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1 **The impact of greenspace and condition of the neighborhood on child overweight**

2

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27 **Abstract**

28 **Background**

29 Childhood overweight/obesity has been associated with environmental, parenting and
30 socioeconomic status (SES) factors. This paper assesses the influence of the amount of
31 green space, accessibility to a garden and neighbourhood condition on being
32 overweight/obese. It investigates whether parental behaviours moderate or mediate this
33 influence and evaluates the interaction of SES with environmental context.

34 **Methods**

35 6467 children from the UK Millennium Cohort Study living in England were analysed. We
36 estimated logistic regressions to examine the initial association between environment and
37 overweight. Subsequently, parenting determinants comprising: food consumption, physical
38 activity, rules and regularity were evaluated as moderators or mediators. Lastly SES related
39 variables were tested as moderators or mediators of the associations.

40 **Results**

41 Statistically significant associations were found between low levels of green space, no
42 access to a garden, run down area and childhood overweight/obesity (odds ratio (OR) (95%
43 confidence interval (CI)) respectively: 1,14 (1,02-1,27), 1,35 (1,16-1,58), 1,22 (1,05-1,42)).

44 None of the parental constructs mediated or moderated the relationships between
45 environment and childhood overweight/obesity. Including SES, parental education
46 moderated the effect of environmental context. Specifically, among lower educated
47 households lack of garden access and less green space was associated with
48 overweight/obesity; and among higher educated households poor neighborhood condition
49 influenced the probability of overweight/obesity respectively: 1,38 (1,12-1,70) OR 1.38, 95%
50 CI 1.21-1.70).

51 **Conclusions**

52 This study suggests that limits on access to outdoor space are associated with future
53 childhood overweight/obesity although the ways in which this occurs are moderated by
54 parental education level.

55 Keywords: Environment, Socioeconomic Status, Green space, Childhood Obesity, Education
56 parenting

57

58

59 **Introduction**

60 The prevalence of overweight and obesity in children has increased dramatically over the last
61 two decades.¹ In England 9.9% of boys and 9.0% of girls aged 4-5 years and 20.8% of boys
62 and 17.3% of girls aged 10-11 years were classified as obese in 2013 according to the
63 British 1990 population monitoring definition of obesity (≥ 95 th centile) (NCMP 2013/14). This
64 has been considered as a major public health challenge, as overweight and obesity at a
65 young age have important short- and long-term health and social consequences.¹⁻⁶

66

67 The neighbourhoods in which children live, play and eat provide an important environmental
68 context that may influence obesity risk.^{7;8} Research has shown that publicly provided
69 recreational infrastructure is positively associated with children's physical activity.⁹ It
70 indicates that children and their parents tend to be more physically active in a conducive
71 environment.^{10;11} Other studies have found that a child's risk of being overweight or obese
72 was related to socioeconomic status (SES), as measured by household income and parents'
73 educational attainment.¹²⁻¹⁴ Many studies suggest that there is in fact a growing
74 socioeconomic status disparity of overweight and obesity prevalence in children. That is,
75 overweight in children is increasing faster in lower socioeconomic groups.¹⁵ Since children
76 with the lowest levels of health inequality were exposed to the greenest environment,¹⁶ this
77 may suggest an interaction between socioeconomic class and physical environment,
78 although this has not previously been researched in relation to child overweight. Besides
79 physical environment, other factors influencing child overweight or obesity include parenting
80 behaviours.¹⁷⁻²⁰

81

82 We hypothesize that environmental context influences the prevalence of overweight or
83 obesity in children and that environmental context and parenting behaviour are intimately
84 linked. Since more affluent parents tend to live in more salubrious areas, the effect of
85 environment may in part be driven by parental SES. At the same time, environmental context
86 may matter more for those otherwise able to take advantage of it. We therefore also

87 hypothesize that there might be an interaction between socioeconomic status and the
88 influence of environmental context on the prevalence of overweight or obesity in children.
89 Therefore the first aim of this study is to assess the influence of green space, access to a
90 garden and condition of the neighbourhood measured at ages 3-5 years on being
91 overweight/ obese at age 7. Second, we investigate whether parenting behaviours moderate
92 or mediate this influence . Lastly, we evaluate the interaction of socioeconomic status with
93 environmental context.

