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Additional Analysis of NNAS2012 Dataset:

Work Packages on vehicle noise annoyance; noise complaints; and noise sensitivity

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1 Executive Summary

- This report present the findings of three additional analysis work packages carried out by Queen Mary University of London on behalf of DEFRA on the National Noise Attitude Survey 2012 (NNAS2012) dataset. The three work packages examined the following:

    - How noise annoyance responses for different types of vehicles was related to other key noise attitudes including noise sensitivity, sleep disturbance and noise complaint behaviour.
    - The extent to which making a noise complaint was associated with noise annoyance and with sociodemographic, dwelling, and geographic factors.
    - Which groups of the population report being the most and least sensitive to noise, focusing on sociodemographic factors?

- In considering the relationships between noise attitudes and other factors in the NNAS2012, it should be remembered that the NNAS2012 data is cross-sectional and therefore causal relationships between these noise attitudes and other factors cannot be inferred.

Work Package 1

- There were associations between noise annoyance for specific vehicle types and other noise attitudes including interference with sleep, noise sensitivity, noise complaints, and interference with activities.
- Comparing the associations between the different vehicle annoyance types and noise attitudes, associations were consistently observed for annoyance for private cars/taxis and heavy lorries. These two vehicle types were most consistently associated with negative noise attitudes.
- Noise annoyance for heavy lorries, private cars/taxis, motorbikes/scooters and refuse collection vehicles were associated with increased responses for interference with sleep.
- Interference with activities within the home were associated with being moderately, very, or extremely annoyed with noise from private cars/taxis and heavy lorries.
- Noise annoyance for private cars/taxis, motorbikes/scooters and other vehicles were associated with making any noise complaint.
- Noise annoyance for motorbike/scooters was associated with several noise attitudes (interference with sleep, noise complaints, not liking the noise around here, interference with using the garden, road traffic noise annoyance and noise sensitivity).

Work Package 2

- Several sources of noise annoyance were associated with making a noise complaint. Respondents who reported being moderately, very or extremely annoyed by aircraft noise, road traffic noise, neighbour noise, or entertainment noise had significantly increased odds of making a noise complaint.
- Associations between noise annoyance and noise complaint behaviour remained after taking noise sensitivity, sociodemographic, dwelling, and geographic factors into account, suggesting that regardless of other factors, noise annoyance is generally associated with noise complaint behaviour.
- Noise sensitive individuals may be more likely to make a noise complaint, although we should be cautious about inferring a causal relationship.
- Respondents in their thirties, forties, and fifties were more likely to make a noise complaint: older respondents aged 75 years or older were less likely to make a noise complaint.
- There was a social gradient in noise complaint behaviour, with respondents in households where the head of household was in social group A[1] were more likely to report a noise complaint and, conversely, those where the head of household was in social groups C2 or D were less likely to report a noise complaint.

Work Package 3

- Within the sample, a wide range of noise sensitivities were observed, with analyses suggesting that certain sub-groups of the population may be more or less sensitive to noise.
- Noise sensitivity was associated with a range of sociodemographic factors, as might be expected, as noise sensitivity is conceived of as an individual-level factor.
- Older respondents (aged mid-forties and upwards), female, those in households without children, and in social groups A and B had higher noise sensitivity scores; whilst younger respondents, male, those with children in the household, and those in social groups C2 or D had lower noise sensitivity scores.
- As also shown in Work Package 1, noise annoyance was associated with noise sensitivity but in the NNAS2012 data; we do not know whether noise sensitive individuals are more likely to report noise annoyance or whether noise annoyed individuals are more likely to report noise sensitivity.

[1] https://www.ipsos-mori.com/DownloadPublication/1285_MediaCT_thoughtpiece_Social_Grade_July09_V3_WEB.pdf
A=higher managerial, administrative, professional; B intermediate managerial, administrative or professional; C1 supervisory, clerical & junior managerial, administrative, professional; C2 skilled manual occupations; D semi-skilled and unskilled manual occupations; E state pensioners, casual or lowest grade workers, unemployed with state benefit only.

2 Introduction

The National Noise Attitude Survey 2012 (NNAS2012) was carried out in 2011/12 and generated a wealth of information on national (UK) attitudes to noise, sources of noise and coping strategies. The methodology and analyses assessing current noise attitudes from the NNAS2012 have already been published by DEFRA (http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=18288).

This report presents the findings of three sets of additional analyses undertaken by Queen Mary University of London & DEFRA, to add to the evidence base on issues of current policy relevance. Three additional workpackages are presented in this report.

Work Package 1: How is noise annoyance for different types of vehicle associated with noise attitudes?

This work package considers how noise annoyance responses for different types of vehicles (namely heavy lorries, smaller lorries, delivery vans, buses/coaches, motorcycles/scooters, private cars/taxis, and refuse collection vehicles) is related to several key noise attitudes, including noise sensitivity, sleep disturbance, and noise complaint behavior.

Work Package 2: Noise Complaints

This work package explores the extent to which the making of a noise complaint is associated with noise annoyance and also with sociodemographic, dwelling and geographic factors, to identify which sub-groups of the population are most and least likely to make a noise complaint.

Work Package 3: Noise Sensitivity

This work package explores which groups of the population report being the most and least sensitive to environmental noise, focusing on sociodemographic factors, but also exploring dwelling and geographical variations. The associations between noise sensitivity and other noise attitudes, including noise annoyance, are also examined.

In this report, each work package is presented separately: a background, method, results and discussion is presented for each work package. All analyses use the sample weighting, as described in the NNAS2012 methodology report (http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=18288).

3 Work Package 1: How is noise annoyance for different types of vehicle associated with noise attitudes?

3.1 Background

The Road Traffic Noise module of the NNAS2012 considered different noise attitudes for different types of vehicles (namely heavy lorries, smaller lorries, delivery vans, buses/coaches, motor bikes/scooters, private cars/taxis, and refuse collection vehicles. Defra is interested in examining how these vehicle categories relate to several key noise attitudes (noise sensitivity, sleep disturbance, complaints). Of particular interest is how response to motor bike/scooter noise compares with responses for other vehicle noise types.

3.2 Method

3.2.1 Noise Annoyance Variables

As shown in the table below, analyses of the NNAS2012 illustrated that noise from road sources was reported as being heard by over 70% of the total sample. The most heard vehicle types were private cars/taxis (89.7%) and refuse collection vehicles (89.9%). However, the vehicle type with the highest rating for being moderately, very, or extremely annoying was motor bikes/scooters (15.5%), followed by private cars/taxis (14.4%) and heavy lorries (14.4%).

The RTN1 variables were scored in the following way for the WP1 analyses:

- 0=not at all/a little bothered, annoyed or disturbed
- 1=moderately, very, or extremely annoyed

The RTN1 annoyance variables examined in this workpackage were:

- Heavy lorries
- Smaller lorries
- Delivery vans
- Buses/coaches
- Private cars/taxis
- Motor bikes/scooters
- Refuse collection
- Any other type of vehicle

RTN1 NAS12 When you are at home, to what extent are you personally bothered, annoyed or disturbed by noise from…? 'Not at all – A little – Moderately – Very – Extremely'				
Noise Category (n=2747)	**Hear**	**Bothered, annoyed or disturbed (%)**		
	(%)	**To some extent**	**Moderately, Very, or Extreme-ly**	**Very or Extreme-ly**
Types of Vehicles				
Heavy lorries	74.3	30.1	14.4	6.0
Smaller lorries	77.8	26.2	11.2	3.6
Delivery vans	85.0	23.2	8.2	1.9
Buses/coaches	70.3	17.7	8.4	2.5
Private cars/taxis	89.7	33.3	14.4	4.7
Motor bikes/scooters	86.0	35.4	15.5	5.8
Refuse collection	89.9	21.5	7.2	1.9
Any other kinds of vehicles	66.9	5.7	3.0	1.3

Table 1: Noise annoyance for different types of vehicles

3.2.2 Statistical analysis

For each vehicle noise annoyance variable, effect coding univariable regression models were run, assessing the strength of the association between the vehicle noise annoyance variable and a range of noise attitude variables (see Analysis Plan for full details of noise attitude variables examined).

Vehicle noise annoyance variables, that showed a significant association with a noise attitude variable (p=<0.05) in the univariable analyses, were then included in a multivariable regression model to examine which vehicle noise annoyance variables remain associated with the noise attitude variable after taking the other significant vehicle noise annoyance variables into account.

3.2.3 Interpreting effect coding regression models

Effect coding in regression analyses does not use dummy variables, as in conventional regression models, where there is a reference group to which all the other categories of the variable are compared in the regression. In effect coding, the regression coefficient for each category of the variable is compared to the unweighted grand mean of all the observations. The coefficients represents the difference between the mean for this group compared to the unweighted grand mean for the sample: unweighted simply reflects the fact that different sub-group sizes are present within the variable being examined.

Statistical significance is indicated in the tables (*p=0.05, **p=0.01, ***p=<0.001).

3.2.4 Analysis Plan

The following variables from the NNAS2012 dataset were examined in relation to annoyance by vehicle type (heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters; refuse collection, any other type of vehicle).

- Reports of road traffic noise interfering with sleeping (RTN0405).
- Noise sensitivity (A8) –scored continuously.
- Complaints (O8a) - Have you or anyone in your household ever done any of these about an issue to do with noise whilst living in this home, within the past five years?
- Complaints (O9b/O10*) -Which types of noise were an issue that either you, or someone else in your household, did something about – road traffic noise?*
- In general, how do you feel about the amount of noise around here (A7)?
- When you are at home, to what extent are you personally bothered, annoyed or disturbed by noise from road traffic noise(A9)?
- Thinking about all the types of noise we have been talking about that you hear at home, which one best describes the extent to which noise spoils your home life (O1a/b)?
- Road traffic noise interferes with resting (RTN0406), having windows open (RTN0409), reading, writing and other quiet activities (RTN0403), spending time in the garden or on the balcony/terrace (RTN0408).
- How much would you say you are bothered, annoyed or disturbed by the road traffic noise while it is going on (RTN6)?

3.3 Results

3.3.1 Interference with sleeping

The table below shows the univariable associations between the different types of vehicle noise annoyance and reports of road traffic noise interfering with sleep. There were significant associations between noise annoyance for the different types of vehicles and reports of road traffic noise interfering with sleep. Respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had higher odds of reporting road traffic noise interfering with sleep compared to the unweighted grand mean for the sample ($p<0.001$, in all cases). Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had lower odds of reporting road traffic noise interfering with sleep compared to the unweighted grand mean for the sample ($p<0.001$, in all cases).

Univariable odds ratios for road traffic noise interference with sleep for annoyance by vehicle type.			
	Road traffic noise interference with sleep		
TYPE OF VEHICLE	**N**	**Odds Ratio**	**95% CI**
Heavy Lorries (N=1926)			**R^2= 0.056**
Not at all and a little	384	0.59***	0.53, 0.67
Moderately, very and extremely	190	1.69***	1.50, 1.89
Smaller Lorries (N=1926)			**R^2=0.066**
Not at all and a little	409	0.54***	0.48, 0.61
Moderately, very and extremely	164	1.85***	1.64, 2.10
Delivery Vans (N=1928)			**R^2=0.037**
Not at all and a little	460	0.59***	0.52, 0.68
Moderately, very and extremely	121	1.68***	1.46, 1.94
Buses/Coaches (N=1928)			**R^2=0.045**
Not at all and a little	1277	0.57***	0.49, 0.65
Moderately, very and extremely	110	1.77***	1.54, 2.04
Private cars/Taxis (N=1930)			**R^2=0.098**
Not at all and a little	360	0.50***	0.45, 0.56
Moderately, very and extremely	215	2.00***	1.78, 2.24
Motor Bikes/Scooters (N=1928)			**R^2= 0.063**
Not at all and a little	368	0.58***	0.52, 0.65
Moderately, very and extremely	206	1.72***	1.54, 1.92
Refuse Collection (N=1928)			**R^2= 0.047**
Not at all and a little	465	0.54***	0.46, 0.63
Moderately, very and extremely	110	1.86***	1.60, 2.15
Any Other Kinds of Vehicles (N=1901)			**R^2= 0.017**
Not at all and a little	524	0.58***	0.46, 0.72
Moderately, very and extremely	44	1.73***	1.39, 2.16

Table 2: Univariable associations between noise annoyance for different types of vehicles with reports of road traffic noise interfering with sleep (RTN0405)

The multivariable analysis showing the associations between the different types of vehicle annoyance and road traffic noise interference with sleep is shown in the table below. After adjustment for all the vehicle annoyance variables that were significant in the univariable analyses, respondents reporting being moderately, very or extremely annoyed by heavy lorries, private cars/taxis, motor bikes/scooters, and refuse collection vehicles had higher odds of reporting road traffic noise interfering with sleep compared to the unweighted grand mean for the sample ($p<0.001$, in all cases). Respondents reporting being not at all or a little annoyed by heavy lorries, private cars/taxis, motor bikes/scooters, and refuse collection vehicles had lower odds of reporting road traffic noise interfering with sleep compared to the unweighted grand mean for the sample. Comparing the effect sizes observed in the multivariable model, private cars/taxis and refuse collection vehicles showed the largest increase in odds for reporting noise interfering with sleeping: private cars/taxis – a 61% (40-84%) increase in odds, motor bikes/scooters – a 24% (9-42%) increase in odds, refuse collection vehicles – a 52% (28-81%) increase in odds, heavy lorries – a 23% (4-45%) increase in odds. The R^2 for this model was 0.157.

Multivariate odds ratios for road traffic noise interference with sleep for annoyance by vehicle type.		
(N=1890)	**Traffic noise interfered with sleep?**	
TYPE OF VEHICLE	**Odds Ratio**	**95% CI**
Heavy Lorries		
Not at all and a little	0.82*	0.69, 0.97
Moderately, very and extremely	1.23*	1.04, 1.45
Smaller Lorries		
Not at all and a little	0.87	0.71, 1.07
Moderately, very and extremely	1.15	0.94, 1.41
Delivery Vans		
Not at all and a little	1.18	0.96, 1.45
Moderately, very and extremely	0.85	0.69, 1.04
Buses/Coaches		
Not at all and a little	0.87	0.72, 1.04
Moderately, very and extremely	1.16	0.96, 1.39
Private cars/Taxis		
Not at all and a little	0.62***	0.54, 0.71
Moderately, very and extremely	1.61***	1.40, 1.84
Motor Bikes/Scooters		
Not at all and a little	0.81**	0.71, 0.92
Moderately, very and extremely	1.24**	1.09, 1.42
Refuse Collection		
Not at all and a little	0.66***	0.55, 0.78
Moderately, very and extremely	1.52***	1.28, 1.81
Any Other Kinds of Vehicles		
Not at all and a little	0.84	0.65, 1.08
Moderately, very and extremely	1.20	0.93, 1.54
		$R^{2\ \text{for model}}$= 0.157

Table 3: Multivariable associations between noise annoyance for different types of vehicles with reports of road traffic noise interfering with sleeping (RTN0405)

3.3.2 Noise sensitivity

Table 4 shows the univariable associations between vehicle noise annoyance and noise sensitivity. Respondents rated 'how sensitive they were to noise' on a 7 point scale, where 1 was 'not at all' and 7 was 'very sensitive'. Respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had higher noise sensitivity scale scores compared to the unweighted grand mean for the sample ($p<0.001$, in all cases except other vehicles where $p=0.05$). Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had lower noise sensitivity scores compared to the unweighted grand mean for the sample ($p<0.001$, in all cases except other vehicles where $p=0.05$).

Univariate analysis for noise sensitivity for annoyance by vehicle type			
	Noise sensitivity		
TYPE OF VEHICLE	**Mean**	**Coefficient**	**95% CI**
Heavy Lorries (N=2725)			**R^2= 0.007**
Not at all and a little	3.75	-0.23***	-0.33, -0.13
Moderately, very and extremely	4.21	0.23***	0.13, 0.33
Smaller Lorries (N=2725)			**R^2= 0.010**
Not at all and a little	3.75	-0.29***	-0.40, -0.18
Moderately, very and extremely	4.33	0.29***	0.18, 0.40
Delivery Vans (N=2727)			**R^2= 0.005**
Not at all and a little	3.78	-0.24***	-0.36, -0.11
Moderately, very and extremely	4.25	0.24***	0.11, 0.36
Buses/Coaches (N=2726)			**R^2= 0.005**
Not at all and a little	3.78	-0.23***	-0.36, -0.10
Moderately, very and extremely	4.24	0.23***	0.10, 0.36
Private cars/Taxis (N=2729)			**R^2= 0.017**
Not at all and a little	3.72	-0.34***	-0.44, -0.24
Moderately, very and extremely	4.40	0.34***	0.24, 0.44
Motor Bikes/Scooters (N=2728)			**R^2= 0.020**
Not at all and a little	3.70	-0.37***	-0.46, -0.27
Moderately, very and extremely	4.43	0.37***	0.27, 0.46
Refuse Collection (N=2729)			**R^2= 0.007**
Not at all and a little	3.77	-0.31***	-0.44, -0.17
Moderately, very and extremely	4.38	0.31***	0.17, 0.44
Any Other Kinds of Vehicles (N=2700)			**R^2= 0.002**
Not at all and a little	3.81	-0.22*	-0.43, -0.02
Moderately, very and extremely	4.25	0.22*	0.02, 0.43

Table 4: Univariable associations between noise annoyance for different types of vehicles with noise sensitivity

The multivariable analysis showing the association between the different types of vehicle annoyance and noise sensitivity is shown in Table 5 below. After adjustment for all the vehicle annoyance variables that were significant in the univariable analyses, respondents reporting being moderately, very or extremely annoyed by private cars/taxis, motor bikes/scooters, and refuse collection vehicles had higher noise sensitivity scores compared to the unweighted grand mean for the sample ($p<0.001$, $p=0.01$, $p=0.05$, respectively). Respondents reporting being not at all or a little annoyed by private cars/taxis, motor bikes/scooters, and refuse collection vehicles had lower noise sensitivity scores compared to the unweighted grand mean for the sample ($p<0.001$, $p=0.01$, $p=0.05$, respectively). Similar effect sizes were observed in the multivariable model of noise annoyance with private cars/taxis, motor bikes/scooters and refuse collection vehicles on noise sensitivity score. The R^2 for this model was 0.030.

Multivariate analysis for noise sensitivity for annoyance by vehicle type.		
(N= 2686)	**Noise sensitivity**	
TYPE OF VEHICLE	**Coefficient**	**95% CI**
Heavy Lorries		
Not at all and a little	-0.03	-0.18, 0.11
Moderately, very and extremely	0.03	-0.11, 0.18
Smaller Lorries		
Not at all and a little	-0.11	-0.29, 0.07
Moderately, very and extremely	0.11	-0.07, 0.29
Delivery Vans		
Not at all and a little	0.10	-0.08, 0.27
Moderately, very and extremely	-0.10	-0.27, 0.08
Buses/Coaches		
Not at all and a little	0.00	-0.16, 0.16
Moderately, very and extremely	0.00	-0.16, 0.16
Private cars/Taxis		
Not at all and a little	-0.20***	-0.32, -0.08
Moderately, very and extremely	0.20***	0.08, 0.32
Motor Bikes/Scooters		
Not at all and a little	-0.23***	-0.34, -0.12
Moderately, very and extremely	0.23***	0.12, 0.34
Refuse Collection		
Not at all and a little	-0.19*	-0.33, -0.04
Moderately, very and extremely	0.19*	0.04, 0.33
Any Other Kinds of Vehicles		
Not at all and a little	0.04	-0.18, 0.25
Moderately, very and extremely	-0.04	-0.25, 0.18
		$R^{2\ for\ model}$= 0.030

Table 5: Multivariable associations between noise annoyance for different types of vehicles with noise sensitivity

3.3.3 Making a complaint about noise

Table 6 below shows the univariable associations between vehicle noise annoyance and having made a complaint about noise in the past five years. Respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had higher odds of having made a noise complaint in the past five years compared to the unweighted grand mean for the sample ($p<0.001$, in all cases). Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had lower odds of having made a noise complaint in the past five years compared to the unweighted grand mean for the sample ($p<0.001$, in all cases).

Univariable odds ratios for noise complaint for annoyance by vehicle type.			
	Complained within the past five years?		
TYPE OF VEHICLE	**N**	**Odds Ratio**	**95% CI**
Heavy Lorries (N=2734)			**R^2= 0.015**
Not at all and a little	465	0.73***	0.65, 0.82
Moderately, very and extremely	125	1.37***	1.22, 1.54
Smaller Lorries (N=2733)			**R^2=0.031**
Not at all and a little	470	0.61***	0.54, 0.70
Moderately, very and extremely	120	1.63***	1.44, 1.85
Delivery Vans (N=2736)			**R^2= 0.024**
Not at all and a little	501	0.61***	0.53, 0.71
Moderately, very and extremely	89	1.63***	1.42, 1.88
Buses/Coaches (N=2736)			**R^2=0.018**
Not at all and a little	505	0.65***	0.56, 0.75
Moderately, very and extremely	86	1.54***	1.33, 1.77
Private cars/Taxis (N=2738)			**R^2= 0.051**
Not at all and a little	428	0.56***	0.50, 0.63
Moderately, very and extremely	163	1.77***	1.58, 1.98
Motor Bikes/Scooters (N=2737)			**R^2= 0.039**
Not at all and a little	429	0.61***	0.55, 0.68
Moderately, very and extremely	162	1.63***	1.46, 1.83
Refuse Collection (N=2736)			**R^2= 0.012**
Not at all and a little	520	0.69***	0.59, 0.80
Moderately, very and extremely	71	1.46***	1.25, 1.70
Any Other Kinds of Vehicles (N=2707)			**R^2= 0.025**
Not at all and a little	537	0.47***	0.37, 0.58
Moderately, very and extremely	44	2.14***	1.72, 2.68

Table 6: Univariable associations between noise annoyance for different types of vehicles and making a noise complaint in the past five years

The multivariable analysis showing the associations between the different types of vehicle annoyance and noise complaints is shown in Table 7 below. After adjustment for all the vehicle annoyance variables that were significant in the univariable analyses, respondents reporting being moderately, very or extremely annoyed by private cars/taxis, motor bikes/scooters, and other vehicles had higher odds of having made a noise complaint in the past five years compared to the unweighted grand mean for the sample ($p<0.001$, in all cases). Respondents reporting being not at all or a little annoyed by private cars/taxis, motor bikes/scooters, and other vehicles had lower odds of having made a noise complaint in the past five years compared to the unweighted grand mean for the sample ($p<0.001$, in all cases). Comparing the effect sizes observed in the multivariable model, annoyance with other vehicles showed the largest increase in odds for making a noise complaint (69% (32-116%)), with annoyance for private cars/taxis being associated with a 44% (25-66%) increase in odds and annoyance for motor bikes/scooters with a 26% (9-44%) increase in odds. The R^2 for this model was 0.077.

