Locating new chiropractor practices in England and Wales

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Abstract
Chiropractor practice is the non use of drugs in healing. In the United Kingdom, these services are not paid for by the Government through the National Health Service but patients must pay for the said services. Chiropractor clinics are increasing becoming popular but are unevenly distributed with their location being subject to both sickness (demand) and ability to pay for the services. In need to establish new clinics in light of increasing demand, this study uses Geographical Information System and statistical analyses to locate optimal location of new clinics. Key factors considered are area's deprivation, illnesses and poverty as recorded in UK's 2001 census data. Areas' deprivation is found to be of less importance in selecting the optimal location areas due to its multiple characters whereas illness, distance from existing clinics and ability to pay are the main determinants. Twenty proposed optimal clinic areas in England and Wales are eventually modelled. These would be used in new establishment with an aim of serving the increasing chiropractor practices demand in the two countries.

1.0 Introduction

There has been an exponential growth of alternative medicine practice in United Kingdom (UK) in the recent past (Zollman and Vickers, 1999, Ernst, 2000). Research have shown inequity in pay health services provision with practitioners in many developed countries being found to favour patients who are able to pay. The rich are also found to be more likely to seek the services as opposed to the poor (Doorslaer V, et el,. 2006). Chiropractors in UK are not an exception and since they are not funded by the National Health Service (NHS), it means that their location would be more influenced by the ability of the population to pay rather than the number of the sick amongst them.

The aim of this paper is to analyse the current distribution of chiropractor practices in England and Wales and make recommendations of 20 optimal areas for new establishments. The approach is to study area characteristics using 2001 Census Area Statistics Wards and electral divisions in England and Wales. These lower geographies are used as small area census data have been cited to offer a comprehensive view of the population characteristics (Noble et al., 2006). The study focuses on how able people are to pay for the services in consideration of their prevailing health status. Deprivation is used as a benchmark but not entirely relied upon for the final conclusion as it is a complex mix of social-economic, environmental and other variables (Venkatapuram and Marmot, 2009), some of which might not be applicable in deciding suitable locations for the practices. Nevertheless it is of importance as its relationship with income has been studied to understand Poverty (Berthoud and Bryan, 2011). Illness is another considered parameter which is not always equitable to deprivation (Kaltenthaler et al., 2004) though some studies say they are (Walsh et al., 2010).

2.0 Literature Review

As defined by D.D. Palmer chiropractic is the non-use of drugs in healing and billions of money are spent on such treatments annually all over the world (Ernst, 2008). There has been increase in alternative therapy in Britain lately, with chiropractic being one of the leading (Zollman and Vickers, 1999)

Measure of deprivation have been carried out in UK and other countries for key decision making about small area geographies (Noble et al., 2006, Kaltenthaler et al., 2004) and indices used in Europe as indicators of poverty (Berthoud and Bryan, 2011). Poverty is a subset of deprivation where people are said to be poor if they are not able to come out of deprivation (Townsend, 1987). There are different kinds of deprivation as noted by Townsend who calls it "the darker side of the entire life style of a people" *p.129*.

European Union definition of poverty is people with too scares resources to at least keep them enjoying lifestyle as their peers in a setting (Berthoud et al., 2004). In other words, according to Berthoud, poverty just like deprivation tends to keep people in exclusion.

The target areas for the establishments should have ill and wealthy people who can afford the service. These are two conflicting scenarios as normally poor people have more health challenges requiring specialised care than the rich but they become illegible in this case as they cannot reach the services due to financial challanges (Stirbu et al., 2011). Donaldson noted an association between ability and willingness to pay and according to Meer, the rich can comfortably pay for better care (Meer et al., 2003)

Employment leads to one becoming financially stable but being in employment does not automatically mean one is completely out of poverty. For instance in 2013, three million employed people in UK were said to be in income poverty and only 70% of those employed between 2007 and 2012 were reported to come out of poverty (ONS, 2015). However and positive enough, according to (Jenkins, 2011, Fouarge and Layte, 2005), lack of employment leads to poverty and if one is employed he/she is likely to come out of poverty.