94

95 **Methods**

96 *Data Millennium Cohort Study*

97 We used the nationally representative UK Millennium Cohort Study (MCS)
98 (www.cls.ioe.ac.uk/mcs). The MCS is a prospective cohort of around 19,000 children born in
99 2000/2001 across the UK and first surveyed at the age of 9 months (sweep 1), with follow-
100 ups at ages 3, 5 and 7 years old (sweeps 2-4).²¹⁻²⁴ The MCS provides an opportunity to
101 simultaneously assess environmental and family factors for childhood obesity using an
102 ecological systems approach.²⁵

103 The MCS children were sampled from families eligible for (universal) Child Benefit. The MCS
104 employed a stratified clustered sample design to over-represent children living in
105 disadvantaged areas and from ethnic minority groups.²⁶ At all sweeps information was
106 collected through interviews with main respondents in the home (over 99% were natural
107 mothers), as well as their co-resident partners (mostly the children's father). A range of
108 health-related data have also been collected, including direct measures of height and weight.
109 The data include a wealth of information describing the social, economic and demographic
110 characteristics of the cohort members and their families. Data were accessed through the UK
111 Data Archive, University of Essex.²⁷ The MCS received ethical approval from the NHS Multi-
112 Centre Research Ethics Committees for all the sweeps.^{25;28}

113

114 In this study we restrict our sample to those children living in England at the time child weight
115 and the predictors were measured. We excluded families who had more than one child in the
116 cohort (n=186), where information was missing on whether the family moved between
117 contacts (n=980), where the level of green space changed between sweeps (1-3) (n=679), or
118 where the child had a missing height or weight (n=230). Some participants met more than
119 one exclusion criterion. Among the 8239 singleton infants who were living in England at the
120 first survey a total of 6467 (78%) children remained in England for the subsequent surveys
121 and participated at all subsequent survey sweeps up to the age 7 survey and provided full
122 data on the relevant variables. These children form our analytic sample.

123

124 *Outcome variables*

125 Figure 1 presents the research questions driving this study. The main outcome was
126 dichotomous: childhood overweight/obesity at age seven with normal weight as the reference
127 category. Children were weighed and measured, without shoes or outdoor clothing, by
128 trained interviewers. Weight was collected using Tanita HD-305 scales (Tanita UK Ltd.,
129 Middlesex, UK), and recorded in kilograms to one decimal place. Heights were measured
130 with the Leicester Height Measure Stadiometer (Seca Ltd., Birmingham, UK) and recorded to
131 the nearest millimetre.²⁹ Cole's international age and sex specific cut-offs for body mass
132 index (BMI, weight/height²) were used to classify children as overweight or obese.³⁰

133

134 *Neighbourhood determinants*

135 Three environmental variables (Figure 1: base model; RQ1) were measured at either the age
136 three or age five survey periods and used as proxies for environmental context; green space,
137 access to a garden and neighbourhood condition. We used "green space" as defined by the
138 Office for National Statistics and measured using the 2001 Generalized Land Use Database
139 (GLUD).³¹ The data are presented in thousands of square metres (1000 m²), to 2 decimal
140 places. Hence, the statistics are accurate to the nearest 10 m². GLUD defined
141 neighbourhood green space as the percentage of space within each Lower Level Super

142 Output Areas (LSOA: a small area geography defined by the Office for National Statistics),
143 which was green. LSOAs were then ranked from 1 (low)-10 (high) according to their
144 concentration of green space across the tenths of the distribution. The respective rank was
145 then linked to the LSOA where the children were living at age 5, based on their postcodes.
146 We further collapsed these tenths of green space into 3 levels: low 30%, middle 40% and
147 high 30% green space.

148 Second, at the age three survey (sweep 2), mothers were asked whether they had access to
149 a garden.

150 Third, also at the age three survey (sweep 2), prior to conducting the interview, the
151 interviewer carried out an observational assessment of the local neighbourhood. Interviewers
152 were asked to report on a number of features of the MCS child's street or immediate
153 neighbourhood comprising i) the general condition of buildings in the street, ii) whether there
154 were security blinds, iii) traffic calming measures, iv) the volume of traffic, v) whether there
155 were burnt-out cars on the street, vi) litter on the street or pavement, vii) dog mess on the
156 pavement, viii) graffiti on walls or public spaces, ix) evidence of vandalism, and x) arguing or
157 fighting in the street. The condition of the neighbourhood was measured as the sum scores
158 of these 10 questions. The range of total scores was then divided in four groups. The
159 complete description of the items, the response options and the scoring per answer are given
160 in Appendix 1.

