



Original Research

How well do area-based deprivation indices identify income- and employment-deprived individuals across Great Britain today?

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ABSTRACT

Background: Area-based deprivation indices are used in many countries to target interventions and policies to populations with the greatest needs. Analyses of the Carstairs deprivation index applied to postcode sectors in 2001 identified that less than half of all deprived individuals lived in the most deprived areas.

Objective: This article examines the specificity and sensitivity of deprivation indices across Great Britain in identifying individuals claiming income- and employment-related social security benefits.

Study design: This was a descriptive analysis of cross-sectional administrative data.

Methods: The data sets for the 2020 Scottish Index of Multiple Deprivation, Scottish Income and Employment Index, the 2019 English Index of Multiple Deprivation and the 2019 Welsh Index of Multiple Deprivation were obtained. For each data set, small areas were ranked by increasing overall deprivation, and the cumulative proportions of individuals who were income and employment deprived were calculated. Receiver operating characteristic curves were plotted to show the sensitivity and specificity of each index, and the percentages of income- and employment-deprived individuals captured at different overall deprivation thresholds were calculated.

Results: Across all indices, the sensitivity and specificity for detecting income- and employment-deprived individuals were low, with less than half living in the most deprived 20% of areas. Between 55% and 62% of income-deprived people and between 56% and 63% of employment-deprived people were missed across the indices at the 20% deprivation threshold. The sensitivity and specificity were slightly higher for income deprivation than employment deprivation across indices and slightly higher for the Scottish Index of Multiple Deprivation and Scottish Income and Employment Index than for the English Index of Multiple Deprivation and Welsh Index of Multiple Deprivation.

Conclusion: Area-based deprivation measures in Great Britain have limited sensitivity and specificity for identifying individuals who are income or employment deprived. Place-based policies and interventions are unlikely to be effective at reducing inequalities as a result. Creation of individually linked data sets and interventions that recognise the social and economic relationships between social groups are likely to be more effective.

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Background

Health inequalities, defined as the “systematic, avoidable and unfair differences in health outcomes that can be observed between populations, between social groups within the same

population or as a gradient across a population ranked by social position”,¹ remain one of the greatest public health challenges today.² Despite there being substantial evidence describing the effective actions to reduce health inequalities,^{3–7} they have remained stubbornly wide across most countries where they have been monitored.⁸

In contrast to many European countries, where individually linked socio-economic position and mortality data are routinely available, monitoring of health inequalities in the United Kingdom

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has relied on area-based deprivation indices to rank the population.^{9–12} The use of a comprehensive range of indicators and statistical analyses to monitor health inequalities has been commended,^{13,14} but there are three key limitations to the use of area-based indices for this purpose. First, it misallocates individuals to the average deprivation level of local areas, which reduces the scale of inequalities towards the null. Second, it can be misused to accord individuals the risk and deprivation of the area (and population average) in which they live (i.e. the ecological fallacy). This is exacerbated when the area unit size is larger (e.g. local authorities compared with data zones or Lower Super Output Areas). Third, some deprivation indices include health outcomes in their weightings, and this leads to a circular logic in the use of the indices for ranking health outcomes (which has led to the creation and use of subindices such as the Index of Employment and Income [IEI] deprivation in Scotland, which do not include health outcomes).

Despite these limitations, the use of area deprivation indices has the key advantage of identifying spatial concentrations of need, which can assist in the planning of services and interventions. This has allowed targeting of health, social and economic interventions and funding to the areas of greatest risk and needs.¹⁵ However, identifying the most deprived areas may not identify the most deprived ‘highest risk’ individuals. Furthermore, area-based strategies ignore the social and economic *relationships* that underlie inequalities between social groups (e.g. they do not address the income flows between landlords and renters, which maintain or exacerbate economic inequalities).^{16,17}

The analysis of the Carstairs deprivation index in 2001 in Scotland demonstrated that targeting the most deprived 20% of postcode sector areas would miss more than half of the most deprived individuals because most did not live in the most deprived areas.¹⁸ This article updates that analysis using the smaller area data and the most commonly used deprivation indices in Scotland, England and Wales (the Scottish Index of Multiple Deprivation [SIMD], the IEI, the English Index of Multiple Deprivation [IMD], and the Welsh Index of Multiple Deprivation [WIMD]) by considering how sensitive these indices are at identifying income- and employment-deprived individuals at different thresholds.

Methods

Data sources

The 2020 SIMD and IEI data sets were obtained from the Scottish Government Web site and by personal correspondence.¹⁹ The 2019 English IMD and WIMD data sets were obtained from the UK Government and Welsh Government, respectively.^{20,21} Although the IEI data set is less commonly used, nor routinely available, it was included because of its value for health inequality analyses because it does not include health measures in the index and thereby avoids the circular logic of using SIMD as a health ranking measure. The data sets included the deprivation ranking, the crude number of individuals claiming unemployment-related social security benefits and the crude number of individuals claiming income-related benefits in each small area. The data relating to individuals are allocated to each small area using their addresses and associated postcodes. These are unique identifiers that avoid misallocation on the basis of imprecise georeferencing, although misallocation could occur as a result of incorrect or out-of-date addresses within administrative records.

