How do different environmental and socioeconomic variables lead to health disparities across London boroughs?

**Literature Review**

*Collection Methodology*

In order to obtain a comprehensive overview of pre-existing scholarship on the topic, phrases such as ‘London health disparities’, ‘socioeconomic determinants of health’, and ‘environmental impacts on health outcomes’ were used across multiple databases. These included: Google Scholar, PubMed, The Lancet, The BMJ, and UCL Explore. These searches provided qualitative and quantitative research papers on health inequalities across London boroughs, and the links between health status and socioeconomic and environmental variables. To ensure that these sources were of high quality, critical appraisal frameworks from **CASP (2020)** were used to evaluate them, by assessing the credibility of their authors, and the reproducibility of results. Grey literature, such as policy recommendations and agendas, was also sourced from government and NGO websites.

*Existing Literature*

**Marmot (2005)** identifies that socioeconomic status, SES, is a crucial determinant of health outcomes. This notion has been corroborated by numerous studies, and is considered a paradigm in public health scholarship **(Lallo and Raitano, 2018; Vanroelen, Levecque and Louckx, 2010; Siegrist and Marmot, 2004; Braveman and Gottlieb, 2014; Demakakos et al., 2008)**. This has led to the recent conceptualisation of the social determinants of health – SDH, or SDOH – in order to better outline what constitutes socioeconomic status **(Braveman and Gottlieb, 2014)**. The SDH are defined by the **WHO (a, 2021)** as ‘the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life’. These include, but are not limited to: poverty, income, employment status, education, and race or ethnicity – frequently used interchangeably in studies **(WHO, a, 2021; Braveman and Gottlieb, 2014; Blane, 1995; Rogers et al., 2017)**. Whilst many frameworks have been developed to understand the social determinants of health, currently the one most utilised by researchers is the Dahlgren-Whitehead Rainbow, **Figure 1**, which categorises determinants into different layers **(ESRC, 2021)**.

Diagram

Description automatically generated

Furthermore, albeit few suggest causation, associations in the form of gradients between individual socioeconomic determinants and health outcomes have been identified consistently across several studies **(Demakakos et al., 2008; Adler et al., 1994; Braveman and Gottlieb, 2014; Siegrist and Marmot, 2004; Vanroelen, Levecque and Louckx, 2010).** Indeed, in a review of longitudinal mortality studies on middle-aged populations across West Europe, **Huisman et al. (2005**) observe that there is an increased mortality rate amongst those with less education. Furthermore, the seminal Whitehall study on civil-servants in London elucidates that those in the highest employment grade have lower mortality than civil-servants in the lowest employment grade **(Marmot, Shipley and Rose, 1984).** Moreover, whilst results for this association vary depending on country, health status and income have been linked in the United Kingdom, whose capital our research is restricted to **(Lynch et al., 2000).** Nevertheless, despite these recognised linkages between single socioeconomic variables and health, there remains a paucity of literature examining the causal relationship between health and multiple, aggregated socioeconomic variables **(Adler et al., 1994)**. This has formed the basis of our research.

Given the short time-span of our investigation, we chose to select 3 socioeconomic variables to represent socioeconomic status as a whole – income, education and race. This was done by considering existing literature and available datasets for London boroughs – our chosen unit for spatial analysis, due to discernible health inequalities amongst boroughs. Justifying our inclusion of income is **Lynch et al.’s (2000)** study on the United Kingdom outlined prior, in addition to a more specific report by the **Greater London Authority (2008)** which outlines that mortality rates across London increase as individuals go down the income gradient. This paper further illustrates the close linkages between income, poverty, and employment, which is why only one of these variables – income – was chosen, to try to minimise compounding and get a broader representation of socioeconomic status using different variables **(Greater London Authority, 2008)**. Secondly, education was chosen due to research by the **Trust for London (b, 2020)** illustrating clear differences in educational attainment across London boroughs, alongside **Huisman et al.’s (2015)** aforementioned study. Lastly, we selected race or ethnicity as a variable to represent socioeconomic status, due to studies conducted in the USA which suggest that racial or ethnic minorities have poorer health outcomes, such as greater mortality **(Penner et al., 2013; Rogers et al., 2017).** This, furthered by the evident differences in the proportion of ethnic minorities per London borough, suggests that race/ethnicity is a suitable variable to represent socioeconomic status, when investigating its impact on health outcomes across London boroughs **(Elahi and Khan, 2016)**.