3.0 Data Sources And Methods

The study covers 8,850 census zones in England and Wales, home to approximately over 52 million people (Brimicombe, 2007). England has 7,969 Census Area Statistics wards while Wales has 881 equivalent electoral divisions according to 2001 census data. The lower level geographies used in this study enables effective targeting of resources as it closely approximate characteristics of near individuals (Noble et al., 2006)

3.1 Deprivation index

Townsend (1979) study showed that insufficient income is a deprivation indicator (Berthoud and Bryan, 2011) and leads to poverty though some researchers have contested the direct relationship between income and deprivation (Whelan et al., 2004). Carstairs and Townsend measure of deprivation are used in the study because they use census data and are acceptable in academics and health (Norman, 2010) although criticized for being narrow in its input variables (Payne and Abel, 2012).

Deprivation index was calculated from five domains by computing percentages, transforming the values to natural logs to make them have near normal distribution and avoid skewness, and then standardized to put them in the same scale of measurement by calculating the z-scores. Finally deciles are established by ranking the indices in an ascending order. Table 1 shows the domains, factors and the formula for the computations.

Table 1 Domains and factors used in calculating deprivation index

3.2 Ill-health/ income indicator

Since deprivation index is not conclusive and exclusive direct pointer to ill-health/income of areas, an index which would closely represent the status was designed which helps in better understanding the underlying population in terms of ill-health and how able to pay they might be. The analysis is based on employer size and employment status such as employment terms and positions as indicators of high/low income and Long Term Illness (LLTI) as proxy for ill-health amongst the high income earners. Table 2 shows the domains and associated variables used.

Table 2 : Domains and variables used to analyze health and income status

Domain	Variables
Large employers	People aged 16-74 and those employed by large employers in high managerial and high professional occupations.
Ill-health and economic activeness	Economically active people, un-employed economically active with Limiting Long Time Illness (LLTI) and economically active full time students with LLTI.
Ill-health and wealth/ Income	all people, people aged 16-34, 35-49, 50-Pensionable and pensionable to 74 years in higher profession and managerial living with LLTI
High income earners	People in full time employment and high job cadre: manager And seniors officials, professional and associate professional Officials, technical, administrative and secretarial occupations as well as skilled traders.

Both ill-health/ income index were computed as follows:
Percentage large employers
People in high job positions in large employers are considered proxy for high income earners. According to ONS 2015, not all employed people are out of income poverty and it is for this reason that only people in senior positions are considered in the calculations. Employees in high level jobs are the highest earners (ONS 2014)
Percentage large employers were computed using the formula:

$$\% \text{ large employers} = \left\{ \frac{\text{Large employer high managerial occupations} + \text{Large employer higher professional occupations}}{\text{Total employed}} \right\} * 100$$

High income earners
This is an important indicator of new location as research shows success of alternative medicines in areas of high income earners (Vickers et al., 2005). Well educated and people of high social status have been found to be the main seekers of alternative therapies such as chiropractors' services (Zollman and Vickers, 1999). Employees in high level jobs and full time as opposed to part time employment were considered. This is due to the fact that according to ONS, those in full time positions are more likely to remain out of employment poverty than their counter-parts in temporary positions who revert back to poverty after unemployment. The number of working hours is also a vital determinant of whether one gets out of poverty courtesy of employment (ONS 2015). Those working maximum hours (over 49) only were considered in the study.
% High income
Earners $= (2+3+4+5+6)/1*100$
Where;

1. Total people of 16- 74 years
2. Managers and senior officials
3. Professional occupations
4. Associate professional and Technical occupations
5. Administrative and secretarial occupations
6. Skilled traders.

Proxy for ill-health and income/wealth were computed as follows:

$$\text{% Ill-health and economic Activeness} = \left\{ \frac{\text{All econ active with LLTI} - \text{Econ active un-employed with LLTI} - \text{Econ active Full-time students with LLTI}}{\text{Total economically active with LLTI}} \right\} * 100$$

$$\text{% Ill-health and wealth **} = \left\{ \frac{\text{16 to 34 yrs} + \text{35 to 49 yrs} + \text{50 to Pensioners} + \text{Pensioners to 74 yrs}}{\text{Total people}} \right\} * 100$$

** *Only higher professional and managerial occupation with LLTI are included*

Percentages for the four domains were computed, transformed and standardized to obtain a single variable for ill-health/ income status.