Analytical approach

Each data set was first ranked by the overall relevant deprivation index. The cumulative proportion of income- and

employment-deprived individuals was then calculated and graphed as a receiver operating characteristic curve to compare sensitivity and specificity across all possible deprivation thresholds. The percentage of income- and employment-deprived individuals resident within the most deprived 5%, 10%, 15%, 20%, 25% and 30% of small areas for each of the deprivation indices were calculated.

Results

The receiver operating characteristic curve for the cumulative percentage of income- and employment-deprived individuals across areas ranked by overall SIMD deprivation in Scotland is shown in Fig. 1. As expected, more deprived areas contain a higher proportion of people who are individually deprived than less deprived areas, but the curve is not steep, indicating a low sensitivity and specificity. Almost identical results were found when the IEI was used to rank Scottish areas instead of SIMD. The IMD for England and the WIMD for Wales are slightly less sensitive than both of the Scottish indices (Table 1).

Taking the 20% most deprived areas as the threshold, only 45% of income-deprived individuals were identified using both of the Scottish indices, with 43% identified using the English IMD and 38% using WIMD. The percentage of employment-deprived individuals identified at the 20% most deprived threshold was slightly lower for all indices, with 44% of people identified with both the SIMD and IEI, 42% with the English IMD and 37% with the WIMD.

Discussion

The sensitivity and specificity of area-based deprivation indices in Great Britain in terms of identifying individuals who are income or employment deprived are low. If the standard threshold of the most deprived 20% of areas is used to identify people at risk or with higher needs, some 55–62% of income-deprived people and 56–63% of employment-deprived people will be missed.

The strengths of the approach taken in this article include the simplicity of the analysis, the triangulation of findings across four deprivation indices and three national populations, and the use of commonly used administrative data that are the most common basis for identifying populations at greatest need across Great Britain. The extent to which this applies beyond Great Britain, to other area-based indices and to other outcomes has not been covered here.

The findings in this article show that the SIMD, IEI, English IMD and WIMD are more sensitive than the Carstairs index as applied to postcode sectors in Scotland in 2001, when only 34% of all income-deprived households and 41% of all employment-deprived individuals were found to live in the most deprived 20% of areas. This is likely to reflect the larger area unit size of postcode sectors compared with the data zones and Lower Super Output Areas used for deprivation indices now.

There are numerous implications of this study across policy, practice and academia. First, as much as area-based indices of deprivation are useful tools for identifying spatial areas with greater needs, they are limited in their sensitivity (i.e. they miss many people experiencing deprivation) and specificity (i.e. they include many people within deprived areas who are not experiencing deprivation). Using area deprivation to identify people at higher risk to plan and target interventions is likely to only have very muted impacts as a result. This compounds the problem of missing the crucial importance of economic and social relationships between social groups (e.g. between renters and landlords, company owners and workers, savers and borrowers), which underpin trends in social, economic and health inequalities.^{16,17,22} Place-based strategies, which have become increasingly popular

