The Health of Places

Disaggregating measures of health and defining more equal places

Policy brief

The issue

Understanding the complex relationship between health and wlider social and economic outcomes is key to help us improve quality of life and reduce inequalities. Health is an important pre-requisite to almost all daily activities, and so understanding how health impacts wider outcomes is essential for designing policies that i) improve health ii) improve wider outcomes and iii) reduce inequalities.

Place is usually thought of in terms of small geographical areas, with the logic being that people can see the people who live geographically close to them and hence identify with them. However, health (and other outcomes) data are usually published at aggregate levels, often too big for an individual to meaningfully feel any sense of belonging to. To overcome this issue, studies have attempted to attribute data reported at aggregate levels to small areas by using attribution algorithms. Little is known, however, about which is the best algorithm to use and so aggregate data may be misattributed, leading to possible spurious relationships.

Additionally, place based (or area based) analysis typically uses the average health outcome of a place (either as an outcome or a key explanatory variable). These values tend to be reported at 'health geography' level. This essentially implicitly assumes that everyone who lives in that area is represented by the 'average' health score of that area. But there is no reason why this should be the case. The smaller the place/area, the more representative it is likely to be. Lower-layer Super Output Areas (LSOAs) are typically the smallest unit of analysis, but even LSOAs have populations of c. 1,5000. LSOAs are made up of 4 to 6 smaller areas called Output Areas (OAs) and certain health outcomes are available at OA level. We therefore think it might be possible to redefined LSOA boundaries by regrouping OAs such that we minimise the variation within the newly created areas.

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This project aims to address the shortfalls in the current literature, outlined above. We have three main objectives:

1. Systematically examine the existing literature that attributes health measures reported at an aggregate level to smaller geographical areas. Then use the most appropriate technique to attribute a range of health measures (including physical and mental) to small geographic areas;
2. Use multidisciplinary approaches to define a new small-level place-based measure of health geography, defined in terms of more equal health *within* these new areas;
3. Analyse the relationship between health measures and social and economic outcomes at small geographical areas, including standard definitions and our new definition.

What we are finding[1]

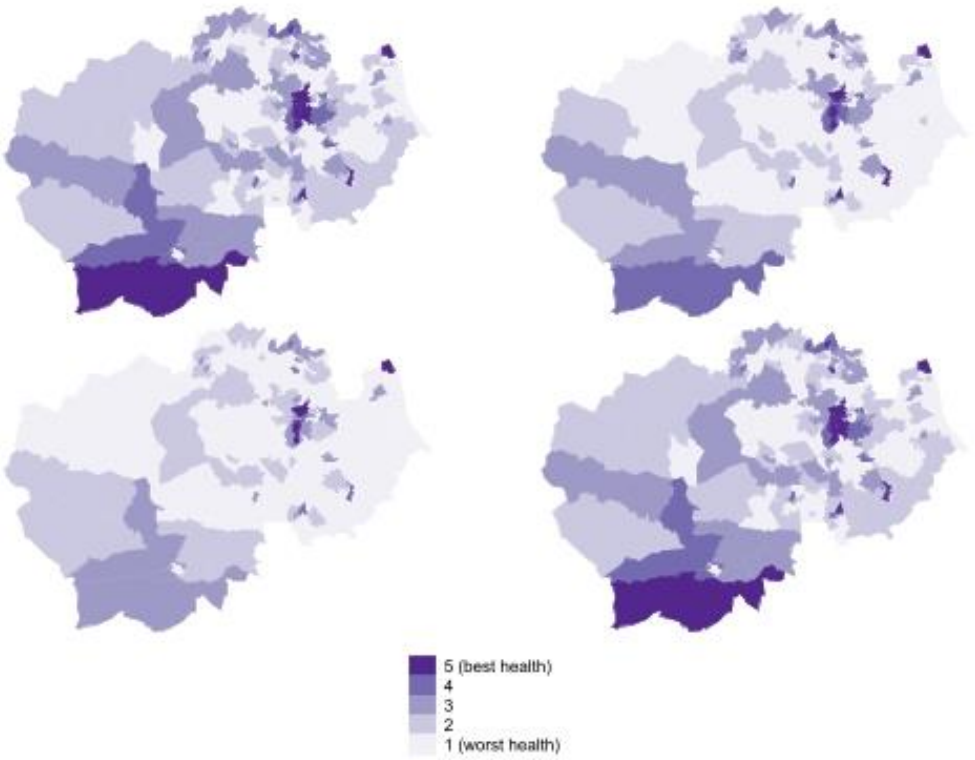
There are many ways to disaggregate measures of health and the can produce markedly different results. Within the health science and geography literatures there are four main attributing methods: spatial interpolation, dasymetric mapping, regression and spatial microsimulation. All of the discussed spatial interpolation methods work by attributing and overlaying information, rather than creating smaller/different areas. None of the methods are data intensive, and often interpolation can be achieved with only one dataset. Spatial interpolation and regression methods were the most utilised in the health science literature. Both groups of methods allow adjustments for the underlying demographic of the populations that are being disaggregated. Given the link between sociodemographic factors and health, it is intuitive that researchers would prioritise these criteria when selecting an attribution algorithm.

