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Noise complaints and its relation to socio-economic factors at city/region scale in England

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ABSTRACT

Reporting noise complaints is an important part of informing noise legislation. While the effects of various socio-economic factors on noise perception have been investigated in previous studies, the aim of this study is to examine relationships between the rate of noise complaints and socio-economic factors. The noise complaints and socio-economic datasets from the government open data source at district and unitary authority levels across the England are used. The socio-economic dataset is categorised into four groups in this study, namely demographic, working, property and deprivation factors. Correlation analysis is conducted between noise complaint rate and socio-economic factors, and the results suggest that the correlations are generally significant. Cities/regions with a higher proportion of young and single residents are likely to receive more noise complaints, and so are cities/regions with a higher unemployment rate and higher proportion of residents living in flats. The deprived city/regions, measured by the English Index of Multiple Deprivation, tend to have a higher noise complaint rate.

Keywords: Noise complaint rate; demographic factors; property factors; job-related factors; deprivation factors.

1. INTRODUCTION

Neighbour complaints appear to be a growing phenomenon, and are a key feature of contemporary urban living. They have significant effects on the quality of life for residents, the level of health, and neighbourhood cohesion (1). To reduce the impact of neighbour complaints, public complaint platforms have been established in many countries, such as those in Australia, the U.S. and the U.K., to deal with problems relating to complaints for residents and to provide data for government decision-making. Among the neighbour complaints, the volume of complaints about noise is the greatest. Socio-economic factors play an important role in neighbour complaints. Complaining about noise is a behaviour based on residents' annoyance with noise and urban noise levels. From the perspective of sound environments, previous studies have examined the impact of socio-economic factors on noise annoyance and noise level (2). However, the relationships between noise complaints and socio-economic factors have not been fully investigated.

Using a combined questionnaire and noise measurement survey in Great Britain, Fields and Walker (3) conducted research to examine the impact of about 35 demographic factors on annoyance arising from railway noise. The results show that there are significant relationships between noise annoyance and older dwellings, older respondents, and life-time residents. Xie and Kang (4) conducted a more comprehensive study to examine the relationships between environmental noise levels and socio-economic factors, focussing on levels in neighbourhoods and boroughs throughout London while including more socio-economic factors. At the neighbourhood level, fewer students and part-time residents lived in quieter areas, and neighbourhood noise levels were negatively associated with their total deprivation rankings. At the borough level, income levels were generally higher in the noisier boroughs. Yu and Kang (5) focused on subjective evaluations of the sound level in an urban open space. Aletta et al. (6) analysed the effect of demographic factors on sound perception using a case study of a cycling path. A range of correlations have been revealed through such small-scale

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research.

Although the relationships between socio-economic factors and noise level and between socio-economic factors and noise annoyance have been investigated, the relationships between socio-economic factors and noise complaints has not been adequately explored, especially on a larger scale. Kang (2) stated that noise complaints are strongly related to noise annoyance when he analysed noise standards and regulations in Europe. Furthermore, Legewie and Schaeffer (7) found that the relationship between ethno-racial diversity in a neighbourhood and the number of noise complaint calls was significant.

Therefore, the aim of this research is to examine the relationships between noise complaints and socio-economic factors. The socio-economic factors are categorised into four groups: demographic factors, property factors, job-related factors and deprivation factors. The noise complaints and socio-economic factors datasets from the government open data source are used through statistical analysis in all district and unitary local authorities across England.

2. METHODOLOGY

2.1 Geographical samples

This study is based on district and unitary administration level across whole England as data availability. City/region, including urban, semi-urban, and rural areas, as a strategic and political level of administration and policymaking, was used to refer to district and unitary authority level (8). There are 325 samples included in this study.

2.2 Noise complaints dataset

The reporting of noise complaints is carried out in England as a part of environmental legislation, providing data for government decision-making. The noise complaint data can be downloaded from Public Health England. The rate of noise complaint data was selected to conduct the correlation analysis, with the aim of comparing a large number of cities/regions across various scales.

The range of data on noise complaint rates is available from 2010 to 2015. A strong relationship was found within these years and the relative value of noise complaints between each city/region did not change dramatically. Therefore, the relationships between socio-economic factors and noise complaints during that period will be similar. As the census of 2011 has the most recent and detailed socio-economic dataset, the 2011 rate of noise complaints was selected for the statistical analysis.

2.3 Socio-economic factors dataset

As previous studies argue, there is a wide range of socio-economic factors that can have an impact on sound environment evaluation. On the basis of the literature review and data availability, 78 factors were selected to conduct the correlation analysis. They are categorised into four groups: demographic, job-related, property, and deprivation factors. The detailed factors are shown in Table 1.

Table 1- Indicators of socio-economic factors.

