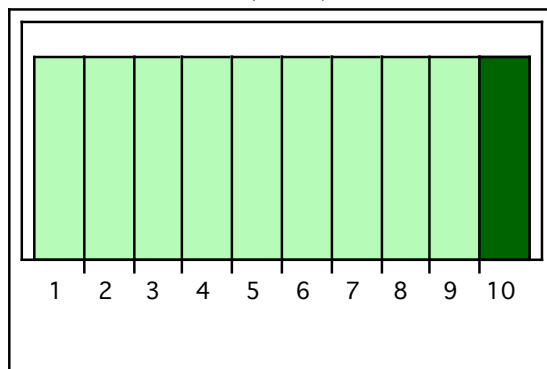

Deciles of raw score (Index)

Figure 2 - Distribution of the raw score with the last decile (most deprived) highlighted

Changes affecting the cities of Drogheda, Dundalk and Wexford

In 1991, these cities were reported as 3 single EDs. In the latest census, Drogheda and Wexford comprise 3 EDs each and Dundalk is now 4 EDs. While this is very welcome it does pose difficulties for comparisons between the 2002 results and the newly computed index for 1991 (see later).

What's in a label?

The index is intended to reflect degrees of material (not *social*) deprivation and the rationale for this was originally set out by Townsend and in the previous SAHRU report (Townsend, 1987, SAHRU, 1997). It is natural to refer to EDs with an index of 10 as 'most deprived' and those with an index of 1 as "most affluent" or perhaps "least deprived". The scale is of course relative, that is, EDs with an index value of 10 have generally higher levels of unemployment, low social class, etc. than EDs whose index value is lower. However, this is not to imply that an ED with an index level of '5' has 5 times more unemployment, etc. as

compared to an ED with an index of '1'; the scale in not linear in that sense. EDs that are considered as deprived on this scale may well be far from deprived on another scale (for example, a scale measuring community cohesiveness). And, of course, it is important to recall that not everyone living in a deprived ED will be personally deprived, and conversely, not everyone living in an affluent ED will be personally affluent – the index is a reflection of the average profile of the ED with regard to the selected factors. Nevertheless, this profile has been shown to be predictive of health outcomes and health service demands.

On-going research in SAHRU is investigating the feasibility of developing indices of multiple forms of deprivation, as the Oxford group has undertaken for regions in the UK. This project has received support from the Health Research Board.

Main Results

The index for each ED nationally is available on an accompanying tab-delimited text file (available from: www.sahru.tcd.ie). The location of the worst 10% of EDs (top decile of ranked scores) is presented in Table 2 over. Dublin City has the highest number (N=76 or 22% of the top decile) of these EDs. This is followed by Donegal County and then the cities of Cork and Limerick.

Maps 1 & 2 (frontispiece) display the indices for 2002 and 1991, respectively. Inspection of these maps points to selected coastal areas, particularly in the North-West and West of the country, as experiencing high levels of deprivation. The pattern of deprivations is seen to be broadly similar for both years. Less obvious – due to the scale of these maps – is the fact that many urban centres also experience high levels of deprivation, most notably in the cities of Dublin, Cork and Limerick.

Comparisons between regions indicates that the bulk (30%) of the most deprived EDs (i.e. the top decile) are located in the Eastern region (Dublin, Wicklow and Kildare), followed by the North Western region (Donegal, Sligo and Leitrim) with 16%.

Table 2 – Location of the most deprived (N=343) EDs

Area	No. EDs	Proportion of the top decile
Dublin City	76	0.222
Donegal County	50	0.146
Cork City	33	0.096
Limerick City	22	0.064
Mayo County	22	0.064
Waterford City	17	0.050
Galway County	16	0.047
South Dublin	11	0.032
Tipperary South	8	0.023
Kerry County	7	0.020
Louth County	6	0.017
Wexford County	6	0.017
Carlow County	5	0.015
Dun Laoghaire-Rathdown	5	0.015

Galway City	5	0.015
Cavan County	4	0.012
Clare County	4	0.012
Fingal	4	0.012
Laois County	4	0.012
Leitrim County	4	0.012
Longford County	4	0.012
Waterford County	4	0.012
Wicklow County	4	0.012
Kildare County	3	0.009
Kilkenny County	3	0.009
Limerick County	3	0.009
Offaly County	3	0.009
Westmeath County	3	0.009
Monaghan County	2	0.006
Sligo County	2	0.006
Cork County	1	0.003
Meath County	1	0.003
Roscommon County	1	0.003

Persons by Deprivation Level

Table 3 shows the population numbers and percentages in each index level. The distribution of the percentages will be seen to be rather higher for levels 1 and 8 through 10 – with the highest percentage in level 10 – although this level had an additional ED assigned.

