How concentrated is health deprivation and disability between Newcastle upon Tyne, Manchester and The City of Bristol?

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Abstract

This paper aims to examine the difference in the concentration of Health Deprivation and Disability (HDD) score across three major cities: Newcastle upon Tyne, Manchester and The City of Bristol, using data from the IMD 2019. HDD measures the risk of premature death and quality of life through four indicators: years of potential life lost, comparative illness and disability ratio, acute morbidity, and mood and anxiety disorders. Through spatial analysis, assessed the concentration of HDD scores across lower-layer super output areas (LSOA) or neighbourhoods in three major cities in England.

Previous studies have examined the link between geographic location and health variation (Curtis and Rees Jones, 1998). Many note a disparity between the North and South of England; studies regarding the North-South divide highlight that inequalities are typically higher within the northern regions of England than the southern regions, with the exception of London (Ajebon and Norman, 2016). However, the study revealed the spatial concentration of HDD is fairly similar throughout cities in the North and the South of England and the concentration of health inequality at the local level may not be as directly influenced by the North-South divide. Although this report gives an overview of three major cities in England, it would be unwise to extrapolate the findings of this short report to the rest of England. Rather, the report indicates potential further research.

Introduction

This paper aims to examine the difference in the concentration of Health Deprivation and Disability (HDD) score across three major cities: Newcastle upon Tyne, Manchester and The City of Bristol, using data from the IMD 2019. Spatial inequalities have become of increasing interest, particularly in what has been commonly termed the 'North-South divide' (Martin, 1988). Previous studies have identified regional disparities in deprivation (Lupton, Obolenskaya and Fitzgerald, 2016), and links have been made between health and deprivation (Carstairs, 1995; Ajebon and Norman, 2016). As such, one may draw inferences between health deprivation and geographical locality. Whilst previous studies have sought to spatially analyse health and deprivation in England more broadly (see: Ajebon and Norman, 2016), the use of the Health Deprivation and Disability Domain from the IMD 2019 is novel, particularly when looking at the concentration of health deprivation at the local level.

Through spatial analysis, it aims to assess the concentration of HDD scores across lower-layer super output areas (LSOA) or neighbourhoods in three major cities in England. Establishing and comparing the concentration of HDD scores between geographic locations can reveal new findings on how concentrated HDD is between these cities and may lead to further research towards the disparities between the North and South of England. Consequently, funding and social policy directives regarding welfare provision can be accurately deployed to ensure that areas with high HDD scores are not unduly disadvantaged, for example the distribution of the 'levelling-up fund', although some may argue that it has not been distributed fairly to previously overlooked local governments (Norris, 2023).

Literature Review

The following literature review will be presented in two sections deprivation and geographic locality. The first section will underpin the links between deprivation and health, whilst the latter will examine literature surrounding spatial variability of health inequalities. This literature review will conclude by highlighting knowledge gaps that will dictate the course of this report.

Deprivation

Before outlining health deprivation, one must understand the link between health and deprivation. Using measures of "'deprivation' — that is, a score composed of a number of social variables" — associations between socioeconomic variables and health outcomes have been made (Carstairs, 1995, p. S4). This association has been well studied by the likes of Townsend, Phillimore and Beattie (1988), Carstairs and Morris (1989; 1991), and Siegel, Mielck and Maier (2015) who all draw links between deprivation and health inequalities, where more deprived areas are seen to have a higher mortality rate or more health inequalities. As such, there is a clear association between deprivation and health inequality. However, one must be weary of overstating the influences of deprivation. Walsh et al. (2010) note that deprivation alone cannot explain health inequalities; consideration towards other variables, such as health behaviours or societal breakdown, is needed to explain wider health inequalities.

By outlining the initial notions of health and deprivation, we can thus define the notion of health deprivation. This is a scale that measures the risk of premature death and quality of life, where those that lack the means to live the average life expectancy or have a standard quality of life, are regarded to have high health deprivation (McLennan et al., 2019). Rather than considering health and deprivation as separate notions, the HDD domain combines these and uses them to indicate the quality of life and premature death.

Geographic Locality

Previous studies have examined the link between geographic location and health variation (Curtis and Rees Jones, 1998). Many note a disparity between the North and South of England; studies regarding the North-South divide highlight that inequalities are typically higher within the northern regions of England than the southern regions, with the exception of London (Ajebon and Norman, 2016). Moreover, Corris et al. (2020) notes health disparities between the North and South of England are potentially widening, meaning those within the North of England are facing more significant health inequalities.