We coded the most used approaches up and tested, using both real and simulated data, which methods performed best. Using the 2011 Census data on self-assessed health, we found that spatial interpolation and regression methods outperformed the other two methods. In particular, we found that the goodness of the estimated models was sensitive to the additional information/variables included in the models. We show it is important to account for as much information as possible. Simple models that only account for the age and gender composition of the larger and smaller areas can lead to very misleading estimates.

Figure 1 shows the results from three disaggregation methods along with the true value of self-assessed health at LSOA level within County Durham. We show that it is important to control for population characteristics.

[1] These results are still preliminary as analysis is continuing using newly available data from Census 2021 and electronic health records.

Figure 1: Self-assessed health[2] of Lower-layer Super Output Areas in County Durham under various disaggregation methods



Note: top left panel = 'true' values obtained from Census 2011. Top right panel = when we adjust for age and gender. Bottom left panel = when we adjust for only age. Bottom right panel = when we adjust for age, gender, ethnicity, and the Index of Multiple Deprivation (IMD)

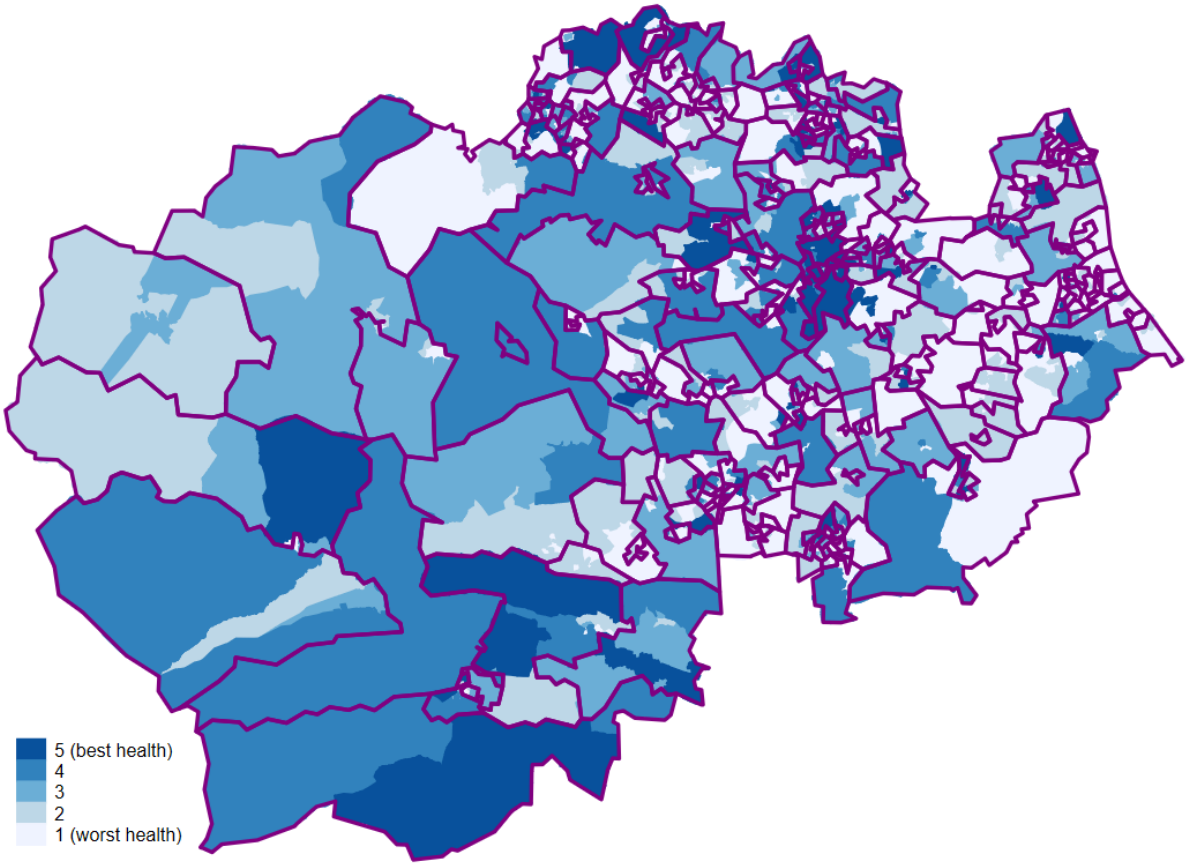
Some small areas have very unequal health within them. Considering County Durham as an example again, Figure 2 shows that some LSOAs contain OAs where the self-assessed health is amongst the worst in the country as well as some OAs where the health is amongst the best in the country.

We developed an algorithm to help us combine OAs together in a different way such that neighbouring OAs were joined together to minimise the variation in health within the newly constructed areas (of similar size to a LSOA).

Our newly defined areas outperform existing LSOAs in minimising the variation of self-assessed health (Table 1). This is important if we want to use area-based measures of health. This will not eradicate, but will help reduce the risk of ecological fallacy.

