

Children in families with limited resources across Scotland 2014-2016 - technical notes

Maike Waldmann 28 November 2017

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2 METHODOLOGY

The Scottish Government published new, experimental statistics on children in combined low income and material deprivation for the first time on 28 November 2017. The statistics are based on data from the Scottish Household Survey (SHS) and were published under the name "Children in families with limited resources across Scotland 2014-2016" to avoid confusion with a similar measure that is based on the Family Resources Survey. This chapter explains how these statistics were derived.

2.1 Material deprivation questions in the SHS

Since 2014, two sets of questions about material deprivation have been included in the SHS. One question asks households whether they can afford each item from a list of eleven household necessities. The other question asks households whether they can afford each item from a list of eleven child necessities. Where respondents say that they don't have an item because they cannot afford it, this is considered an indicator of material deprivation.

The questions were based on [poverty research](#) by Professor Nick Bailey at the University of Glasgow¹. The list of 22 items is based on what most people agree is a basic necessity, and it provides a robust material deprivation measure. The questions are listed below in the order in which they were asked.

Household necessities ("Do you have..."):

- Enough money to save regularly (of at least £20) for rainy days
- Enough money to repair/replace broken electrical goods
- Enough money to make regular payments into an occupational or private pension (only asked if someone in the household is aged 16-64)
- All recommended dental work/treatment
- Enough money to keep your home in a decent state of decoration
- Enough money to take part in sport/exercise activities or classes
- Enough money to take part in a hobby or leisure activity
- Appropriate clothes for job interviews (only asked if someone in the household is aged 16-64)
- Home contents insurance
- A damp free home
- Access to £500 to cover an unexpected, but necessary, expense

Child necessities:

- Does your child have money to save
- Does your child have a holiday away from home at least once a year
- Does your child have day trips with family once a month

¹ <http://www.poverty.ac.uk/editorial/pse-reduced-and-responsive-scales>

- Does your child have access to a computer and internet for homework
- Does your child get pocket money
- Does your child have a warm winter coat
- Does your child have at least four pairs of trousers, leggings, jeans etc.
- Does your child have some new, not second-hand clothes
- Is there a garden or outdoor space nearby where your child can play safely
- Does your child attend toddler groups etc. at least once a week (pre-school age children only)
- Are there enough bedrooms for every child aged 10 or older of different sex to have their own bedroom

Only households with dependent children are asked these questions. This is the case if any household members are aged 0-16 and are a biological, adopted or step-child, or if any household members are aged 17-19 and a biological, adopted or step-child and in full-time education and living at home.

Since the questions were first introduced in 2014, they have only been asked of households with dependent children **in a one third of the total SHS sample**. For the first publication of these statistics, data from 2014, 2015 and 2016 was combined to have a large enough sample size in each of the Scottish local authorities. This were 2,424 households in total. From 2018 on, all households with dependent children will be asked these questions to increase the sample size.

2.2 Material deprivation definition

If a household doesn't have an item because they cannot afford it, they are considered to have a material deprivation. For the purpose of these statistics, those households that have three or more material deprivations are classified as experiencing material deprivation.

This definition is based on data analysis of the responses to the material deprivation questions and the respondents' household income. The definition best distinguishes families with low incomes from families with higher incomes.

This definition is different from the material deprivation definition used for the FRS-based measure and includes a wider range of families. One reason for the difference is that the lists of necessities differ between the two surveys.

2.3 Low income definition

Households with an equivalised net household income below 70% of the Scottish median (middle) income are considered to be on a low income. The Scottish median is based on all households in the SHS (with or without children), using the income information collected through the SHS.

Equivalisation takes into account different household sizes and compositions. We used the modified OECD equivalisation scales² for income before housing costs (BHC) and income after housing costs (AHC).

For household income (BHC), the income of a one-adult household is divided by an equivalence factor of 0.67, increasing by 0.33 for each additional adult and by 0.2 for each child under 15. For example, the equivalised net household income (BHC) of a family of two adults and one child would be their combined household income after taxes divided by 1.2.

For household income (AHC), the first adult is assigned a factor of 0.58, increasing with each additional adult by 0.42 and with each child under 15 by 0.2

There are two issues with this: one relates to the quality of the income data that the SHS collects, and the other to the suitability of the chosen equivalisation scale.

While the SHS collects information about who lives in the household, it doesn't collect detailed information about household incomes for all people in the household. Information about incomes is only asked of the person in the household with the highest income and their partner. This means that the income of households with more than two people with incomes may be underestimated.

