1. Introduction

The United Kingdom is full of diverse people from around the world. The studies based on health can provide helpful information and extend the knowledge. Relations between statistical variables bring the answers to some interesting questions. Results can help develop strategies to minimise the health inequalities in the United Kingdom. This article aims to research the correlations between bad health and independent variables like ethnicity, regions where that people live in or in what industry they are working. This topic is especially interesting because as a human geographer, we should recognise the pattern of place, space relations to the people. The results also would show the area for improvement and a point where future attention of research should be directed. How does ethnicity, place and occupation affect the health inequalities? The outcome variable is bad health. The article will explore the already done research in this field and explain the methodology, then show the result as well as provide the discussion on the outcome.

2. Literature Review

The focus of Britain government in England should be directed on health inequalities. One of the authors of the health inequalities review, Marmot (2020) states that those are even wider after ten years of review of his paper. The author takes note of more deprived areas in the north where health is significantly lower based on the life expectancy decreasing in contrast to the London and southeast. Furthermore, Ellis and Fry's (2010) study show lower life expectancy in the north of England than the average and also higher expectancy in the south. Further, the research presents that the incidence of illnesses like cancer and factors contributing to bad health like smoking or alcohol consumption is higher in the north than in the south. Aspinall (2000) draws attention to the importance of observing the minorities' health in the UK in Census questionaries. In order to explain what is causing the health inequalities, LaVeist (2005) conduct a study that shows the significant correlation between race and socioeconomic status. Research showed that race disparities that evaluate from lower-income have a relationship with some health problems. The study of race and health inequalities by Roe et al. (2016) supports the theory that place and environmental spaces have a connection with bad health among minorities. Minorities tend to live away from richer white areas, thus they are often living in more deprived, low-quality accommodations which cause the rise in mortality among them (Bécares et al., 2009). Moreover, Williams (1999) suggests that bad health among the black minority is caused by racism and policies that allow the low socio-economic status in contrast to better earnings by white people. Therefore, the type of work undertaken by ethnicity is responsible for socio-economic status. The study by Davey-Smith et al. (1998) shows that there is a correlation between lower occupational social class and risk of having worse health. Moreover, Ravesteijn et al.'s (2013) research based on the health inequalities among occupations show that those in professional employment have a 63% less chance of becoming disabled than those in manual work in Netherlands. In United Kingdom, based on a census from 1991-2011, there is a significant difference in occupational mortality between those in routine having higher rates than those in higher managerial positions (Katikireddi et al., 2017). However, there is a knowledge gap in the current studies in combining all three factors that affect health inequalities and bad health in UK – ethnicity, place and occupation.

3. Methodology

In the United Kingdom, every ten years all households are obligated to fill the Census survey, which contains various information about each person. Thus, this quantitative analysis is based on Samples of Anonymised Records (SAR) from the 2011 Census of England and Wales (ONS, 2015). Census is done by Office for National Statistics on behalf of the British government and was conducted in 2011. Sample of Anonymised Records (SAR) is only 5 % of total responses. In SAR, all of them are anonymised