Table 3 – Persons living in EDs by level of deprivation

Index Level	No. EDs	Population	% Total Pop.
1	342	588838	15.0
2	342	337162	8.6
3	342	344895	8.8
4	342	248302	6.3
5	342	257607	6.6
6	343	289236	7.4
7	342	289244	7.4
8	342	396459	10.1
9	342	473437	12.1
10	343	692023	17.7

(NB: note the343 EDs for level 10.)

In terms of numbers of individuals living in deprived EDs, in 2002 just under 18% of the national population lived in the 343 most deprived EDs. This corresponds to 692,023 persons. [NB: clearly not everyone living in deprived EDs are themselves deprived and *vice versa*.]

Forty eight percent (48%) of the 692,023 persons living in the most deprived EDs (top decile) are in the Eastern Region of Dublin, Wicklow and Kildare.

Comparison with 1991 (Pre and Post "Celtic Tiger")

The coefficients for the raw variables are provided below Table 4. The corresponding coefficients for the 2002 data are shown for comparison. The most marked difference is between the coefficients for Unemployment in terms of the raw variable (13.3 for 1991 up to 21.4 for 2002).

Table 4 Comparison between the coefficients of the 1st principal components analysis (after shrinkage) for 1991 and 2002.

Variables	Coefficients 1st PC 1991	Coefficients for unstandardised variables 1991	Coefficients 1st PC 2002	Coefficients for unstandardised variables 2002
Unemployment	0.52	13.30	0.50	21.42
Low SC	0.46	4.34	0.45	5.94
No Car	0.45	3.20	0.44	3.87
LA Rent or Purchase	0.48	3.90	0.49	5.50
Overcrowding	0.30	4.67	0.34	7.60
Constant		-6.92		-7.52

Comparisons

In the following, we have retained only the EDs that are consistently defined for both censuses – this gives a total of N=3411 EDs (see page 10 below)

Changes in deprivation level between 2002 and 1991 are summarised in Table 5. About 33% of the EDs show no change in level between the two time periods. If we ignore slight changes (up or down 1 level), then the agreement rises to nearly 64%.
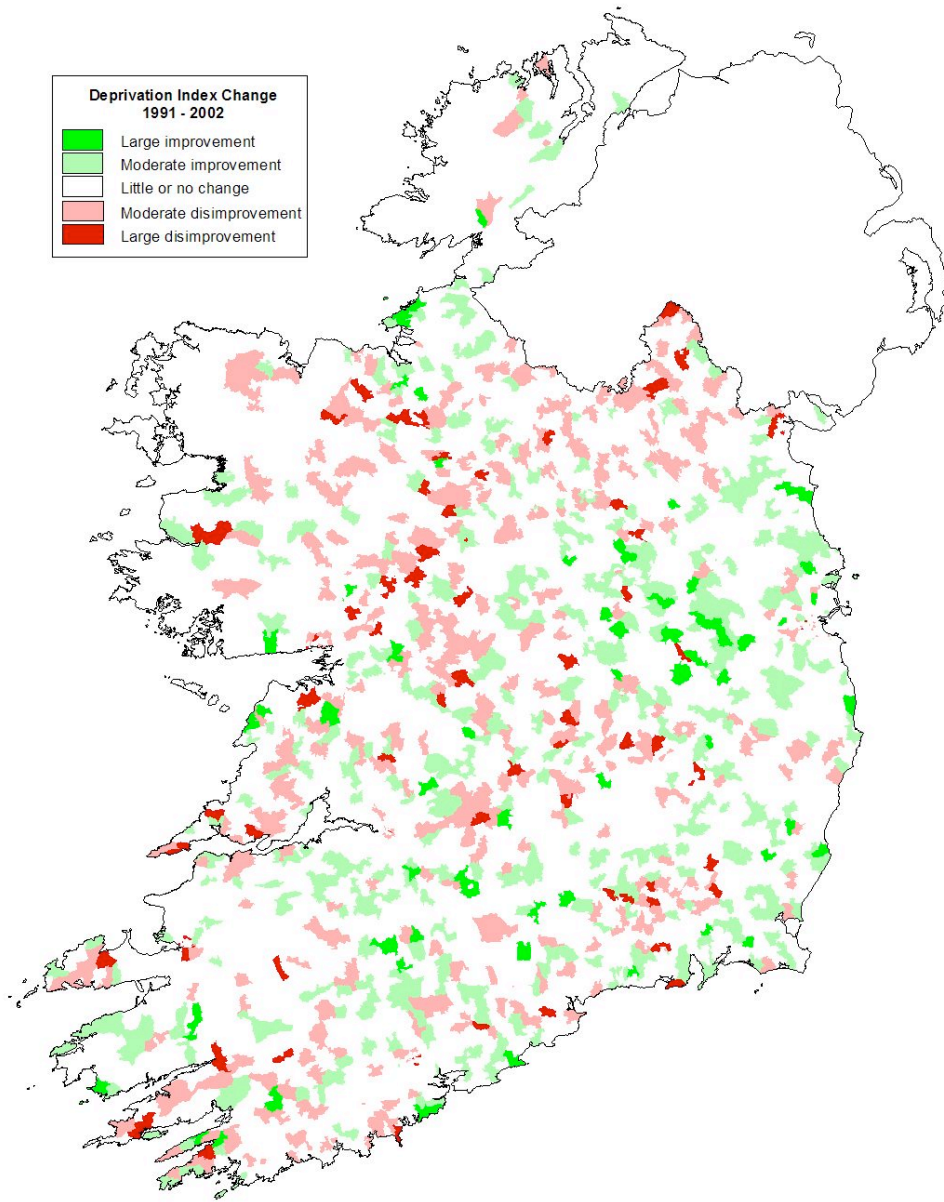
Table 5 Cross-tabulation of deprivation index for 1991 and 2002