In addition, equivalisation leads to a reduced household income for households with more than two adults, without taking into account any income they might add.

From 2018, more detailed questions about income from additional adults will be introduced in the SHS. The equivalisation scale will also be reviewed for the next update of these statistics.

2.4 From sample to population

These statistics report on the percentage of children who live in families in combined low income and material deprivation as defined above. To estimate the percentage of children in the whole population from the percentage of children in the sample, weights were applied to each household in the sample. The weights take into account the survey design and the number of children in each household.

2.5 Measurement uncertainty

For some council areas, the sample size is relatively small and this will affect how precise our estimations for this area are. For example, the statistics for Argyll & Bute are based on only 46 households. Basing an estimate for all families in Argyll & Bute on only 46 households leads to a considerable measurement uncertainty.

² <http://www.oecd.org/eco/growth/OECD-Note-EquivalenceScales.pdf>

This is why we publish a 95% confidence interval, which is a range of values likely to contain the true figure. If the sample contained a different set of households, it would likely lead to a slightly different estimate within this range.

Below is a list of how many households in each council area were included in the analysis.

Council area	Number of households
Aberdeen City	59
Aberdeenshire	71
Angus	68
Argyll & Bute	46
Clackmannanshire	68
Dumfries & Galloway	55
Dundee City	64
East Ayrshire	51
East Dunbartonshire	69
East Lothian	84
East Renfrewshire	73
City of Edinburgh	151
Na h-Eileanan an Iar	63
Falkirk	67
Fife	129
Glasgow City	202
Highland	72
Inverclyde	60
Midlothian	63
Moray	65
North Ayrshire	65
North Lanarkshire	139
Orkney Islands	50
Perth & Kinross	65
Renfrewshire	65
Scottish Borders	55
Shetland Islands	75
South Ayrshire	58
South Lanarkshire	89
Stirling	63
West Dunbartonshire	55
West Lothian	65

As a consequence of the relatively small sample size, the measurement uncertainty in the council area analysis is large. As the sample size will increase for future updates, the measurement uncertainty will decrease.

3 FUTURE DEVELOPMENT - YOUR FEEDBACK

These statistics were published as experimental statistics. Experimental statistics are a type of official statistic that are under development, involving users and stakeholders. Below, we listed a number of topics that are currently being reviewed, and any user feedback on these (and others) is welcome. Please email us at social-justice-analysis@gov.scot.

3.1 Sample size & frequency of publication

In the first publication, we reported on data aggregated over the years 2014-2016. Using three years' worth of data was necessary for obtaining a large enough sample in each council area, as the material deprivation questions were only asked of every third household with children in the full SHS sample. The 2018 publication is suggested to be a rolling update that reports on data aggregated over the years 2015-2017.

From 2018 on, all households with children will be asked the material deprivation questions. This means that the sample size will be tripled, and the 2019 update and future updates could report on a single data year each. However, in order to achieve more precise estimates with narrower confidence intervals, it may be preferable to continue to aggregate data over two or three years.

Any statistics based on multiple years' worth of data could either be published annually as a rolling update (preferred option), or alternatively, every two or three years.

The table below suggests which data years would be covered by each update, using rolling updates, and approximately how many households would be included in each update.

Year	Number of households in sample	Reporting period and number of households in each update
2014	800	---
2015	800	---
2016	800	---
2017	800	2017 Publication uses 2014-2016 data (2,400 households)
2018	2,400	2018 Update uses 2015-2017 data (2,400 households)
2019	2,400	2019 Update uses 2016-2018 data (4,000 households)
2020	2,400	2020 Update uses 2017-2019 data (5,600 households)
2021	2,400	2021 Update uses 2018-2020 data (7,200 households)
2022	2,400	2022 Update uses 2019-2021 data (7,200 households)
...

3.2 Outputs & presentation

The 2017 publication includes a booklet with charts that illustrate the main results. The data is published as open data as well as tables in an Excel spreadsheet. In addition, we publish a detailed methodology document.

For future updates, we suggest to include these statistics in a new chapter in the main SHS publication document and tables. We are not planning to create another booklet. It might be possible to publish charts if required.

In the 2017 publication, data is broken down by:

- Council area
- Health board
- Number of adults in household
- Number of children in household
- Disability status
- Work status
- Tenure
- 3-fold urban/rural classification
- SIMD quintile
- Before / after housing costs

It also includes the proportion of children in families that cannot afford each individual necessity.