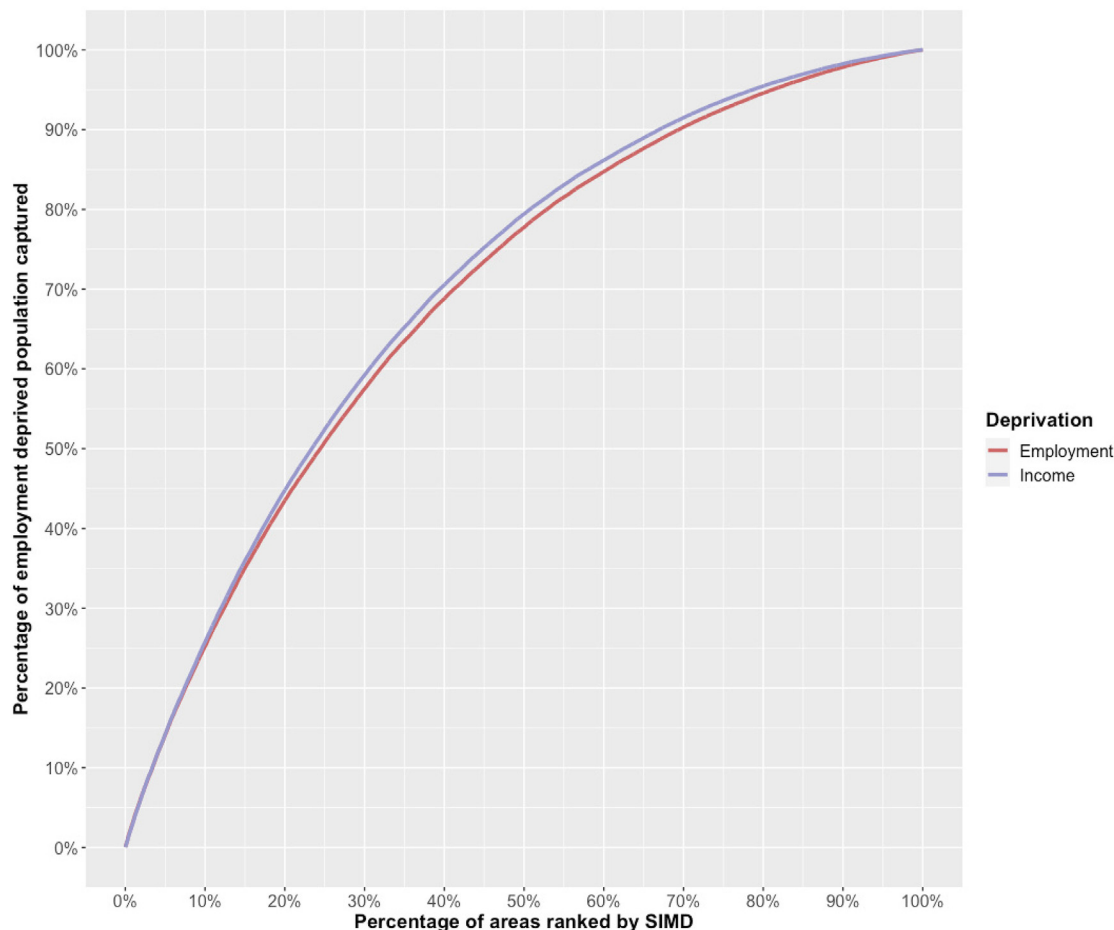


Fig. 1. The cumulative percentage of individuals who are income and employment deprived across data zones ranked by SIMD.

Table 1

Percentage of income- and employment-deprived individuals found within the most deprived areas using the Scottish IMD and IEI ranks, 2020, Scotland, English IMD ranks, 2019, England and Welsh IMD rank, 2019, Wales.

Individual deprivation outcome	Nation	Deprivation index	Deprivation threshold (i.e. the percentage of areas included in the most deprived group)					
			5%	10%	15%	20%	25%	30%
Income deprived	Scotland	SIMD	14.2%	25.8%	36.0%	44.8%	52.4%	59.2%
	Scotland	IEI	14.2%	25.8%	35.6%	44.8%	52.5%	59.3%
	England	IMD	13.9%	25.3%	34.9%	43.4%	50.9%	57.6%
	Wales	WIMD	12.0%	21.5%	29.9%	37.9%	44.9%	51.2%
Employment deprived	Scotland	SIMD	14.1%	25.2%	35.1%	43.5%	55.1%	57.5%
	Scotland	IEI	14.2%	25.3%	35.1%	43.5%	50.8%	57.6%
	England	IMD	13.5%	24.3%	33.5%	41.6%	48.9%	55.4%
	Wales	WIMD	11.3%	20.5%	28.9%	36.8%	43.8%	50.3%

IEI, Scottish Income and Employment Index; IMD, the 2019 English Index of Multiple Deprivation; SIMD, Scottish Index of Multiple Deprivation; WIMD, the 2019 Welsh Index of Multiple Deprivation.

amongst policymakers in recent years, are likely to have very limited impacts on inequalities as a result.¹⁵

However, in the absence of individual-level data on socio-economic position being routinely linked, in particular to health data, area deprivation indices provide an important and useful means of monitoring health inequality trends and identifying areas with greater needs for service planning. However, facilitating and funding a sustained linkage of individual socio-economic position (e.g. from the census, Her Majesty’s Revenue and Customs and the Department for Work and Pensions) and health, mortality and other outcome data would vastly improve the understanding of inequality trends, make higher quality evaluations

possible and allow for much better targeting of policies and interventions.

Conclusion

Area-based multiple deprivation measures, including SIMD and IEI, English IMD and WIMD, are not sensitive or specific at identifying income- or employment-deprived individuals. The use of area-based deprivation indices and place-based approaches risks misunderstanding the extent of need across spatial areas and might misdirect attention away from the economic and social relationships between social groups that underlie inequality trends.

Author statements

Ethical approval

No ethical approval was sought, as this study was restricted to analysis of secondary data.

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No funding for this study was received. G.M. and D.L. are salaried by the University of Glasgow. D.W. and R.H. are salaried by the NHS.

Competing interests

We declare that no author has any conflicts of interest.

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