# Linking perceptions of health to neighbourhood environment in the Lisbon Metropolitan Area, Portugal

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## Abstract

The past century has seen the rise of an urban environment that differs greatly from anything that has gone before. Urbanization has brought many benefits, but has also raised concerns about sustainability. Urban/suburban sustainability goes hand in hand with physical and social environment sustainability, i.e. the challenge of creating sustainable, healthy communities. Development must occur with a sense of place, history and cultural distinctiveness, with a view to reducing inequality between groups. In other words, proper development and planning can create healthy communities. Research into the role of the social and material environment in determining healthy communities has highlighted the need to use more innovative data in describing geographical areas, in spite of the difficulty and time involved in the collection, utilisation, comparison and interpretation of such data. This paper is based on a case study of empirical data collected in Portugal. Logistic regression models were used to measure the relationship between the material and social environment and self-rated health (representing quality of life and wellbeing). We used new contextual measures, created through PCA and individual data from the National Health Survey for Lisbon Metropolitan Area (LMA). The results show the importance of neighbourhood (social and material environment) in determining health, alongside traditional factors such as age, social class and lifestyles. In LMA, a high level of political engagement and community participation, and good access to public transport and to health services improve self-rated health scores. Associations were found to be independent of gender, age, social class (occupation and education), economic activity and lifestyle (physical activity or smoking). Moreover, both the features of social and material environment and the magnitude of association with self-rated health are different for both genders.
*Keywords: neighbourhood, self-rated health, individual explanations, ecological explanation, Lisbon Metropolitan Area, Portugal.*

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# 1 Introduction

Researchers and policy makers are increasingly coming to accept the role of the neighbourhood (material and social context) in shaping individual and community health. Studies into how place influences health have become more and more common, supporting a range of interventions to improve health and reduce health inequalities at the area level [1, 2]. However, there still remain the tasks of accurately identifying the characteristics of place that influence health and of determining how they can be properly measured. Hoping to highlight the inside of the "black box of places" [1, 3, 4], some authors have suggested the use of a conceptual framework of universal human needs as a basis for thinking about specific chains of causality that might link place of residence with health outcomes.

In this paper we aim to go beyond the usual global measures of deprivation in order to investigate the role of a range of social and material infrastructures on self-rated health. Although self-rating is a subjective tool, it is nevertheless a powerful predictor of healthy life expectancy, well-being [5] and future morbidity and mortality [6]. Moreover, self-rating appears able to capture the sum of cumulative contextual effects that affect human health. This is an important characteristic, since our approach is based precisely upon a concept of cumulative exposure and access to local social and material resources.

Current research into neighbourhoods and health has examined the role of area deprivation on health [1, 2, 7]. Area deprivation often arises from individual data or a composite of socioeconomic data such as unemployment, income, education or overcrowding. The Carstair and Townsend Deprivation Indexes are perhaps two of the best-known applied composite measures of deprivation. Several studies have concluded that there is a close relationship between these deprivation measures and health [8–10]. In the Lisbon Metropolitan Area (LMA), a previous study has shown unequivocal correlations between a deprivation index and premature mortality [7].

However, a summary index of deprivation is not so useful for distinguishing the specific features of the residential environment that impinge upon health. Deprived areas may suffer from poor infrastructures and a lack of resources, such as inadequate public transport, housing, sport and recreation facilities, health and educational services, etc [1]. On the other hand, socioeconomically deprived areas are less attractive, and most of the individuals entering these neighbourhoods did not actively choose to live there. Thus, they may be less prone to take care of the maintenance of their houses, which results in structural degradation. Civic engagement, trust, and reciprocity may be undermined and crime may become more prevalent [11]. This spiral of specific environmental risk factors is not reducible to a global measure of area deprivation.