[2] Source: Census 2011.

Figure 2: The average self-assessed health[3] of Output Areas in County Durham



Note: the solid (purple) lines are existing LSOA boundaries.

Boundaries of some small places changed after the 2021 Census and so we think it is important to redo our analysis of self-assessed health using the latest data and the most recent LSOA boundaries.

[3] Source: Census 2011.

Table 1: Comparing variation within areas of existing geographies and our prosed new geographies

	Current LSOAs	New areas
Number (N)	34,753	31,324
Number of OAs in LSOA/new area	5.21 [Range: 2 to 13]	5.24 [Range: 4 to 7]
Population size	1,614 [Range: 983 to 8,300]	1,791 [Range: 1,224 to 9,363]
Average 'health' of an area	80.7% [Range: 48.0 to 97.0]	80.6% [Range: 48.2 to 97.1]
Within area standard deviation	5.15 [Range: 0.21 to 28.21]	3.17 [Range: 0.16 to 16.48]

What needs to happen next?

We have shown that it is important to correctly disaggregate measures of health to smaller geographical areas. We urge data owners to provide data at as small a geographical level as possible.

Further, we have shown that health can vary substantially within small areas and so to get better information on population health we need to consider more homogenous areas with respect to health.

We are currently working on repeating our analysis using more up-to-date information and other measures of health.

We are working with some Combined Authorities and ICSs so understand the implications of our proposed new areas

About the project

This project is being led by researchers at the University of Manchester in collaboration with the University of York, and funded by the Health Foundation under the Social and Economic Value of Place programme (grant number FR-00002346). The funders had no role in the writing of the report.

We would also like to thank the members of the project advisory group and all members of the public who participated in the various events related to this project.

You can find more information about the project here.