Other break-downs are possible in principle, but this would depend on whether the group considered is sufficiently represented in the sample.

3.3 Equivalisation

To determine a household income that can be compared across different household sizes, the total household income from wages and benefits after tax is adjusted by applying an equivalisation factor. This takes account of the higher living costs of larger families.

The factor is based on how many adults and children live in the household. We used the modified OECD scale which works as follows. For the first adult, the factor is assigned a value of 1, any additional adult will increase this factor by 0.5, and each child under 15 will increase this factor by an additional 0.3. For example, a family with two adults and two children will be assigned a factor of $1 + 0.5 + 0.3 + 0.3 = 2.1$. The household income will be divided by this factor to obtain the equivalised household income. The modified OECD equivalence scale is the standard scale for the Statistical Office of the European Union (Eurostat)³. It is also used by several government departments in the UK for key household

³ <http://www.oecd.org/eco/growth/OECD-Note-EquivalenceScales.pdf>

income statistics. For example, the Department for Work and Pensions (DWP) use the modified OECD equivalence scale for their Households Below Average Income (HBAI) publication.

This equivalisation scale may not be appropriate for these statistics as it works under the assumption that we know the incomes of all adults in the household, whereas currently, the SHS collects income information of only up to two adults per household. On the other hand, there is value in using the same scale as other income and poverty statistics.

Other scales exist. For example, the PSE uses a scale based on a minimum income standard. Alternatively, a new scale could be developed that is bespoke to the SHS.

3.4 Income data

The SHS collects only basic information about incomes of the highest income earner and their partner. No information about the income of any additional adults in the household is currently collected. This means that the income of households with more than two people with incomes may be underestimated.

The SHS team are currently developing further questions on income to estimate the income of any additional adults in the household.

3.5 Income threshold

This publication reports on children in combined low income and material deprivation. Low income is defined as a household income below 70% of the Scottish median, as determined by the SHS income data. This was selected to ensure internal validity.

Alternative reference points include the official Scotland median income as determined through the Family Resources Survey, or the UK median income from the same source. It is worth noting that the FRS-based official statistics in children in combined low income and material deprivation use the UK median.

3.6 Housing cost data

Where income statistics are concerned, it is important to distinguish between household income before and household income after housing costs. In Scotland, the key poverty and inequality statistics are reported for incomes after housing cost. In this publication, housing costs include rent payments and mortgage payments, but not council tax. For future updates, we plan to impute the council tax base rate from the council tax band in each council area. We are also considering whether the SHS data allows us to apply council tax reductions to these costs.

In other poverty publications, mortgage payments are usually not included in the housing costs, only mortgage interest payments, but there are arguments for including either. Mortgage interest payment data is currently unavailable from the SHS.

3.7 Your input

We welcome any feedback on the topics listed above (and others). This could include your preferences on how we publish these statistics, and what exactly we publish, or any thoughts on the technical details of the methodology. Please email us at social-justice-analysis@gov.scot.

4 HOW WE DEVELOPED THE METHODOLOGY

This chapter explains in detail how we developed the methodology. In particular, it explains why this measure uses a different definition of material deprivation compared to other, similar measures.

4.1 Other combined low income and material deprivation measures

This publication estimates the percentage of children in combined low income and material deprivation for the purpose of providing council area break-downs. The methodology was developed based on similar measures, but tailored to the SHS dataset. Apart from being statistically sound, the methodology was designed to be consistent with existing measures where that was reasonable, and only as complex as necessary.

The methodologies of other, similar measures can be found in the links below. The methodology of this publication is most closely related to the PSE measure.

- UK and Scotland Official Statistics: [FRS-based Children in combined low income and material deprivation](#)⁴
- Poverty and Social Exclusion survey: [PSE](#)⁵
- EU material deprivation measure: [EU statistics on income and living conditions \(EU-SILC\)](#)⁶

4.2 Material deprivation definition

To develop the measure of children in combined low income and material deprivation using SHS data, we analysed the available dataset to find a definition of material deprivation that best distinguishes families on a low income from other families.

⁴ <http://www.gov.scot/About/Performance/scotPerforms/TechNotes/childdeprivation>

⁵ <http://www.poverty.ac.uk/sites/default/files/attachments/PSE-Child-poverty-and-exclusion-final-report-2014.pdf>

⁶ [http://ec.europa.eu/eurostat/statistics-explained/index.php/EU_statistics_on_income_and_living_conditions_\(EU-SILC\)_methodology_-_material_deprivation_by_dimension](http://ec.europa.eu/eurostat/statistics-explained/index.php/EU_statistics_on_income_and_living_conditions_(EU-SILC)_methodology_-_material_deprivation_by_dimension)

We also considered weighting each item as done in the FRS-based measure. However, research showed⁷ that the complexity added to the methodology by using weights is not justified by more accurate results.