		2002 index										
		1	2	3	4	5	6	7	8	9	10	
1991 index	1	206	69	36	16	7	3	1	3	0	0	341
	2	73	99	67	47	26	17	6	5	1	0	341
	3	31	71	81	59	52	32	9	5	2	0	342
	4	17	53	62	75	60	40	26	7	1	0	341
	5	9	31	48	63	69	55	39	22	4	1	341
	6	4	12	27	40	64	77	68	37	10	3	342
	7	2	7	14	31	45	66	77	70	27	2	341
	8	0	0	6	7	16	40	93	104	62	14	342
	9	0	0	1	4	2	13	22	75	175	49	341
	10	0	0	0	0	1	0	1	13	57	267	339
		342	342	342	342	342	343	342	341	339	336	3411

In considering these changes (or indeed, lack of change) it should be recalled that coefficients associated with the set of variables in 1991 differs from that for 2002 (as would levels of unemployment, etc.) as noted in Table 4. Also, the population in any given ED will have changed to a greater or lesser degree in terms of numbers (inward and outward migration) and socio-economic status and other demographic and social characteristics.

With this *caveat* in mind, the ED-level changes are mapped in Map 3 below.

**Deprivation Index Change
1991 - 2002**

- Large improvement
- Moderate improvement
- Little or no change
- Moderate disimprovement
- Large disimprovement

Map 3 Changes in deprivation level between 1991 and 2002

Comparison of persons living in EDs by Deprivation Level

It is of interest to compare the numbers of persons living in more or less deprived areas in 1991 and 2002. *The caveat already noted is repeated: it should be borne in mind that not everyone living in a deprived area is necessarily personally deprived and conversely, relatively deprived individuals will be found living in affluent areas.* For purposes of the comparison of areas, the number of EDs in common between both periods is 3411 as indicated above. However, for the present exercise, a problem exists in terms of how the CSO present information on populations in a small number of urban and rural ED s in 1991 and 2002 in the respective small-area population statistics (SAPS).

As outlined in Appendix 4 of (Volume 1: Population Classified by Area) of the 2002 Census results, a total of 23 towns and boroughs have been extended since 1926. This involves the extension of a town or borough boundary to encompass a portion of the population in a neighbouring rural ED. This has been necessary due to the high levels of population growth in some Urban Districts around the country. A difficulty arises in the manner in which the data for these divided rural EDs is represented. [Note: with the exception of the 23 towns and boroughs mentioned above, Urban District boundaries are consistent with ED boundaries.]