Figure 2 shows the output mapped as deciles where 1 has people who are well-up in terms of income but living with illnesses followed by 2 and so on with 10 having most income deprived people living with illnesses.

4.0 Results And Discussion
4.1 Current distribution of chiropractor practices

Consistent with the literature, there are less practices in Northern England and Wales than in Southern England (Zollman and Vickers, 1999) and most are located in the cities and generally metropolitan areas such as London as shown in Figure 1. From the map inset, London has a high concentration of practices, the reason being there might be more ill people as research links urban areas with high deprivation and illnesses (Carstairs, 1995). The map shows the current locations of chiropractor practices and deprivation deciles, with 1 being the least deprived and 10 the most deprived area. The Northern parts of England and Wales have few practices yet they have considerable rates of deprivation.

The question which arises is; are people in deprived areas suffering from lack of income and vice versa? This is a dilemma the answer to which can be explained in the calculation of ill-health/ income index. Figure 2 shows the calculated indices where deciles 1 shows areas with high income and ill people and 10 those equally ill but with lower income. The distribution of the practices for areas like London and Manchester are now better explained as they are ranked in deciles 1 (ill-health highest, income earners) hence the high concentration of practices. According to (Vickers et al., 2005), alternative medicine practices succeed in areas with rich people. This is supported by figures showing that London income rose highest in the UK during the fiscal period 1996/97 to 2006/7 (Brewer et al., 2007)Figure 1: Deprivation indices **in England and Wal**
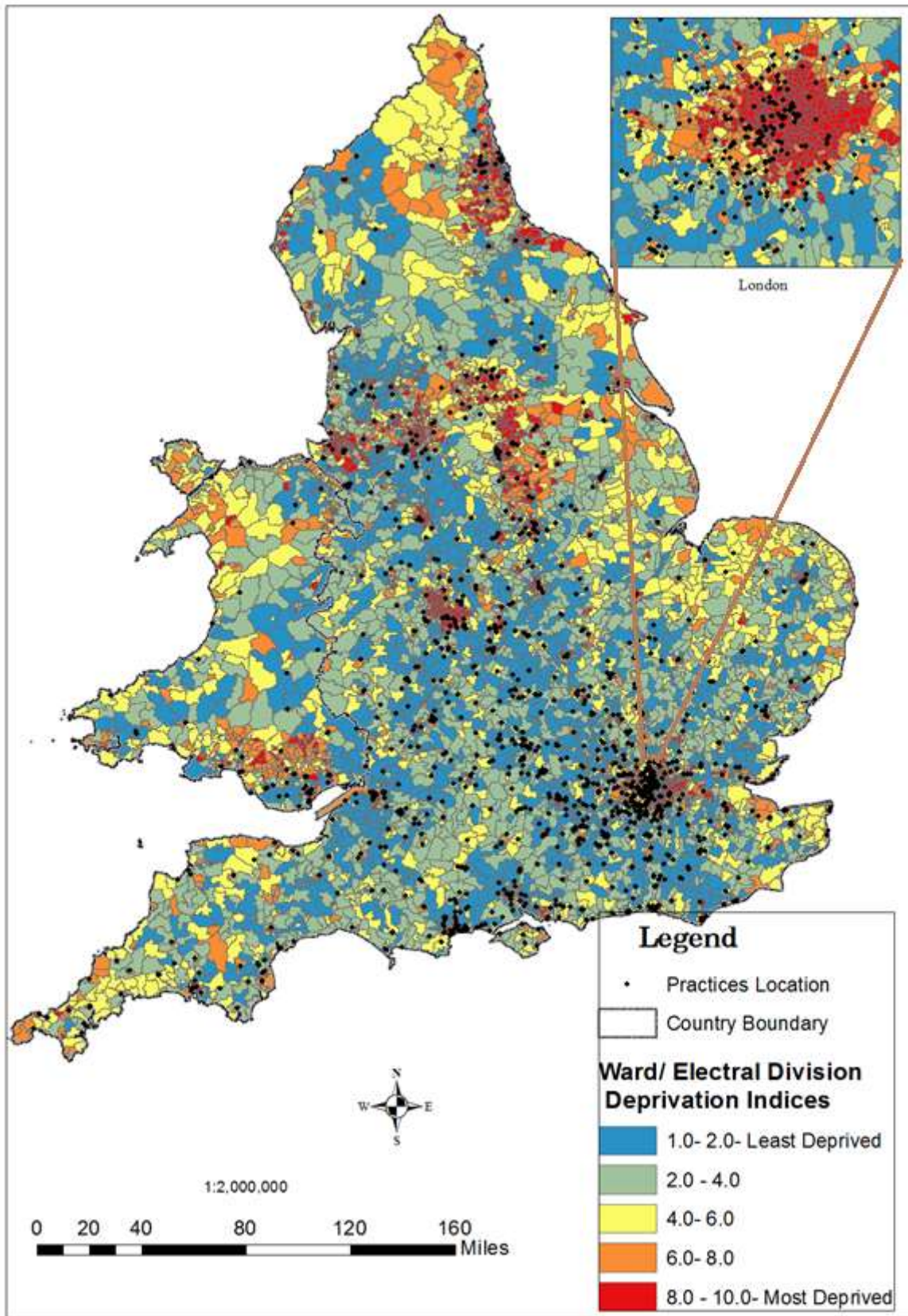
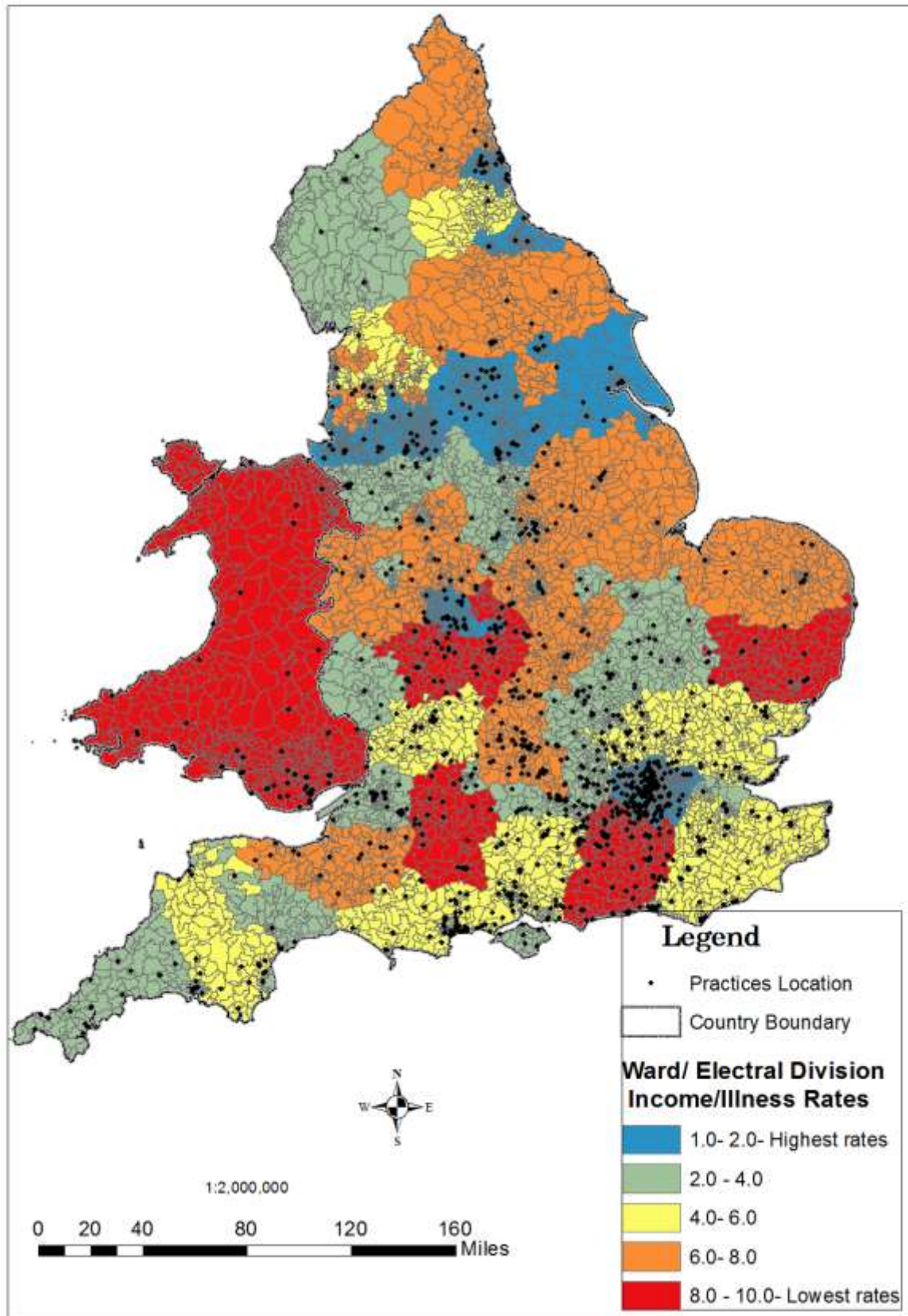**Figure 1: Deprivation indices in England and Wales**