Spatial analysis of health inequalities in England has revealed a growing divide in the country. Whitehead and Doran (2011) argued that spatial inequality is due to social and economic factors, and consideration of both is needed to reduce the divide. Moreover, growing amounts of research revealed allocating resources to deprived areas has reduced the gap in health inequality (Barr, Bambra and Whitehead, 2014). Consequently, one must consider the growing concerns around the provision of welfare, access to hospitals and GP practices and the allocation of resources across space to ensure people are not left behind.

Whilst earlier studies focused on deprivation and its influence on health outcomes across England, HDD measures the extent to which a neighbourhood is deprived of the quality of life. By comparing the concentration of HDD scores between Newcastle upon Tyne, Manchester and The City of Bristol, it may reveal further disparities within cities and highlight areas in need of support to ensure health inequalities are not widened.

Description of data and Methods

The data stems from a collection of datasets from Webb and Thomas (2020) and is of the total population of small areas or neighbourhoods (LSOAs) in England. The variable focused on (HDD) is from the IMD (2019) official statistics, which measures the relative deprivation of 32,844 LSOAs across England. HDD measures the risk of premature death and quality of life through four indicators: years of potential life lost, comparative illness and disability ratio, acute morbidity, and mood and anxiety disorders; it does not measure aspects of behaviour or environment that may impact future health deprivation (McLennan et al., 2019). These indicators are then combined and placed onto a scale — HDD domain — and ranked from least to most deprived (Department for Communities and Local Government, 2015).

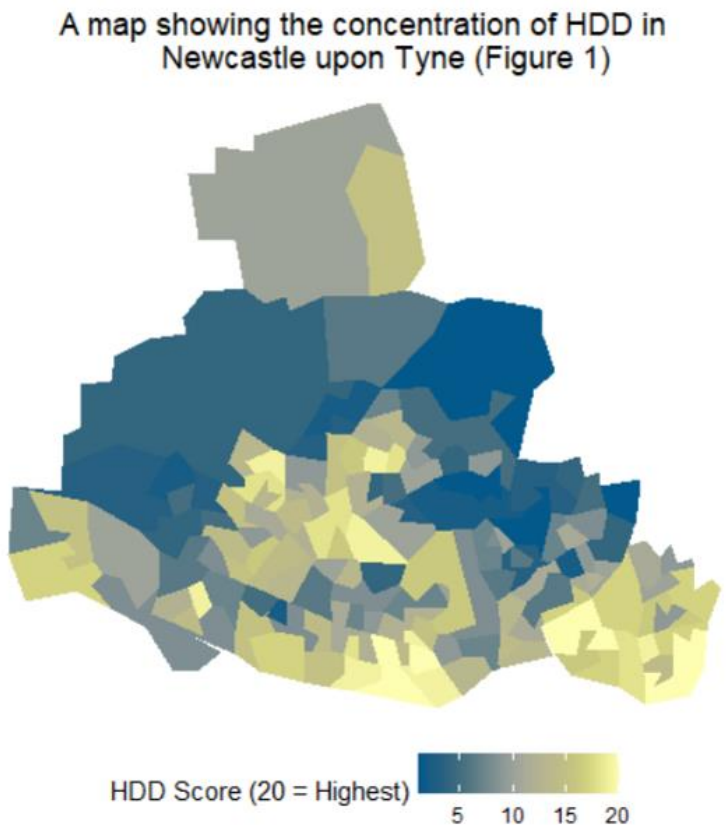
Using spatial data at the LSOA level, spatial analysis was conducted on Newcastle upon Tyne, Manchester, and The City of Bristol to analyse the concentration of HDD within the cities and enable comparison between each city. The variable HDD score was visualised spatially and transformed into quantiles (n=20) for ease of visualisation. A Euclidean distance matrix was used, and the spatial data was visualised through choropleth maps. Spatial autocorrelation was also assessed through Moran's I to assess the spatial relationship of HDD and compare between cities.

Findings

A disclaimer is needed; the primary focus should be on the initial choropleth maps; however, overlayed choropleth maps are included in the appendix to help locate landmarks (figures 4-6). Statistical estimations of Moran’s I can also be found in the appendix (figures 7-9).