The map on the left below shows Monaghan Urban ED and the surrounding Monaghan Rural ED. The map on the right shows a shaded region which approximates the region in Monaghan Rural ED which is contained in the Monaghan Urban District. In previous editions of the the SAPS, the population in the shaded region was aggregated with the Monaghan Urban ED population. In the most recent edition of the SAPS, the population of the shaded region was aggregated with the rest of the Monaghan Rural ED.
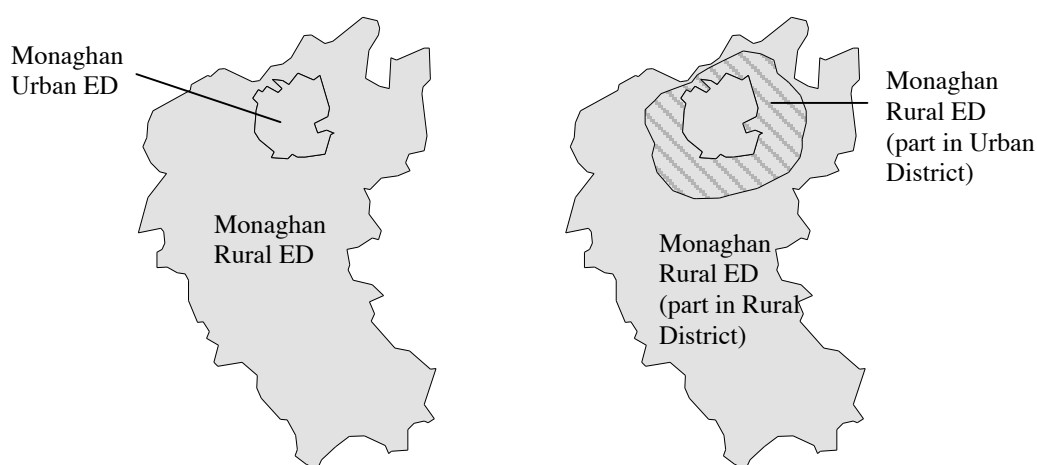

Table 6 shows the numbers of persons in the Monaghan Urban and Rural EDs according to the SAPS data.

Table 6 Numbers of persons in Monaghan Urban and Rural EDs 1991 and 2002

Area	1991	2002
Monaghan Urban District		
004. Monaghan Urban	5,750	2,032
063. Monaghan Rural (pt.)		0
Monaghan Rural District		
063. Monaghan Rural (pt.)	1,227	4,969

As the disaggregated data are not available in the SAPS, it is not possible to generate comparable population statistics for a number of EDs. The figures in the table above indicate that comparisons between Monaghan Rural ED in 1991 and 2002 poses a number of problems. Not only has there been a significant change in population size, but it has also changed from being a predominantly rural ED to a predominantly urban ED. This, of course, has implications for any demographic comparisons between 1991 and 2002.

Of the 23 areas where urban boundaries have been redefined, 6 give rise to noticeable inconsistencies between the 1991 and 2002 SAPS figures: Carlow, Castleblayney, Dundalk, Letterkenny, Monaghan and Tralee. In all of these cases, the Rural ED population that was formerly given as part of the Urban District population is now included in the aggregate Rural ED population.

For this reason, in the following presentation these EDs have had to be excluded.
Table 7 shows the population percentage in each decile of deprivation for 1991 and 2002. The general profile across the deprivation level is very similar with just a slight reduction in the percentage in decile 10 in 2002.

Table 7 Percentage of the population in each decile of deprivation in 1991 and 2002 (NB: for N=3411 comparable EDs only)

Deprivation Level	% Pop 1991	% Pop 2002
1	16.13	15.45
2	8.11	8.85
3	6.27	9.05
4	7.23	6.51
5	6.71	6.76
6	7.13	7.29
7	9.60	7.59
8	8.71	9.48
9	11.25	12.09
10	18.87	16.94

Consistency

Health information is not routinely coded by small area in Ireland. Hence, it is not possible to offer any (external to SAPS) validation of the index at this time.   Consistency checks are however possible to some degree. A number of relevant variables have been selected from SAPS (and elsewhere) to check the consistency of the index (see Appendix 2 for details of these variables). These are:

1.   Proportion of persons with a disability
2.   Proportion households with no central heating
3.   Proportion early school leavers
4.   Proportion unable to work

And a non-SAPS variable

5.   GMS card holders/1000 population for ERHA region (March 2000)
6.   GMS cards/household for ERHA region (March 2000)

The non-parametric correlations are all highly significant (Table 8) and range from a low of 0.40 (for % disability and % early school leavers) to a high of 0.76 for GMS Cards/Household). Percentage Unemployment is also shown correlated with GMS Cards/Household.

Table 8 Non-parametric correlations between the deprivation score and selected variables

Variable	by Variable	Correlation coefficient	p-value
Deprivation Score	% Disability	0.403	<.0001
Deprivation Score	% No heating	0.427	<.0001
Deprivation Score	% Early school leaver	0.407	<.0001
Deprivation Score	% Unable to work	0.500	<.0001
Deprivation Score	GMS pat/1000 pop	0.739	<.0001
Deprivation Score	GMS Cards/Household	0.764	<.0001
% Unemployment	GMS Cards/Household	0.681	<.0001

The magnitude of these correlations are generally modest (with the exception of the relationship with both GMS variables) and this serves to underline the fact that health outcomes have many determinants and that area-level deprivation is but one factor in explaining area-to-area variations.