by removing the names and address and some other precautions. To better understand the phenomena and to make research clearer, transformations were necessary. Dummy variables are created for the 'ethnicity' section to differentiate the outcomes for each group. The 'region' is transformed into the five groups (north, south, midlands, Wales and London) and into dummy variables for a clearer understanding of differences on the bigger geographic scale. Transformation of variable 'nssec', which contains the occupations of respondents, is also regrouped and transformed to the three groups (higher managerial, administrative and professional occupation; intermediate; routine and labour occupation) and convert to the dummy variables. Moreover, the variables with values from 9 to 12 (never worked or long-term unemployed, full-time student, not classifiable, a child aged 0-15) from the 'nssec' are filtered out as they are not significant in this analysis. Lastly, the 'health' is transformed from five to a binary variable: good health and bad or fair health. To get the most accurate outcomes of this research, logistic regression model is used. This model is applied when the qualitative and binary variable is used and it predicts the probability of the occurrence based on the independent variables. As this paper is based on analysis of categorical variable 'health' and three independent 'region', 'ethnicity' and 'nssec'(occupation), a logistic regression model is the best fit. Figure 3.1 represents the graphic representation of variables that influence the outcome variable which is 'bad health'.
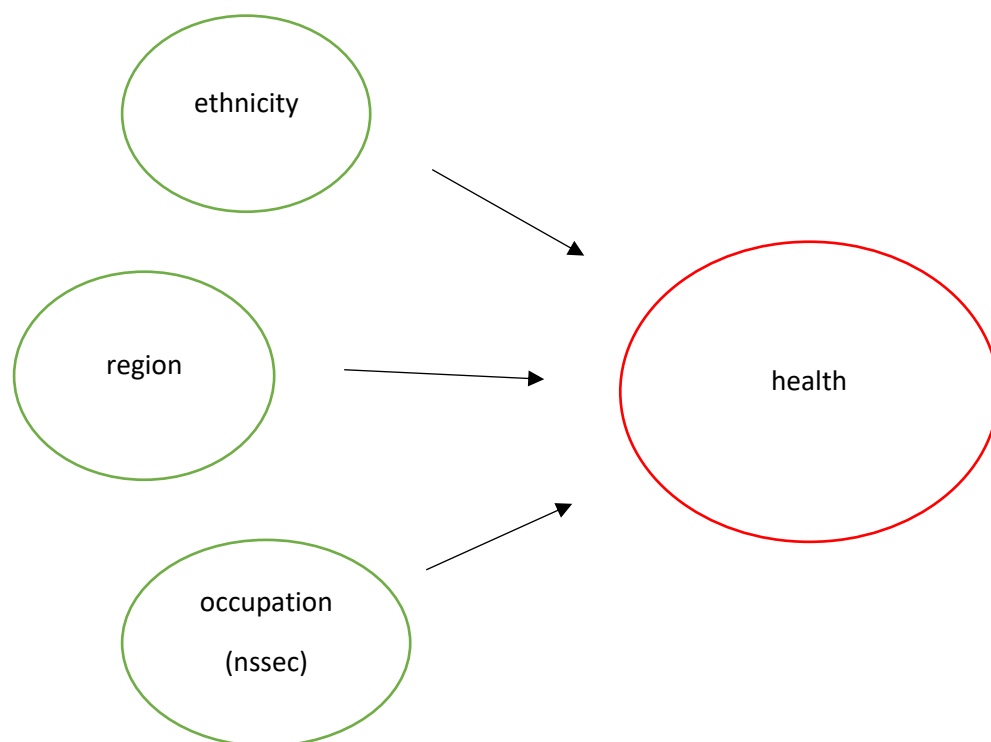

Figure 3.1 Graphic representation of variables taken up in the analysis (Author's creation)

4. Results

The first logistic regression model is represented in table 4.1 which contains the independent variables like region and occupation. London is the base category for the region to compare the health most efficiently as Marmot (2020) draws attention to the health inequalities between north and south. The model confirms that the probability of these events is higher. Regression indicates that people living in the north of England are 1.275 as likely as those living in London to have bad health, holding all other variables constant. Figure 4.1 also indicates the higher percentage of people in the north having bad health, however, Wales is the most affected. By living in Wales odds of having bad health are increased by a factor of 1.411, holding all other variables constant. As data was collected in 2011, the higher probability of having bad health might be caused by a lack of digital health information. Gann (2019) state that Wales have more elder people than rest of the UK and noteworthy level of deprivation. Also, researcher suggest that people living in rural areas in Wales have less access to important services to maintain healthy well-being and are often excluded from digital information. The combination of these characteristics may explain the finding that people living in Wales have the biggest probability of having bad health.

Table 4.1 Logistic regression model containing region and occupation variables

Variables	Sig.	Exp(B)
North	0	1.275
Midlands	0	1.211
Wales	0	1.411
South	0	1.047
Intermediate occupations and small employers	0	1.597
Manual and routine occupations	0	2.469
Constant	0	0.152
Nagelkerke R Square	0.042	
Cox & Snell R Square	0.280	

Source: Author's calculations based upon Samples of Anonymised Records (SAR) from the 2011 Census of England and Wales (ONS, 2015)
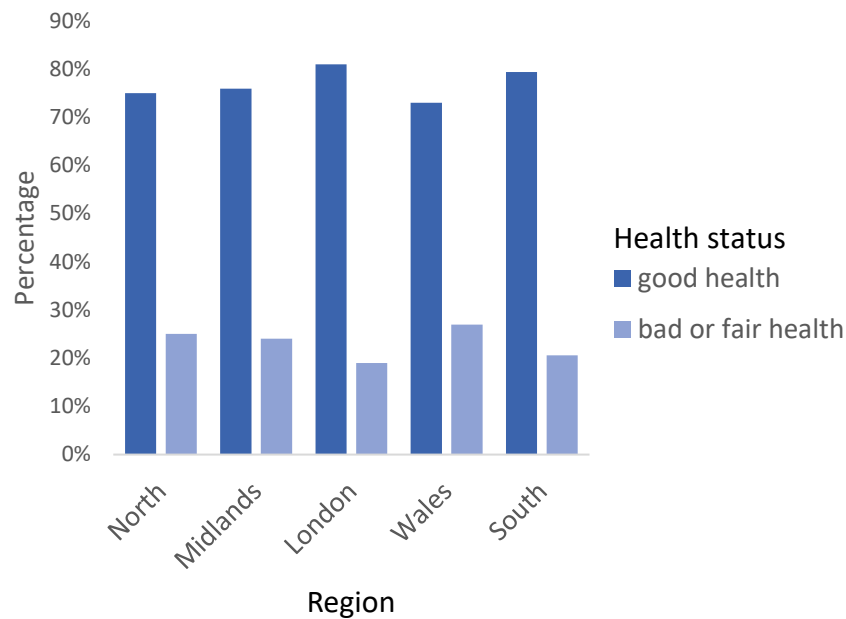
Figure 4.1 Health status in comparison to regions
Source: Author's calculations based upon SAR from the 2011 Census of England and Wales (ONS, 2015)