Table 1: Summary of Moran’s I statistic

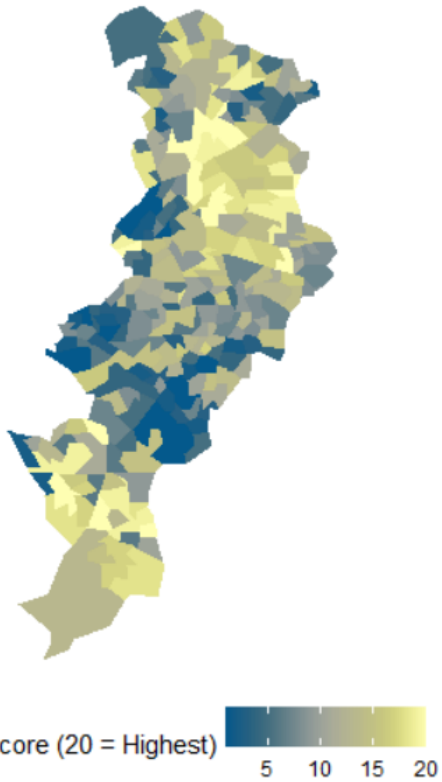
City	Moran’s I Statistic
Newcastle upon Tyne	0.1043955
Manchester	0.0823432
Bristol	0.1031677



Newcastle upon Tyne

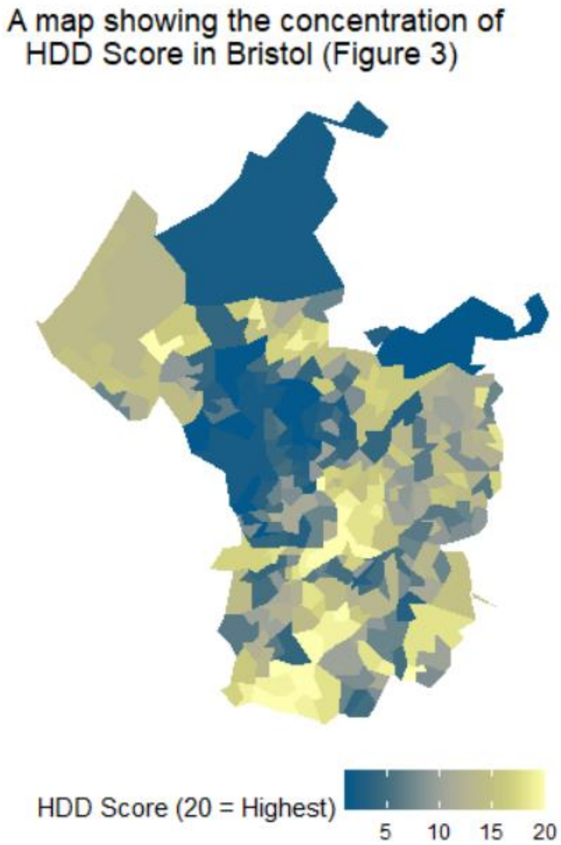
The Moran's I statistic for Newcastle upon Tyne was approximately 0.104 ($p<0.05$) (Figure 7). This indicates there is some clustering of neighbourhoods for HDD, although this is quite weak, and the distribution is close to random. When comparing this to the choropleth map (Figure 1), it appears higher HDD scores are concentrated around the city centre and along the River Tyne, particularly towards the East near Byker. There also seems to be a concentration of higher HDD scores towards Blakelaw. Interestingly, it does appear that neighbourhoods that contain or are near hospitals have a lower concentration of HDD.

A map showing the concentration of HDD Score in Manchester (Figure 2)



Manchester

When assessing Moran's I statistic for Manchester (Figure 8) it was approximately 0.082 ($p<0.05$), meaning it appears to have a weak, close to random, spatial concentration of neighbourhoods. When looking at Figure 2, we can observe that higher HDD scores are more dispersed throughout Manchester, although there is still some clustering of neighbourhoods. Interestingly, the inverse is apparent where there are concentrations of low HDD, particularly in the city centre, Didsbury and Chorlton-cum-Hardy. The rest of the region appears to have relatively higher scores. It appears that the locality of hospitals has little impact on HDD in the surrounding neighbourhoods.



Bristol

The Moran's I statistic for Bristol (Figure 9) was approximately 0.103 ($p<0.05$). Again, this indicates some clustering of HDD around neighbourhoods, but the spatial correlation is relatively low and random. When looking at Figure 3, there appears to be a concentration of neighbourhoods with low HDD towards the city centre. In contrast, clusters of higher HDD appear towards the south of Bristol in areas such as Hartcliffe. Moreover, neighbourhoods around hospitals do appear to have lower HDD than those further away.