Multivariate odds ratios for noise complaint for annoyance by vehicle type.		
(N= 2692)	**Complained within the past five years?**	
TYPE OF VEHICLE	**Odds Ratio**	**95% CI**
Heavy Lorries		
Not at all and a little	1.15	0.95, 1.39
Moderately, very and extremely	0.87	0.72, 1.05
Smaller Lorries		
Not at all and a little	0.84	0.67, 1.05
Moderately, very and extremely	1.19	0.95, 1.49
Delivery Vans		
Not at all and a little	0.92	0.75, 1.14
Moderately, very and extremely	1.08	0.88, 1.33
Buses/Coaches		
Not at all and a little	0.96	0.79, 1.16
Moderately, very and extremely	1.04	0.86, 1.26
Private cars/Taxis		
Not at all and a little	0.69***	0.60, 0.80
Moderately, very and extremely	1.44***	1.25, 1.66
Motor Bikes/Scooters		
Not at all and a little	0.80***	0.70, 0.91
Moderately, very and extremely	1.26***	1.09, 1.44
Refuse Collection		
Not at all and a little	0.94	0.79, 1.13
Moderately, very and extremely	1.06	0.88, 1.27
Any Other Kinds of Vehicles		
Not at all and a little	0.59***	0.46, 0.76
Moderately, very and extremely	1.69***	1.32, 2.16
		$R^{2\ \text{for model}}$= 0.077

Table 7: Multivariable associations between noise annoyance for different types of vehicles with having made a noise complaint in the past five years

3.3.4 Road traffic noise complaints

Table 8 below shows the associations between the noise annoyance for the different vehicle types with having made a noise complaint specifically relating to road traffic noise in the past five years. Only 87 respondents reported having made a complaint in relation to road traffic noise in the NNAS2012 sample so there is limited power for these analyses. Respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, and other vehicles had higher odds of having made a complaint about road traffic noise in the past five years compared to the unweighted grand mean for the sample ($p<0.001$, in all cases). Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, and other vehicles had lower odds of having made a complaint about road traffic noise in the past five years compared to the unweighted grand mean for the sample ($p<0.001$, in all cases). Refuse collection vehicle noise annoyance was not significantly associated with making a complaint about road traffic noise.

Univariable odds ratios for road traffic noise complaint for annoyance by vehicle type.			
	Complained about road traffic noise within the past five years?		
TYPE OF VEHICLE	**N**	**Odds Ratio**	**95% CI**
Heavy Lorries (N=598)			**R^2= 0.068**
Not at all and a little	52	0.54***	0.43, 0.69
Moderately, very and extremely	37	1.84***	1.45, 2.34
Smaller Lorries (N=598)			**R^2= 0.071**
Not at all and a little	53	0.54***	0.42, 0.68
Moderately, very and extremely	37	1.87***	1.47, 2.38
Delivery Vans (N=599)			**R^2= 0.051**
Not at all and a little	62	0.56***	0.43, 0.73
Moderately, very and extremely	28	1.79***	1.38, 2.32
Buses/Coaches (N=599)			**R^2= 0.093**
Not at all and a little	57	0.46***	0.35, 0.59
Moderately, very and extremely	33	2.18***	1.69, 2.82
Private cars/Taxis (N=599)			**R^2= 0.068**
Not at all and a little	45	0.56***	0.45, 0.71
Moderately, very and extremely	44	1.78***	1.42, 2.25
Motor Bikes/Scooters (N=599)			**R^2= 0.047**
Not at all and a little	49	0.62***	0.49, 0.78
Moderately, very and extremely	41	1.62***	1.29, 2.05
Refuse Collection (N=599)			**R^2= 0.003**
Not at all and a little	76	0.85	0.62, 1.18
Moderately, very and extremely	13	1.17	0.85, 1.62
Any Other Kinds of Vehicles (N=587)			**R^2= 0.028**
Not at all and a little	71	0.57***	0.41, 0.80
Moderately, very and extremely	14	1.76***	1.25, 2.46

Table 8: Univariable associations between noise annoyance for different types of vehicles and making a noise complaint relating to road traffic noise in the past five years

The multivariable analysis showing the associations between the different types of vehicle annoyance and making a complaint about road traffic noise is shown in Table 9 below. After adjustment for all the vehicle annoyance variables that were significant in the univariable analyses, respondents reporting being moderately, very or extremely annoyed by buses/coaches had higher odds of having made a complaint about road traffic noise compared to the unweighted grand mean for the sample. Respondents reporting being not at all or a little annoyed by buses/coaches had lower odds of making a complaint about road traffic noise compared to the unweighted grand mean for the sample. Being annoyed by bus/coach noise increased the odds of making a complaint about road traffic noise by 60% (14-126%). The R^2 for this model was 0.125.

Multivariate odds ratios for road traffic noise complaint for annoyance by vehicle type.		
(N=586)	**Complained about road traffic noise within the past five years?**	
TYPE OF VEHICLE	**Odds Ratio**	**95% CI**
Heavy Lorries		
Not at all and a little	0.92	0.61, 1.39
Moderately, very and extremely	1.08	0.72, 1.63
Smaller Lorries		
Not at all and a little	0.89	0.57, 1.39
Moderately, very and extremely	1.12	0.72, 1.75
Delivery Vans		
Not at all and a little	0.93	0.64, 1.36
Moderately, very and extremely	1.07	0.74, 1.56
Buses/Coaches		
Not at all and a little	0.62**	0.44, 0.88
Moderately, very and extremely	1.60**	1.14, 2.26
Private cars/Taxis		
Not at all and a little	0.79	0.58, 1.08
Moderately, very and extremely	1.26	0.92, 1.73
Motor Bikes/Scooters		
Not at all and a little	0.95	0.70, 1.29
Moderately, very and extremely	1.06	0.78, 1.44
Any Other Kinds of Vehicles		
Not at all and a little	0.77	0.52, 1.13
Moderately, very and extremely	1.30	0.89, 1.92
		$R^{2\ \text{for model}} = 0.125$

Table 9: Multivariable associations between noise annoyance for different types of vehicles and making a noise complaint relating to road traffic noise in the past five years

3.3.5 Feelings about the amount of noise around here?

Table 10 shows the univariable associations between noise annoyance for the different vehicle types with ratings of how they feel about the amount of noise around here (scored 1 ‘definitely like’ to 7 ‘definitely don’t like’). Respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had higher scores on this variable compared to the unweighted grand mean for the sample ($p<0.001$, in all cases), indicating that they were more likely to state that they didn’t like the noise around here. Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had lower scores on this variable compared to the unweighted grand mean for the sample ($p<0.001$, in all cases), indicating that they were more likely to state that they liked the noise around here.

Univariable analysis for feeling about noise for annoyance by vehicle type.			
	How do you feel about the amount of noise around here?		
TYPE OF VEHICLE	**Mean**	**Coefficient**	**95% CI**
Heavy Lorries (N=2728)			**R^2= 0.111**
Not at all and a little	2.39	-0.76***	-0.84, -0.68
Moderately, very and extremely	3.91	0.76***	0.68, 0.84
Smaller Lorries (N=2728)			**R^2= 0.111**
Not at all and a little	2.42	-0.85***	-0.94, -0.76
Moderately, very and extremely	4.11	0.85***	0.76, 0.94
Delivery Vans (N=2730)			**R^2= 0.056**
Not at all and a little	2.50	-0.70***	-0.81, -0.59
Moderately, very and extremely	3.89	0.70***	0.59, 0.81
Buses/Coaches (N=2728)			**R^2= 0.085**
Not at all and a little	2.47	-0.85***	-0.95, -0.74
Moderately, very and extremely	4.16	0.85***	0.74, 0.95
Private cars/Taxis (N=2732)			**R^2= 0.135**
Not at all and a little	2.37	-0.84***	-0.92, -0.76
Moderately, very and extremely	4.06	0.84***	0.76, 0.92
Motor Bikes/Scooters (N=2731)			**R^2= 0.116**
Not at all and a little	2.37	-0.76***	-0.84, -0.68
Moderately, very and extremely	3.89	0.76***	0.68, 0.84
Refuse Collection (N=2732)			**R^2= 0.033**
Not at all and a little	2.53	-0.57***	-0.68, -0.45
Moderately, very and extremely	3.66	0.57***	0.45, 0.68
Any Other Kinds of Vehicles (N= 2702)			**R^2= 0.024**
Not at all and a little	2.57	-0.72***	-0.90, -0.55
Moderately, very and extremely	4.01	0.72***	0.55, 0.90

Table 10: Univariable associations between noise annoyance for different types of vehicles and how they feel about the amount of noise around here

The multivariable analysis showing the associations between the different types of vehicle annoyance and liking the amount of noise around here is shown in Table 11 below. After adjustment for all the vehicle annoyance variables that were significant in the univariable analyses, respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles and other vehicles had higher scores on this variable compared to the unweighted grand mean for the sample. This indicates that annoyance to each vehicle type was significantly associated with reporting not liking the amount of noise around here. Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles and other vehicles had lower scores on this variable compared to the unweighted grand mean for the sample. This indicates that low annoyance to each vehicle type was significantly associated with reporting liking the amount of noise around here. Comparing the effect sizes observed in the multivariable model, private cars/taxis, motor bikes/ scooters, and heavy lorries vehicles showed the largest increase in scores for disliking the noise around here: private cars/taxis – a 0.43 (0.34, 0.52) increase in score, motor bikes/scooters – a 0.38 (0.29, 0.47) increase in score, heavy lorries – a 0.30 (0.19, 0.42) increase in score. The R^2 for this model was 0.214.

Multivariate analysis for feeling about noise for annoyance by vehicle type.		
(N= 2688)	**How do you feel about the amount of noise around here?**	
TYPE OF VEHICLE	**Coefficient**	**95% CI**
Heavy Lorries		
Not at all and a little	-0.30***	-0.42, -0.19
Moderately, very and extremely	0.30***	0.19, 0.42
Smaller Lorries		
Not at all and a little	-0.16*	-0.30, -0.03
Moderately, very and extremely	0.16*	0.03, 0.30
Delivery Vans		
Not at all and a little	0.19**	0.05, 0.32
Moderately, very and extremely	-0.19**	-0.32, -0.05
Buses/Coaches		
Not at all and a little	-0.26***	-0.38, -0.14
Moderately, very and extremely	0.26***	0.14, 0.38
Private cars/Taxis		
Not at all and a little	-0.43***	-0.52, -0.34
Moderately, very and extremely	0.43***	0.34, 0.52
Motor Bikes/Scooters		
Not at all and a little	-0.38***	-0.47, -0.29
Moderately, very and extremely	0.38***	0.29, 0.47
Refuse Collection		
Not at all and a little	-0.13*	-0.25, -0.02
Moderately, very and extremely	0.13*	0.02, 0.25
Any Other Kinds of Vehicles		
Not at all and a little	-0.17*	-0.33, -0.00
Moderately, very and extremely	0.17*	0.00, 0.33
		$R^{2\ for\ model}$= 0.214

Table 11: Multivariable associations between noise annoyance for different types of vehicles and how they feel about the amount of noise around here

3.3.6 Road traffic noise annoyance

Table 12 shows the univariable associations between noise annoyance for the different vehicle types with the overall reports of road traffic noise annoyance. As expected, the two measures of annoyance show associations with each other, reflecting the fact that overall road traffic noise annoyance is likely to be influenced by annoyance to specific vehicle types.

Respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had higher odds of being moderately, very or extremely annoyed by road traffic noise compared to the unweighted grand mean for the sample ($p<0.001$, in all cases).

Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had lower odds of being moderately, very or extremely annoyed by road traffic noise compared to the unweighted grand mean for the sample ($p<0.001$, in all cases).

Univariable odds ratios for bothered, annoyed or disturbed by road noise for annoyance by vehicle type.			
	Moderately, very or extremely bothered, annoyed or disturbed by road traffic noise.		
TYPE OF VEHICLE	**N**	**Odds Ratio**	**95% CI**
Heavy Lorries (N=2733)			**R^2= 0.239**
Not at all and a little	391	0.28***	0.25, 0.31
Moderately, very and extremely	285	3.60***	3.19, 4.07
Smaller Lorries (N=2732)			**R^2= 0.220**
Not at all and a little	438	0.25***	0.22, 0.29
Moderately, very and extremely	239	3.94***	3.42, 4.55
Delivery Vans (N=2735)			**R^2= 0.136**
Not at all and a little	513	0.30***	0.26, 0.35
Moderately, very and extremely	165	3.31***	2.83, 3.87
Buses/Coaches (N=2735)			**R^2= 0.181**
Not at all and a little	493	0.24***	0.20, 0.29
Moderately, very and extremely	186	4.14***	3.49, 4.91
Private cars/Taxis (N=2737)			**R^2= 0.260**
Not at all and a little	385	0.26***	0.23, 0.29
Moderately, very and extremely	295	3.86***	3.41, 4.38
Motor Bikes/Scooters (N=2736)			**R^2= 0.174**
Not at all and a little	411	0.36***	0.32, 0.40
Moderately, very and extremely	268	2.80***	2.50, 3.13
Refuse Collection (N=2735)			**R^2= 0.049**
Not at all and a little	570	0.48***	0.42, 0.56
Moderately, very and extremely	110	2.07***	1.79, 2.40
Any Other Kinds of Vehicles (N=2706)			**R^2= 0.045**
Not at all and a little	610	0.34***	0.27, 0.44
Moderately, very and extremely	59	2.91***	2.27, 3.71

Table 12: Univariable associations between noise annoyance for different types of vehicles and road traffic noise annoyance

The multivariable analysis showing the associations between the different types of vehicle annoyance and overall road traffic noise annoyance is shown in Table 13 below. After adjustment for all the vehicle annoyance variables that were significant in the univariable analyses, respondents reporting being moderately, very or extremely annoyed by heavy lorries, buses/coaches, private cars/taxis, motor bikes/scooters, and other vehicles had higher odds of being moderately, very or extremely annoyed by road traffic noise compared to the unweighted grand mean for the sample. Respondents reporting being not at all or a little annoyed by heavy lorries, buses/coaches, private cars/taxis, motor bikes/scooters, and other vehicles had lower odds of being annoyed by road traffic noise compared to the unweighted grand mean for the sample. Comparing the effect sizes observed in the multivariable model, the largest effect was observed for private cars/taxis – 142% (108-181%) increase in odds for road traffic noise annoyance, followed by heavy lorries – a 108% (74-148%) increase in odds for road traffic noise annoyance, and buses/coaches – a 101% (61-151%) increase in odds for road traffic noise annoyance. Motor bikes/scooter and other vehicle noise annoyance were associated with a 70% increase in odds for road traffic noise annoyance (47-96%; 22-138%, respectively). The R^2 for this model was 0.411.

Multivariate odds ratios for bothered, annoyed or disturbed by road noise for annoyance by vehicle type.		
N=2691	**Moderately, very or extremely bothered, annoyed or disturbed by road noise.**	
TYPE OF VEHICLE	**Odds Ratio**	**95% CI**
Heavy Lorries		
Not at all and a little	0.48***	0.40, 0.58
Moderately, very and extremely	2.08***	1.74, 2.48
Smaller Lorries		
Not at all and a little	0.83	0.66, 1.04
Moderately, very and extremely	1.21	0.96, 1.51
Delivery Vans		
Not at all and a little	1.03	0.80, 1.32
Moderately, very and extremely	0.98	0.76, 1.25
Buses/Coaches		
Not at all and a little	0.50***	0.40, 0.62
Moderately, very and extremely	2.01***	1.61, 2.51
Private cars/Taxis		
Not at all and a little	0.41***	0.36, 0.48
Moderately, very and extremely	2.42***	2.08, 2.81
Motor Bikes/Scooters		
Not at all and a little	0.59***	0.51, 0.68
Moderately, very and extremely	1.70***	1.47, 1.96
Refuse Collection		
Not at all and a little	1.00	0.81, 1.25
Moderately, very and extremely	1.00	0.80, 1.24
Any Other Kinds of Vehicles		
Not at all and a little	0.59**	0.42, 0.82
Moderately, very and extremely	1.70**	1.22, 2.38
		$R^{2\ \text{for model}}$= 0.411

Table 13: Multivariable associations between noise annoyance for different types of vehicles and road traffic noise annoyance

3.3.7 Noise spoils home life

The sample was asked to rate the extent to which all types of noise that they hear at home spoils their home life. Half of the sample rated this question using a 5 point scale with the following options: completely, a great deal, a fair amount, a little, not at all – Question O1a. Half of the sample rated this question using a 5 point scale with the following options: totally, quite a lot, a little, not very much, not at all – Question O1b. The tables below show the associations between noise annoyance by vehicle type and reports of noise spoiling home life, firstly for question O1a and, secondly for question O1b.

3.3.7.1 O1a question

Table 14 below shows the univariable associations between annoyance for the different vehicle types and noise spoiling their home life (question O1a). There were significant associations between noise annoyance for the different types of vehicles and reports of noise spoiling home life. Respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had higher odds of reporting noise as spoiling home life completely a great deal or a fair amount compared to the unweighted grand mean for the sample ($p<0.001$, in all cases). Respondents reporting

being not at all or a little annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had lower odds of reporting noise as spoiling home life completely a great deal or a fair amount compared to the unweighted grand mean for the sample ($p<0.001$, in all cases).

Univariable odds ratios for noise spoiling home life for annoyance by vehicle type.			
	Spoiled home life completely/a great deal or a fair amount?		
TYPE OF VEHICLE	**N**	**Odds Ratio**	**95% CI**
Heavy Lorries (N=1343)			**R^2= 0.064**
Not at all and a little	110	0.52***	0.43, 0.62
Moderately, very and extremely	58	1.94***	1.62, 2.33
Smaller Lorries (N=1352)			**R^2= 0.074**
Not at all and a little	116	0.47***	0.39, 0.57
Moderately, very and extremely	52	2.13***	1.76, 2.58
Delivery Vans (N=1355)			**R^2= 0.079**
Not at all and a little	124	0.42***	0.34, 0.51
Moderately, very and extremely	44	2.40***	1.94, 2.97
Buses/Coaches (N=1354)			**R^2= 0.033**
Not at all and a little	137	0.55***	0.43, 0.69
Moderately, very and extremely	31	1.83***	1.46, 2.31
Private cars/Taxis (N=1354)			**R^2= 0.075**
Not at all and a little	106	0.49***	0.41, 0.59
Moderately, very and extremely	62	2.03***	1.70, 2.43
Motor Bikes/Scooters (N=1355)			**R^2= 0.063**
Not at all and a little	110	0.52***	0.43, 0.62
Moderately, very and extremely	58	1.93***	1.61, 2.31
Refuse Collection (N=1355)			**R^2= 0.025**
Not at all and a little	142	0.57***	0.45, 0.73
Moderately, very and extremely	26	1.75***	1.37, 2.23
Any Other Kinds of Vehicles (N=1343)			**R^2= 0.051**
Not at all and a little	143	0.36***	0.26, 0.49
Moderately, very and extremely	21	2.77***	2.03, 3.79

Table 14: Univariable associations between noise annoyance for different types of vehicles and noise spoils home life (O1a question)

The multivariable analysis showing the associations between the different types of vehicle annoyance and noise spoiling home life (question O1a) is shown in Table 15 below. After adjustment for all the vehicle annoyance variables that were significant in the univariable analyses, respondents reporting being moderately, very or extremely annoyed by delivery vans, private cars/taxis, and other vehicles had higher odds of reporting noise as spoiling home life completely a great deal or a fair amount compared to the unweighted grand mean for the sample. Respondents reporting being not at all or a little annoyed by delivery vans, private cars/taxis, and other vehicles had lower odds of reporting noise as spoiling home life completely a great deal or a fair amount compared to the unweighted grand mean for the sample. Comparing the effect sizes observed in the multivariable model, other vehicles showed the largest increase in odds for reporting noise spoiling home life: other vehicles – a 103% (41-192%) increase in odds private cars/taxis – a 38% (8-77%) increase in odds, and delivery vans - a 55% (12-115%) increase in odds The R^2 for this model was 0.144.

Multivariate odds ratios for noise spoiling home life for annoyance by vehicle type.		
N=1336	**Spoiled home life completely/a great deal or a fair amount?**	
TYPE OF VEHICLE	**Odds Ratio**	**95% CI**
Heavy Lorries		
Not at all and a little	0.75	0.57, 1.00
Moderately, very and extremely	1.33	1.00, 1.76
Smaller Lorries		
Not at all and a little	0.96	0.68, 1.35
Moderately, very and extremely	1.04	0.74, 1.47
Delivery Vans		
Not at all and a little	0.64**	0.47, 0.89
Moderately, very and extremely	1.55**	1.12, 2.15
Buses/Coaches		
Not at all and a little	1.13	0.82, 1.56
Moderately, very and extremely	0.88	0.64, 1.22
Private cars/Taxis		
Not at all and a little	0.72**	0.57, 0.92
Moderately, very and extremely	1.38**	1.08, 1.77
Motor Bikes/Scooters		
Not at all and a little	0.83	0.65, 1.05
Moderately, very and extremely	1.21	0.96, 1.53
Refuse Collection		
Not at all and a little	0.99	0.73, 1.35
Moderately, very and extremely	1.01	0.74, 1.37
Any Other Kinds of Vehicles		
Not at all and a little	0.49***	0.34, 0.71
Moderately, very and extremely	2.03***	1.41, 2.92
		$R^{2\ \text{for model}}$= 0.144

Table 15: Multivariable associations between noise annoyance for different types of vehicles and noise spoils home life (O1a question)

3.3.7.2 O1b question

Table 16 below shows the univariable associations between annoyance for the different vehicle types and noise spoiling their home life (question O1b). There were significant associations between noise annoyance for the different types of vehicles and reports of noise spoiling home life. Respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had higher odds of reporting noise as spoiling home life totally, quite a lot or a little compared to the unweighted grand mean for the sample ($p<0.001$, in all cases). Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had lower odds of reporting noise as spoiling home life totally, quite a lot or a little compared to the unweighted grand mean for the sample ($p<0.001$, in all cases).