161

162 *Parenting measures*

163 For research question 2 (Figure 1, RQ2a and b): do parenting behaviours mediate or
164 moderate the relationship between the environmental variables and childhood
165 overweight/obesity?, we used the interviews with the main carer conducted when the child
166 was around 5 years old. Standardised questions were asked about the choices parents
167 made in the upbringing of the child (and their siblings, if any). In total 13 questions were
168 judged to be potentially related to child BMI. These included behaviours such as physical
169 activity with the child, eating habits, rules and discipline. An overview of the items, the

170 response options and the scoring per answer are presented in Appendix 1. We initially tested
171 the contribution of each of the items individually before performing an exploratory factor
172 analysis on all the items to assess which items were correlated. Next the items that grouped
173 on a factor were tested with principle component analysis, with varimax rotation and
174 eigenvalue -1 cut off. Four parental constructs were identified: food construct (4 items),
175 physical activity construct (4 items), rules construct (2 items) and regularity construct (2
176 items). Note that, as Appendix 1 shows, the physical activity construct was not based on
177 direct but on reported measures of physical activity, which do not necessarily reflect intensity
178 of activity. After the principal component analysis it became evident that one item did not
179 correlate with any of the other questions: self-assessment of the level of competence as a
180 parent. We actually found it to be inversely correlated to questions of a more objective
181 nature. For this reason we chose to exclude this item.

182

183 *Socio economic status measures*

184 Research question 3 (Figure 1; RQ3) evaluates the interaction of SES with environmental
185 context and childhood overweight/obesity. The SES variables selected were, first,
186 educational qualifications as measured by the National Vocational Qualification (NVQ)
187 framework. The original NVQ had five levels but due to the limited number of postgraduate-
188 level educated parents we recoded it into four levels: Secondary school low grades;
189 secondary school high grades; vocational training, and undergraduate or postgraduate level
190 education. The highest NVQ level of the mother or father was used. Second, low income was
191 added as a dichotomous variable (measured as <60% median or >60% median).

192

193 *Statistical analysis*

194 Due to the design of the study, in which children living in disadvantaged areas and from
195 ethnic minority groups are over sampled, not all participants had an equal selection
196 probability.²⁶ To correct for this complex survey design, all analyses were performed using
197 Complex Sample Analysis.³² For the basic model (that is, evaluating the influence of

198 environmental variables on childhood overweight and obesity) logistic regression models
199 were estimated, with a minimum threshold for statistical significance of $p \leq 0.05$. To test if
200 parental choices moderate the raw model (figure 1; RQ 2a), interactions between the
201 environmental variables and each of the four parental constructs were tested. Moderation
202 was judged to be present if at least two of the three interaction variables had a p value ≤ 0.1 .
203 If moderation was identified the model would be adjusted accordingly. Mediation of the
204 parental influence on the model (figure 1; RQ 2b) was tested in two steps. The relationship
205 between the environmental variables and the possible mediator (i.e. parental construct) was
206 first tested using ordinal regression models. Then the parental construct was added to the
207 logistic regression model. If step 1 was significant ($p \leq 0.05$) and step 2 changed the original
208 odds ratio by 10% or more, then the parental construct would be considered to be a
209 mediating variable. The model would be adjusted accordingly.

210

211 The model derived from these sequential steps was then tested for moderation or mediation
212 of both SES related variables (family poverty and parental education) (figure 1; RQ 3) using
213 the same approach as for the parental constructs. All analyses were performed using SPSS
214 (Version 22, IBM Corp, Armonk, NY).

215

216 **Results**

217 According to the unweighted statistics, about half of the children were female (49.7%), nearly
218 one in five was overweight or obese (19.9%), and almost 90% had access to a garden. Due
219 to oversampling of deprived areas, about 40% of parents had finished secondary school
220 (Table 1).