# 2 Data and methods

The sampling universe consisted of individuals living in LMA. Trained interviewers collected a representative sample of 5004 individuals from 143

wards (National Health Survey - NHS - 1998/1999). Within each selected area, data on self-rated health status and other individual variables were drawn from the NHS for men and women aged 15 or over. This interview supplied data on self-rated health, measured on a five-point scale: excellent, good, fair, bad, very bad. Age, sex, occupation, economic activity or inactivity (unemployment), education, tobacco consumption and physical activity were also obtained at interview. 4577 individuals made up the final sample, of whom 60.5% rated their health as less than good; 44% had less than 4 years of education; 53.7% were manual workers; 21.8 % were current smokers, and only 32.7 % did any physical activity. To each of the 4577 people in the 143 wards in this study we applied two kinds of measures: a composite index of area deprivation and 19 neighbourhood factor scores reflecting some specific features of the local material and social environment.

We proceeded to create a deprivation score, by selecting three variables from the 2001 Census that reflect the multi-faceted nature of deprivation [8]. These are related with occupation (i.e. male unemployment and unskilled jobs) and living conditions (i.e. percentage of people living in shanties).

The generation of this ecological data began with a consideration of what humans need in their local environment in order to lead a healthy life [1, 3, 4]. We drew up a list of 14 domains concerning these needs: 1. Housing environment (indoor); 2. Residential Environment (outdoor); 3. Health services; 4. Leisure and Recreation; 5. Sports facilities; 6. Family support services; 7. Local resources; 8. Housekeeping; 9. Work and employment; 10. Educational services; 11. Crime and policing; 12. Traffic security; 13. Transport Accessibility; 14. Social capital and cohesion. The next step was the selection, analysis and interpretation of data reflecting those domains. Over 240 variables were collected and assigned to the previously established domains.

Following the method of Carstairs and Morris [12], each variable was standardized to give a population-weighted mean of zero and a variance of one (z-score method) [7], meaning that each variable has equal influence on the resultant score. The deprivation score results from the sum of the new standardized variables.

The large amount of data created and assigned to the previously determined domains, reflecting the local context, had to be processed effectively. So we used Principal Component Analysis (PCA) to explore the data and extract factor scores for each of our constructs. As the aim of PCA is to reduce the number of variables to be used in statistical analysis, some components were rejected as irrelevant using Kaiser's Criterion. All components were rotated, using varimax rotation to maximise factor loadings. Those variables, with a low loading onto components, were discarded from the construct. Our aim was to create a single strong component in each construct. However, some domains revealed a bi-dimensional structure, which resulted in 19 factor scores, with 82 variables.

The next step was to evaluate the internal consistency of the extracted factors and the ability of the factor scores to measure the latent contextual domains. Reliability was measured with standardised Alpha Scores, which ranged from

Table 1: Characteristics of 4577 Health Survey for LMA respondents.

| Characteristic | Number (4577) | Percentage (%) |
|---|---|---|
| **Sex** | | |
| Male | 1830 | 40.0 |
| Female | 2747 | 60.0 |
| **Age** | | |
| 15-24 | 416 | 9.1 |
| 25-34 | 591 | 12.9 |
| 35-44 | 752 | 16.4 |
| 45-54 | 920 | 20.1 |
| 55-64 | 849 | 18.5 |
| 65-74 | 685 | 15.0 |
| 75+ | 364 | 8.0 |
| **Level of education** | | |
| < 4 years | 2029 | 44.0 |
| 5 - 12 years | 1884 | 41.2 |
| 13 + years | 664 | 14.5 |
| **Economic activity** | | |
| Employed | 2423 | 52.9 |
| Unemployed | 240 | 5.2 |
| Other | 1914 | 41.8 |
| **Occupation** | | |
| Manual | 2117 | 53.7 |
| Not manual | 2460 | 46.3 |
| **Self-rated health** | | |
| Very bad | 181 | 4.0 |
| Bad | 583 | 12.7 |
| Fair | 2004 | 43.8 |
| Good | 1592 | 34.8 |
| Very good | 217 | 4.7 |
| **Physical activity** | | |
| With physical activity | 1495 | 32.7 |
| Without physical activity | 3082 | 67.3 |
| **Tobacco consumption** | | |
| Smoker | 996 | 21.8 |
| Non-smoker | 2873 | 62.8 |
| Ex-smoker | 708 | 15.5 |

0.98 to 0.51. These high values show that variables within each factor are strongly related and this gives us confidence that the scores reliably capture something unique about the local environment.