Univariable odds ratios for noise spoiling home life for annoyance by vehicle type.			
	Spoiled home life Totally, Quite a lot or a little amount?		
TYPE OF VEHICLE	**N**	**Odds Ratio**	**95% CI**
Heavy Lorries (N=1375)			**R^2= 0.079**
Not at all and a little	245	0.49***	0.42, 0.58
Moderately, very and extremely	100	2.03***	1.73, 2.37
Smaller Lorries (N=1375)			**R^2= 0.078**
Not at all and a little	260	0.46***	0.39, 0.55
Moderately, very and extremely	84	2.18***	1.83, 2.60
Delivery Vans (N=1375)			**R^2= 0.066**
Not at all and a little	279	0.45***	0.37, 0.54
Moderately, very and extremely	66	2.25***	1.84, 2.74
Buses/Coaches (N=1376)			**R^2= 0.082**
Not at all and a little	269	0.43***	0.35, 0.51
Moderately, very and extremely	76	2.35***	1.94, 2.84
Private cars/Taxis (N=1378)			**R^2= 0.105**
Not at all and a little	239	0.44***	0.37, 0.51
Moderately, very and extremely	106	2.28***	1.95, 2.68
Motor Bikes/Scooters (N=1376)			**R^2= 0.071**
Not at all and a little	239	0.53***	0.45, 0.61
Moderately, very and extremely	107	1.90***	1.64, 2.21
Refuse Collection (N=1375)			**R^2= 0.036**
Not at all and a little	292	0.54***	0.44, 0.66
Moderately, very and extremely	53	1.85***	1.51, 2.26
Any Other Kinds of Vehicles (N=1358)			**R^2= 0.021**
Not at all and a little	320	0.48***	0.35, 0.67
Moderately, very and extremely	23	2.08***	1.51, 2.87

Table 16: Univariable associations between noise annoyance for different types of vehicles and noise spoils home life (O1b question)

The multivariable analysis showing the associations between the different types of vehicle annoyance and noise spoiling home life (question O1b) is shown in Table 17 below. After adjustment for all the vehicle annoyance variables that were significant in the univariable analyses, respondents reporting being moderately, very or extremely annoyed by heavy lorries, private cars/taxis, buses/coaches, and motor bikes/scooters had higher odds of reporting noise as spoiling home life totally, quite a lot or a little compared to the unweighted grand mean for the sample. Respondents reporting being not at all or a little annoyed by heavy lorries, private cars/taxis, buses/coaches, and motor bikes/scooters had lower odds of reporting noise as spoiling home life totally, quite a lot or a little compared to the unweighted grand mean for the sample. Comparing the effect sizes observed in the multivariable model, private cars/taxi vehicles showed the largest increase in odds for reporting noise spoiling home life:– a 65% (35-100%) increase in odds; heavy lorries – a 33% (3-70%) increase in odds; motor bikes/scooters a 31% (9-57%) increase in odds; and buses/coaches - a 41% (11-80%) increase in odds The R^2 for this model was 0.162.

Multivariate odds ratios for noise spoiling home life for annoyance by vehicle type.		
N=1350	**Spoiled home life Totally, Quite a lot or a little amount?**	
TYPE OF VEHICLE	**Odds Ratio**	**95% CI**
Heavy Lorries		
Not at all and a little	0.76*	0.59, 0.97
Moderately, very and extremely	1.33*	1.03, 1.70
Smaller Lorries		
Not at all and a little	1.10	0.81, 1.50
Moderately, very and extremely	0.91	0.67, 1.23
Delivery Vans		
Not at all and a little	0.89	0.67, 1.17
Moderately, very and extremely	1.13	0.85, 1.49
Buses/Coaches		
Not at all and a little	0.71**	0.55, 0.90
Moderately, very and extremely	1.41**	1.11, 1.80
Private cars/Taxis		
Not at all and a little	0.61***	0.50, 0.74
Moderately, very and extremely	1.65***	1.35, 2.00
Motor Bikes/Scooters		
Not at all and a little	0.77**	0.64, 0.92
Moderately, very and extremely	1.31**	1.09, 1.57
Refuse Collection		
Not at all and a little	0.80	0.63, 1.02
Moderately, very and extremely	1.25	0.98, 1.59
Any Other Kinds of Vehicles		
Not at all and a little	0.80	0.55, 1.17
Moderately, very and extremely	1.25	0.86, 1.84
		$R^{2\ \text{for model}}$= 0.162

Table 17: Multivariable associations between noise annoyance for different types of vehicles and noise spoils home life (O1b question)

Comparing the multivariable findings for question O1a and O1b which both assess noise spoiling home life, albeit with different rating scales, we find slightly different results. For both questions, annoyance with private cars/taxis is associated with increased odds of reporting noise spoiling home life, but other associates differ, with question O1a suggesting that annoyance with delivery vans and other vehicles were important, and question 01b suggesting that annoyance with heavy lorries, buses/coaches, and motor bikes/scooters being important. These differences may be explained by the different rating scales used for the O1 questions: the categorisation of the O1a and O1b variables meant that rating noise as spoiling home life 'a little' was included in the dichotomisation of O1b but not O1a: this means that the O1b question is less conservative than question O1a in terms of its assessment of noise spoiling home life.

3.3.8 Road traffic noise interference with activities at home

The following tables show the associations between noise annoyance by vehicle type and reports of road traffic noise interfering with various activities at home: resting, having windows open, reading, writing and other quiet activities, and spending time in the garden or on the balcony/terrace.

3.3.8.1 Interference with resting

Respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had higher odds of reporting road traffic noise interfering with resting compared to the unweighted grand mean for the sample ($p<0.001$, in all cases). Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had lower odds of reporting road traffic noise interfering with resting compared to the unweighted grand mean for the sample ($p<0.001$, in all cases).

Univariable odds ratios for road traffic noise interfering with resting for annoyance by vehicle type.			
	Road traffic noise interferes with resting		
TYPE OF VEHICLE	**N**	**Odds Ratio**	**95% CI**
Heavy Lorries (N=1926)			**R^2= 0.095**
Not at all and a little	253	0.50***	0.44, 0.56
Moderately, very and extremely	172	2.00***	1.78, 2.26
Smaller Lorries (N=1926)			**R^2= 0.115**
Not at all and a little	270	0.44***	0.39, 0.50
Moderately, very and extremely	155	2.28***	2.00, 2.59
Delivery Vans (N=1928)			**R^2= 0.067**
Not at all and a little	318	0.49***	0.43, 0.57
Moderately, very and extremely	107	2.03***	1.75, 2.34
Buses/Coaches (N=1928)			**R^2= 0.078**
Not at all and a little	308	0.47***	0.41, 0.54
Moderately, very and extremely	114	2.12***	1.84, 2.45
Private cars/Taxis (N=1930)			**R^2= 0.115**
Not at all and a little	243	0.47***	0.41, 0.53
Moderately, very and extremely	181	2.15***	1.91, 2.42
Motor Bikes/Scooters (N=1928)			**R^2= 0.055**
Not at all and a little	266	0.59***	0.53, 0.67
Moderately, very and extremely	159	1.68***	1.50, 1.90
Refuse Collection (N=1928)			**R^2= 0.027**
Not at all and a little	347	0.62***	0.53, 0.73
Moderately, very and extremely	77	1.61***	1.38, 1.88
Any Other Kinds of Vehicles (N=1901)			**R^2= 0.016**
Not at all and a little	383	0.58***	0.46, 0.73
Moderately, very and extremely	36	1.72***	1.37, 2.15

Table 18: Univariable associations between noise annoyance for different types of vehicles and road traffic noise interfering with resting

The multivariable analysis showing the associations between the different types of vehicle annoyance and road traffic noise interference with resting is shown in Table 19 below. After adjustment for all the vehicle annoyance variables that were significant in the univariable analyses, respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, buses/coaches, and private cars/taxis had higher odds of reporting road traffic noise interfering with resting compared to the unweighted grand mean for the sample. Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, buses/coaches and private cars/taxis had lower odds of reporting road traffic noise interfering with resting compared to the unweighted grand mean for the

sample. Comparing the effect sizes observed in the multivariable model, private cars/taxis showed the largest increase in odds for reporting noise interfering with sleeping: private cars/taxis – a 62% (40-87%) increase in odds, with heavy lorries, smaller lorries and buses/coaches a 30% increase in odds. The R^2 for this model was 0.182.

Multivariate odds ratios for road traffic noise interfering with resting for annoyance by vehicle type.		
(N= 1890)	**Road traffic noise interferes with resting**	
TYPE OF VEHICLE	**Odds Ratio**	**95% CI**
Heavy Lorries		
Not at all and a little	0.77**	0.64, 0.92
Moderately, very and extremely	1.30**	1.09, 1.56
Smaller Lorries		
Not at all and a little	0.77*	0.62, 0.95
Moderately, very and extremely	1.30*	1.05, 1.61
Delivery Vans		
Not at all and a little	1.01	0.82, 1.24
Moderately, very and extremely	1.00	0.81, 1.23
Buses/Coaches		
Not at all and a little	0.77**	0.64, 0.93
Moderately, very and extremely	1.30**	1.08, 1.56
Private cars/Taxis		
Not at all and a little	0.62***	0.53, 0.71
Moderately, very and extremely	1.62***	1.40, 1.87
Motor Bikes/Scooters		
Not at all and a little	0.92	0.79, 1.07
Moderately, very and extremely	1.09	0.94, 1.26
Refuse Collection		
Not at all and a little	0.86	0.72, 1.04
Moderately, very and extremely	1.16	0.96, 1.40
Any Other Kinds of Vehicles		
Not at all and a little	0.90	0.69, 1.17
Moderately, very and extremely	1.11	0.85, 1.45
		$R^{2\ \text{for model}}$= 0.182

Table 19: Multivariable associations between noise annoyance for different types of vehicles and road traffic noise interfering with resting

3.3.8.2 Interference with having windows open

Respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had higher odds of reporting road traffic noise interfering with having windows open compared to the unweighted grand mean for the sample. Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had lower odds of reporting road traffic noise interfering with having windows open compared to the unweighted grand mean for the sample.

Univariable odds ratios for road traffic noise interfering with having windows open for annoyance by vehicle type.			
	Road traffic noise interferes with having windows open by annoyance by vehicle type?		
TYPE OF VEHICLE	**N**	**Odds Ratio**	**95% CI**
Heavy Lorries (N=1926)			**R^2= 0.115**
Not at all and a little	337	0.47***	0.42, 0.53
Moderately, very and extremely	219	2.13***	1.89, 2.39
Smaller Lorries (N=1926)			**R^2= 0.118**
Not at all and a little	370	0.44***	0.38, 0.49
Moderately, very and extremely	187	2.30***	2.02, 2.61
Delivery Vans (N=1928)			**R^2= 0.059**
Not at all and a little	432	0.52***	0.45, 0.60
Moderately, very and extremely	124	1.93***	1.68, 2.23
Buses/Coaches (N=1928)			**R^2= 0.100**
Not at all and a little	409	0.42***	0.37, 0.49
Moderately, very and extremely	146	2.36***	2.04, 2.73
Private cars/Taxis (N=1930)			**R^2= 0.139**
Not at all and a little	327	0.43***	0.39, 9.49
Moderately, very and extremely	230	2.30***	2.05, 2.59
Motor Bikes/Scooters (N=1928)			**R^2= 0.094**
Not at all and a little	336	0.52***	0.46, 0.58
Moderately, very and extremely	220	1.94***	1.74, 2.17
Refuse Collection (N=1928)			**R^2= 0.019**
Not at all and a little	468	0.67***	0.58, 0.78
Moderately, very and extremely	89	1.49***	1.28, 1.73
Any Other Kinds of Vehicles (N=1901)			**R^2= 0.018**
Not at all and a little	503	0.57***	0.45, 0.71
Moderately, very and extremely	44	1.76***	1.41, 2.20

Table 20: Univariable associations between noise annoyance for different types of vehicles and road traffic noise interfering with window opening

The multivariable analysis showing the associations between the different types of vehicle annoyance and road traffic noise interference with window opening is shown in Table 21 below. After adjustment for all the vehicle annoyance variables that were significant in the univariable analyses, respondents reporting being moderately, very or extremely annoyed by heavy lorries, buses/coaches, private cars/taxis, and motor bikes/scooters had higher odds of reporting road traffic noise interfering with window opening compared to the unweighted grand mean for the sample. Respondents reporting being not at all or a little annoyed by heavy lorries, buses/coaches, private cars/taxis and motor bikes/scooters had lower odds of reporting road traffic noise interfering with window opening compared to the unweighted grand mean for the sample. Comparing the effect sizes observed in the multivariable model, private cars/taxis showed the largest increase in odds for reporting noise interfering with sleeping: private cars/taxis – a 65% (43-89%) increase in odds, whilst heavy lorries showed a 43% (21-69%) increase in odds, buses/coaches a 50% (25-80%) increase in odds and motor bikes/scooters with a 37% (19-56%) increase in odds. The R^2 for this model was 0.221.

Multivariate odds ratios for road traffic noise interfering with having the windows open for annoyance by vehicle type.		
(N= 1890)	**Road traffic noise interferes with having windows open by annoyance by vehicle type?**	
TYPE OF VEHICLE	**Odds Ratio**	**95% CI**
Heavy Lorries		
Not at all and a little	0.70***	0.59, 0.83
Moderately, very and extremely	1.43***	1.21, 1.69
Smaller Lorries		
Not at all and a little	0.82	0.67, 1.01
Moderately, very and extremely	1.22	0.99, 1.50
Delivery Vans		
Not at all and a little	1.17	0.95, 1.45
Moderately, very and extremely	0.85	0.69, 1.06
Buses/Coaches		
Not at all and a little	0.67***	0.55, 0.80
Moderately, very and extremely	1.50***	1.25, 1.80
Private cars/Taxis		
Not at all and a little	0.61***	0.53, 0.70
Moderately, very and extremely	1.65***	1.43, 1.89
Motor Bikes/Scooters		
Not at all and a little	0.73***	0.64, 0.84
Moderately, very and extremely	1.37***	1.19, 1.56
Refuse Collection		
Not at all and a little	0.99	0.82, 1.19
Moderately, very and extremely	1.01	0.84, 1.22
Any Other Kinds of Vehicles		
Not at all and a little	0.89	0.68, 1.17
Moderately, very and extremely	1.12	0.86, 1.47
		$R^{2\ \text{for model}}$ = 0.221

Table 21: Multivariable associations between noise annoyance for different types of vehicles and road traffic noise interfering with window opening

3.3.8.3 Interference with reading, writing & other quiet activities

Respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had higher odds of reporting road traffic noise interfering with reading, writing or other quiet activities compared to the unweighted grand mean for the sample ($p<0.001$, in all cases). Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had lower odds of reporting road traffic noise interfering with reading, writing or other quiet activities compared to the unweighted grand mean for the sample ($p<0.001$, in all cases).

Univariable odds ratios for road traffic noise interfering with reading, writing or other quiet activities by annoyance by vehicle type.			
	Road traffic noise interferes with reading, writing or other quiet activities by noise annoyance by vehicle type		
TYPE OF VEHICLE	**N**	**Odds Ratio**	**95% CI**
Heavy Lorries (N=1926)			**R^2= 0.056**
Not at all and a little	182	0.57***	0.50, 0.65
Moderately, very and extremely	114	1.75***	1.53, 2.00
Smaller Lorries (N=1926)			**R^2= 0.075**
Not at all and a little	190	0.50***	0.44, 0.58
Moderately, very and extremely	105	1.99***	1.73, 2.29
Delivery Vans (N=1928)			**R^2= 0.049**
Not at all and a little	220	0.53***	0.46, 0.62
Moderately, very and extremely	75	1.87***	1.60, 2.19
Buses/Coaches (N=1928)			**R^2= 0.047**
Not at all and a little	220	0.54***	0.47, 0.64
Moderately, very and extremely	76	1.84***	1.58, 2.14
Private cars/Taxis (N=1930)			**R^2= 0.129**
Not at all and a little	152	0.43***	0.38, 0.49
Moderately, very and extremely	145	2.33***	2.04, 2.65
Motor Bikes/Scooters (N=1928)			**R^2= 0.067**
Not at all and a little	171	0.55***	0.48, 0.62
Moderately, very and extremely	126	1.83***	1.60, 2.08
Refuse Collection (N=1928)			**R^2= 0.026**
Not at all and a little	239	0.61***	0.52, 0.72
Moderately, very and extremely	59	1.63***	1.38, 1.93
Any Other Kinds of Vehicles (N=1901)			**R^2= 0.022**
Not at all and a little	262	0.53***	0.42, 0.67
Moderately, very and extremely	30	1.88***	1.49, 2.37

Table 22: Univariable associations between noise annoyance for different types of vehicles and road traffic noise interfering with reading, writing or other quiet activities

The multivariable analysis showing the associations between the different types of vehicle annoyance and road traffic noise interference with reading, writing and other quiet activities is shown in Table 23 below. After adjustment for all the vehicle annoyance variables that were significant in the univariable analyses, respondents reporting being moderately, very or extremely annoyed by private cars/taxis, motor bikes/scooters, and other vehicles had higher odds of reporting road traffic noise interfering with reading, writing and other quiet activities compared to the unweighted grand mean for the sample. Respondents reporting being not at all or a little annoyed by private cars/taxis, motor bikes/scooters, and other vehicles had lower odds of reporting road traffic noise interfering with reading, writing and other quiet activities compared to the unweighted grand mean for the sample. Comparing the effect sizes observed in the multivariable model, private cars/taxis showed the largest increase in odds for reporting noise interfering with sleeping: private cars/taxis – an 82% (55-113%) increase in odds: motor bikes/scooters with a 27% (8-49%) increase in odds: and other vehicles with a 31% increase in odds (0-72%). The R^2 for this model was 0.158.

Multivariate odds ratios for road traffic noise interfering with reading, writing or other quiet activities by annoyance by vehicle type		
(N= 1890)	**Road traffic noise interferes with reading, writing or other quiet activities by noise annoyance by vehicle type**	
TYPE OF VEHICLE	**Odds Ratio**	**95% CI**
Heavy Lorries		
Not at all and a little	0.86	0.70, 1.06
Moderately, very and extremely	1.17	0.95, 1.44
Smaller Lorries		
Not at all and a little	0.90	0.70, 1.15
Moderately, very and extremely	1.11	0.87, 1.42
Delivery Vans		
Not at all and a little	1.03	0.82, 1.30
Moderately, very and extremely	0.97	0.77, 1.22
Buses/Coaches		
Not at all and a little	0.94	0.76, 1.15
Moderately, very and extremely	1.07	0.87, 1.32
Private cars/Taxis		
Not at all and a little	0.55***	0.47, 0.65
Moderately, very and extremely	1.82***	1.55, 2.13
Motor Bikes/Scooters		
Not at all and a little	0.79**	0.67, 0.92
Moderately, very and extremely	1.27**	1.08, 1.49
Refuse Collection		
Not at all and a little	0.85	0.70, 1.04
Moderately, very and extremely	1.18	0.96, 1.44
Any Other Kinds of Vehicles		
Not at all and a little	0.76*	0.58, 1.00
Moderately, very and extremely	1.31*	1.00, 1.72
		$R^{2\ \text{for model}} = 0.158$

Table 23: Multivariable associations between noise annoyance for different types of vehicles and road traffic noise interfering with reading, writing or other quiet activities

3.3.8.4 Interference with using the garden or the balcony/terrace

Respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, and other vehicles had higher odds of reporting road traffic noise interfering with using the garden or the balcony/terrace compared to the unweighted grand mean for the sample. Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, and other vehicles had lower odds of reporting road traffic noise interfering with using the garden or the balcony/terrace compared to the unweighted grand mean for the sample.

Univariable odds ratios for road noise interfering with using the garden or the balcony/terrace for annoyance by vehicle type.			
	Road traffic noise interferes with using the garden or the balcony/terrace		
TYPE OF VEHICLE	**N**	**Odds Ratio**	**95% CI**
Heavy Lorries (N=1926)			**R^2= 0.075**
Not at all and a little	208	0.53***	0.47, 0.60
Moderately, very and extremely	139	1.88***	1.66, 2.14
Smaller Lorries (N=1926)			**R^2= 0.061**
Not at all and a little	236	0.54***	0.47, 0.62
Moderately, very and extremely	112	1.85***	1.61, 2.11
Delivery Vans (N=1928)			**R^2= 0.033**
Not at all and a little	272	0.60***	0.51, 0.70
Moderately, very and extremely	77	1.67***	1.44, 1.95
Buses/Coaches (N=1928)			**R^2= 0.035**
Not at all and a little	269	0.59***	0.51, 0.69
Moderately, very and extremely	79	1.69***	1.45, 1.96
Private cars/Taxis (N=1930)			**R^2= 0.076**
Not at all and a little	209	0.53***	0.47, 0.60
Moderately, very and extremely	140	1.89***	1.66, 2.14
Motor Bikes/Scooters (N=1928)			**R^2=0.046**
Not at all and a little	218	0.61***	0.54, 0.70
Moderately, very and extremely	131	1.63***	1.44, 1.85
Refuse Collection (N=1928)			**R^2= 0.002**
Not at all and a little	307	0.88	0.73 1.05
Moderately, very and extremely	43	1.14	0.95, 1.37
Any Other Kinds of Vehicles (N=1901)			**R^2= 0.005**
Not at all and a little	321	0.73*	0.57, 0.94
Moderately, very and extremely	23	1.36*	1.06, 1.75

Table 24: Univariable associations between noise annoyance for different types of vehicles and road traffic noise interfering with using the garden or the terrace/balcony

The multivariable analysis showing the associations between the different types of vehicle annoyance and road traffic noise interference with using the garden or the balcony/terrace is shown in Table 25 below. After adjustment for all the vehicle annoyance variables that were significant in the univariable analyses, respondents reporting being moderately, very or extremely annoyed by heavy lorries, private cars/taxis, and motor bikes/scooters had higher odds of reporting road traffic noise interfering with use of the garden or the balcony/terrace compared to the unweighted grand mean for the sample. Respondents reporting being not at all or a little annoyed by heavy lorries, private cars/taxis, and motor bikes/scooters had lower odds of reporting road traffic noise interfering with use of the garden or the balcony/terrace compared to the unweighted grand mean for the sample. Comparing the effect sizes observed in the multivariable model, heavy lorries and private cars/taxis showed a increase in odds for reporting noise interfering with using the garden/balcony/terrace –a 55% (29-87%) and 50% (28-75%) increase in odds, respectively: motor bikes/scooters were associated with a 25% increase in odds (8-45%). The R^2 for this model was 0.117.