221 The raw relationship between the environment factors and childhood overweight/obesity is
222 depicted in Table 2. Living in an area where the amount of green space was in the lowest
223 30%, a child had a higher chance of being overweight or obese at age seven (Odds Ratio
224 [OR] 1.14, 95% confidence Interval [CI] 1.02-1.27). This was also the case for children
225 without access to a garden (OR 1.35 95% CI 1.16-1.58) and living in surroundings that were

226 more rundown (worst surroundings: OR 1.22, 95% CI 1.05-1.42, second worst surroundings:
227 (OR 1.27, 95% CI 1.11-1.47)). Parenting constructs relating to physical activity and regularity
228 were significantly related to childhood overweight/obesity in the expected directions.

229 The food and rules constructs were not associated with overweight/obesity, even when we
230 tested the individual indicators for the constructs separately. Moreover, none of the parental
231 constructs mediated or moderated the relationships between the environment and childhood
232 overweight/obesity.

233

234 Children of higher educated parents tend to live in greener areas, have greater access to a
235 garden and better surroundings (Table 3). The highest level of education (NVQ) was found
236 not to mediate but to moderate the relationship between environmental factors and child
237 overweight/obesity. Therefore, the relationship between environmental variables and
238 childhood overweight / obesity was analysed separately for each NVQ-level (Table 4). This
239 showed that children in households where one or both parents had an undergraduate degree
240 (or equivalent) or higher had an increased probability of being overweight or obese when the
241 environment was more rundown of 4.4 percentage points (probability best
242 surroundings:16.2%, more run down: 20.6%). By contrast, for children in households with
243 secondary school as their highest level of education, the absence of a garden and less green
244 space in the surrounding area increased the probability of being overweight or obese by
245 respectively 3.8 and 2.9 percentage points (probability: garden access: 20.9%, no garden
246 access: 25.7%; high green surroundings: 21.1%, low green surroundings: 24.0%).

247

248 **Discussion**

249 More green space in the local neighbourhood may be important for children having the
250 opportunity to engage in physical activities and thereby attain a healthier weight status.^{2;5;6;12}

251 This study contributes to the understanding of the relationship between the level of green
252 space, accessibility to a garden and the degree of dilapidation of an area and children's risks
253 of being overweight or obese. We found that children living in an area with less green space,

254 or which was less hospitable and children without access to a garden had a higher chance of
255 being overweight or obese. Therefore, improving the neighbourhoods they live in may
256 contribute to healthier behaviours and less overweight.

257

258 Our findings are consistent with other studies demonstrating a relationship between the level
259 of green space and the chance of being overweight or obese.³³⁻³⁵ The influence of having
260 access to a garden has thus far not been studied but can be compared to the effects of
261 having a higher level of green space. In addition, access to a garden can be viewed as a
262 simpler and safer way for children to access green spaces.

263

264 Our finding that a more rundown neighbourhood is related to a higher chance of childhood
265 overweight/obesity is also consistent with other studies.^{34;36-38} In these studies environment
266 was based on the perception of the care givers whereas in our study the interviewer scored
267 the individual items that were combined into the variable depicting the quality of the
268 environment. This is important as it means that parental choices that may relate to children's
269 risks of obesity are not confounded with their perceptions of the neighbourhood. Unlike these
270 other studies, therefore we can treat the quality of the neighbourhood as exogenous to
271 parenting decisions.

272

273 Both our results and those of other studies show a relationship between child overweight
274 /obesity and the choices made by parents regarding physical activity and having rules and
275 family discipline.^{18-20;39} Our study is the first, however, to test whether parenting mediates or
276 moderates the relationship between environmental factors and childhood overweight/obesity.
277 Against our expectations we found that none of the parental constructs either mediated or
278 moderated this relationship. This implies that parenting and the environment exert
279 independent influences on child overweight/obesity.

280

281 Many studies have shown that SES is associated with children's risks of being overweight or
282 obese.^{10;12;13} We were able to demonstrate that the associations between the environment
283 and childhood overweight/obesity were dependent on the educational level of the parents.
284 Children growing up in lower educated families (parents with secondary school qualifications
285 only) had a higher chance of overweight in a less green environment or if there was no
286 access to a garden. This is congruent with the findings of Lovasi et al. who found that
287 children in lower income families had a lower chance of obesity if they lived in an area with a
288 higher density of trees.⁴⁰ However, the focus on low income families in that study meant they
289 were unable to assess how the relationship varied with SES. In our study, we did not find this
290 relationship for families with post-compulsory educational qualifications. Instead, for those
291 with more highly qualified parents, living in a more rundown area was linked to overweight
292 and obesity suggesting that such parents may be more sensitive to their children playing
293 outside in such contexts. To our knowledge, this is the first study to report associations for
294 specific SES (educational- level) groups and show that they differ. The cause and
295 mechanisms of these differences are areas for further research.