Using data from the Scottish Household Survey (SHS) aggregated over three years, the dataset considered here contains 2,424 records of households with dependent children and three variables:

- A deprivation score, which is a count taking values between 0 and 22. This is the number of items/services a household cannot afford.
- The equivalised household income after housing costs
- The number of adults in the household

Records are weighted to account for survey design as well as the number of children in each household. This means that households with many children have a larger weight.

Records need to be split into two groups by introducing a cut-off. Deprivation scores above this cut-off will constitute material deprivation.

A statistical approach to selecting a cut-off is to select it in such a way that minimises differences within each of the two groups and maximises differences between the groups in terms of income distributions, an approach that was taken for the PSE child poverty measure.

Three statistical methods were used to find such a cut-off as listed below. Each method was applied to different cut-offs, and different measures of goodness of fit were considered. Each method was applied with as well as without including the number of adults in each household, so that the particular circumstances of lone parent families would be taken into account. For all methods, the logarithm of income was used to reduce the skewedness of the income distribution.

1. Logistic regression model

This model looks at how well household income and the number of adults in the household can predict the deprivation status (in material deprivation or not).

Independent variables:

- Equivalised household income after housing costs
- Number of adults in household

Dependent variable:

- Deprivation status (Deprived vs. not deprived)

⁷ <https://doi.org/10.1007/s11135-013-9838-0>

2. Discriminant function analysis

This method looks at how well the deprivation status distinguishes households in material deprivation from households not in material deprivation, by household income and number of adults in the household.

Independent variable:

- Deprivation status

Dependent variables:

- Equivalised household income after housing costs
- Number of adults in household

3. Analysis of variance (ANOVA)

This method looks at how well the deprivation status explains differences in household income and the number of adults in the households. For this method, unweighted records were used due to the limitations of the software used.

Independent variable:

- Deprivation status

Dependent variables:

- Equivalised household income after housing costs
- Number of adults in household

Logistic regression and discriminant function analysis suggest the best cut-off lies between two and three deprivations, whereas ANOVA yields a better fit when the cut-off sits between one and two deprivations. (Removing the number of adults in the households from the method leads to the same cut-offs for all methods, but isn't shown here.) Both cut-offs are lower than those used in other material deprivation measures.

The data provides no single cut-off that clearly distinguishes households of different deprivation scores. Furthermore, the income distributions for any grouping largely overlap. **The analyses suggest two potential cut-offs: identifying those households as materially deprived that either lack two or more, or three or more items.**

In addition to the data analysis, we considered how many households are materially deprived for each of these two definitions. The lower cut-off would result in 41% of children living in households which are considered materially deprived (independently of income), whereas the higher cut-off would result in 34% of children living in households which are considered materially deprived.

We chose the higher threshold, meaning that households that cannot afford three or more items from the list of necessities are considered to be in material deprivation.

The reasons for this choice are as follows. The statistical analysis suggests two thresholds, slightly favouring the higher one. The method that favours the lower one is based on unweighted data, which makes its result less reliable.

In addition to the statistical analysis, we considered the threshold set by the FRS based measure on children in combined low income and material deprivation. This uses a more complicated threshold which is equivalent to 4-5 items or more, resulting in a lower number of households considered to be in material deprivation. In order to not deviate too far from this measure, again a higher threshold is favoured.

Professor Nick Bailey (University of Glasgow) and Professor David Gordon (University of Bristol) were of great help in discussing approaches to find the best threshold.

4.3 Weights

The standard weights included in the SHS dataset are household weights. Using these would allow analysis of the *proportion of households* in which children are in combined low income and material deprivation. However, it would not allow analysis of the *proportion of children* in combined low income and material deprivation. The other standard child poverty measures (including the combined low income and material deprivation measure from the FRS) are based on the proportion of children, which is the preferred measure.

Whilst there is a random child weight in the SHS, this does not match with the definition of a child used for the material deprivation question - all 0-16 year olds along with 17-19 year olds in full-time education and living at home.

We considered two options for creating an appropriate child weight.