To examine the relationship between self-rated health and individual and contextual characteristics, we used the ordered logistic model. We started with a simple model, considering individual factors as independent variables. In this model, we selected the variables with a conventional significance of $p \leq 0.05$. In a second stage, we developed this model by entering ecological variables that were selected if they were significant ($p \leq 0.05$). Two models were achieved: one with individual factors and the 19 neighbourhood factor scores (table 1), and another with individual factors and area deprivation index. Using the estimated coefficients of these models, and attributing to the individuals living in the worst quintile the value that represents the best conditions in the LMA, we estimated, using the latent variable, the probabilities for each category of self-reported health for the individuals living in those areas. Finally, the model with the 19 neighbourhood factor scores was developed for male and female (results not shown).

## 3 Results and discussion

Table 2 shows: a) the association between self-rated health, individual factors and neighbourhood factor scores (model 1); b) and self-rated health and area deprivation (model 2). Coefficients of individual variables in model 2 are very similar to individual coefficients in model 1.

As expected, women tended to assess their health worse than men (1.7 times more likely); age was found to have a detrimental effect on self-rated health, and the odds of individuals reporting poor health increased by 51% for each additional 10 years. Manual labour was a significant factor in increasing poor health ratings, with the odds of a negative health status increasing by 47%. Education level also played a part. Individuals with lower levels of education were 97.5% more likely to report a negative health status. Tobacco consumption showed similar results, with the odds of smokers reporting worse health status increasing by 21%. Employment has a positive effect on self-rated health - increasing the odds of a positive health status by 68%. Physical activity also had a positive influence, and active individuals were 73% more likely to report positive health status.

As to contextual determinants, a significant correlation was found between self-rated health and health services, transport accessibility, social capital and cohesion (measured by civic engagement and political participation) and area deprivation. Individuals that lived in more deprived wards were more likely to report poorer health (approximately 10% more). The positive association between self-rated health and the availability of health services was also confirmed, with the odds of reporting better health increasing by 12%. The relationship between a poor health and poor transport accessibility, long distances between facilities and automobile use is also shown in the model by a 9% increase in the odds of reporting negative self-rated health. Individuals living

in wards with lower levels of civic engagement were 11% more likely to report worst self-rated health. Political participation showed a similar influence; lower levels of political participation increased the odds of reporting worst self-rated health by 15.5%.

Table 2: Logistic regression models for examining contextual characteristics as determinants of health.

| Variables [a] | Coefficient | 95% IC | Coefficient | 95% IC |
|---|---|---|---|---|
| | **Model 1** | | **Model 2** | |
| Sex | -.530*** | -.65 ; -.41 | -.524*** | -.65 ; -.40 |
| Age | -.041*** | -.05 ;-.04 | -.041*** | -.05 ; -.04 |
| Occupation | -.388*** | -.53 ; -.25 | -.038*** | -.52 ; -.24 |
| Physical activity | .546*** | .42 ; .68 | .538*** | .41 ; .67 |
| Economic activity: employed | .517*** | .39 ; .64 | .511*** | .39 ; .64 |
| Tobacco consumption: smoker | -.193* | -.34 ; -.05 | -.181** | -.33 ; -.04 |
| Education: < 4 years | -.680*** | -.83 ; -.53 | -.676*** | -.83 ; -.53 |
| Education: 13 + years | .604*** | .42 ; .79 | .599*** | .42 ; .78 |
| Accessibility of public transport and automobile use | -.087* | -.17 ; -.01 | | |
| Ancillary services | .112** | .05 ; .18 | | |
| Social capital - political participation | -.144*** | -.22 ; -.07 | | |
| Social capital – civic engagement | -.105* | -.18 ; -.03 | | |
| Area deprivation index | | | -.046*** | -.07 ; -.02 |
| **Model 1** | | | | |
| **Model Fitting Information:** | Log Likelihood Ratio = 1733.55*** | | | |
| **Pseudo R-Square** | Cox and Snell = .32 | | | |
| | Nagelkerke = .34 | | | |
| | McFadden = .15 | | | |
| **Model 2** | | | | |
| **Model Fitting Information:** | | | Log Likelihood Ratio = 1702.65*** | |
| **Pseudo R-Square** | | | Cox and Snell = .31 | |
| | | | Nagelkerke = .34 | |
| | | | McFadden = .15 | |

a) We show only the significant variables; * p<0.05; ** p<0.01; *** p<0.001.