296

297 **Strengths and limitations**

298 The study has certain limitations. We cannot claim causality for our findings only
299 associations. Nevertheless, one of the strengths of this study is that children and their
300 caregivers were followed over time and that variables measured earlier in life (at age 3 and
301 5) were associated with being overweight or obese at age 7, reducing the problem of
302 potential reverse causality. We addressed problems of selection by only including families
303 who continued living in an environment that did not change its level of green space (i.e. they
304 either didn't move or moved to an area with similar level of green space). It would be
305 interesting, however, to assess what happens to the BMI of the child when a family moves to
306 an area with more or less green space.

307

308 **Conclusions**

309 Associations are found between environmental variables at ages 3 and 5 with children being
310 overweight and obese at age 7. But these associations are moderated by the education level
311 in the household. The influence of level of green space and having garden access on child
312 weight is only identified for lower educated families whereas more rundown areas are more
313 relevant for child overweight among more highly educated families. Both findings, however,
314 emphasise the relevance of safe, congenial outdoor spaces for children to play in if their
315 rates of overweight are to be tackled.

316

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325 the writing of the manuscript. BZ contributed to data analysis, data interpretation, generation
326 of figures and writing of the manuscript. GN and PE contributed to study design, data
327 interpretation and writing of the manuscript. LP contributed to data collection, data analysis,
328 data interpretation and writing of the manuscript. All authors read and approved the final
329 manuscript.

330 **Conflicts of interest**

331 The authors declare that they have no competing interests.

332 **Key points:**

- 333 • Children living in an area with less green space or that is more run down or who are
334 without access to a garden have a higher chance of being overweight or obese;
- 335 • The education level of the child's parents moderates the relationship between
336 environment and the chance of overweight or obesity;
- 337 • Children from lower educated parents have a lower risk of being overweight or obese
338 when they have access to a garden or green space, those from higher educated
339 parents have a higher risk of overweight or obesity when they live in a more run down
340 area.

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454 **Table 1 Participant characteristics**

Variable		N (6467 total)	% of total
Gender	Female	3212	(49.7%)
Weight	Overweight or obese	1290	(19.9%)
Environmental variables			
Green space ¹	Top 3 deciles	1807	(27.9%)
	Middle 4 deciles	2386	(36.9%)
	Bottom 3 deciles	2274	(35.2%)
Access to garden	Yes	5806	(89.8%)
Condition of the neighborhood	Best	2114	(32.7%)
	Good	1552	(24.0%)
	Not too good	1056	(16.3%)
	Worst	1562	(24.2%)
Parenting related variables			
Food construct			
Eats breakfast	7 days/week	5934	(91.8%)
	≥6 days/week	508	(7.9%)
Snacks between meals	No or only healthy	446	(7.2%)
	Unhealthy	5956	(92.1%)

Importance of having meals together with at least one adult	Very	4623	(71.5%)
	Fairly	1654	(25.6%)
	Not really or not at all	157	(2.4%)
Pieces of fruit per day	≥3	3349	(51.8%)
	2	1758	(27.2%)
	1	1086	(16.8%)
	None	246	(3.4%)

Physical activity (PA) construct

PA child	≥3 times/week	565	(8.7%)
	1-2 times/week	2782	(43.0%)
	None	3120	(48.2%)
PA parent and child	≥3 times/week	1674	(25.9%)
	1-2 times/week	2527	(39.1%)
	≤1/month	1306	(20.2%)
	≤1/year	960	(14.8%)
Park visits	≥3 times/week	1079	(16.7%)
	1-2 times/week	2726	(42.2%)
	1-2/month	1854	(28.7%)
	<1/month	785	(12.1%)

Television viewing	<1 hour/day	1340 (20.7%)
	1-2 hours/day	4139 (64.0%)
	≥3 hours/day	967 (15.0%)

Rules construct

Having rules	Lots of rules	1926	(29.8%)
	Not many	2853	(44.3%)
	It varies	1655	(25.6%)
Importance of having rules	Strictly enforced	3110	(48.1%)
	Not very strictly enforced	1668	(25.8%)
	It varies	1656	(25.6%)