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Appendix 1

Definitions of Deprivation Variables (Variable Names and SAPS Column Numbers)

Unemployment
 ("Males 15+ 1st job seekers" + "Males 15+ unemployed" +
"Females 15+ 1st job seekers" + "Females 15+ unemployed")
 / ("Males 15+ total" + "Females 15+ total")

SAPS codes: (467 + 468 + 476 + 477) / (474 + 483)

Low Social Class
  ("Social class 5 total males" + "Social class 6 total males" +
"Social class 5 total females" + "Social class 6 total females")
/ ("Social class 1 total males" + "Social class 2 total males" +
"Social class 3 total males" + "Social class 4 total males" +
"Social class 5 total males" + "Social class 6 total males" +
"Social class 1 total females" + "Social class 2 total females" +
"Social class 3 total females" + "Social class 4 total females" +
"Social class 5 total females" + "Social class 6 total females")

SAPS codes: (708 + 709 + 756 + 757) / (704 + 705 + 706 + 707 + 708 + 709 + 752 + 753 + 754 + 755 + 756 + 757)

Local Authority Housing (Rent/Purchase)
  ("Being purchased from Local Authority - households" + "Rented from Local Authority - households")
/ ("Owner occupied - with mortgage - households" + "Owner occupied - no mortgage - households" +
"Being purchased from Local Authority - households" + "Rented from Local Authority - households" +
 "Rented unfurnished from other - households" + "Rented furnished from other - households" +
"Occupied free of rent - households")

SAPS codes: (1066 + 1067) / (1064 + 1065 + 1066 + 1067 + 1068 + 1069 + 1070)

No Car
 ("Private Households -Number of cars = 0")
/ ("Private Households -Number of cars = 0" +
"Private Households -Number of cars = 1" +
"Private Households -Number of cars = 2" +
"Private Households -Number of cars = 3+")

SAPS codes: (1152) / (1152 + 1153 + 1154 + 1155)

Overcrowding
 ("Persons in Private Households - Number of rooms =1" +
"Persons in Private Households - Number of rooms =2" +
"Persons in Private Households - Number of rooms =3" +
"Persons in Private Households - Number of rooms =4" +
"Persons in Private Households - Number of rooms =5" +
"Persons in Private Households - Number of rooms =6" +
"Persons in Private Households - Number of rooms =7" +
"Persons in Private Households - Number of rooms =8")
/ ("Private Households - Number of rooms =1"*1 +
"Private Households - Number of rooms =2"*2 +
"Private Households - Number of rooms =3"*3 +

"Private Households - Number of rooms =4"*4 +
"Private Households - Number of rooms =5"*5 +
"Private Households - Number of rooms =6"*6 +
"Private Households - Number of rooms =7"*7 +
"Private Households - Number of rooms =8+"*8)

SAPS codes: (1129 + 1130 + 1131 + 1132 + 1133 + 1134 + 1135 + 1136)
/ (1120*1 + 1121*2 + 1122*3 + 1123*4 + 1124*5 + 1125*6 + 1126*7 + 1127*8)

Appendix 2

Definitions of Variables used for Consistency checks (Variable Names and SAPS Column Numbers)

Proportion Disabled
("Persons with a disability - aged 1-14" + "Persons with a disability - aged 15-24" +
"Persons with a disability - aged 25-44" + "Persons with a disability - aged 45-64" +
"Persons with a disability - aged 65+")
/ ("total persons")

SAPS codes: (1029 + 1030 + 1031 + 1032 + 1033) / 001

Proportion of Private Households with no central heating
("Private households with no central heating")
/ ("Private households with no central heating" + "Private households with central heating")

SAPS codes: 1139 / (1138 + 1139)

Proportion of Early school leaver
("Age education ceased - under 15 total") / ("Males 15+ total" + "Females 15+ total")

SAPS codes: 930 / (474 + 483)

Proportion Unable to work
("Males 15+ unable to work" + "Females 15+ unable to work) / ("Males 15+ total" + "Females 15+ total")

SAPS codes: (472 + 481) / (474 + 483)

GMS Card Holders (non SAPS variable) (March 2000 for ERHA region)
"Number of GMS card holders and dependents"

GMS Card Holders /1000 population (March 2000 for ERHA region)
"Number of GMS card holders and dependents" * 1000 / ("total persons")