The first was to multiply the household weights by the number of children in the household. Initial analysis suggested this should be a good enough approximation. Subsequent analysis (based only on the number of children aged 0-16) showed a reasonable match to the NRS population estimates but with some larger differences for some local authorities - it is difficult to know whether these differences are big enough to be concerning. This will need to be revisited for future updates.

The second option was to create bespoke weights. This is still being considered but, for the moment, the weights from the first option are being used.

4.4 Income data

The SHS income data is known to be limited and is meant to provide a reference for data break downs by income. For the purpose of this publication, more detailed income information would be preferable. In particular, we would need the income of any additional adults.

We considered imputing additional incomes, but decided against it when the decision was made to improve the income data collected in future household surveys.

5 QUALITY ASSURANCE

This chapter summarises the analysis done to fully understand the quality of the data used for the statistics on children in families with limited resources.

5.1 SHS income data

To understand the quality of the SHS income data, we compared the equivalised net income distribution and the median incomes by family type to the equivalent statistics from the Scotland sample in the Family Resources Survey (FRS).

The income distributions (BHC as well as AHC) of SHS and FRS data have the same shape, with SHS incomes consistently slightly below FRS incomes. This is to be expected given the SHS figures exclude the incomes of some household members and are also likely to miss certain other income sources as fewer, and less detailed income questions are asked during the SHS interviews.

The comparison of median incomes by household type confirmed that incomes of households with more than two adults are lower in the SHS. Incomes of small families are similar. Unexpectedly, incomes of single parent families are slightly higher in the SHS compared to the FRS. As the difference is only just statistically significant, this is not considered cause for concern, but will be revisited for the next update.

5.2 SHS material deprivation questions

The material deprivation questions in the SHS were chosen from those in the FRS and those used by the Poverty and Social Exclusion survey (PSE).

For those questions that are comparable because the item is the same and the wording of the question is similar, we compared the percentage of respondents that said they cannot afford each item between the surveys (SHS 2014-16, FRS 2014/15, PSE 2012).

Of the 22 items in the SHS, eight are comparable to FRS items. For these, there are almost no statistically significant differences in the percentage of children in families that cannot afford each item. There is one exception. In the FRS, more children live in families unable to afford access to garden or an outdoor space nearby to play in safely. However, the wording of the questions differs sufficiently between the two question to explain the discrepancy.

All 22 items in the SHS are comparable to items in the PSE. However, the latest PSE data is from 2012 and refers to the whole of the UK and to children in a different age range, so direct comparisons between the figures are difficult. However, the items that most households cannot afford are the same ones.

We also compared how many items households cannot afford across SHS and FRS surveys, and the frequency distributions are similar.

5.3 Combined low income & material deprivation

This publication reports on children experiencing combined low income and material deprivation. The measure is similar to the existing, FRS-based measure; however, the exact definitions of low income and material deprivation differ between the two measures.

5.3.1 Low income definition

The SHS measure defines low income as incomes below 70% of the *SHS-derived Scottish median* equivalised net household income, whereas the FRS measure defines low income as incomes below 70% of the *FRS-derived UK median* equivalised net household income.

5.3.2 Material deprivation definition

The differences in the definition of material deprivation is even larger. In the SHS measure, a household is considered materially deprived if it is unable to afford three or more items from a list of 22 items.

The FRS includes a series of 21 items. Where a household cannot afford the item this counts toward a material deprivation score. The score given for each item is determined using a prevalence weighting method which means that the larger the proportion of the population who own an item the bigger score it has. The logic being that if a household cannot afford an item that is very common across the population this is 'worse' than a household being unable to afford a relatively rare item. The scores are added for each household across all 21 items and then divided by the maximum possible score and multiplied by 100. Where a household has a resulting score of 25 or more the children in that household are deemed to be materially deprived. This usually equates to being unable to afford around 4 or 5 items.

To understand whether the FRS measure and the SHS measure give comparable results, we recalculated the FRS measure using the material deprivation definition that we used for the SHS measure. This resulted in a larger percentage of children in material deprivation. It is reasonable to assume that the difference is due to the difference in items.

5.3.3 Comparison with HMRC local child poverty estimates

We also compared the council area figures with the child poverty estimates that HMRC last published for 2014, and which are based on benefit and child tax credit administrative data.

There is moderate correlation between the HMRC child poverty estimates and the SHS low income and material deprivation figures. Those council areas that are significantly different from the Scotland average (Glasgow, Aberdeenshire, East Lothian, East Renfrewshire, Shetland Islands & Moray) are also mostly at the lower/higher end of the HMRC child poverty distribution.

6 REFERENCES

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