Demographic factors	Job-related factors	Job-related factors	Deprivation factors
Age			
Sex			
Marital status		Accommodation size	
Household size	Economic activity	Central heating	
Qualification	Hours worked	Accommodation type and tenure	--
Health	Occupation	Car or van availability	
Social grade			
Religion diversity			
Ethnic diversity			

All socio-economic factors are extracted from Census 2011. To compare cities/regions across various scales, all other indicators are presented by percentage, excluding deprivation factors, which

are shown as rank, mean age, median age, car or van availability, and religious and ethnic diversity. In terms of ethnicity and religion, the diversity is calculated using Simpson's Diversity Index, which is universally accepted (9,10). The formula is:

$$D = \sum_{i=1}^{S} \left(\frac{N_i}{N}\right)^2 \quad (1)$$

where D is Simpson's Diversity Index; Ni is the population by ethnicity or religion i. Religions include Christianity, Buddhism, Hinduism, Judaism, Islam, Sikhism, and Other. Ethnic groups include White, Mixed/Multiple, Asian/Asian British, Black/African/Caribbean/Black British, and Other. N is the total population.

3. RESULTS

3.1 Demographic factors

The correlation analysis between demographic factors and noise complaints are examined in this part, including age, marital status, qualification, health, religion and ethnic diversity. The rate of noise complaints has modest negative correlations with mean and median age, with coefficients of about -0.5. Noise complaints have a positive and weak relationship with the proportion of males, with a 0.194 correlation coefficient at a 0.01 significance level. A strong positive relationship is found between noise complaints and the proportion of single residents, with a higher coefficient value at 0.612. Significant correlations are found between residents' highest level of qualification and noise complaints, as shown in Table 2. The cities/regions with a higher percentage of residents with a higher education tend to receive more noise nuisance reports.

Table 2-Correlation coefficients between the percentage of residents with various qualification levels and noise complaints (** indicates p<0.05, * indicates p<0.01).

No qualifications	Level 1 qualifications	Level 2 qualifications	Apprenticeship	Level 3 qualifications	Level 4 qualifications and above	Other qualifications
-0.132*	-0.318**	-0.533**	-0.498**	-0.149**	0.255**	0.562**

The impact of sound environment on health problems has been intensively investigated. In this study, the noise complaints are generally related to general health, long-term health problem or disability, and provision of unpaid care per week, as shown in Table 3.

Both ethnic and religious diversity have positive modest relationships with noise complaints (the correlation coefficients are 0.554 and 0.474 at a 0.01 significance level). In a diverse society, therefore, there could be more conflicts. This finding is consistent with that of Legewie and Schaeffer (7), who found that residents living between racial enclaves tend to complain more about noise than those who live within clearly defined racial boundaries.

Table 3-Correlation coefficients between health factors and noise complaints (** indicates p<0.05, * indicates p<0.01).

General Health			Long-term health problem or disability		Provision of unpaid care per week	
Good	Fair	Bad	Day-to-day activities limited (all residents)	Day-to-day activities limited (workers)	No unpaid care	50 or more hours
0.093	-0.214**	0.083	-0.206**	0.119*	0.512**	-0.184**

3.2 Job-related factors

There are three categories of job-related factors: economic activity, hours worked, and occupation. Economic activity is an indicator of residents' status of employment. In terms of being economically

active, the percentage of residents with part-time jobs has negative relationships with the rate of noise complaints, with a coefficient of -0.523 (Table 4). Noise complaints do not show correlation with the percentage of residents having full-time and self-employed jobs. As for the percentage of unemployed residents, noise complaint is positively related, with coefficient values of 0.406. As for economically inactive residents, a significant negative relationship is found between noise complaints and the percentage of retired residents, with a coefficient of -0.522. Positive relationships are found between noise complaints and all remaining factors, including the percentage of students and disabled residents. The results indicate that cities/regions with a higher proportion of unemployed residents might be facing more serious noise complaint problems. In addition, the cities/regions with a higher percentage of residents who work more hours tend to receive more noise nuisance reports.

Table 4-Correlation coefficients between economic activity status and noise complaints (** indicates $p<0.05$, * indicates $p<0.01$).

Economically active		Part-time	-0.523**
		Full-time	0.013
		Self- employed	-0.065
	Unemployed	Total unemployed residents	0.406**
		Unemployed male	0.339**
		Unemployed female	0.488**
Economically inactive		Retired	-0.522**
		Student	0.411**
		Looking after home or family	0.340**
		Long-term sick or disabled	0.175**
		Other	0.555**

In terms of residents' occupation, the proportion of residents with professional or senior occupations has positive relationships with noise complaints, while residents with entry-level or blue-collar occupations have a negative relationship. As the share of professional, associate professional, and technical occupations increases, the rate of noise complaints also increases. In contrast, such occupations – administrative and secretarial, skilled trades, caring, leisure and other service occupations, and process plant and machine operatives – have negative values in terms of noise complaint rates. The remaining occupations do not show statistically significant correlations. Overall, noise complaints have a positive relationship with the percentage of residents in professional-level occupations.