Overall, when looking at the autocorrelation of the HDD variable using Moran's I statistic (Table 1), we can argue that all cities have a weak positive spatial autocorrelation. Newcastle and Bristol have similar clustering; higher HDD scores were more clustered together, while lower scores were typically more concentrated together. However, the autocorrelation remains relatively low, meaning the spatial patterns of HDD do not have a strong relationship and are more random. On the other hand, Manchester appears to have a much lower autocorrelation, meaning the clustering of values seems to be more random; therefore, HDD score is more dispersed throughout Manchester than the former two cities.

Discussion and conclusion

Generally, the spatial concentration of HDD is fairly similar throughout cities in the North and the South of England. Whilst this may not directly contradict initial findings by Ajebon and Norman (2016), it does give an alternative view. The concentration of health inequality at the local level may not be as directly influenced by the North-South divide; other confounding factors may be at play such as income or health attitudes (Walsh et al., 2010). This can be seen with the spatial concentration of HDD in Newcastle upon Tyne, where there is a high concentration of HDD in the city centre, contrasting with the latter two cities where it shows the opposite. Therefore, as Walsh et al. (2010) note, one should consider the influence of other variables than just deprivation when assessing health inequalities across space to gain a greater understanding of the apparent concentration.

Furthermore, when assessing the spatial concentration of HDD, we can argue there is a place for space and health. As Curtis and Rees Jones (1998) note, place and space can have an impact on health experience and inequality. We can see this with the findings where there are apparent clusters or concentrations of neighbourhoods with higher HDD and vice versa. Whilst variations may be complex and influenced by a multitude of confounding factors, we must acknowledge the apparent spatial inequalities at the local level. This is particularly important as the allocation of resources can have an impact on health inequalities (Barr, Bambra and Whitehead, 2014). Findings have revealed a potential link between hospital location and HDD, where neighbours that are closer to hospitals may have less HDD. However, this trend was not apparent in Manchester; thus, further work is needed to understand the link between access to health services and the impact on health inequality.

Although this report gives an overview of three major cities in England, it would be unwise to extrapolate the findings of this short report to the rest of England. Rather, the report indicates potential further research. Whilst previous research has looked at resource allocation at the regional level (see: Barr, Bambra and Whitehead, 2014), this report addresses the concentration of HDD at the local level. As noted before, the findings of this report have potentially revealed a link between HDD and access to hospitals. Further study could involve examining access to hospitals, GP practices and the allocation of resources at the local level and whether this improves health inequalities.

Overall, this report investigates the concentration of HDD across three major cities in England. It has revealed that within the three cities, there is some clustering of neighbourhoods for HDD, although this is quite weak, and the distribution is close to random. Interestingly there may be a link between the location of hospitals and the reduction in HDD, though this needs further research such as examining the spatial relationship between access to hospitals and levels of HDD. Moreover, the North-South divide may not be as apparent when looking at the spatial concentration of HDD at the local level.

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Figure 7. Moran's I test - Newcastle

```
## Warning in mat2listw(ncl_close): style is M (missing); style should be set to a
## valid value
##
## Moran I test under randomisation
##
## data: ncl_centroids$hlth_dpr_ads
## weights: mat2listw(ncl_close)
##
## Moran I statistic standard deviate = 12.999, p-value < 2.2e-16
## alternative hypothesis: greater
## sample estimates:
## Moran I statistic Expectation Variance
## 0.10439546248 -0.00574712644 0.00007179639
```

Figure 8. Moran's I test - Manchester

```
## Warning in mat2listw(manc_close): style is M (missing); style should be set to
## a valid value
##
## Moran I test under randomisation
##
## data: manc_centroids$hlth_dpr_ads
## weights: mat2listw(manc_close)
##
## Moran I statistic standard deviate = 17.186, p-value < 2.2e-16
## alternative hypothesis: greater
## sample estimates:
## Moran I statistic Expectation Variance
## 0.08234324089 -0.00355871886 0.00002498425
```

Figure 9. Moran's I test - Bristol

```
## Warning in mat2listw(bristol_close): style is M (missing); style should be set
## to a valid value
##
## Moran I test under randomisation
##
## data: bristol_centroids$hlth_dpr_ads
## weights: mat2listw(bristol_close)
##
## Moran I statistic standard deviate = 21.28, p-value < 2.2e-16
## alternative hypothesis: greater
## sample estimates:
## Moran I statistic Expectation Variance
## 0.10316774894 -0.00375939850 0.00002524905
```