Finally, in models developed for males and females, we found that contextual influences were different for men and women. In women, self-rated health was also sensitive to housing (lack of conditions like water, electricity, toilets and sewage systems) and family support services (like day-nurseries, nursing home, day-care centers and child day-care centers), while men were more sensitive to a large range of local resources, like banks, ATMs, dentists, opticians and bookshops.

These results can allow us to assess the theoretical improvements to health that might arise from interventions at area level. In fact, on the basis of developed models, we can indicate some possible strategies to improve health and quantify this theoretical improvement. To do this, we applied to individuals living in worst quintile the opposite value, representing the best conditions of the whole metropolitan area. Then, we estimated what would happen to the health ratings of the population living in the worst areas. Table 3 summarises the improvements in health ratings achieved by a modification in environmental features.

Table 3: Percentage of people living in worst quintiles reporting good to very good self-rated health: real cases and estimated cases after an improvement of material and social features of local context.

| Contextual determinants of health | Real cases (%) | Cases estimated with better environmental conditions (%) |
|---|---|---|
| Ancillary services | 38.8 | 60.4 |
| Accessibility to public transport and automobile use | 41.7 | 54.4 |
| Political participation | 38.1 | 44.0 |
| Civic engagement | 40 | 49 |
| Area deprivation | 34.8 | 36.5 |

Interventions aimed at reducing socioeconomic disadvantage, improving the availability of local health services, improving accessibility of public transport and reducing automobile use, and improving social cohesion need to be implemented.

## 4 Conclusions and proposals for healthy urban planning

We created a set of neighbourhood attributes that attempted to capture different features of local environment, by using data from routine and non-routine sources. The results are in keeping with public health literature about the effects of place on health. Lower access to public transport and higher automobile use, poor health services (ancillary services), lower political engagement and lower civic participation were all associated with poorer health ratings, over and above individual characteristics [2, 12–14].

At all levels, planning should improve both geographical and social proximity. Opportunities, facilities and formal support services should be easily

accessible, providing good alternative ways of travelling, in particular by stressing mobility through walking, cycling and public transport. This implies changes to land use and urban design policies, promoting diversity of use and supporting alternative means of transport to reduce the number and length of trips people need to take every day [15]. But there are other arenas, and planning for health promotion also implies planning for equality, reducing socioeconomic disadvantage and promoting civic engagement and political participation at the community level. Identity, a sense of belonging and reciprocity should be improved, by creating attractive, safe, healthy communities [16]. Neighbourhood is vitally important for health and well-being and it could be reinvented in order to create spaces for opportunity. This goal is especially important in more disadvantaged neighbourhoods, which have poor access to the basic facilities required for a healthy life. On the one hand, the place where people live significantly affects their health outcomes; on the other, people shape the neighbourhoods in which they live, and healthy people create healthy neighbourhoods. Places form people as much as they are formed by them. Improving the local environment is a powerful way of improving health.

It is important to note that this research is part of a larger project, which intends to investigate the relationships between places and health at different levels in the LMA. We began by studying the whole metropolitan area and this paper presents our results. We have now turned our attention to just one municipality - Amadora. Amadora was chosen as a case study due to its specificity: it is a small ward located near Lisbon, with an area of 24 $Km^2$ and a population of 175 872 inhabitants, which gives it one of the highest densities in the country (7390 inhabitants/$Km^2$). It is also very diversified, with socially contrasting neighbourhoods and people of different cultures, nationalities and ethnic backgrounds.

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