3.3 Property factors

There were generally significant correlations between property factors and noise complaints. The results show that noise complaints have a negative relationship with the average number of rooms and bedrooms per household, with coefficient values of -0.610 for rooms and -0.581 for bedrooms. In terms of central heating, the percentage of centrally heated households is negatively related to the rate of noise complaints, with a correlation coefficient value of -0.167. In addition, as the average number of car or van per household increases, the noise complaint rate tends to decrease.

In terms of accommodation type, negative relationships are found between the proportion of residents living in a whole house or bungalow and noise complaints, with a coefficient value of -0.653 (Table 5). Detached and semi-detached dwellings also have negative relationships with noise complaints, with lower coefficient values of -0.500 and -0.456, respectively. Noise complaints, however, are positively related to the proportion of residents living in terraced houses. Similar relationships appear for flats: noise complaints are generally positively related to the proportion of residents living in a flat, with coefficient values of 0.627, 0.606, and 0.360, for purpose-built blocks of flats or tenements, for part of a converted or shared house, and for commercial buildings, respectively. To some extent, terraced houses are more similar to flats in spatial patterns as the rooms are contiguous, although they are categorised under whole house or bungalow. Therefore, they show similar

relationships with noise. As for the last variable, caravan or other mobile or temporary structure, it is positively related to noise complaints. The results show that cities/regions with more residents living in flats have an increasing rate of complaint activity.

Table 5-Correlation coefficients between accommodation type and tenure, and noise complaints (** indicates $p<0.05$, * indicates $p<0.01$).

Accommodation type	Whole house or bungalow	-0.653**
	Detached	-0.500**
	Semi-detached	-0.456**
	Terraced	0.164**
	Flat, maisonette, or apartment	0.653**
	Purpose-built block of flats or tenement	0.627**
	Part of a converted or shared house	0.606**
	In commercial building	0.360**
	Caravan or other mobile or temporary structure	-0.253**
Accommodation Tenure	Owned	-0.668**
	Shared ownership	0.242**
	Social rented	0.532**
	Private rented	0.594**
	Rent free	0.039

The results of tenure are shown in Table 6. It can be clearly seen that there is a significant and strong inverse relationship between noise complaints and the percentage of a household that owns the accommodation it occupies, with a coefficient value of -0.668. However, noise complaints appear to be positively related to the percentage of households who share ownership with others, with a lower coefficient value of 0.242. Households living in rented accommodation are classified by the type of landlord who owns or manages the accommodation. Noise complaint has a positive relationship with the percentage of households that rents from social and private properties, with higher coefficient values of 0.532 and 0.594, respectively.

3.4 Deprivation factors

In terms of deprivation factors, the first ranking cities/regions represent the most deprived cities/regions, namely disadvantaged areas. The results show a negative relationship between total deprivation and noise complaints, with a coefficient value of -0.373, indicating that more deprived cities/regions tend to have more noise complaints. In terms of barriers to housing and services, crime, living environment, and income deprivation all have negative relationships with noise complaints, with similar coefficient values, compared to total deprivation. Employment and health are also negatively related to noise complaints, but with lower coefficient values.

4. CONCLUSIONS

This study examines the relationships between noise complaints and socio-economic factors, including demographic, job-related, property, and deprivation factors based on statistical analysis in the district and unitary local authority-levels in England. The results of this investigation are as follows;

1. From the perspective of demographic factors, complainants are likely to have a higher education level and live in an area with diverse religions and ethnicities. Cities/regions with a higher proportion of single individuals are prone to receive more noise complaints.
2. If the unemployment rate of the cities/regions is higher, residents tend to report more noise issues. The unemployment rate of females has a closer relationship with noise complaints than that of

males.

3. In terms of property factors, if there are more flats or rented houses in an area, noise problems become considerably significant.

4. More deprived cities/regions tend to have more noise complaints in terms of each aspect in the deprivation index: housing and services, crime, employment, health, environment, and income.

This study has revealed the strengths of the relationships between each socio-economic factor and noise complaints, and it can help predict the noise complaint rate. Furthermore, these results can help government organisations to prioritise resources in terms of noise complaints as a part of neighbour complaints, both geographically and socio-economically. For instance, if a city/region has a higher unemployment rate, it tends to have a higher noise complaint rate. Therefore, more resources could be allocated in such cities/regions.

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