Multivariate odds ratios for road noise interfering with using the garden or the balcony/terrace for annoyance by vehicle type.		
(N=1891)	**Road traffic noise interferes with using the garden or the balcony/terrace**	
TYPE OF VEHICLE	**Odds Ratio**	**95% CI**
Heavy Lorries		
Not at all and a little	0.64***	0.54, 0.77
Moderately, very and extremely	1.55***	1.29, 1.87
Smaller Lorries		
Not at all and a little	1.01	0.80, 1.26
Moderately, very and extremely	0.99	0.79, 1.25
Delivery Vans		
Not at all and a little	1.07	0.86, 1.32
Moderately, very and extremely	0.94	0.76, 1.16
Buses/Coaches		
Not at all and a little	0.92	0.75, 1.11
Moderately, very and extremely	1.09	0.90, 1.33
Private cars/Taxis		
Not at all and a little	0.67***	0.57, 0.78
Moderately, very and extremely	1.50***	1.28, 1.75
Motor Bikes/Scooters		
Not at all and a little	0.80**	0.69, 0.93
Moderately, very and extremely	1.25**	1.08, 1.45
Any Other Kinds of Vehicles		
Not at all and a little	1.07	0.81, 1.41
Moderately, very and extremely	0.94	0.71, 1.24
		$R^{2\ \text{for model}}$= 0.117

Table 25: Multivariable associations between noise annoyance for different types of vehicles and road traffic noise interfering with using the garden or the terrace/balcony

3.3.9 Road traffic noise annoyance whilst the noise is going on

Table 26 below shows the associations for being annoyed by road traffic noise whilst it is going on with annoyance for the different vehicle types. Road traffic noise annoyance whilst the noise was going on was rated on a 7 point scale, where 1 was 'not at all' and 7 was 'very seriously'. There were significant associations between noise annoyance for the different types of vehicles and reports of road traffic noise whilst the noise was going on. Respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had higher odds of reporting being annoyed by road traffic noise whilst it was going on compared to the unweighted grand mean for the sample ($p<0.001$, in all cases). Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles had lower odds of reporting being annoyed by road traffic noise whilst it was going on compared to the unweighted grand mean for the sample ($p<0.001$, in all cases).

Univariable analysis for being bothered, annoyed or disturbed by road traffic noise whilst the noise is going on for annoyance by vehicle type.			
	How bothered, annoyed or disturbed by road traffic noise are you, whilst it is going on?		
TYPE OF VEHICLE	**Mean**	**Coefficient**	**95% CI**
Heavy Lorries (N=1959)			**R^2= 0.145**
Not at all and a little	2.61	-0.86***	-0.95, -0.77
Moderately, very and extremely	4.33	0.86***	0.77, 0.95
Smaller Lorries (N=1959)			**R^2= 0.140**
Not at all and a little	2.67	-0.93***	-1.03, -0.83
Moderately, very and extremely	4.52	0.93***	0.83, 1.03
Delivery Vans (N=1960)			**R^2= 0.066**
Not at all and a little	2.79	-0.73***	-0.85, -0.61
Moderately, very and extremely	4.25	0.73***	0.61, 0.85
Buses/Coaches (N=1959)			**R^2= 0.089**
Not at all and a little	2.76	-0.84***	-0.96, -0.72
Moderately, very and extremely	4.44	0.84***	0.72, 0.96
Private cars/Taxis (N=1962)			**R^2= 0.143**
Not at all and a little	2.62	-0.85***	-0.95, -0.76
Moderately, very and extremely	4.32	0.85***	0.76, 0.95
Motor Bikes/Scooters (N=1961)			**R^2= 0.090**
Not at all and a little	2.67	-0.66***	-0.75, -0.57
Moderately, very and extremely	3.99	0.66***	0.57, 0.75
Refuse Collection (N=1962)			**R^2= 0.025**
Not at all and a little	2.86	-0.47***	-0.60, -0.34
Moderately, very and extremely	3.80	0.47***	0.34, 0.60
Any Other Kinds of Vehicles (N=1936)			**R^2= 0.031**
Not at all and a little	2.89	-0.79***	-0.98, -0.59
Moderately, very and extremely	4.47	0.79***	0.59, 0.98

Table 26: Univariable associations between noise annoyance for different types of vehicles and road traffic noise annoyance whilst the noise was going on

The multivariable analysis showing the association between the different types of vehicle annoyance and noise annoyance for road traffic noise whilst the noise is going on is shown in Table 27 below. After adjustment for all the vehicle annoyance variables that were significant in the univariable analyses, respondents reporting being moderately, very or extremely annoyed by heavy lorries, smaller lorries, buses/coaches, private cars/taxis, motor bikes/scooters, and other vehicles had higher odds of reporting road traffic noise annoyance whilst the noise was going on compared to the unweighted grand mean for the sample. Respondents reporting being not at all or a little annoyed by heavy lorries, smaller lorries, buses/coaches, private cars/taxis, motor bikes/scooters, and other vehicles had lower odds of reporting road traffic noise annoyance whilst the noise was going on compared to the unweighted grand mean for the sample. Comparing the effect sizes observed in the multivariable model, noise annoyance for heavy lorries and private cars/taxis showed the largest increase in scores for road traffic noise annoyance whilst the noise was going on – a 44% (32-56%) and 48% (37-58%) increase, respectively). Noise annoyance for smaller lorries, buses/coaches, motor bikes/scooters and other kinds of vehicles were associated with an increase in scores ranging from 0.20 to 0.29 in the noise annoyance score (smaller lorries 20% (5-35%); buses/coaches 23% (10-37%); motor bikes/scooters 25% (15-35%); other kinds of vehicles 29% (10-47%)). The R^2 for this model was 0.245.

Multivariate analysis for being bothered, annoyed or disturbed by road traffic noise whilst the noise is going on for annoyance by vehicle type.		
(N= 1924)	**How bothered, annoyed or disturbed by road traffic noise are you, whilst it is going on?**	
TYPE OF VEHICLE	**Coefficient**	**95% CI**
Heavy Lorries		
Not at all and a little	-0.44***	-0.56, -0.32
Moderately, very and extremely	0.44***	0.32, 0.56
Smaller Lorries		
Not at all and a little	-0.20*	-0.35, -0.05
Moderately, very and extremely	0.20*	0.05, 0.35
Delivery Vans		
Not at all and a little	0.11	-0.03, 0.26
Moderately, very and extremely	-0.11	-0.26, 0.03
Buses/Coaches		
Not at all and a little	-0.23***	-0.37, -0.10
Moderately, very and extremely	0.23***	0.10, 0.37
Private cars/Taxis		
Not at all and a little	-0.48***	-0.58, -0.37
Moderately, very and extremely	0.48***	0.37, 0.58
Motor Bikes/Scooters		
Not at all and a little	-0.25***	-0.35, -0.15
Moderately, very and extremely	0.25***	0.15, 0.35
Refuse Collection		
Not at all and a little	-0.06	-0.19, 0.07
Moderately, very and extremely	0.06	-0.07, 0.19
Any Other Kinds of Vehicles		
Not at all and a little	-0.29**	-0.47, -0.10
Moderately, very and extremely	0.29**	0.10, 0.47
		$R^{2\ \text{for model}}$= 0.245

Table 27: Multivariable associations between noise annoyance for different types of vehicles and road traffic noise annoyance whilst the noise was going on

3.4 Discussion

The Road Traffic Noise module of the NNAS2012 considered noise annoyance responses for different types of vehicles, namely heavy lorries, smaller lorries, delivery vans, buses/coaches, motor bikes/scooters, private cars/taxis, and refuse collection vehicles. This report has examined how these vehicle categories relate to several key noise attitudes (noise sensitivity, sleep disturbance, complaints, interference with activities, road traffic noise annoyance). Of particular interest for Defra was how response to motor bike/scooter noise compared with responses for the other vehicle noise types.

The analyses suggest that there are associations between annoyance for specific vehicle types and other noise attitudes. However, in considering the findings in this report, it should be remembered that the data in NNAS2012 are all cross-sectional and that causal relationships between vehicle noise annoyance and noise attitudes cannot be inferred.

This discussion focuses on the findings of the multivariable analyses in the report, so discusses findings relating to vehicle noise annoyance that have been adjusted for other significant vehicle noise annoyance variables.

Noise annoyance for heavy lorries, private cars/taxis, motor bikes/scooters and refuse collection vehicles were associated with increased responses for interference with sleep. Refuse collection vehicles, in particular, may operate in the early hours of the morning, which may explain the association observed for interference with sleep. Future academic research could examine at which times of the day interference with sleep is being reported for these different vehicle sources: is exposure to these vehicle types in the evening, at night, in the early morning or at any time more important for interference with sleep?

Noise annoyance for private cars/taxis, motor bikes/scooters, and other vehicles showed the largest associations with making any noise complaint. However, when specifically examining making a complaint in relation to road traffic noise, noise annoyance with buses/coaches was important, yet, it must be borne in mind that the statistical power to examine associations for road traffic noise complaints in the NNAS2012 may be limited. Interestingly, refuse collection vehicle annoyance was not associated with making a complaint, perhaps reflecting the acceptance of the necessity and short-duration of such noise exposures.

The evaluation of 'not liking the noise around here' was independently associated with a wide range of vehicle noise annoyance measures, including heavy lorries, small lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters, refuse collection vehicles, and other vehicles. The finding that these types of vehicle annoyance all independently contributed to the rating of liking the noise around here, suggest that residents evaluate their environment holistically, taking into account a wide range of vehicle noise exposures. In comparison, reports of noise spoiling home life were consistently associated with noise annoyance for private cars/taxis, which was found for both the o1a and o1b question about noise spoiling home life.

We explored the association of noise annoyance for different vehicle types with the overall rating of road traffic noise annoyance. In considering these findings it is important to acknowledge the collinear relationship that exists between these different annoyance measures. The multivariable findings suggest that moderate, very or extreme road traffic noise annoyance was associated with moderate, very, or extreme annoyance with private cars/taxis, heavy lorries, buses/coaches, motor bikes and scooters, and other vehicles. Similarly, noise annoyance whilst the noise was going on was associated with noise annoyance for a range of different vehicle types (heavy lorries, small lorries, buses/coaches, private cars/taxis, motor bikes/scooters, and other vehicles). Motor bikes/scooters were not associated with more annoyance whilst the noise was going on, compared to the other vehicle types. These findings suggest that a range of vehicle sources is contributing to respondents' evaluation of road traffic noise annoyance.

Overall, interference with activities within the home showed the largest associations with being moderately, very or extremely annoyed with noise from private cars/taxis and heavy lorries. However, noise annoyance with other vehicle types may also be important for specific activities. Interference with use of the garden was associated with noise annoyance for most vehicle types (heavy lorries small lorries, delivery vans, buses/coaches, private cars/taxis, motor bikes/scooters and other vehicles), whilst interference with resting was associated with commercial vehicles (heavy lorries, smaller lorries, buses/coaches), as well as private cars/taxis.

Overall, comparing the associations between the different vehicle annoyance types and the noise attitudes (interference with sleep, noise sensitivity, noise complaints, road traffic noise annoyance, and interference with activities) associations were consistently observed for two types of vehicle annoyance: annoyance for private cars/taxis and for heavy lorries. These two vehicle types were consistently associated with negative noise attitudes. Future academic research could examine whether there are acoustical characteristics of private car/taxis and heavy lorries that might explain these findings. The findings do not appear to be explained by the extent to which these vehicle types were heard by the sample, as whilst private cars/taxis were heard by a high proportion (89.7%) of the NNAS2012 sample, heavy lorries were heard by 74.3% of the sample, which, whilst a sizeable proportion was one of the lowest reports, with only buses/coaches (70.3%) and other vehicle types (66.9%) being less frequently reported. More detailed examination of the frequency of which these vehicle types are heard as opposed to whether they are heard or not may shed further light on these findings. Private cars/taxis and heavy lorries were amongst the most frequent vehicle types to be associated with moderate, very, or extreme annoyance – reported by 14.4% of the sample for each source, respectively. Only motor bikes/scooters had a higher report of moderate, very or extreme annoyance at 15.5%. It may therefore be possible that the strong associations between noise annoyance for private cars/taxis and heavy lorries and noise attitudes may be operating via noise annoyance responses. The findings may also be explained by expectations relating to use of the home environment specifically in relation to noise exposure from private cars/taxis and heavy lorries.

DEFRA was specifically interested in whether noise attitudes in relation to noise annoyance for motor bike/scooters differed compared with noise annoyance for other types of vehicle. As previously highlighted, comparing the findings across the different noise attitudes examined it appears that noise annoyance for private cars/taxis and heavy lorries were most consistently associated with noise attitudes. However, noise annoyance for motor bike/scooters was important for several noise attitudes (interference with sleep, noise complaints, not liking the noise around here, interference with using the garden, road traffic noise annoyance, noise sensitivity). Overall, noise attitudes in relation to noise annoyance for motor bike/scooters did not differ compared with noise annoyance for private cars/taxis and heavy lorries but did differ compared to other vehicle annoyance types, such as buses/coaches, refuse collection vehicles, smaller lorries, and other vehicles.

4 Work Package 2: Factors Associated with Noise Complaints

4.1 Background

The prevalence of reports of complaints has already been explored in the main report, along with perceptions as to the effectiveness of the complaint(s). This report explores the extent to which the making of a noise complaint is associated with noise annoyance and also with sociodemographic, dwelling and geographic factors, to identify which sub-groups of the population are most and least likely to make a noise complaint. The report also explores how noise sensitivity relates to noise complaints: are noise complaints associated with noise sensitivity after controlling for demographic variables?

The noise complaint outcome used in this report is whether the respondent or someone in their household had made a complaint or taken action about a noise issue within the past five years. Table 28 below illustrates the noise sources about which the total NNAS2012 sample (n=2747) reported making a complaint or taking action about a noise issue within the past 5 years; the table also illustrates the same data restricted to the sub-sample who had reported making a complaint or taking action about a noise issue (n=591). One-fifth of the total sample (21.5% n=591) reported that they or someone in their household had made a complaint or taken action about a noise issue within the past five years. The sources about which the complaints or action had been taken were predominantly concerned with neighbour noise: 8.2% and 6.8% of the total sample, respectively, had taken action about neighbours inside or outside their homes, with a further 2.8% of the total sample having taken action about other people nearby. Action had been taken in relation to road traffic noise by 3.2% of the total sample, with a further 2.6% having taken action about 'other' types of noise (see Section 2.11 'Actions taken about noise' of Volume 2 for more details).

O9b/O10 Which types of noise were an issue that either you, or someone else in your household, did something about?		
(n=2747)	**% (n) n=2747**	**% (n) n=591**
Road traffic	3.2 (87)	14.7 (87)
Neighbours (inside their homes)	8.2 (224)	37.9 (224)
Neighbours (outside their homes)	6.8 (186)	31.5 (186)
Other people nearby	2.8 (78)	13.2 (78)
Trains or railway stations	0.1 (3)	0.5 (3)
Aircraft/airports	0.8 (23)	3.8 (23)
Sea, river or canal traffic	0.1 (2)	0.3 (2)
Building, construction, demolition, renovation or road works	1.0 (28)	4.8 (28)
Sports	0.3 (7)	1.2 (7)
Other entertainment or leisure	0.6 (16)	2.8 (16)
Industrial sites	0.5 (13)	2.2 (13)
Other commercial premises	0.3 (9)	1.5 (9)
Forestry, farming or agriculture	0.1 (4)	0.6 (4)
Community buildings	0.1 (2)	0.3 (2)
Other	2.6 (70)	11.9 (70)

Table 28: Types of noise for which actions were taken (O9b/O10)

4.2 Method

4.2.1 Statistical analysis

For each individual variable assessing a sociodemographic, dwelling, or geographic factor, as well as noise annoyance and noise sensitivity, effect coding univariable logistic regression models were run, assessing the strength of the association between the variable and making a complaint about noise.

Sociodemographic, dwelling, or geographic, noise annoyance and noise sensitivity variables which showed a significant association with noise complaints (p=<0.05) in the univariable analyses, were then included in a multivariable regression model to examine which variables remain associated with noise complaints after taking the other significant factors into account.

It was not possible to include the variables 'working from home' or 'shift work' in the multivariable analyses, as these data were only available for the working sub-sample of the population. Similarly, 'urbanicity' data were only available for the English sub-sample. To maximise the power of the multivariable analyses it was not possible to include these variables in the models.

4.2.2 Interpreting effect coding regression models

Effect coding in regression analyses does not use dummy variables, as in conventional regression models, where there is a reference group to which all the other categories of the variable are compared in the regression. In effect coding, the regression coefficient for each category of the variable is compared to the unweighted grand mean of all the observations. The coefficients represents the difference between the mean for this group compared to the unweighted grand mean for the sample: unweighted simply reflects the fact that different sub-group sizes are present within the variable being examined and thus we use the mean of all sub-group means.

Statistical significance is indicated in the tables (*p=0.05, **p=0.01, ***p=<0.001).

4.2.3 Analysis Plan

Noise complaint, as the outcome, was included in the analyses as a categorical variable; coded as someone within the household had not made a complaint (0) versus someone within the household had made a complaint (1).

The following analyses were carried out on the NNAS2012 dataset.

1. Noise Annoyance

1.1. Univariable logistic regressions of the following noise annoyance measures with making a noise complaint:
  1.1.1. Aircraft noise
  1.1.2. Road noise
  1.1.3. Neighbourhood noise
  1.1.4. Rail noise
  1.1.5. Entertainment noise

All the noise annoyance variables were dichotomized 0=not at all/a little versus 1=moderately, very, extremely) for analyses.

1.2. Cross-tabs of the different types of noise annoyance listed in 1.1. above with each other, to begin to determine collinearity of the annoyance reports for those who have made a noise complaint.

2. Noise sensitivity

2.1. Univariable logistic regression of noise sensitivity (assessed as a continuous variable) with making a noise complaint.

3. Sociodemographic factors

3.1. Univariable logistic regressions of the following sociodemographic factors with making a noise complaint:
- 3.1.1. Age
- 3.1.2. Gender
- 3.1.3. Home ownership
- 3.1.4. Any children
- 3.1.5. Employment status
- 3.1.6. Work at home
- 3.1.7. Shift work
- 3.1.8. Social group of head of household
- 3.1.9. Interviewer rating of respondent having a hearing problem

3.2. Multivariable logistic regression of the sociodemographic factors associated with making a complaint in 3.1. All significant sociodemographic factors added in one step to the same model.

4. Dwelling factors

4.1. Univariable logistic regressions of the following dwelling factors with making a noise complaint:
- 4.1.1. Double glazing in the home
- 4.1.2. Age of house
- 4.1.3. How long lived in the home
- 4.1.4. Type of house
- 4.1.5. Access to garden
- 4.1.6. Noticeable noise from road traffic
- 4.1.7. Noticeable noise from neighbours or other people nearby
- 4.1.8. Noticeable noise from aircraft, airports or airfields
- 4.1.9. Noticeable noise from trains or railway stations.

4.2. Multivariable logistic regression of the dwelling factors associated with making a noise complaint in 4.1. All significant dwelling factors added in one step to the same model.

5. Geographic factors

5.1. Univariable logistic regressions of the following geographic factors with making a noise complaint:
   5.1.1. Region
   5.1.2. Location of dwelling
   5.1.3. Urbanicity LA rating

5.2. Multivariable logistic regression of the geographic factors associated with making a noise complaint in 5.1. All significant dwelling factors added in one step to the same model.

6. Final multivariable models for noise complaints

6.1. All sociodemographic, dwelling, and geographic factors that were significant in models 3.2., 4.2, and 5.2.
6.2. All significant sociodemographic, dwelling and geographic factors that were significant in model 6.1, plus adjustment for each of the following (if significant in earlier models 1.1/2.1):
   6.2.1. Road noise annoyance and noise sensitivity
   6.2.2. Neighbour noise annoyance and noise sensitivity
   6.2.3. Aircraft noise annoyance and noise sensitivity
   6.2.4. Rail noise annoyance and noise sensitivity
   6.2.5. Entertainment noise annoyance and noise sensitivity

4.3 Results

4.3.1 Level of Noise Annoyance

Table 29 shows the results of the univariable logistic regression analyses of aircraft noise annoyance, road traffic noise annoyance, neighbour noise annoyance, train or railway station noise annoyance, and entertainment noise annoyance with noise complaints.

Respondents who reported being moderately, very, or extremely annoyed by aircraft noise, road traffic noise, neighbour noise, or entertainment noise had increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.38, 95%CI 1.22, 1.56; OR=1.63, 95%CI 1.48, 1.79; OR=2.32, 95%CI 2.10, 2.55; OR=1.63, 95%CI 1.32, 2.02, respectively). Respondents who reported being not at all or a little annoyed by aircraft noise, road traffic noise, neighbour noise, or entertainment noise had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.73, 95%CI 0.64, 0.82; OR=0.61, 95%CI 0.56, 0.68; OR=0.43, 95%CI 0.39, 0.48; OR=0.61, 95%CI 0.50, 0.76, respectively). There were no significant associations between train or railway station noise annoyance and noise complaints. The R^2 for the individual noise annoyance models were low, ranging from 0.011 to 0.152, for those showing significant associations with noise complaints.

Univariable odds ratios showing odds for complaining about noise for noise annoyance factors.			
	Have you complained about noise?		
	N	**Odds ratio**	**95% CI**
NOISE ANNOYANCE FACTORS			
Aircraft Noise (N=2747)			**R^2=0.014**
Not at all and a little	473	0.73***	0.64, 0.82
Moderately, very and extremely	118	1.38***	1.22, 1.56
Road Noise (N=2746)			**R^2=0.052**
Not at all and a little	351	0.61***	0.56, 0.68
Moderately, very and extremely	240	1.63***	1.48, 1.79
Neighbourhood Noise From All (N=2747)			**R^2=0.152**
Not at all and a little	274	0.43***	0.39, 0.48
Moderately, very and extremely	317	2.32***	2.10, 2.55
Train or railway station Noise (N=2747)			**R^2=0.002**
Not at all and a little	574	0.77	0.58, 1.03
Moderately, very and extremely	17	1.29	0.97, 1.73
Entertainment Noise (N=2744)			**R^2=0.011**
Not at all and a little	553	0.61***	0.50, 0.76
Moderately, very and extremely	38	1.63***	1.32, 2.02

Table 29: Univariable logistic regression for noise annoyance with making a complaint

Table 30 shows the associations between noise annoyance for the different noise sources, for those respondents who had made a noise complaint. Aircraft noise annoyance was significantly associated with road traffic noise annoyance and entertainment noise annoyance but not with neighbour noise annoyance or train or railway station noise annoyance. Road noise annoyance was significantly associated with neighbour noise annoyance and entertainment noise annoyance but not with train or railway station annoyance. Neighbour noise annoyance was significantly associated with entertainment noise annoyance but not with train or railway station annoyance.