Figure 2: The distribution of income/illness among economically stable population

4.2 Locating the optimal areas for the new practices

The selection of areas suitable for establishment of new practices was based on various aspects. Firstly, the distance from the existing practices to avoid overlapping and overcrowding. A buffer of 30km was made on

the existing practices and out of a total of 8850 zones, only 47 whose centroids did not fall within the buffer intercept were selected as potential areas. These were more than the required 20 hence further elimination criteria had to be designed. The remaining eligible areas were evaluated on the basis of their ill-health/income indices. Only those with above the mean value of -2.5 qualified for selection, which gave a resulted to 27 zones. Out of those, St. Agnes, St. Martin's, St. Mary's and Tresco at the island of Isles of Scilly were found to be favoured by distance as they are obviously far island. To avoid this biasness, only St. Martin's was selected as it had the highest ill-health/income rate of the other four. But some eligible zones were too close to each other which would make the new practices cluster at some point. To avoid this and further eliminate extra zones, a 2 km buffer was made on the remaining eligible zones centroids which resulted in only 20 most viable areas as spatially shown in Figure 3.
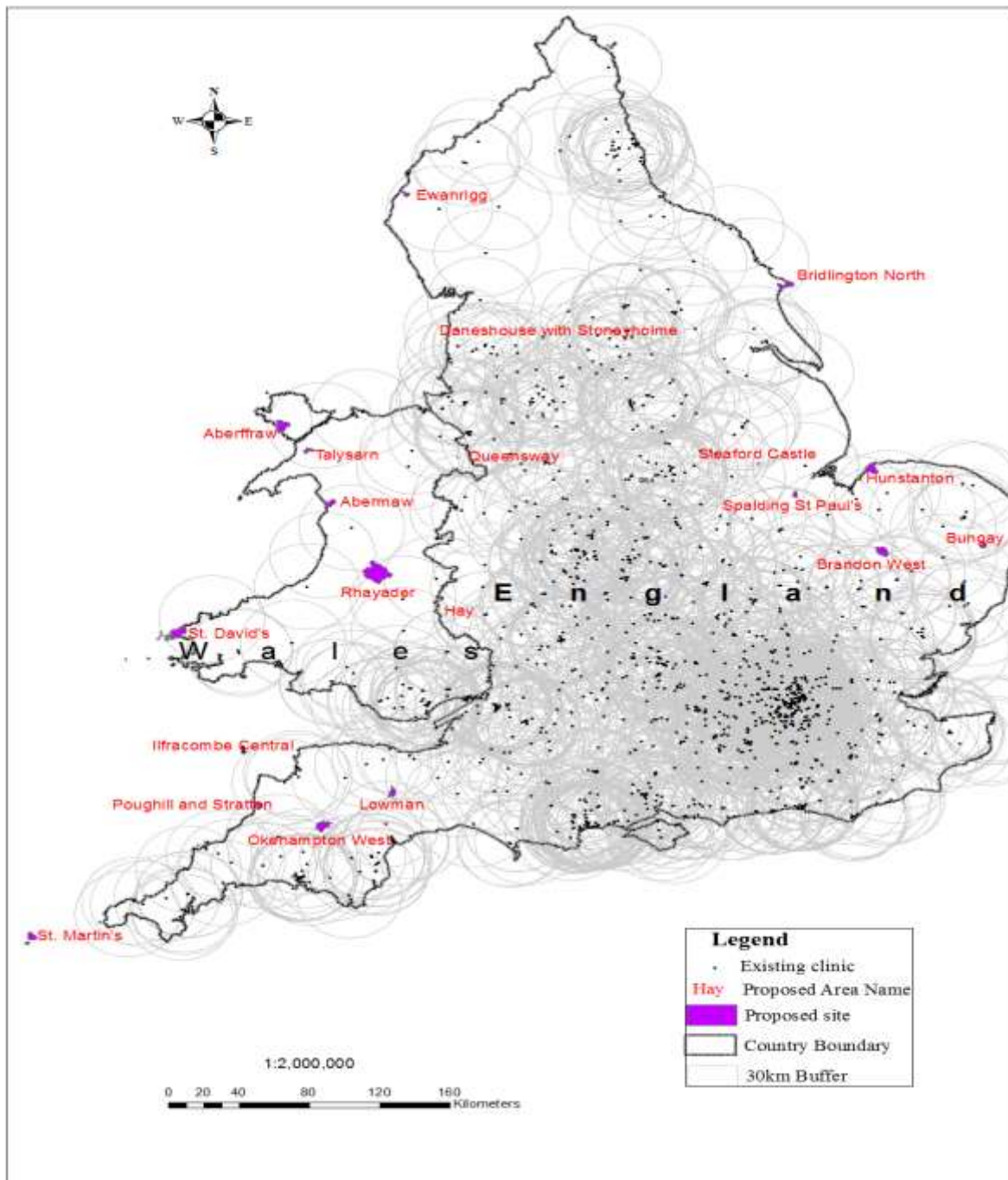

Figure 3: Buffer analyses to determine zones for the recommended 20 new chiropractor practices In the final analysis, the key determinant for the selection of the 20 zones was the ill-health/income index and not deprivation. Figure 4 shows how the two indices change within the 20 selected zones where the latter is almost constant while the former varies across all the zones. Low values are good as they show more ill-