The next independent variable, which is occupation, is also represented in the first logistic regression model shown in table 4.1. Higher managerial, administrative and professional occupation is the base category. To help with a clear representation of the data, figure 4.2 represents the percentage of bad and good health across the three categories of occupation. It shows the high percentage of people working in manual and routine occupations and a relatively small percentage of people working the higher managerial and professional occupations with bad health. The model estimations indicate that being employed in manual and routine occupations increase the odds of having bad health by a factor of 2.469, holding all other variables constant. Similarly, in intermediate occupations by a factor of 1.597 as those employed in the higher professions. Model agrees with the findings of Davey-Smith et al. (1998) who research has shown that men in the manual professions have problems with blood pressure as well as they are smokers more often than people in higher professions. The socio-economic background also has an impact on the probability of serious accidents and injuries (Ravesteijn et al., 2013) what can explain the higher probability of bad health in manual and routine occupations.
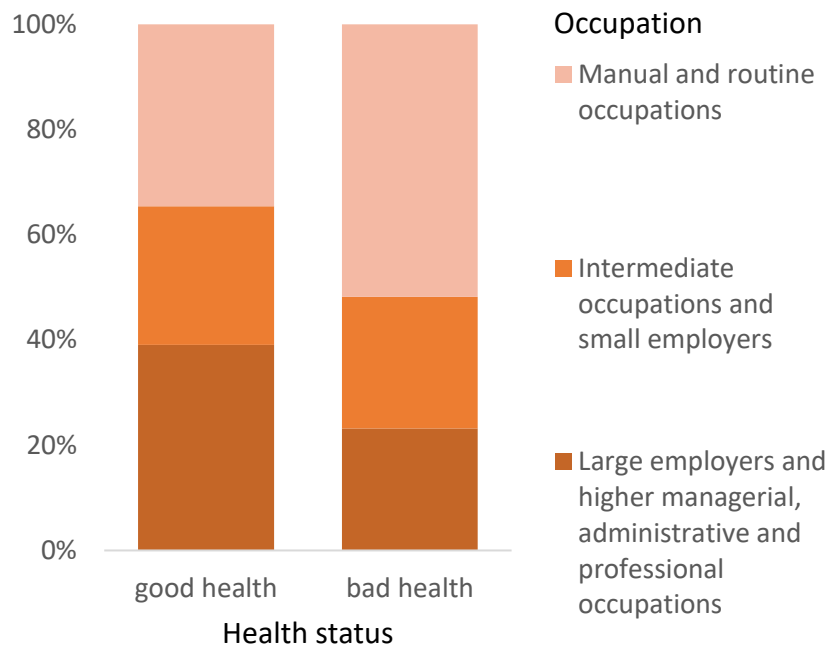
Figure 4.2 Health status by occupations
Source: Author's calculations based upon SAR from the 2011 Census of England and Wales (ONS, 2015)

Literature often takes note of health inequalities in the context of ethnic minorities from the impoverished socio-economic background. The second logistic regression model represented in table 4.2 contains the ethnicity variables. As a based category, 'white British' has been selected to compare the statistics to the native residents of the United Kingdom. The outcome is showing interesting results. Only two ethnic groups are more likely to have worse health than white British. The model indicated that being a 'white Irish' increases the odds of having bad health by a factor of 1.289, and similarly, being identified as 'black other' increases the probability of having bad health by a factor of 1.146, holding all other variables constant. As figure 4.3 indicates, there is a connection between being 'black other' and having worse socio-economic background which can put your health at risk like many academics see links between these variables (for example Williams, 1999; LaVeist, 2005). However, as figure 4.3 indicates, white Irish are mainly employed in higher professions. Delaney et al. (2013) suggest that bad health among white Irish may be caused by the stress of immigration and the research also shown higher average alcohol consumption than white British. The regression model from table 4.2 also indicates that being the 'black African' decreases the probability of having bad health by a factor of 0.361, holding all other variables constant. This and other ethnic groups that may indicate migrants and also have fewer odds of having bad health may be related to the fact of relatively young migrants in the contrast to ageing white British natives (ONS, 2015).