Associations between noise annoyance for different noise sources			
(N=2746)	**Aircraft Noise N (col %)(row %)**		
	Not at all and a little	Moderately, very and Extremely	Total
Road Noise			
Not at all and a little	291 (61.7)(82.9)	60 (50.8)(17.1)	351 (59.5) (100.0)
Moderately, very and extremely	181 (38.3)(75.7)	58 (49.2)(24.3)	239 (40.5) (100.0)
Total	472 (100.0)(80.0)	118 (100.0)(20.0)	590
			X^2=4.57, p value = 0.032
(N=2747)	**Aircraft Noise N (col %)(row %)**		
	Not at all and a little	Moderately, very and Extremely	Total
Neighbourhood Noise From All			
Not at all and a little	226 (47.8)(82.5)	48 (40.7)(17.5)	274 (46.4) (100.0)

Moderately, very and extremely	247 (52.2)(77.9)	70 (59.3)(22.1)	317 (53.6) (100.0)
Total	473 (100.0)(80.0)	118 (100.0)(20.0)	591
			X^2=1.92, p=0.166
(N=2747)	**Aircraft Noise N (col %)(row %)**		
	Not at all and a little	Moderately, very and Extremely	Total
Train or railway station Noise			
Not at all and a little	461 (97.5)(80.3)	113 (95.8)(19.7)	574 (97.1) (100.0)
Moderately, very and Extremely	12 (2.5)(70.6)	5 (4.2)(29.4)	17 (2.9) (100.0)
Total	473 (100.0)(80.0)	118 (100.0)(20.0)	591
			Fisher's Exact[2] *p* value = 0.354
(N=2744)	**Aircraft Noise N (col %)(row %)**		
	Not at all and a little	Moderately, very and Extremely	Total
Entertainment Noise			
Not at all and a little	450 (95.1)(81.4)	103 (87.3)(18.6)	553 (93.6) (100.0)
Moderately, very and extremely	23 (4.9)(60.5)	15 (12.7)(39.5)	38 (6.4) (100.0)
Total	473 (100.0)(80.0)	118 (100.0)(20.0)	591
			X^2=9.67, p=0.002
(N=2746)	**Road Noise N (col %)(row %)**		
	Not at all and a little	Moderately, very and Extremely	Total
Neighbourhood Noise From All			
Not at all and a little	180 (51.3)(65.9)	93 (38.8)(34.1)	273 (46.2) (100.0)
Moderately, very and extremely	171 (48.7)(53.8)	147 (61.3)(46.2)	318 (53.8) (100.0)
Total	351 (100.0)(59.4)	240 (100.0)(40.6)	591
			X^2=9.01, p=0.003
(N=2746)	**Road Noise N (col %)(row %)**		
	Not at all and a little	Moderately, very and Extremely	Total
Train or railway station Noise			
Not at all and a little	343 (97.7)(59.9)	230 (95.8)(40.1)	573 (97.0) (100.0)
Moderately, very and extremely	8 (2.3)(44.4)	10 (4.2)(55.6)	18 (3.0) (100.0)
Total	351 (100.0)(59.4)	240 (100.0)(40.6)	591
			Fisher's Exact p value = 0.226
(N=2744)	**Road Noise N (col %)(row %)**		

[2] Fisher's exact tests are used where cell count sizes are small n=<5. Fisher's exact test calculate probability, thus only the p-value is presented here.

	Not at all and a little	Moderately, very and Extremely	Total
Entertainment Noise			
Not at all and a little	335 (95.4)(60.6)	218 (90.8)(39.4)	553 (93.6) (100.0)
Moderately, very and extremely	16 (4.6)(42.1)	22 (9.2)(57.9)	38 (6.4) (100.0)
Total	351 (100.0)(59.4)	240 (100.0)(40.6)	591
			X^2=5.03, p=0.025
(N=2747)	**Neighbourhood Noise From All N (col %)(row %)**		
	Not at all and a little	Moderately, very and Extremely	Total
Train or railway station Noise			
Not at all and a little	268 (98.2)(46.8)	305 (96.2)(53.2)	573 (97.1) (100.0)
Moderately, very and extremely	5 (1.8)(29.4)	12 (3.8)(70.6)	17 (2.9) (100.0)
Total	273 (100.0)(46.3)	317 (100.0)(53.7)	590
			Fisher's Exact p value = 0.217
(N=2746)	**Neighbourhood Noise From All N (col %)(row %)**		
	Not at all and a little	Moderately, very and Extremely	Total
Entertainment Noise			
Not at all and a little	264 (96.4)(47.7)	289 (90.9)(52.3)	553 (93.4) (100.0)
Moderately, very and extremely	10 (3.6)(25.6)	29 (9.1)(74.4)	39 (6.6) (100.0)
Total	274 (100.0)(46.3)	318 (100.0)(53.7)	592
			X^2=7.15, p=0.007
(N=2745)	**Train or railway station Noise N (col %)(row %)**		
	Not at all and a little	Moderately, very and Extremely	Total
Entertainment Noise			
Not at all and a little	538 (93.7)(97.3)	15 (88.2)(2.7)	553 (93.6) (100.0)
Moderately, very and extremely	36 (6.3)(94.7)	2 (11.8)(5.3)	38 (6.4) (100.0)
Total	574 (100.0)(97.1)	17 (100.0)(2.9)	591
			Fisher's Exact p value = 0.300

Table 30: Cross-tabulation of different sources of noise annoyance, if made a noise complaint

4.3.2 Noise sensitivity

Table 31 shows the association between noise sensitivity and noise complaints. There was a significant association between noise sensitivity and making a noise complaint: a one-point increase in noise sensitivity scores (scale ranges 1-7) was associated with a 25% increase in the odds for making a noise complaint (OR=1.25, 95%CI 1.19, 1.31). The R^2 for this model was 0.043.

Univariable odds ratios showing odds for complaining about noise for sensitivity to noise.

(N=2737)	Have you complained about noise?		
	N	Odds ratio	95% CI
SENSITIVITY TO NOISE			
Continuous	590	1.25***	1.19, 1.31
			R^2=0.043

Table 31: Univariable logistic regression for noise sensitivity with making a noise complaint

4.3.3 Sociodemographic Factors

Table 32 shows the results of the univariable logistic regression analyses for each of the sociodemographic factors with noise complaints. The following sociodemographic factors were statistically significantly associated with noise complaints: age, homeownership, employment status, working at home, and social group of head of household.

Respondents aged 35-44 years, 45-54 years, and 65-74 years had increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.51, 95%CI 1.22, 1.89; OR=1.61, 95%CI 1.31, 1.97; OR=1.29, 95%CI 1.03, 1.62, respectively). Respondents aged 25-34 and 75 years or older had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.62, 95%CI 0.42, 0.93; OR=0.67, 95%CI 0.49, 0.93, respectively). The R^2 for this model was 0.024.

Respondents who bought their house on a mortgage had increased odds of making a noise complaint compared to the unweighted grand mean (OR=1.30, 95%CI 1.05, 1.60). Respondents who rented their home from a private landlord had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.70, 95%CI 0.52, 0.93). The R^2 for this model was 0.011.

Respondents who were in full-time education had decreased odds of making a noise complaint compared to the unweighted grand mean (OR=0.64, 95%CI 0.44, 0.92). The R^2 for this model was 0.008.Respondents who worked at home had significantly increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.20, 95%CI 1.06, 1.37). Respondents who did not work at home had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.83, 95%CI 0.73, 0.94). The R^2 for this model was 0.009.

Respondents where the head of household was in social group A or B had significantly increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.72, 95%CI 1.29, 2.29; OR=1.20, 95%CI 1.01, 1.43). Respondents where the head of household was in social group C2 or D had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.72, 95%CI 0.58, 0.98; OR=0.75, 95%CI 0.58, 0.98). The R^2 for this model was 0.016.

Univariable odds ratios showing odds for complaining about noise for sociodemographic factors.			
	Have you complained about noise?		
	N	Odds ratio	95% CI
SOCIODEMOGRAPHIC FACTORS			
Age (H12) (N=2743)			**R^2=0.024**
16-19	16	0.68	0.43, 1.10
20-24	23	0.62*	0.42, 0.93
25-34	58	0.97	0.74, 1.27
35-44	112	1.51***	1.22, 1.89
45-54	142	1.61***	1.31, 1.97
55-64	106	1.15	0.92, 1.43
65-74	96	1.29*	1.03, 1.62
75+	37	0.67*	0.49, 0.93
Gender (H13) (N=2746)			**R^2=0.000**
Male	285	0.97	0.88, 1.06
Female	306	1.04	0.95, 1.14
Home ownership (H6) (N=2746)			**R^2=0.011**
Being bought on a mortgage	248	1.30*	1.05, 1.60
Owned outright by household	206	0.95	0.77, 1.17
Rented from local authority or housing association	76	1.29	0.99, 1.69
Rented from private landlord	52	0.70*	0.52, 0.93
Other	8	0.90	0.49, 1.66
Any children aged 0-17 (H14) (N=2746)			**R^2=0.001**
No	511	0.92	0.81, 1.06
Yes	79	1.09	0.95, 1.24
Employment status (H15) (N=2743)			**R^2=0.008**
Working FT	244	1.08	0.90, 1.29
Working PT	93	1.15	0.91, 1.47
Unemployed	21	1.03	0.66, 1.59
Retired	149	0.82	0.67, 1.01
FT Education	27	0.64*	0.44, 0.92
Home maker	36	1.06	0.75, 1.49
Other	21	1.41	0.90, 2.19
Work at home (H15a) (N=1373)			**R^2=0.009**
No	205	0.83**	0.73, 0.94
Sometimes work at home	132	1.20**	1.06, 1.37
Shift work (H16) (N=1373)			**R^2=0.000**
No	278	1.01	0.86, 1.19
Yes	59	0.99	0.84, 1.16
Social group **of head of household (H17) (N=2746)**			**R^2=0.016**
A	54	1.72***	1.29, 2.29
B	181	1.20*	1.01, 1.43
C1	162	0.87	0.73, 1.03
C2	83	0.72**	0.58, 0.90
D	52	0.75*	0.58, 0.98
E	57	1.04	0.80, 1.35
Interviewer rating of respondent having hearing problem (I01)			**R^2=0.002**
No	563	0.84	0.68, 1.04
Yes – quite a bit or only a bit	27	1.20	0.97, 1.48

Table 32: Univariable logistic regression for sociodemographic factors with making a complaint

Table 33 shows the results of the multivariable logistic regression model, which included all of the sociodemographic variables that showed a significant association with noise complaints in the univariable analyses (Table 3.1.). The following sociodemographic factors were statistically significantly associated with noise complaints in the multivariable model: age and social group. The R^2 for this multivariable model was 0.044.

Respondents aged 35-44 years, 45-54 years, and 65-74 years had increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.41, 95%CI 1.12, 1.78; OR=1.48, 95%CI 1.20, 1.83; OR=1.30, 95%CI 1.00, 1.68, respectively). Respondents aged 75 years or older had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.69, 95%CI 0.49, 0.97).

Respondents where the head of household was in social group A had significantly increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.79, 95%CI 1.33, 2.41). Respondents where the head of household was in social group C2 or D had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.72, 95%CI 0.58, 0.90; OR=0.76, 95%CI 0.58, 0.99, respectively).

Multivariable odds ratios showing odds for complaining about noise for sociodemographic factors associated with complaining.		
(N=2743)	**Have you complained about noise?**	
	Odds ratio	**95% CI**
Age (H12)		
16-19	0.68	0.42, 1.10
20-24	0.69	0.45, 1.04
25-34	0.98	0.74, 1.30
35-44	1.41**	1.12, 1.78
45-54	1.48***	1.20, 1.83
55-64	1.16	0.93, 1.46
65-74	1.30*	1.00, 1.68
75+	0.69*	0.49, 0.97
Home ownership (H6)		
Being bought on a mortgage	1.12	0.89, 1.40
Owned outright by household	0.87	0.68, 1.11
Rented from local authority or from housing association	1.34	1.00, 1.80
Rented from private landlord	0.78	0.58, 1.06
Other	0.98	0.53, 1.83
Work at home (H15a)		
No	Removed	
Sometimes work at home	Removed	
Social group **of head of household (H17)**		
A	1.79***	1.33, 2.41
B	1.16	0.97, 1.40
C1	0.89	0.74, 1.07
C2	0.72**	0.58, 0.90
D	0.76*	0.58, 0.99
E	1.00	0.74, 1.34
		$R^{2\ \text{for model}}$=0.044

Table 33: Multivariable logistic regression of sociodemographic factors associated with making a complaint

4.3.4 Dwelling Factors

Table 34 shows the results of the univariable logistic regression analyses for each of the dwelling factors with noise complaints. The following dwelling factors were statistically significantly associated with making a noise complaint: length of time living in home, type of house, and noticeable road traffic noise at the dwelling.

Respondents who had been living in their home for less than 6 months had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.50, 95%CI 0.30, 0.81). Respondents who had been living in their home for 2-5 years, 5 years but less than 10 years, and 10 years or more had increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.32, 95%CI 1.03, 1.70; OR=1.55, 95%CI 1.24, 1.94; OR=1.29, 95%CI 1.08, 1.54, respectively). The R^2 for this model was 0.014.

Respondents living in a purpose built flat/maisonette or a mid-terrace house had increased odds of making a noise complaint compared to the unweighted grand mean for the sample

(OR=1.79, 95%CI 1.24, 2.59; OR=1.43, 95%CI 1.06, 1.94, respectively). Respondents living in a bungalow had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.57, 95%CI 0.38, 0.86). The R^2 for this model was 0.018.

Dwellings where the interviewer noticed road traffic noise had increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.13, 95%CI 1.01, 1.25). Dwellings where the interviewer did not notice road traffic noise had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.89, 95%CI 0.80, 0.99). The R^2 for this model was 0.003.

Univariable odds ratios showing odds for complaining about noise for dwelling factors			
	Have you complained about noise?		
	N	**Odds ratio**	**95% CI**
DWELLING FACTORS			
Double glazing in the home (H01) (N=2746)			**R^2=0.000**
All	490	0.98	0.83, 1.16
Some	66	1.07	0.86, 1.34
None	35	0.95	0.73, 1.24
Age of house (H04 + H05) (N=2746)			**R^2=0.004**
Before 1919	115	0.93	0.73, 1.18
1919-1940	110	0.90	0.70, 1.16
1941-1960	87	0.97	0.79, 1.21
1961-1990	183	1.16	0.91, 1.48
1991-2000	44	1.04	0.75, 1.44
2001-2012	47	1.36	0.98, 1.89
Don't know	5	0.75	0.33, 1.69
How long have you lived in this home? (A11) (N=2747)			**R^2=0.014**
Less than 6 months	13	0.50**	0.30, 0.81
6 months but less than 1 year	20	0.70	0.47, 1.06
1 year but less than 2 years	34	1.09	0.77, 1.53
2 years but less than 5 years	81	1.32*	1.03, 1.70
5 years but less than 10 years	121	1.55***	1.24, 1.94
10 years or more	322	1.29**	1.08, 1.54
Type of house (A13) (N=2747)			**R^2=0.018**
Purpose built flat/maisonette	53	1.79**	1.24, 2.59
Converted flat/maisonette	13	1.23	0.70, 2.18
Semi-detached/end of terrace house	210	0.96	0.73, 1.26
Mid terrace house	114	1.43*	1.06, 1.94
Detached house	171	1.16	0.87, 1.53
Bungalow	29	0.57**	0.38, 0.86
Other	2	0.50	0.14, 1.78
Access to garden or other private outdoor space (A12) (N=2747)			**R^2=0.000**
No	27	1.04	0.83, 1.29
Yes	564	0.97	0.78, 1.21
While you were in the home or immediately outside it, was there noticeable noise from outside the home from (I02)..road traffic			**R^2=0.003**

(N=2747)			
No	445	0.89*	0.80, 0.99
Yes	146	1.13*	1.01, 1.25
neighbours or other people nearby (N=2747)			**R^2=0.000**
No	573	0.89	0.68, 1.18
Yes	17	1.12	0.85, 1.47
aircraft, airports or airfields (N=2747)			**R^2=0.001**
No	570	1.13	0.89, 1.44
Yes	21	0.89	0.70, 1.13
trains or railway stations (N=2747)			**R^2=0.000**
No	583	0.90	0.59, 1.36
Yes	8	1.11	0.74, 1.69

Table 34: Univariable logistic regression of dwelling factors with making a complaint

Table 35 shows the results of the multivariable logistic regression model, which included all of the dwelling variables that showed a significant association with noise complaints in the univariable analyses (Table 34). The following dwelling factors were statistically significantly associated with noise complaints in the multivariable model: length of time living in home, type of house, and noticeable noise from road traffic noise. The R^2 for this multivariable model was 0.037.

Respondents who had been living in their home for less than 6 months had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.45, 95%CI 0.27, 0.73). Respondents who had been living in their home for 2-5 years, 5 years but less than 10 years, and 10 years or more had increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.31, 95%CI 1.01, 1.69; OR=1.66, 95%CI 1.31, 2.09; OR=1.42, 95%CI 1.18, 1.71, respectively). Respondents living in a purpose built flat/maisonette or a mid-terrace house had increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.83, 95%CI 1.26, 2.66; OR=1.42, 95%CI 1.05, 1.93, respectively). Respondents living in a bungalow had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.53, 95%CI 0.35, 0.81).

Dwellings where the interviewer noticed road traffic noise had increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.27, 95%CI 1.02, 1.59). Dwellings where the interviewer did not notice road traffic noise had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.89, 95%CI 0.79, 0.99).

Multivariable odds ratios showing odds for complaining about noise for dwelling factors associated with complaining.		
(N=2747)	**Have you complained about noise?**	
	Odds ratio	**95% CI**
How long have you lived in this home? (A11)		
Less than 6 months	0.45***	0.27, 0.73
6 months but less than 1 year	0.66	0.44, 1.01
1 year but less than 2 years	1.10	0.78, 1.55
2 years but less than 5 years	1.31*	1.01, 1.69
5 years but less than 10 years	1.66***	1.31, 2.09
10 years or more	1.42***	1.18, 1.71
Type of house (A13)		
Purpose built flat/maisonette	1.83***	1.26, 2.66
Converted flat/maisonette	1.55	0.87, 2.79
Semi-detached/end of terrace house	0.92	0.70, 1.21
Mid terrace house	1.42*	1.05, 1.93
Detached house	1.07	0.80, 1.42
Bungalow	0.53**	0.35, 0.81
Other	0.47	0.13, 1.69
While you were in the home or immediately outside it, was there noticeable noise from outside the home from (I02)..road traffic		
No	0.89*	0.79, 0.99
Yes	1.27*	1.02, 1.59
		$R^{2\text{ for model}}$=0.037

Table 35: Multivariable logistic regression of dwelling factors associated with making a complaint

4.3.5 Geographic Factors

Table 36 shows the univariable logistic regression analyses showing the associations between the geographic factors and noise complaints. There was no significant difference in noise complaints for region, but there were differences for the location of the dwelling and for urbanicity. Urbanicity was only available for the England sub-sample.

Respondents from dwellings located in the countryside had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.64, 95%CI 0.44, 0.93). The R^2 for this model was 0.004.

Respondents living in an area rated as rural by the local authority had significantly increased odds of making a noise complaint compared to the unweighted grand mean for the England sub-sample (OR=1.33, 95%CI 1.13, 1.55). Respondents living in an area rated as semi-rural in England had decreased odds if making a noise complaint compared to the unweighted grand mean for the England sub-sample (OR=0.73, 95%CI 0.58, 0.92). The R^2 for this model was 0.008.

Univariable odds ratios showing odds for complaining about noise for geographic factors			
	Have you complained about noise?		
	N	**Odds ratio**	**95% CI**
GEOGRAPHIC FACTORS			
Region (N=2747)			**R^2=0.002**
England	513	1.21	0.97, 1.51
Wales	39	1.17	0.84, 1.62
Scotland	27	0.89	0.62, 1.27
Northern Ireland	12	0.80	0.49, 1.29
I4 Is the dwelling located in? (N=2742)			**R^2=0.004**
The centre of a large city	17	1.20	0.77, 1.88
Suburbs/outskirts of a large city	190	1.14	0.94, 1.39
A large town or small city	107	1.02	0.82, 1.28
In a country village/small town	254	1.12	0.93, 1.35
In the countryside	22	0.64*	0.44, 0.93
Urbanicity (LA Rating)† (N=2315)			**R^2=0.008**
Rural	204	1.33***	1.13, 1.55
Semi-rural	42	0.73**	0.58, 0.92
Urban	265	1.04	0.89, 1.21

Table 36: Univariable logistic regression of geographic factors with making a complaint

No multivariable model was run for the geographic factors, as urbanicity data was only available for the England sub-sample.

4.3.6 Final Multivariable Models

4.3.6.1 Multivariable model showing odds for making a noise complaint for sociodemographic, dwelling, and geographic factors.

Table 37 shows the results of the multivariable logistic regression models, which included all the statistically significant variables from the multivariable analyses of the sociodemographic (Table 33) and dwelling factors (Table 35), as well as the only significant geographic variable available for the entire sample – dwelling location.

The following factors were associated with noise complaints in the multivariable model: age; social group; length of residence; type of house, and noticeable noise from road traffic noise. The R^2 for this multivariable model was 0.073.

Respondents aged 35-44 years and 45-54 years had increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.54, 95%CI 1.22, 1.94; OR=1.49, 95%CI 1.20, 1.83, respectively). Respondents aged 75 years or older had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.65, 95%CI 0.46, 0.91).

Respondents where the head of household was in social group A or B had significantly increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.72, 95%CI 1.27, 2.31; OR=1.23, 95%CI 1.03, 1.48, respectively).

Respondents where the head of household was in social group C2 or D had significantly decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.70, 95%CI 0.56, 0.87; OR=0.72, 95%CI 0.55, 0.95, respectively).

Respondents who had been living in their home for less than 6 months had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.48, 95%CI 0.29, 0.79). Respondents who had been living in their home for 5 years but less than 10 years, and 10 years or more had increased odds of making a noise complaint compared to the unweighted grand mean for the sample(OR=1.51, 95%CI 1.19, 1.92; OR=1.48, 95%CI 1.20, 1.83, respectively).

Respondents living in a purpose built flat/maisonette had increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.94, 95%CI 1.32, 2.85). Respondents living in a bungalow had decreased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=0.52, 95%CI 0.34, 0.80).

Dwellings where the interviewer noticed road traffic noise had increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR=1.26, 95%CI 1.01, 1.58). Dwellings where the interviewer did not notice road traffic noise had decreased odds of making a noise complaint to the unweighted grand mean (OR=0.89, 95%CI 0.80, 1.00).

Dwellings located in a country village or small town had increased odds of making a noise complaint compared to the unweighted grand mean for the sample (OR 1.24, 95%CI 1.02, 1.52).