health people but with good income. All the zones except St. Martin's comprised of people with high income but ill and in different deprivation levels.
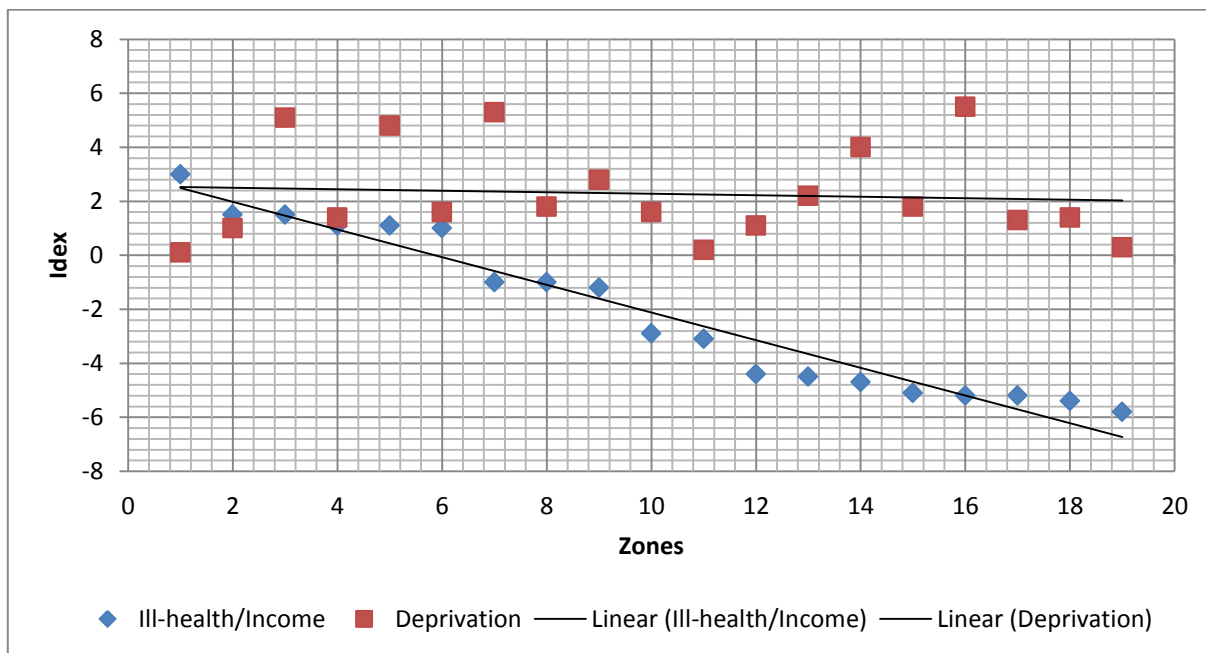

Figure 4: Relationship between deprivation and ill-health/income indices of the selected areas

Table 3 shows the list of final 20 areas presented as potentially viable for establishment of new practices. England had 13 out of the possible 20 due to its dominance in terms of income over Wales.

Table 3 Eligible areas for new chiropractor practices in England and Wales

Name	Country	Depr index	ill-health/income
1 Bridlington North	England	0.1	3.0
2 Poughill and Stratton	England	1.0	1.5
3 Ewanrigg	England	5.1	1.5
4 Lowman	England	1.4	1.1
5 Ilfracombe Central	England	4.8	1.1
6 Okehampton West	England	1.6	1.0
7 Daneshouse with Stoneyholme	England	5.3	-1.0
8 Sleaford Castle	England	1.8	-1.0
9 Spalding St Paul's	England	2.8	-1.2
10 Hunstanton	England	1.6	-2.9
11 Brandon West	England	0.2	-3.1
12 Bungay	England	1.1	-4.4
13 Aberffraw	Wales	2.2	-4.5
14 Abermaw	Wales	4.0	-4.7
15 Talysarn	Wales	1.8	-5.1
16 Queensway	Wales	5.5	-5.2
17 Hay	Wales	1.3	-5.2
18 Rhayader	Wales	1.4	-5.4
19 St. David's	Wales	0.3	-5.8
20 St. Martin's	England	-5.6	-5.1

From the analyses of areas where people pay for medical services such as the case with chiropractor practices, deprivation is not sufficient enough to delineate areas with high levels of illnesses and income. One of the reasons being that an area with high deprivation may have well-up people an affluent area may have deprived people (Smith, 1999). Also census data contains few straight forward measures deprivation (Noble et al., 2006) . For this reasons, other indicators which give a better indication of health and income status should be devised.

Deprivation and ill-health/income indices showed different patterns. London and Manchester which were grouped as most deprived are found to have least income deprived people but who are living with illnesses. This indeed justifies the large concentration of practices in these areas. It also explains why probably there are few practices in Wales compared to England as most areas in Wales are categorized as income stressed The author suggests a separate analyses for the two countries as in this case England seems to have dominated Wales. The dominance of England can be attributed to its dominance in gross value added per head in UK which according to the latest figures released on 5th June, 2014 was at 21,937 pounds compared to Wales at 15,401 pounds. This is a measure of a country's contribution to the entire economy (ONS 2015)

Weakness of the research is that it does not consider the distance decay such that even if people are sick and financially well-up, one would choose to attend a practice which is nearest to minimize on travel cost and time.

5.0 Acknowledgements

6.0 References

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