Moreover, in addition to socioeconomic status, emerging literature identifies that health outcomes are further influenced by geographic, environmental variables **(Salgado et al., 2020)**. In particular, there is more evidence regarding 3 key variables – air pollution, noise pollution, and green space. Subsequently, these will be used in our research to represent environmental factors as a whole, in order to ascertain the overall effect of the environment on health outcomes across London boroughs. This is a topic on which there is currently minimal literature, elucidating the value of our research.

Justifying our utilisation of air pollution as a variable is the **WHO (b, 2021)** which reports that there is substantial epidemiological evidence to suggest that air pollution is a risk factor for both specific health conditions, such as lung cancer and cardiovascular diseases, alongside mortality more generally. This is further supported by other recent experimental studies and systematic reviews investigating the impacts of exposure to air pollutants **(Jorgenson et al., 2021; Afoakwah et al., 2020; Salgado et al., 2020)**. Furthermore, noise pollution was chosen as an environmental variable due to systematic research by **Murphy and King (2014)** which linked noise pollution to an increased risk of physical and mental health disorders, such as hypertension and anxiety, and ultimately greater mortality. Lastly, green space was chosen as a variable to indicate environmental factors, due to research conducted by **Salgado et al. (2020)** highlighting that green space is associated with improved mental and physical wellbeing, affecting mortality.

*Our Research*

Informed by existing scholarship, in addition to gaps in knowledge as outlined prior, we have identified methodological shortcomings. Indeed, most literature solely utilises one or two indicators at a time to represent health status. However, the indicator that is used, whether that may be life expectancy, healthy expectancy, subjective social well-being status, or prevalence of a specific disease, is not consistent across studies. Therefore, for a more nuanced understanding of overall health status across London boroughs, we have chosen to create a Borough Score index, that takes into consideration 4 key indicators: life expectancy, healthy life expectancy, self-reported well-being (happiness score), and self-reported well-being (anxiety score) in a borough. Their selection was influenced by the availability of data for all 33 London boroughs and indicators included in prior studies by **Demakakos et al. (2008) and Braveman and Gottlieb (2014**).

Other considerations we have made include the time frame of our research. Indeed, all data included is from between 2000-2019. This is recent enough to entail valid and contextually relevant data points, whilst being from before the COVID-19 outbreak, which will mitigate uncertainties from reductions in data collection triggered by the pandemic. Further regarding the scope of our research, we have chosen to restrict our investigation to the 33 London boroughs, rather than extending it to the UK as a whole. This has been informed by **Centeno, Finkelman and Selinus’ (2016)** study on the public health implications of environmental variables. Whilst this study focuses on variables not included in our research, such as heavy metals, we have been influenced by its decision to limit the research scope to specific cities, in order to provide more contextualised information **(Centeno, Finkelman and Selinus, 2016)**.

Therefore, by investigating the relationship between health and environmental variables as a whole, in addition to the relationship between overall socioeconomic status and health, we will be able to compare the effects of the two factors on health outcomes across London boroughs. This will allow us to identify whether socioeconomic or environmental factors are more strongly correlated with poor health outcomes in London, which is currently an under-researched facet of scholarship. Consequently, our study will contribute to the wider interdisciplinary discourse of public health, in addition to the fields of sociology, economics, and environmental studies, elucidating its potential impact. Moreover, our research will allow us to quantitatively identify which area should be a priority for policymakers to address. Indeed, by understanding which factor is most important in engendering the health inequalities observed amongst London boroughs, policymakers may be able to implement more targeted interventions and laws, contributing to the enhancement of health levels throughout London.