Regularity construct

Regular bedtimes	Always	2627	(40.6%)
	Usually	2436	(37.7%)
	Sometimes	912	(14.1%)
	Never or almost never	460	(7.1%)
Regular mealtimes	Always	2955	(45.7%)
	Usually	2858	(44.3%)
	Sometimes	498	(7.7%)
	Never or almost never	132 (2.0%)	

Socio-economic Status related variables (household highest)

National Vocational Qualification (NVQ)	Under graduate or higher	2963	(45.8%)
	Vocational training	973	(15.0%)
	Secondary school higher grades	1545	(23.9%)
	Secondary school lower grades	338	(5.2%)
	Other	648	(10.0%)
Poverty ³	No poverty	5322	(82.3%)
	Poverty	1145	(17.7%)

455 ¹Based on Deciles of % green space Layer Super Output Areas (LSOA) Level.

456 ²Addition of variables scored by interviewer (general condition buildings, presence of security
457 blinds, traffic calming, traffic volume, burnt out cars on the street, litter on street, dog mess
458 on pavement, graffiti on walls, evidence of vandalism, arguing/fighting on street).

459 ³Poverty is when the household income is below 60% of the median of MCS-families

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463 **Table 2 Basic model.** Relationship between overweight/obese and environmental variables.

Independent variables		OR	(95% CI)
Greenspace ¹ (reference = Highest 30%)	lowest 30%	1,139*	(1,023- 1,267)
	middle 40%	1,023	(0,914 1,146)
Access to garden (reference = yes)	no	1,352*	(1,156 1,582)
Condition of the neighbourhood ² (reference = best surroundings)	worst surroundings	1,221*	(1,050 - 1,420)
	surroundings not too	1,274*	
	good		(1,108 - 1,466)
	good surroundings	1,090	(0,977- 1,216)

464 ¹Based on Deciles of % green space Layer Super Output Areas (LSOA) Level.

465 ²Sum score of variables scored by interviewer (general condition buildings, presence of
466 security blinds, traffic calming, traffic volume, burnt out cars on the street, litter on street, dog
467 mess on pavement, graffiti on walls, evidence of vandalism, arguing/fighting on street).

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470 **Table 4** Relationship between environmental variables and overweight/obese by level of education.

Independent variables		NVQ level 1 ³		NVQ level 2		NVQ level 3		NVQ level 4	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Greenspace ¹	Lowest 30%	1,08	(0,592- 9 2,002)	1,24	(1,020- 6 1,523)*	1,26	(0,938- 2 1,697)	0,98	(0,831- 2 1,162)
	(reference = Highest 30%) Middle 40%	0,97	(0,593- 7 1,607)	0,82	(0,661- 4 1,026)	1,33	(0,970- 4 1,834)	0,99	(0,854- 8 1,165)
Access to garden	No	0,64	(0,255- 5 1,632)	1,41	(1,087- 3 1,837)*	1,13	(0,970- 4 1,834)	1,28	(0,989- 8 1,677)
	(reference = Yes)								
Condition of the neighborhood ²	Worst surroundings	0,90	(0,508- 3 1,605)	0,83	(0,663- 7 1,056)	1,21	(0,903- 9 1,646)	1,38	(1,121- 2 1,704)*
	(reference = Best surroundings) Surroundings not too good	0,53	(0,336- 7 1,227)	1,25	(0,977- 8 1,620)	1,14	(0,865- 1 1,505)	1,27	(1,047- 2 1,546)*

	0,86	(0,515-	1,21	(0,945-	1,22	(0,938-	1,03	(0,897-
Good surroundings	8	1,461)	5	1,561)	0	1,586)	5	1,193)

471 ¹Based on Deciles of % green space Layer Super Output Areas (LSOA) Level.

472 ²Addition of variables scored by interviewer (general condition buildings, presence of security blinds, traffic calming, traffic volume, burnt out
473 cars on the street, litter on street, dog mess on pavement, graffiti on walls, evidence
474 of vandalism, arguing/fighting on street).

475 ³NVQ (National Vocational Qualification) Level 1: Secondary school lower grades. Level 2: Secondary school higher grades. Level 3: Vocational
476 training. Level 4: Under graduate or higher.

477 *significant finding (p<0.05)

478 **Figure 1 Construct of the research questions (RQ) driving this study**

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