Multivariate odds ratios showing odds for complaining about noise for sociodemographic, dwelling, and geographic factors associated with complaining.		
(N=2739)	**Have you complained about noise?**	
	Odds ratio	**95% CI**
Age (H12)		
16-19	0.70	0.43, 1.13
20-24	0.73	0.48, 1.10
25-34	1.04	0.77, 1.40
35-44	1.54***	1.22, 1.94
45-54	1.49***	1.20, 1.83
55-64	1.08	0.86, 1.35
65-74	1.19	0.93, 1.53
75+	0.65*	0.46, 0.91
Social group of head of household (H17)		
A	1.72***	1.27, 2.31
B	1.23*	1.03, 1.48
C1	0.88	0.73, 1.06
C2	0.70**	0.56, 0.87
D	0.72*	0.55, 0.95
E	1.08	0.82, 1.43
How long have you lived in this home? (A11)		
Less than 6 months	0.48**	0.29, 0.79
6 months but less than 1 year	0.68	0.44, 1.04
1 year but less than 2 years	1.17	0.82, 1.67
2 years but less than 5 years	1.18	0.91, 1.53
5 years but less than 10 years	1.51***	1.19, 1.92
10 years or more	1.48***	1.20, 1.83
Type of house (A13)		
Purpose built flat/maisonette	1.94***	1.32, 2.85
Converted flat/maisonette	1.70	0.93, 3.11
Semi-detached/end of terrace house	0.84	0.63, 1.12
Mid terrace house	1.36	0.99, 1.86
Detached house	0.88	0.65, 1.19
Bungalow	0.52**	0.34, 0.80
Other	0.58	0.16, 2.12
While you were in the home or immediately outside it, was there noticeable noise from outside the home from (I02)..road traffic		
No	0.89*	0.80, 1.00
Yes	1.26*	1.01, 1.58
I4 Is the dwelling located in?		
The centre of a large city	1.03	0.64, 1.65
Suburbs/outskirts of a large city	1.16	0.95, 1.43
A large town or small city	0.98	0.78, 1.24
In a country village/small town	1.24*	1.02, 1.52
In the countryside	0.68	0.46, 1.01
		$R^{2\ \text{for model}}$=0.076

Table 37: Multivariable model showing odds for making a noise complaint for sociodemographic, dwelling, and geographic factors

4.3.6.2 Multivariable models showing odds for making a noise complaint additionally adjusted for noise annoyance and noise sensitivity

The following tables show the full multivariable model in Table 37, additionally adjusted for i) road noise annoyance and noise sensitivity, ii) neighbour noise and noise sensitivity, iii) aircraft noise annoyance and noise sensitivity, lastly iv) entertainment noise annoyance and noise sensitivity. The multivariable model was not additionally adjusted for train or railway station noise annoyance as this was not associated with making a noise complaint in the univariable analyses.

4.3.6.2.1 Road traffic noise annoyance and noise sensitivity

Table 38 shows that additionally adjusting the multivariable sociodemographic, dwelling and geographic model for road noise annoyance and noise sensitivity resulted in the coefficients for age, social group, length of residence, and type of house remaining largely unchanged, with a couple of exceptions. After adjustment for road noise annoyance and noise sensitivity, the association between being aged 75 years or older and noise complaints became non-significant. This association was borderline significant in the multivariable model (Table 37) prior to these additional adjustments.

The association for noticeable noise from road traffic noise and noise complaints also became non-significant, after adjustment for road traffic noise annoyance and noise sensitivity: this probably reflects the collinearity between road traffic noise annoyance and noticeable noise from road traffic noise.

In the multivariable model, being moderately, very or extremely annoyed by road traffic noise was associated with increased odds of making a noise complaint (OR=1.57, 95%CI 1.41, 1.74): being not at all or a little annoyed by road traffic noise was associated with decreased odds of making a noise complaint (OR=0.64, 95%CI 0.57, 0.71). Noise sensitivity was also associated with making a noise complaint: a one-point increase in noise sensitivity was associated with a 21% increase in the odds of making a noise complaint (OR=1.21, 95%CI 1.15, 1.28). The R^2 for this multivariable model was 0.142.

Multivariable odds ratios showing odds for complaining about noise for sociodemographic, dwelling, and geographic factors associated with complaining: additionally adjusted for road traffic noise annoyance and noise sensitivity.		
(N=2728)	**Have you complained about noise?**	
	Odds ratio	**95% CI**
Age (H12)		
16-19	0.77	0.47, 1.26
20-24	0.77	0.50, 1.18
25-34	1.08	0.80, 1.47
35-44	1.47***	1.16, 1.86
45-54	1.38**	1.11, 1.72
55-64	0.97	0.76, 1.22
65-74	1.13	0.88, 1.46
75+	0.71	0.50, 1.00
Social group of head of household (H17)		
A	1.67***	1.22, 2.28
B	1.22*	1.01, 1.47
C1	0.88	0.73, 1.06
C2	0.73**	0.58, 0.92
D	0.70*	0.53, 0.93
E	1.10	0.83, 1.48
How long have you lived in this home? (A11)		
Less than 6 months	0.50**	0.30, 0.84
6 months but less than 1 year	0.68	0.44, 1.05
1 year but less than 2 years	1.13	0.79, 1.63
2 years but less than 5 years	1.13	0.86, 1.48
5 years but less than 10 years	1.48**	1.16, 1.89
10 years or more	1.54***	1.24, 1.92
Type of house (A13)		
Purpose built flat/maisonette	1.97***	1.33, 2.93
Converted flat/maisonette	1.80	0.97, 3.33
Semi-detached/end of terrace house	0.86	0.64, 1.15
Mid terrace house	1.34	0.97, 1.84
Detached house	0.87	0.64, 1.19
Bungalow	0.50**	0.32, 0.77
Other	0.57	0.15, 2.12
While you were in the home or immediately outside it, was there noticeable noise from outside the home from (I02)..road traffic		
No	1.04	0.92, 1.17
Yes	0.93	0.73, 1.19
I4 Is the dwelling located in?		
The centre of a large city	1.07	0.66, 1.74
Suburbs/outskirts of a large city	1.10	0.89, 1.35
A large town or small city	0.95	0.75, 1.21
In a country village/small town	1.26*	1.03, 1.55
In the countryside	0.71	0.48, 1.06
Road Noise Annoyance		
Not at all and a little	0.64***	0.57, 0.71
Moderately, very and extremely	1.57***	1.41, 1.74

Noise sensitivity	1.21***	1.15, 1.28
		$R^{2\ for\ model}$=0.142

Table 38: Multivariable models showing odds for making a noise complaint additionally adjusted for road traffic noise annoyance and noise sensitivity

4.3.6.2.2 Neighbour noise annoyance and noise sensitivity

Table 39 shows that additionally adjusting the multivariable sociodemographic, dwelling and geographic model for neighbour noise annoyance and noise sensitivity resulted in the coefficients for age, social group, length of residence, and type of house remaining largely unchanged, with a few exceptions. After adjustment for neighbour noise annoyance and noise sensitivity, the association between being aged 75 years or older and noise complaints became non-significant.

The association between noticeable noise from road traffic and noise complaints became non-significant after adjustment for neighbour noise annoyance and noise sensitivity.

In the multivariable model, being moderately, very or extremely annoyed by neighbour noise was associated with increased odds of making a noise complaint (OR=2.22, 95%CI 2.00, 2.47): being not at all or a little annoyed by neighbour noise was associated with decreased odds of making a noise complaint (OR=0.45, 95%CI 0.41, 0.50). Noise sensitivity was also associated with making a noise complaint: a one point increase in noise sensitivity was associated with a 15% increase in the odds of making a noise complaint (OR=1.15, 95%CI 1.08, 1.21). The R^2 for this multivariable model was 0.220.

Multivariable odds ratios showing odds for complaining about noise for sociodemographic, dwelling, and geographic factors associated with complaining: additionally adjusted for neighbour noise annoyance and noise sensitivity.		
(N=2729)	**Have you complained about noise?**	
	Odds ratio	**95% CI**
Age (H12)		
16-19	0.64	0.39, 1.07
20-24	0.65	0.42, 1.01
25-34	0.96	0.70, 1.32
35-44	1.51***	1.18, 1.93
45-54	1.44**	1.15, 1.81
55-64	1.06	0.83, 1.35
65-74	1.26	0.97, 1.65
75+	0.86	0.60, 1.24
Social group of head of household (H17)		
A	1.72***	1.24, 2.38
B	1.24*	1.02, 1.51
C1	0.91	0.75, 1.10
C2	0.75*	0.59, 0.95
D	0.66**	0.49, 0.89
E	1.05	0.78, 1.42
How long have you lived in this home? (A11)		
Less than 6 months	0.53**	0.31, 0.89
6 months but less than 1 year	0.69	0.44, 1.07
1 year but less than 2 years	1.14	0.78, 1.67
2 years but less than 5 years	1.14	0.86, 1.51
5 years but less than 10 years	1.43**	1.11, 1.85
10 years or more	1.48***	1.18, 1.86
Type of house (A13)		
Purpose built flat/maisonette	1.65*	1.10, 2.50
Converted flat/maisonette	1.66	0.88, 3.13
Semi-detached/end of terrace house	0.83	0.61, 1.12
Mid terrace house	1.27	0.91, 1.77
Detached house	0.94	0.68, 1.29
Bungalow	0.62*	0.40, 0.98
Other	0.60	0.16, 2.30
While you were in the home or immediately outside it, was there noticeable noise from outside the home from (I02)..road traffic		
No	0.92	0.82, 1.04
Yes	1.18	0.93, 1.50
I4 Is the dwelling located in?		
The centre of a large city	1.04	0.62, 1.73
Suburbs/outskirts of a large city	1.10	0.88, 1.37
A large town or small city	0.95	0.74, 1.23
In a country village/small town	1.25*	1.01, 1.55
In the countryside	0.74	0.49, 1.11
Neighbour Noise Annoyance		
Not at all and a little	0.45***	0.41, 0.50
Moderately, very and extremely	2.22***	2.00, 2.47
Noise sensitivity	1.15***	1.08, 1.21

		$R^{2\ for\ model}$=0.220

Table 39: Multivariable models showing odds for making a noise complaint additionally adjusted for neighbour noise annoyance and noise sensitivity

4.3.6.2.3 Aircraft noise annoyance and noise sensitivity

Table 40 shows that additionally adjusting the multivariable sociodemographic, dwelling and geographic model for aircraft noise annoyance and noise sensitivity resulted in the coefficients for age, social group, length of residence, and type of house remaining largely unchanged, with a couple of exceptions. After further adjustment the association between being in social group B and noise complaints became non-significant; and living in your home for 6 months but less than 1 year and living in a mid terrace house became significantly associated with making a noise complaint (OR=0.65, 95%CI 0.42, 0.99; OR=1.39, 95%CI 1.01, 1.91, respectively).

The association between noticeable noise from road traffic and noise complaints became non-significant after adjustment for aircraft noise annoyance and noise sensitivity.

In the multivariable model, being moderately, very or extremely annoyed by aircraft noise was associated with increased odds of making a noise complaint (OR=1.28, 95%CI 1.12, 1.45): being not at all or a little annoyed by aircraft noise was associated with decreased odds of making a noise complaint (OR=0.78, 95%CI 0.69, 0.89). Noise sensitivity was also associated with making a noise complaint: a one-point increase in noise sensitivity was associated with a 22% increase in the odds of making a noise complaint (OR=1.22, 95%CI 1.16, 1.29). The R^2 for this multivariable model was 0.115.

Multivariable odds ratios showing odds for complaining about noise for sociodemographic, dwelling, and geographic factors associated with complaining: additionally adjusted for aircraft noise annoyance and noise sensitivity.		
(N=2729)	**Have you complained about noise?**	
	Odds ratio	**95% CI**
Age (H12)		
16-19	0.76	0.46, 1.24
20-24	0.80	0.52, 1.22
25-34	1.09	0.80, 1.47
35-44	1.51***	1.19, 1.90
45-54	1.37**	1.10, 1.70
55-64	0.98	0.77, 1.24
65-74	1.18	0.91, 1.51
75+	0.65*	0.46, 0.92
Social group of head of household (H17)		
A	1.55**	1.14, 2.11
B	1.19	0.99, 1.43
C1	0.90	0.75, 1.08
C2	0.75*	0.59, 0.94
D	0.74*	0.56, 0.98
E	1.09	0.82, 1.45
How long have you lived in this home? (A11)		
Less than 6 months	0.51**	0.31, 0.84
6 months but less than 1 year	0.65*	0.42, 0.99
1 year but less than 2 years	1.15	0.80, 1.65
2 years but less than 5 years	1.16	0.89, 1.52
5 years but less than 10 years	1.52***	1.19, 1.94
10 years or more	1.51***	1.22, 1.87
Type of house (A13)		
Purpose built flat/maisonette	2.06***	1.39, 3.05
Converted flat/maisonette	1.81	0.98, 3.34
Semi-detached/end of terrace house	0.86	0.64, 1.15
Mid terrace house	1.39*	1.01, 1.91
Detached house	0.85	0.62, 1.16
Bungalow	0.53**	0.34, 0.82
Other	0.50	0.13, 1.86
While you were in the home or immediately outside it, was there noticeable noise from outside the home from (I02)..road traffic		
No	0.90	0.80, 1.01
Yes	1.23	0.98, 1.55
I4 Is the dwelling located in?		
The centre of a large city	0.98	0.61, 1.59
Suburbs/outskirts of a large city	1.15	0.94, 1.42
A large town or small city	1.02	0.80, 1.29
In a country village/small town	1.29*	1.05, 1.58
In the countryside	0.68	0.45, 1.01
Aircraft Noise Annoyance		
Not at all and a little	0.78***	0.69, 0.89
Moderately, very and extremely	1.28***	1.12, 1.45

Noise sensitivity	1.22***	1.16, 1.29
		$R^{2\ for\ model}$=0.115

Table 40: Multivariable models showing odds for making a noise complaint additionally adjusted for aircraft noise annoyance and noise sensitivity

4.3.6.2.4 Train and railway noise annoyance and noise sensitivity

As there was no significant association between train and railway noise annoyance and making a noise complaint (see Table 29), the multivariable model was not additionally adjusted for train and railway noise annoyance.

4.3.6.2.5 Entertainment noise annoyance and noise sensitivity

Table 41 shows that additionally adjusting the multivariable sociodemographic, dwelling and geographic model for entertainment noise annoyance and noise sensitivity resulted in the coefficients for age, social group, length of residence, and type of house remaining largely unchanged, with the exception that the association for mid terrace house with making a complaint became significant (OR=1.40, 95%CI 1.02, 1.93).

The association between noticeable noise from road traffic and noise complaints became non-significant after adjustment for entertainment noise annoyance and noise sensitivity.

In the multivariable model, being moderately, very, or extremely annoyed by entertainment noise was associated with increased odds of making a noise complaint (OR=1.60, 95%CI 1.27, 2.01): being not at all or a little annoyed by entertainment noise was associated with decreased odds of making a noise complaint (OR=0.63, 95%CI 0.50, 0.79). Noise sensitivity was also associated with making a noise complaint: a one point increase in noise sensitivity was associated with a 23% increase in the odds of making a noise complaint (OR=1.23, 95%CI 1.16, 1.29). The R^2 for this multivariable model was 0.117.

Multivariable odds ratios showing odds for complaining about noise for sociodemographic, dwelling, and geographic factors associated with complaining: additionally adjusted for entertainment noise annoyance and noise sensitivity.		
(N=2726)	**Have you complained about noise?**	
	Odds ratio	**95% CI**
Age (H12)		
16-19	0.74	0.45, 1.20
20-24	0.76	0.49, 1.16
25-34	1.13	0.83, 1.53
35-44	1.51***	1.20, 1.91
45-54	1.42***	1.14, 1.76
55-64	1.00	0.79, 1.26
65-74	1.17	0.91, 1.50
75+	0.64*	0.45, 0.91
Social group of head of household (H17)		
A	1.63**	1.20, 2.21
B	1.21*	1.01, 1.46
C1	0.90	0.75, 1.08
C2	0.73**	0.58, 0.91
D	0.72*	0.55, 0.96
E	1.08	0.81, 1.43
How long have you lived in this home? (A11)		
Less than 6 months	0.51**	0.31, 0.85
6 months but less than 1 year	0.68	0.44, 1.04
1 year but less than 2 years	1.10	0.76, 1.58
2 years but less than 5 years	1.15	0.88, 1.50
5 years but less than 10 years	1.50***	1.18, 1.91
10 years or more	1.52***	1.23, 1.89
Type of house (A13)		
Purpose built flat/maisonette	2.00***	1.35, 2.96
Converted flat/maisonette	1.65	0.89, 3.03
Semi-detached/end of terrace house	0.85	0.63, 1.13
Mid terrace house	1.40*	1.02, 1.93
Detached house	0.85	0.63, 1.16
Bungalow	0.51**	0.33, 0.79
Other	0.59	0.16, 2.18
While you were in the home or immediately outside it, was there noticeable noise from outside the home from (I02)..road traffic		
No	0.92	0.82, 1.03
Yes	1.18	0.94, 1.48
I4 Is the dwelling located in?		
The centre of a large city	1.00	0.62, 1.63
Suburbs/outskirts of a large city	1.16	0.94, 1.42
A large town or small city	0.99	0.78, 1.25
In a country village/small town	1.25*	1.02, 1.53
In the countryside	0.70	0.47, 1.05
Entertainment Noise Annoyance		
Not at all and a little	0.63***	0.50, 0.79
Moderately, very and extremely	1.60***	1.27, 2.01
Noise sensitivity	1.23***	1.16, 1.29

		$R^{2 \text{ for model}}$=0.117

Table 41: Multivariate models showing odds for making a noise complaint additionally adjusted for entertainment noise annoyance and noise sensitivity

4.4 Discussion

This section has examined the extent to which the making of a noise complaint is associated with noise annoyance, noise sensitivity and with sociodemographic, dwelling and geographic factors. The analyses suggest that certain sub-groups of the population may be more or less likely to make a noise complaint. However, it should be remembered that the data in NNAS2012 are all cross-sectional and therefore causal relationships between these factors and noise complaint behaviour cannot be inferred. It should also be noted that the outcome of making a noise complaint, relates to anyone within the household having made a noise complaint, whilst the the sub-group analyses examine both household level variables (e.g. type of house) and individual level variables (e.g. age, gender).

Several sources of noise annoyance were associated with making a noise complaint. Respondents who reported being moderately, very, or extremely annoyed by aircraft noise, road traffic noise, neighbour noise, or entertainment noise had significantly increased odds of making a noise complaint. Conversely, being not at all or a little annoyed by aircraft noise, road traffic noise, neighbour noise, or entertainment noise was associated with decreased odds of making a noise complaint. Train and railway station noise annoyance was the only source of noise annoyance examined which was not associated with noise complaint behaviour. The associations between noise annoyance and noise complaint behaviour remained after taking noise sensitivity, sociodemographic, dwelling and geographic factors into account, suggesting that regardless of other factors noise annoyance is associated with noise complaint behaviour.

There was a significant association between noise sensitivity and making a noise complaint: an association which remained after taking noise annoyance, sociodemographic, dwelling and geographic factors into account. Noise complaints remain associated with noise sensitivity after controlling for demographic factors. These findings are suggestive that noise sensitive individuals may be more likely to make a noise complaint. However, a causal relationship cannot be inferred from these data.

Considered individually several sociodemographic factors were significantly associated with making a noise complaint; age, homeownership, employment status, working at home, and social group of head of household. Taking other statistically significant sociodemographic, dwelling, and geographic factors into account, as well as noise sensitivity and noise annoyance in the multivariate analyses, age and social group remained significantly associated with noise complaints. Respondents in their thirties, forties and fifties were more likely to made a noise complaint; respondents aged 75 years or older were less likely to have made a noise complaint. These findings suggest that the odds for a noise complaint rise with increasing age in adulthood, but decrease again in older age. There is a social gradient in noise complaint behaviour, with respondents with a head of household with social group A being more likely to make a noise complaint and respondents where the head of household had social group C2 or D being less likely to make a noise complaint. Future academic research could examine what factors might explain this social gradient, including attitudes, behaviours and expectations relating to noise exposure within the home environment.

Individually, several dwelling factors were statistically significantly associated with making a noise complaint: length of time living in home, type of house, and noticeable road traffic noise at the dwelling. After taking other statistically significant sociodemographic, dwelling, and geographic factors into account, as well as noise sensitivity and noise annoyance in the multivariate analyses, length of time living in the home, type of house, and noticeable noise from road traffic remained significantly associated with noise complaints. Respondents who had recently moved into their home were less likely to make a noise complaint, whilst those who had lived in their homes for 5 to 10 years or more were more likely to make a noise complaint. Those who have lived longer in their homes have increased odds for making a noise complaint: future academic research may profit from examining reasons that may explain this increase in complaint behaviour such as change in noise exposure over time and expectations relating to noise exposure overtime given a longer period of residence.

Respondents living in purpose built flat/maisonettes had increased odds of making a noise complaint: the age of home did not show an association with noise complaint behaviour suggesting that the increased odds for purpose built flat/maisonettes may be explained by something to do with design of these types of buildings rather than the age of the building per se, as we would expect newer purpose build flat/maisonettes to have greater noise insulation according to Building Regulations. Respondents living in bungalows had significantly decreased odds of making a noise complaint. This is likely to be explained by the larger plot size and less close proximity of neighbours associated with the design of some bungalow homes.

Whilst noise exposure has not be acoustically assessed or modelled in the NNAS2012, dwellings where the interviewer noticed road traffic noise had increased odds of making a noise complaint and dwellings where the interviewer did not notice road traffic noise had decreased odds of making a noise complaint. These findings suggest that noticeable road traffic noise is associated with noise complaint behaviour.

Overall, geographical factors showed few associations with noise complaint behaviour: whilst urbanicity and location of the dwelling were individually associated with complaint behaviour, no associations were observed after taking other sociodemographic and dwelling factors into account. These findings suggest that geographical factors have little impact upon noise complaint behaviour.

5 Work Package 3: Factors Associated with Noise Sensitivity

5.1 Background

At any given level of environmental noise there will be variation in the degree of annoyance expressed by different people to that environmental noise[1]. This has led researchers to examine whether certain individuals are more vulnerable or more resilient to the effects of noise, with noise sensitivity identified as a potential explanatory factor[1].

Noise sensitivity has various definitions but is generally defined as "the internal states (be they physiological, psychological [including attitudinal], or related to life style or activities conducted) of any individual which increase their degree of reactivity to noise in general"[2]. In community surveys noise sensitivity is measured by self-report questions[2], with assessments making use of either one question (e.g. How sensitive would you say you were to noise?), to more robust multi-item scales, such as the Weinstein Noise Sensitivity Scale[3]. Noise sensitivity is thought to moderate an individual's response to noise: the Caerphilly & Speedwell study found that noise sensitive men were more likely to be highly annoyed by road traffic noise exposure than less noise-sensitive men[1].

Little is known about whether a negative response to noise and, in particular, noise sensitivity, is more common in certain groups of the population. Quantifying the effect of noise sensitivity on responses to noise would also further feed into policy decision making and links to the previous work package.

The aims of this analysis are to examine:

- Which groups of the population report being the most and least noise sensitive?
- The strength of associations between self-reports of noise sensitivity and other responses to noise such as noise annoyance.