Table 4.2 Logistic regression model containing ethnic group variables

Variables	Sig.	Exp(B)
White Irish	0	1.289
White Other	0	0.440
Mixed White/Black	0	0.682
Mixed Other	0	0.620
Indian	0	0.687
Pakistani	0	0.874
Bangladeshi	0	0.896
Chinese	0	0.483
Other Asian	0	0.575
Black African	0	0.361
Black Other	0	1.146
Other	0	0.735
Constant	0	0.308
Nagelkerke R Square	0.010	
Cox & Snell R Square	0.007	

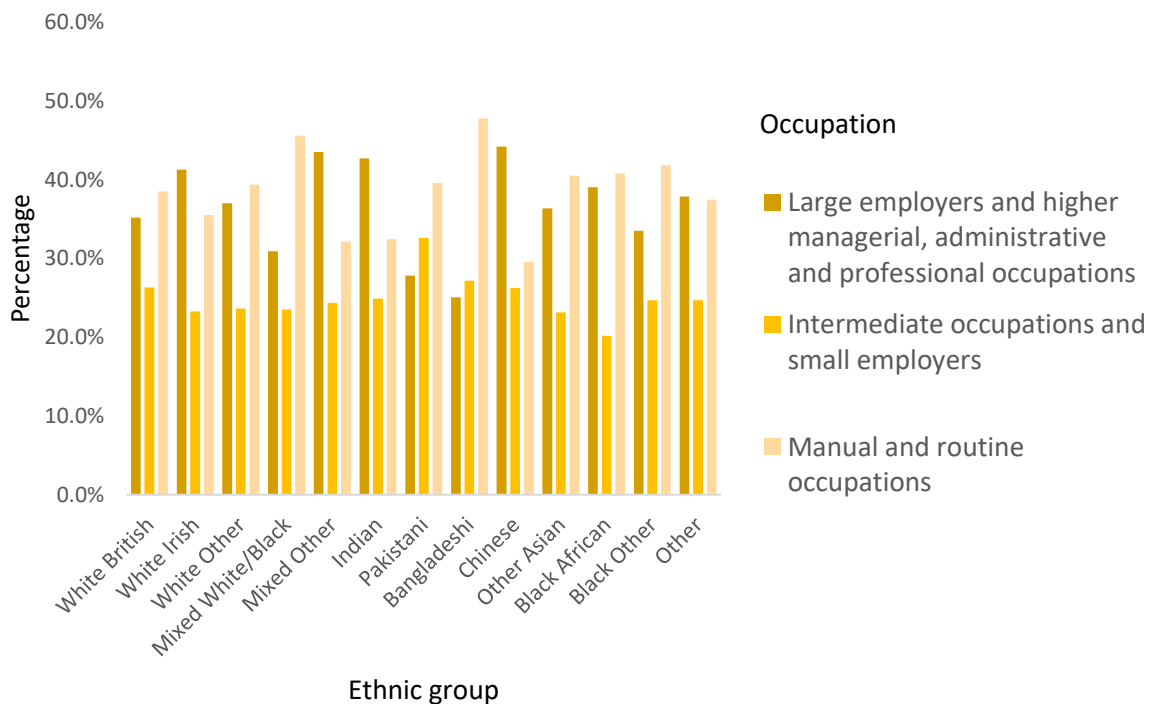*Source: Author's calculations based upon SAR from the 2011 Census of England and Wales (ONS, 2015)*

Figure 4.3 Ethnic groups and occupation in percentages
Source: Author's calculations based upon SAR from the 2011 Census of England and Wales (ONS, 2015)

5. Conclusion

Exploring the causes of poor health is important for governments to maintain sustainable growth. This research aimed to explore the relevant factors causing bad health in the United Kingdom to help in minimising the health inequalities. Establishing what is causing the problem may lead to the solution. Findings of the health inequalities between north and south may provide more information about the government resource management. A lot bigger probability of having bad health in manual and routine occupations may indicate the need for more education about health at work. The socio-economic background is also connected to race. However, this report is only showing a bit of a problem of health inequalities. More extensive research, as well as more explanations, is needed to fully understand this complex challenge.

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