5.2 Method

5.2.1 Measuring Noise Sensitivity

The main outcome for the analyses is the assessment of noise sensitivity. Respondents rated how sensitive they were to noise on a seven-point scale ranging from 'not at all sensitive' to 'very sensitive'. A range of noise sensitivities were reported by the respondents, as indicated by the median score of 4. As the sample was fairly evenly distributed across the range of noise sensitivities, noise sensitivity was analysed as a continuous variable.

A8 NAS12 How sensitive would you say you are to noise? 'Not at all sensitive – Very sensitive'	
(n=2747)	**% (n)**
1 Not at all sensitive	12.8 (352)
2	14.7 (405)
3	18.0 (495)
4	19.2 (527)
5	13.9 (382)
6	9.4 (258)
7 Very sensitive	11.6 (318)
Don't know	0.4 (11)
Mean (SD)	3.83 (1.87)
Median	4.00

Table 42: Frequencies for noise sensitivity (A8)

5.2.2 Statistical analysis

For each individual variable assessing a dwelling, sociodemographic or geographic factor, effect coding univariable regression models were run, assessing the strength of the association between the variable and noise sensitivity.

Dwelling, sociodemographic or geographic variables which showed a significant association with noise sensitivity (p=<0.05) in the univariable analyses, were then included in a multivariable regression model to examine which variables remain associated with noise sensitivity after taking the other significant dwelling, sociodemographic and geographic factors into account.

It was not possible to include the variables 'working from home' or 'shift work' in the multivariable analyses, as these data were only available for the working sub-sample of the population. Similarly, 'urbanicity' data were only available for the English sub-sample. To maximise the power of the multivariable analyses it was not possible to include these variables in the models.

5.2.3 Interpreting effect coding regression models

Effect coding in regression analyses does not use dummy variables, as in conventional regression models, where there is a reference group to which all the other categories of the variable are compared in the regression. In effect coding, the regression coefficient for each category of the variable is compared to the unweighted grand mean of all the observations. The coefficients represents the difference between the mean for this group compared to the unweighted grand mean for the sample: unweighted simply reflects the fact that different sub-group sizes are present within the variable being examined.

Statistical significance is indicated in the tables (*p=0.05, **p=0.01, ***p=<0.001).

5.2.4 Analysis Plan

The following analyses were carried out on the NNAS2012 dataset.

1. Sociodemographic factors

1.1. Univariable linear regressions of the following sociodemographic factors with noise sensitivity:
- 1.1.1. Age
- 1.1.2. Gender
- 1.1.3. Home ownership
- 1.1.4. Any children
- 1.1.5. Employment status
- 1.1.6. Work at home
- 1.1.7. Shift work
- 1.1.8. Social group of head of household
- 1.1.9. Interviewer rating of respondent having a hearing problem

1.2. Multivariable linear regression of the sociodemographic factors association with noise sensitivity in 1.1. All significant sociodemographic factors added in one step to the same model.

2. Dwelling factors

2.1. Univariable linear regressions of the following dwelling factors with noise sensitivity:
- 2.1.1. Double glazing in the home
- 2.1.2. Age of house
- 2.1.3. How long lived in the home
- 2.1.4. Type of house
- 2.1.5. Access to garden
- 2.1.6. Noticeable noise from road traffic
- 2.1.7. Noticeable noise from neighbours or other people nearby
- 2.1.8. Noticeable noise from aircraft, airports or airfields
- 2.1.9. Noticeable noise from trains or railway stations.

2.2. Multivariable linear regression of the dwelling factors association with noise sensitivity in 2.1. All significant dwelling factors added in one step to the same model.

3. Geographic factors

3.1. Univariable linear regressions of the following geographic factors with noise sensitivity:
- 3.1.1. Region
- 3.1.2. Location of dwelling
- 3.1.3. Urbanicity LA rating (only available for England sub-sample)

3.2. Multivariable linear regression of the geographic factors association with noise sensitivity. All significant geographic factors added in one step to the same model.

4. Level of Noise Annoyance

4.1. Univariable linear regressions of the following noise annoyance measures with noise sensitivity:
  4.1.1. Aircraft noise
  4.1.2. Road noise
  4.1.3. Neighbourhood noise
  4.1.4. Train and railway station noise
  4.1.5. Entertainment noise
  All noise annoyance variables were categorized as 0=not at all/a little versus 1=moderately, very, extremely for analyses.

5. Final multivariable models for noise sensitivity

5.1. All sociodemographic, dwelling, and geographic factors that were significant in models 1.2., 2.2, and 3.2.
5.2. All significant sociodemographic, dwelling and geographic factors that were significant in model 5.1, plus adjustment for each of the following (if significant in earlier models 4.1.1 to 4.1.5):
  5.2.1. Road noise annoyance
  5.2.2. Neighbour noise annoyance
  5.2.3. Aircraft noise annoyance
  5.2.4. Train or railway station noise annoyance
  5.2.5. Entertainment noise annoyance

5.3 Results

5.3.1 Sociodemographic factors

Table 43 shows the results of the univariable linear regression analyses for each of the sociodemographic factors with noise sensitivity. The following sociodemographic factors were statistically significantly associated with noise sensitivity scores: age; gender, homeownership, children, employment status, working at home, shift work, social group, and interviewer rating of hearing problems.

Respondents aged 45-54 years, 55-64 years, and 65-74 years had higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.37, 95%CI 0.21, 0.53; β=0.33, 95%CI 0.17, 0.49; β=0.25, 95%CI 0.07, 0.42, respectively). Respondents aged 16-19, 20-24, and 25-34 years had lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.46, 95%CI -0.76,-0.16; β=-0.36, 95%CI -0.61,-0.11; β=-0.21, 95%CI -0.40,-0.02, respectively). The R^2 for this model was 0.019.

Males had lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.16, 95%CI -0.23,-0.09). Females had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.16, 95%CI 0.09,0.23). The R^2 for this model was 0.007.

Respondents who were buying their home with a mortgage or who owned their home outright had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.22, 95%CI 0.07, 0.38; β=0.25, 95%CI 0.09, 0.40, respectively). The R^2 for this model was 0.006.

Respondents who had children under 17 years of age in the household had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.13, 95%CI -0.24, -0.03). Respondents who did not have children under 17 years of age in the household had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.13, 95%CI 0.03, 0.24). The R^2 for this model was 0.002.

Respondents who worked full-time or who were in full-time education had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.20, 95%CI -0.34, -0.06; β=-0.36, 95%CI -0.61, -0.11, respectively). Respondents who worked part-time had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.19, 95%CI 0.00, 0.38). The R^2 for this model was 0.008.

Respondents who worked at home had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.23, 95%CI 0.13, 0.33). Respondents who did not work at home had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.23, 95%CI -0.33, -0.13). The R^2 for this model was 0.014.

Respondents who undertook shift work had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.32, 95%CI -0.44, -0.20). Respondents who did not undertake shift work had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.32, 95%CI 0.20, 0.44). The R^2 for this model was 0.019.

Respondents where the head of household was in social group A had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.49, 95%CI 0.25, 0.74). Respondents where the head of household was in social group C2 or D had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.30, 95%CI -0.45, -0.14; β=-0.24, 95%CI -0.43, -0.05). The R^2 for this model was 0.012.

Respondents without hearing problems had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.40, 95%CI 0.25, 0.54). Respondents with hearing problems had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.40, 95%CI -0.54, -0.25). The R^2 for this model was 0.010.

Univariable linear regression for sensitivity to noise for sociodemographic factors.			
	Sensitivity To Noise		
	Mean	**Coefficient**	**95% CI**
SOCIODEMOGRAPHIC FACTORS			
Age (H12) (N=2734)			**R^2=0.019**
16-19	3.24	-0.46**	-0.76, -0.16
20-24	3.34	-0.36**	-0.61, -0.11
25-34	3.49	-0.21*	-0.40, -0.02
35-44	3.83	0.13	-0.04, 0.30
45-54	4.07	0.37***	0.21, 0.53
55-64	4.03	0.33***	0.17, 0.49
65-74	3.95	0.25**	0.07, 0.42
75+	3.66	-0.04	-0.25, 0.16
Gender (H13) (N=2736)			**R^2=0.007**
Male	3.66	-0.16***	-0.23, -0.09
Female	3.97	0.16***	0.09, 0.23
Home ownership (H6) (N=2736)			**R^2=0.006**
Being bought on a mortgage	3.88	0.22**	0.07, 0.38
Owned outright by household	3.90	0.25**	0.09, 0.40
Rented from local authority or from housing association	3.66	-0.00	-0.21, 0.21
Rented from private landlord	3.56	-0.10	-0.30, 0.10
Other	3.29	-0.37	-0.81, 0.08
Any children aged 0-17 (H14) (N=2736)			**R^2=0.002**
No	3.85	0.13*	0.03, 0.24
Yes	3.58	-0.13*	-0.24, -0.03
Employment status (H15) (N=2734)			**R^2=0.008**
Working FT	3.69	-0.20**	-0.34, -0.06
Working PT	4.09	0.19*	0.00, 0.38
Unemployed	3.88	-0.02	-0.36, 0.32
Retired	3.82	-0.08	-0.23, 0.07
FT Education	3.54	-0.36**	-0.61, -0.11
Home maker	4.03	0.14	-0.13, 0.40
Other	4.23	0.33	-0.03, 0.70
Work at home (H15a) (N=1435)			**R^2=0.014**
No	3.65	-0.23***	-0.33, -0.13
Sometimes work at home	4.11	0.23***	0.13, 0.33
Shift work (H16) (N=1435)			**R^2=0.019**
No	3.91	0.32***	0.20, 0.44
Yes	3.27	-0.32***	-0.44, 0.20
Social group of head of household (H17) (N=2736)			**R^2=0.012**
A	4.35	0.49***	0.25, 0.74
B	3.99	0.13	-0.01, 0.27
C1	3.77	-0.08	-0.21, 0.05
C2	3.56	-0.30***	-0.45, -0.14
D	3.61	-0.24*	-0.43, -0.05
E	3.85	-0.01	-0.21, 0.20
Interviewer rating of respondent having hearing problem (I01) (N=2732)			**R^2=0.010**
No	3.86	0.40***	0.25, 0.54
Yes – quite a bit or only a bit	3.07	-0.40***	-0.54, -0.25

Table 43: Univariable linear regressions for sociodemographic factors with noise sensitivity

Table 44 shows the results of the multivariable linear regression model, which included all of the sociodemographic variables that showed a significant association with noise sensitivity in the univariable analyses (Table 43). The following sociodemographic factors were statistically significantly associated with noise sensitivity scores in the multivariable model: age; gender, homeownership, children, employment status, social group, and interviewer rating of hearing problems. The R^2 for this multivariable model was 0.057.

Respondents aged 45-54 years, 55-64 years, and 65-74 years had higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.30, 95%CI 0.12, 0.48; β=0.33, 95%CI 0.15, 0.51; β=0.42, 95%CI 0.17, 0.67, respectively). Respondents aged 16-19 and 20-24 years had lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.86, 95%CI -1.26, -0.46; β=-0.48, 95%CI -0.77, -0.19, respectively).

Males had lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.14, 95%CI -0.21,-0.06). Females had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.14, 95%CI 0.06, 0.21).

Respondents who bought their house on a mortgage had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.18, 95%CI 0.02, 0.35).

Respondents who had children under 17 years in the household had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.16, 95%CI -0.28, -0.04). Respondents who did not have children under 17 years of age in the household had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.16, 95%CI 0.04, 0.28).

Respondents in full time work and who were retired had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.30, 95%CI -0.47, -0.14 and β=-0.37, 95%CI -0.61, -0.12, respectively). Working at home and shift work were not included in the multivariate model due to collinearity with employment and sample size reduction.

Respondents where the head of household was in social group A had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.45, 95%CI 0.21, 0.70). Respondents where the head of household was in social group C2 or D had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.24, 95%CI -0.40, -0.09; β=-0.21, 95%CI -0.40, -0.02).

Respondents without hearing problems had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.41, 95%CI 0.26, 0.57). Respondents with hearing problems had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.41, 95%CI -0.57, -0.26).

Multivariable linear regression for sensitivity to noise for sociodemographic factors.		
(N=2727)	**Sensitivity To Noise**	
	Coefficient	**95% CI**
Age (H12)		
16-19	-0.86***	-1.26, -0.46
20-24	-0.48***	-0.77, -0.19
25-34	-0.18	-0.40, 0.05
35-44	0.17	-0.04, 0.38
45-54	0.30***	0.12, 0.48
55-64	0.33***	0.15, 0.51
65-74	0.42***	0.17, 0.67
75+	0.29	-0.00, 0.59
Gender (H13)		
Male	-0.14***	-0.21, -0.06
Female	0.14***	0.06, 0.21
Home ownership (H6)		
Being bought on a mortgage	0.18*	0.02, 0.35
Owned outright by household	0.10	-0.08, 0.27
Rented from local authority or from housing association	-0.02	-0.24, 0.20
Rented from private landlord	0.00	-0.21, 0.21
Other	-0.26	-0.70, 0.18
Any children aged 0-17 (H14)		
No	0.16**	0.04, 0.28
Yes	-0.16**	-0.28, -0.04
Employment status (H15)		
Working FT	-0.30***	-0.47, -0.14
Working PT	0.01	-0.19, 0.21
Unemployed	0.06	-0.28, 0.41
Retired	-0.37**	-0.61, -0.12
FT Education	0.35	-0.02, 0.71
Home maker	0.04	-0.24, 0.31
Other	0.21	-0.17, 0.59
Work at home (H15a)	Not included	
Shift work (H16)	Not included	
Social group of head of household (H17)		
A	0.45***	0.21, 0.70
B	0.11	-0.04, 0.25
C1	-0.08	-0.22, 0.05
C2	-0.24**	-0.40, -0.09
D	-0.21*	-0.40, -0.02
E	-0.02	-0.26, 0.21
Interviewer rating of respondent having hearing problem (I01)		
No	0.41***	0.26, 0.57
Yes – quite a bit or only a bit	-0.41***	-0.57, -0.26
		$R^{2\ \text{for model}}$=0.057

Table 44: Multivariable linear regression of the sociodemographic factors associated with noise sensitivity

5.3.2 Dwelling Factors

Table 45 shows the results of the univariable linear regression analyses for each of the dwelling factors with noise sensitivity. The following dwelling factors were statistically significantly associated with noise sensitivity scores: age of house; length of time living in home; and type of house.

Respondents living in homes built between 1919-1940 had lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.24, 95%CI -0.43, -0.06). The R^2 for this model was 0.006.

Respondents who had been living in their home for less than 6 months had lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.31, 95%CI -0.59, -0.04). Respondents who had been living in their home for 5 years but less than 10 years had higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.17, 95%CI 0.01, 0.34). The R^2 for this model was 0.004.

Respondents living in a detached house had higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.28, 95%CI 0.09, 0.48). The R^2 for this model was 0.007.

Univariable linear regression for sensitivity to noise for dwelling factors.			
	Sensitivity To Noise		
	Mean	**Coefficient**	**95% CI**
DWELLING FACTORS			
Double glazing in the home (H01) (N=2736)			**R^2=0.001**
All	3.83	0.06	-0.07, 0.19
Some	3.84	0.08	-0.10, 0.25
None	3.63	-0.14	-0.34, 0.07
Age of house (H04 + H05) (N=2736)			**R^2=0.006**
Before 1919	3.84	0.17	-0.01, 0.35
1919-1940	3.94	-0.24*	-0.43, -0.06
1941-1960	3.52	0.12	-0.04, 0.28
1961-1990	3.88	0.07	-0.11, 0.25
1991-2000	3.86	0.09	-0.16, 0.34
2001-2012	3.74	-0.03	-0.29, 0.24
Don't know	3.58	-0.18	-0.75, 0.39
How long have you lived in this home? (A11) (N=2736)			**R^2=0.004**
Less than 6 months	3.43	-0.31*	-0.59, -0.04
6 months but less than 1 year	3.78	0.04	-0.22, 0.30
1 year but less than 2 years	3.59	-0.15	-0.40, 0.10
2 years but less than 5 years	3.92	0.18	-0.01, 0.36
5 years but less than 10 years	3.92	0.17*	0.01, 0.34
10 years or more	3.82	0.07	-0.05, 0.20
Type of house (A13) (N=2736)			**R^2=0.007**
Purpose built flat/maisonette	3.78	-0.00	-0.28, 0.28
Converted flat/maisonette	3.81	0.03	-0.41, 0.47
Semi-detached/end of terrace house	3.72	-0.06	-0.24, 0.12
Mid terrace house	3.70	-0.08	-0.29, 0.14
Detached house	4.06	0.28**	0.09, 0.48
Bungalow	3.69	-0.09	-0.34, 0.17

Other	3.69	-0.09	-0.83, 0.65
Access to garden or other private outdoor space (A12) (N=2736)			**R^2=0.000**
No	3.71	-0.06	-0.23, 0.12
Yes	3.82	0.06	-0.12, 0.23
While you were in the home or immediately outside it, was there noticeable noise from outside the home from (I02)			
road traffic (N=2736)			**R^2=0.000**
No	3.79	-0.05	-0.14, 0.04
Yes	3.89	0.05	-0.04, 0.14
neighbours or other people nearby (N=2736)			**R^2=0.000**
No	3.82	0.02	-0.20, 0.24
Yes	3.77	-0.02	-0.24, 0.20
aircraft, airports or airfields (N=2736)			**R^2=0.000**
No	3.81	-0.05	-0.22, 0.12
Yes	3.91	0.05	-0.12, 0.22
trains or railway stations (N=2736)			**R^2=0.000**
No	3.81	-0.09	-0.43, 0.24
Yes	4.00	0.09	-0.24, 0.43

Table 45: Univariable linear regressions for dwelling factors with noise sensitivity

Table 46 shows the results of the multivariable linear regression model, which included all of the dwelling variables that showed a significant association with noise sensitivity in the univariable analyses (Table 45). The following dwelling factors were statistically significantly associated with noise sensitivity scores in the multivariable model: age of house; length of time living in home; and type of house. The R^2 for this multivariable model was 0.016.

Respondents living in homes built between 1919-1940 had lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.20, 95%CI -0.39, -0.01). Respondents living in homes built before 1919 had higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.20, 95%CI 0.02, 0.38).

Respondents who had been living in their home for less than 6 months had lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.33, 95%CI -0.61, -0.05).

Respondents living in a detached house had higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.26, 95%CI 0.07, 0.46).

Multivariable linear regression for sensitivity to noise for dwelling factors.		
(N=2735)	**Sensitivity To Noise**	
	Coefficient	**95% CI**
DWELLING FACTORS		
Age of house (H04 + H05)		
Before 1919	0.20*	0.02, 0.38
1919-1940	-0.20*	-0.39, -0.01
1941-1960	0.09	-0.07, 0.25
1961-1990	0.08	-0.11, 0.27
1991-2000	-0.03	-0.28, 0.23
2001-2012	-0.09	-0.36, 0.18
Don't know	-0.05	-0.63, 0.52
How long have you lived in this home? (A11)		
Less than 6 months	-0.33*	-0.61, -0.05
6 months but less than 1 year	0.10	-0.16, 0.36
1 year but less than 2 years	-0.13	-0.38, 0.11
2 years but less than 5 years	0.18	-0.00, 0.37
5 years but less than 10 years	0.14	-0.03, 0.31
10 years or more	0.04	-0.09, 0.17
Type of house (A13)		
Purpose built flat/maisonette	0.01	-0.28, 0.29
Converted flat/maisonette	0.06	-0.39, 0.52
Semi-detached/end of terrace house	-0.09	-0.28, 0.09
Mid terrace house	-0.10	-0.32, 0.12
Detached house	0.26**	0.07, 0.46
Bungalow	-0.10	-0.36, 0.16
Other	-0.04	-0.79, 0.71
		$R^{2\ \text{for model}}$=0.016

Table 46: Multivariable linear regression of the dwelling factors associated with noise sensitivity

5.3.3 Geographic factors

Table 47 shows the univariable regression analyses showing the associations between the geographic factors and noise sensitivity. There was no significant difference in noise sensitivity scores for the location of the dwelling or for the urbanicity variable. There was a difference for region: respondents from England had higher noise sensitivity scores compared to the unweighted mean score for the sample (β=0.19, 95%CI 0.04, 0.35). As region was the only geographic factor to show a significant association with noise sensitivity scores, no multivariable model was run containing the geographic factors.

Univariable linear regression for sensitivity to noise for geographic factors.			
	Sensitivity To Noise		
	Mean	**Coefficient**	**95% CI**
GEOGRAPHIC FACTORS			
Region (N=2736)			**R^2=0.003**
England	3.86	0.19*	0.04, 0.35
Wales	3.63	-0.04	-0.28, 0.20
Scotland	3.46	-0.21	-0.46, 0.04
Northern Ireland	3.72	0.05	-0.27, 0.38
I4 Is the dwelling located in? (N=2734)			**R^2=0.003**
The centre of a large city	3.81	0.02	-0.12, 0.16
Suburbs/outskirts of a large city	3.71	-0.09	-0.44, 0.26
A large town or small city	3.92	0.13	-0.02, 0.28
In a country village/small town	3.64	-0.16	-0.33, 0.01
In the countryside	3.90	0.10	-0.15, 0.35
Urbanicity (LA Rating) (N=2303)			**R^2=0.001**
Rural	3.91	0.09	-0.03, 0.21
Semi-rural	3.70	-0.12	-0.28, 0.04
Urban	3.86	0.03	-0.08, 0.14

Table 47: Univariable linear regressions for geographic factors with noise sensitivity

5.3.4 Noise Annoyance

Table 48 shows the univariable regression analyses for aircraft, road noise, neighbourhood noise, train or railway station noise, and entertainment noise annoyance with noise sensitivity.

Respondents reporting being moderately, very or extremely annoyed by aircraft noise had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.30, 95%CI 0.20, 0.40). Respondents reporting being not at all or a little annoyed by aircraft noise had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.30, 95%CI -0.40, -0.20). The R^2 for this multivariable model was 0.012.

Respondents reporting being moderately, very or extremely annoyed by road noise had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.23, 95%CI 0.15, 0.31). Respondents reporting being not at all or a little annoyed by road noise had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.23, 95%CI -0.31, -0.15). The R^2 for this multivariable model was 0.012.

Respondents reporting being moderately, very or extremely annoyed by neighbourhood noise had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.37, 95%CI 0.29, 0.45). Respondents reporting being not at all or a little annoyed by neighbourhood noise had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.37, 95%CI -0.45, -0.29). The R^2 for this model was 0.030.

Train or railway station noise annoyance and entertainment noise annoyance were not significantly associated with noise sensitivity.

Univariable linear regression for sensitivity to noise for noise annoyance factors.			
	Sensitivity To Noise		
	Mean	**Coefficient**	**95% CI**
NOISE ANNOYANCE FACTORS			
Aircraft noise (N=2736)			**R^2=0.012**
Not at all and a little	3.73	-0.30***	-0.40, -0.20
Moderately, very and extremely	4.33	0.30***	0.20, 0.40
Road noise (N=2736)			**R^2=0.012**
Not at all and a little	3.70	-0.23***	-0.31, -0.15
Moderately, very and extremely	4.16	0.23***	0.15, 0.31
Neighbourhood noise (all) (N=2736)			**R^2=0.030**
Not at all and a little	3.62	-0.37***	-0.45, -0.29
Moderately, very and extremely	4.37	0.37***	0.29, 0.45
Train or railway station noise (N=2736)			**R^2=0.000**
Not at all and a little	3.81	-0.03	-0.28, 0.22
Moderately, very and extremely	3.88	0.03	-0.22, 0.28
Entertainment Noise (N=2734)			**R^2=0.001**
Not at all and a little	3.80	-0.17	-0.36, 0.03
Moderately, very and extremely	4.13	0.17	-0.03, 0.36

Table 48: Univariable linear regressions for noise annoyance factors with noise sensitivity

5.3.5 Final Multivariable Models

Table 49 shows the results of the multivariable linear regression models, which included all the statistically significant variables from the multivariable sociodemographic (Table 44) and dwelling (Table 46) analyses, as well as the only significant geographic variable – region. None of the dwelling factors remained significantly associated with noise sensitivity after adjustment for the sociodemographic and geographic factors. The following factors were associated with noise sensitivity in the model: age; gender; home ownership; children; employment status; social group; hearing problems; and region. The R^2 for this multivariable model was 0.070.

Respondents aged 45-54 years, 55-64 years, 65-74 years, and 75 years or older had higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.28, 95%CI 0.10, 0.47; β=0.34, 95%CI 0.16, 0.52; β=0.44, 95%CI 0.18, 0.69; β=0.34, 95%CI 0.04, 0.65 respectively). Respondents aged 16-19 and 20-24 years had lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.89, 95%CI -1.28, -0.49; β=-0.48, 95%CI -0.77,-0.19, respectively).

Males had lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.15, 95%CI -0.22,-0.07). Females had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.15, 95%CI 0.07, 0.22).

Respondents who are buying their house on a mortgage had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.18, 95%CI 0.01, 0.36).

Respondents who had children under 17 years of age in the household had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.16, 95%CI -0.28, -0.04). Respondents who did not have children under 17 years of age in the household had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.16, 95%CI 0.04, 0.28).
Respondents who were working full-time or who were retired had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.30, 95%CI -0.47, -0.14; β=-0.37, 95%CI -0.61, -0.12, respectively). Respondents who were in full-time education had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.37, 95%CI 0.00, 0.74).

Respondents where the head of household was in social group A had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.37, 95%CI 0.12, 0.62). Respondents where the head of household was in social group C2 had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.20, 95%CI -0.36, -0.40).

Respondents without hearing problems had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.41, 95%CI 0.26, 0.57). Respondents with hearing problems had significantly lower noise sensitivity scores compared to the unweighted grand mean for the sample (β=-0.41, 95%CI -0.57, -0.26).
Respondents living in England had significantly higher noise sensitivity scores compared to the unweighted grand mean for the sample (β=0.18, 95%CI 0.02, 0.33).

Multivariable linear regression for sensitivity to noise for sociodemographic, dwelling and geographic factors.		
(N=2728	**Sensitivity To Noise**	
	Coefficient	**95% CI**
Age (H12)		
16-19	-0.89***	-1.28, -0.49
20-24	-0.48***	-0.77, -0.19
25-34	-0.19	-0.42, 0.04
35-44	0.15	-0.07, 0.36
45-54	0.28**	0.10, 0.47
55-64	0.34***	0.16, 0.52
65-74	0.44***	0.18, 0.69
75+	0.34*	0.04, 0.65
Gender (H13)		
Male	-0.15***	-0.22, -0.07
Female	0.15***	0.07, 0.22
Home ownership (H6)		
Being bought on a mortgage	0.18*	0.01, 0.36
Owned outright by household	0.13	-0.05, 0.32
Rented from local authority/housing association	0.02	-0.21, 0.25
Rented from private landlord	-0.04	-0.27, 0.19
Other	-0.29	-0.74, 0.15
Any children aged 0-17 (H14)		
No	0.16**	0.04, 0.28

Yes	-0.16**	-0.28, -0.04
Employment status (H15)		
Working FT	-0.30***	-0.47, -0.14
Working PT	-0.01	-0.21, 0.20
Unemployed	0.10	-0.25, 0.44
Retired	-0.37**	-0.61, -0.12
FT Education	0.37*	0.00, 0.74
Home maker	0.01	-0.27, 0.28
Other	0.20	-0.18, 0.58
Social group of head of household (H17)		
A	0.37**	0.12, 0.62
B	0.07	-0.08, 0.22
C1	-0.08	-0.22, 0.06
C2	-0.20*	-0.36, -0.40
D	-0.16	-0.36, 0.03
E	0.01	-0.24, 0.25
Interviewer rating of respondent having hearing problem (I01)		
No	0.41***	0.26, 0.57
Yes – quite a bit or only a bit	-0.41***	-0.57, -0.26
DWELLING FACTORS		
Age of house (H04 + H05)		
Before 1919	0.15	-0.03, 0.33
1919-1940	-0.16	-0.35, 0.03
1941-1960	0.10	-0.07, 0.26
1961-1990	0.01	-0.18, 0.20
1991-2000	0.04	-0.21, 0.29
2001-2012	-0.04	-0.31, 0.23
Don't know	-0.09	-0.66, 0.48
How long have you lived in this home? (A11)		
Less than 6 months	-0.25	-0.54, 0.04
6 months but less than 1 year	0.20	-0.07, 0.46
1 year but less than 2 years	-0.01	-0.26, 0.24
2 years but less than 5 years	0.14	-0.04, 0.33
5 years but less than 10 years	0.03	-0.16, 0.21
10 years or more	-0.11	-0.27, 0.05
Type of house (A13)		
Purpose built flat/maisonette	0.06	-0.24, 0.35
Converted flat/maisonette	0.25	-0.20, 0.70
Semi-detached/end of terrace house	-0.15	-0.33, 0.04
Mid terrace house	-0.09	-0.31, 0.12
Detached house	0.12	-0.08, 0.33
Bungalow	-0.25	-0.52, 0.02
Other	0.06	-0.69, 0.80
GEOGRAPHIC FACTORS		
Region		
England	0.18*	0.02, 0.33
Wales	-0.06	-0.30, 0.18
Scotland	-0.15	-0.41, 0.10
Northern Ireland	0.03	-0.30, 0.37
		$R^{2\ for\ model}$=0.070

Table 49: Multivariable model for sociodemographic, dwelling and geographic factors with noise sensitivity

The following tables show the full multivariable model in Table 49 additionally adjusted for i) road noise annoyance, ii) neighbour noise, and iii) aircraft noise annoyance. The model was not additionally adjusted for train or railway station noise annoyance or entertainment noise annoyance as these variables were not associated with noise sensitivity in the univariable analyses.

Table 50 shows that additionally adjusting the multivariable sociodemographic, dwelling and geographic model for road noise annoyance resulted in the coefficients for age, gender, home ownership, children, employment status, social group, hearing problems and region remaining largely unchanged, with a couple of exceptions. The result for social group gained an additional significant association, with social group D being associated with lower noise sensitivity compared to the unweighted group mean for the sample (β=-0.21, 95%CI -0.40, -0.02). The association between being in full-time education and lower noise sensitivity scores became non-significant, as did the association between living in England and lower noise sensitivity scores. These changes reflect road traffic annoyance having an impact upon findings that were borderline significant in the preceding model. Being moderately, very or extremely annoyed by road traffic noise was associated with higher noise sensitivity scores compared to the unweighted group mean for the sample (β=0.23, 95%CI 0.15, 0.31). Being not at all or a little annoyed by road traffic noise was associated with lower noise sensitivity scores compared to the unweighted group mean for the sample (β=-0.23, 95%CI -0.31, -0.15). The R^2 for this multivariable model was 0.070.

Multivariable linear regression for sensitivity to noise for sociodemographic, dwelling, geographic factors and road noise annoyance.		
(N=2728)	**Sensitivity To Noise**	
	Coefficient	**95% CI**
Age (H12)		
16-19	-0.82***	-1.22, -0.42
20-24	-0.49***	-0.77, -0.20
25-34	-0.17	-0.40, 0.05
35-44	0.16	-0.05, 0.36
45-54	0.28**	0.10, 0.46
55-64	0.31***	0.14, 0.49
65-74	0.40**	0.15, 0.65
75+	0.33*	0.04, 0.63
Gender (H13)		
Male	-0.14***	-0.21, -0.06
Female	0.14***	0.06, 0.21
Home ownership (H6)		
Being bought on a mortgage	0.19*	0.03, 0.36
Owned outright by household	0.11	-0.07, 0.29
Rented from local authority /housing association	0.01	-0.21, 0.23
Rented from private landlord	-0.01	-0.22, 0.20
Other	-0.31	-0.74, 0.13
Any children aged 0-17 (H14)		
No	0.17**	0.05, 0.29
Yes	-0.17**	-0.29, -0.05
Employment status (H15)		

Working FT	-0.31***	-0.47, -0.15
Working PT	0.02	-0.18, 0.22
Unemployed	0.09	-0.26, 0.43
Retired	-0.36**	-0.60, -0.12
FT Education	0.32	-0.04, 0.69
Home maker	0.03	-0.24, 0.31
Other	0.20	-0.17, 0.58
Social group of head of household (H17)		
A	0.44***	0.19, 0.68
B	0.10	-0.05, 0.24
C1	-0.08	-0.22, 0.06
C2	-0.22**	-0.38, -0.07
D	-0.21*	-0.40, -0.02
E	-0.02	-0.26, 0.22
Interviewer rating of respondent having hearing problem (I01)		
No	0.41***	0.26, 0.56
Yes – quite a bit or only a bit	-0.41***	-0.56, -0.26
GEOGRAPHIC FACTORS		
Region		
England	0.12	-0.03, 0.27
Wales	-0.02	-0.26, 0.22
Scotland	-0.17	-0.42, 0.08
Northern Ireland	0.07	-0.26, 0.40
NOISE ANNOYANCE FACTORS		
Road Noise		
Not at all and a little	-0.23***	-0.31, -0.15
Moderately, very and Extremely	0.23***	0.15, 0.31
		$R^{2\ for\ model}$=0.070

Table 50: Multivariable model for significant sociodemographic, dwelling, & geographic factors and road noise annoyance with noise sensitivity

Table 51 shows that additionally adjusting the multivariable sociodemographic, dwelling and geographic model for neighbour noise annoyance resulted in the coefficients for age, gender, home ownership, children, employment status, social group, and hearing problems remaining largely unchanged with a couple of exceptions. The result for social group gained an additional significant association, with social group D being associated with lower noise sensitivity compared to the unweighted group mean for the sample (β=-0.23, 95%CI -0.42, -0.04). The association between being in full-time education and lower noise sensitivity scores became non-significant, as did the association between living in England and lower noise sensitivity scores. These changes reflect neighbour noise annoyance having an impact upon findings that were borderline significant in the preceding model. Being moderately, very or extremely annoyed by neighbour noise was associated with higher noise sensitivity scores compared to the unweighted group mean for the sample (β=0.39, 95%CI 0.31, 0.46). Being not at all or a little annoyed by neighbour noise was associated with lower noise sensitivity scores compared to the unweighted group mean for the sample (β=-0.39, 95%CI -0.46, -0.31). The R^2 for this multivariable model was 0.090.

Multivariable linear regression for sensitivity to noise for sociodemographic, dwelling, geographic factors and neighbour noise annoyance.		
(N=2728)	**Sensitivity To Noise**	
	Coefficient	**95% CI**
Age (H12)		
16-19	-0.83***	-1.22, -0.44
20-24	-0.50***	-0.78, -0.22
25-34	-0.22	-0.44, 0.00
35-44	0.16	-0.05, 0.37
45-54	0.29**	0.11, 0.47
55-64	0.33***	0.15, 0.51
65-74	0.40***	0.16, 0.65
75+	0.37*	0.08, 0.66
Gender (H13)		
Male	-0.12***	-0.19, -0.05
Female	0.12***	0.05, 0.19
Home ownership (H6)		
Being bought on a mortgage	0.19*	0.03, 0.36
Owned outright by household	0.14	-0.04, 0.31
Rented from local authority /housing association	-0.08	-0.29, 0.14
Rented from private landlord	0.00	-0.20, 0.21
Other	-0.26	-0.69, 0.18
Any children aged 0-17 (H14)		
No	0.17**	0.05, 0.28
Yes	-0.17**	-0.28, -0.05
Employment status (H15)		
Working FT	-0.32***	-0.48, -0.16
Working PT	0.02	-0.18, 0.22
Unemployed	0.12	-0.22, 0.46
Retired	-0.34**	-0.58, -0.10
FT Education	0.25	-0.11, 0.61
Home maker	0.06	-0.21, 0.33
Other	0.21	-0.16, 0.58
Social group of head of household (H17)		
A	0.42***	0.18, 0.66
B	0.10	-0.04, 0.25
C1	-0.07	-0.20, 0.07
C2	-0.21**	-0.37, -0.06
D	-0.23*	-0.42, -0.04
E	-0.02	-0.25, 0.22
Interviewer rating of respondent having hearing problem (I01)		
No	0.41***	0.26, 0.56
Yes – quite a bit or only a bit	-0.41***	-0.56, -0.26
GEOGRAPHIC FACTORS		
Region		
England	0.10	-0.05, 0.25
Wales	-0.08	-0.31, 0.16
Scotland	-0.16	-0.40, 0.09
Northern Ireland	0.14	-0.19, 0.46

NOISE ANNOYANCE FACTORS		
Neighbour Noise		
Not at all and a little	-0.39***	-0.46, -0.31
Moderately, very and Extremely	0.39***	0.31, 0.46
		$R^{2\ for\ model}$=0.090

Table 51: Multivariable model for significant sociodemographic, dwelling & geographic factors and neighbour noise annoyance with noise sensitivity

Table 52 shows that additionally adjusting the multivariable sociodemographic, dwelling and geographic model for aircraft annoyance resulted in the coefficients for age, gender, home ownership, children, employment status, social group, and hearing problems remaining largely unchanged, with a couple of exceptions. The associations of being in full-time education, being aged 75 years or older, and living in England with noise sensitivity scores became non-significant. These changes reflect aircraft traffic annoyance having an impact upon findings that were borderline significant in the preceding model. Being moderately, very or extremely annoyed by aircraft noise was associated with higher noise sensitivity scores compared to the unweighted group mean for the sample (β=0.24, 95%CI 0.14, 0.35). Being not at all or a little annoyed by aircraft noise was associated with lower noise sensitivity scores compared to the unweighted group mean for the sample (β=-0.24, 95%CI -0.35, -0.14). The R^2 for this multivariable model was 0.066.

Multivariable linear regression for sensitivity to noise for sociodemographic, dwelling, geographic factors and aircraft noise annoyance.		
(N=2728)	**Sensitivity To Noise**	
	Coefficient	**95% CI**
Age (H12)		
16-19	-0.84***	-1.24, -0.44
20-24	-0.47***	-0.76, -0.18
25-34	-0.15	-0.37, 0.08
35-44	0.17	-0.03, 0.38
45-54	0.28**	0.10, 0.46
55-64	0.31***	0.13, 0.49
65-74	0.42***	0.17, 0.67
75+	0.28	-0.02, 0.57
Gender (H13)		
Male	-0.14***	-0.21, -0.07
Female	0.14***	0.07, 0.21
Home ownership (H6)		
Being bought on a mortgage	0.17*	0.00, 0.33
Owned outright by household	0.10	-0.08, 0.28
Rented from local authority /housing association	0.00	-0.22, 0.22
Rented from private landlord	-0.00	-0.21, 0.21
Other	-0.27	-0.71, 0.17
Any children aged 0-17 (H14)		
No	0.17**	0.05, 0.28
Yes	-0.17**	-0.28, -0.05
Employment status (H15)		
Working FT	-0.30***	-0.46, -0.14
Working PT	0.01	-0.19, 0.21
Unemployed	0.02	-0.32, 0.37
Retired	-0.35**	-0.60, -0.11
FT Education	0.34	-0.03, 0.70
Home maker	0.01	-0.27, 0.28
Other	0.27	-0.11, 0.65
Social group of head of household (H17)		
A	0.40***	0.15, 0.65
B	0.07	-0.07, 0.22
C1	-0.08	-0.22, 0.06
C2	-0.22**	-0.37, -0.06
D	-0.18	-0.37, 0.01
E	0.00	-0.24, 0.24
Interviewer rating of respondent having hearing problem (I01)		
No	0.41***	0.25, 0.56
Yes – quite a bit or only a bit	-0.41***	-0.56, -0.25
GEOGRAPHIC FACTORS		
Region		
England	0.11	-0.04, 0.27
Wales	-0.06	-0.29, 0.18
Scotland	-0.13	-0.38, 0.12
Northern Ireland	0.07	-0.26, 0.40
NOISE ANNOYANCE FACTORS		

Aircraft Noise		
Not at all and a little	-0.24***	-0.35, -0.14
Moderately, very and extremely	0.24***	0.14, 0.35
		$R^{2\ for\ model}$=0.066

Table 52: Multivariable model for significant sociodemographic, dwelling & geographic factors and aircraft noise annoyance with noise sensitivity

5.4 Discussion

This section has examined which groups of the population report being the most and least noise sensitive, as well as the associations between noise sensitivity and noise annoyance. The analyses suggest that certain sub-groups of the population may be more or less noise sensitive compared with the UK population as a whole. However, in considering the findings, it should be remembered that the data in NNAS2012 are all cross-sectional and that causal relationships between noise sensitivity and annoyance, or between different types of individual characteristics and noise sensitivity cannot be inferred.

In this general population sample, a range of noise sensitivities were reported by the respondents, as shown by the median score of 4 on the 7-point noise sensitivity scale. This indicates that within the UK population a range of sensitivity to noise is observed. This study made use of a one-item measure of noise sensitivity 'How sensitive would you say you were to noise', scored on a 7-point scale. In consider the findings of this report, it is important to acknowledge that the question used for this study may influence the findings. A more robust multi-item noise sensitivity scale may provide a more accurate assessment of an individual's noise sensitivity.

Overall, noise sensitivity showed more consistent associations with sociodemographic factors than with dwelling or geographic factors. This might be expected, as noise sensitivity is defined as an individual-level factor making it perhaps less likely to be influenced by dwelling or geographical influences and more likely to be influenced by sociodemographic factors at the individual level such as age and gender.

Considered individually several sociodemographic factors were significantly associated with noise sensitivity: age; gender, homeownership, children, employment status, working at home, shift work, social group, and interviewer rating of hearing problems. These factors remained associated with noise sensitivity scores, after taking other statistically significant sociodemographic, dwelling, and geographic factors into account, as well as noise annoyance.

Older respondents (aged mid-forties and upwards) had higher noise sensitivity scores, whilst younger respondents (aged 16-24 years) had lower noise sensitivity. There was also a significant gender difference in noise sensitivity, with males having lower noise sensitivity scores and females having higher noise sensitivity scores. These findings suggest that within the population, younger respondents and male respondents may be less sensitive to environmental noise exposure than older respondents and female respondents.

Respondents who were buying their house on a mortgage had significantly higher noise sensitivity scores, even after controlling for other factors, such as age, which might explain the association as respondents in certain age groups are more likely to have a mortgage. This finding seems specific to respondents buying their home with a mortgage, rather than home ownership per se, as respondents who owned their home outright did not have

significantly higher noise sensitivity scores. Attitudes that might explain the association between being a mortgagee and noise sensitivity could be explored in future academic studies.

Respondents who had children under 17 years of age living in the household had significantly lower noise sensitivity scores and respondents without children under 17 years of age in the household had significantly higher noise sensitivity scores. These findings might be explained by higher internal noise exposure within houses with children under 17 years of age, associated with activities within the home and more residents per se, making respondents less sensitive to noise. It might also be the case that people who are less sensitive to noise are more tolerant of having children.

Respondents who were working full-time or who were retired had significantly lower noise sensitivity scores. This may reflect the fact that respondents who work full-time probably spend less time at home compared to the general population. It is unclear why retired respondents might be less noise sensitive: it may be due to changes in the auditory system due to aging, but is more likely to be explained by other attitudes and behaviour, as the association between retirement and noise sensitivity remained after taking hearing problems into account.

There was a social gradient in noise sensitivity, with noise sensitivity being higher in respondents with a head of household with social group (A) and lower in respondents where the head of household had social group C2 or D. Future academic research could examine what other individual or situational factors might explain this social gradient.

The results also suggest that hearing ability might be related to noise sensitivity: respondents without hearing problems had significantly higher noise sensitivity and respondents with hearing problems had significantly lower noise sensitivity scores.

When considered univariately, several dwelling factors were significantly associated with noise sensitivity scores: age of house; length of time living in home; and type of house. However, none of the dwelling factors remained significantly associated with noise sensitivity after adjustment for sociodemographic and geographic factors. The univariate associations between dwelling factors and noise sensitivity appear to be explained by the sociodemographic factors.

Noise sensitivity scores were significantly higher in England both before and after adjustment for the other sociodemographic and dwelling factors, however, this association did not remain after further adjustment for noise annoyance. Overall, geographic factors appear to have little relationship with noise sensitivity in the UK population.

Noise annoyance to various noise sources showed strong associations with noise sensitivity scores. Before and after adjustment for sociodemographic, dwelling and geographic factors, noise sensitivity scores were significantly higher for respondents reporting being moderately, very or extremely annoyed by road traffic noise, neighbour noise or aircraft noise and significantly lower for respondents being not at all or a little annoyed by road traffic noise, neighbour noise or aircraft noise. This cross-sectional dataset makes us unable to untangle the direction of causation between noise annoyance responses and noise sensitivity. We do not know whether noise sensitive individuals are more likely to report noise annoyance, or whether noise annoyed individuals are more likely to report noise sensitivity in our data. A previous study found that noise sensitivity moderated noise annoyance responses, with noise sensitive men more likely to be highly annoyed by road traffic than less noise sensitive men[1], but this study also relied upon

cross-sectional data. It is possible that the relationship might operate in both directions. Longitudinal data is required to determine the relationship between noise annoyance and noise sensitivity. Noise sensitivity was not significantly associated with train and railway station noise annoyance or entertainment noise annoyance: these findings need replicating in further datasets to determine whether noise sensitivity is specifically related to road traffic, neighbour and aircraft noise annoyance. It may be the case that the analyses lacked power to examine associations for train and railway station noise annoyance and entertainment noise annoyance, due to low exposure within our sample.

6 References

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