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Mapping area variability in social and behavioural difficulties among Glasgow pre-schoolers: linkage of a survey of pre-school staff with routine monitoring data

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Abstract

Background—Social, emotional and behavioural development in early to middle childhood impact upon many outcomes in future life and are influenced by home, neighbourhood and school environments. We used linked data to investigate differences between areas in Glasgow City in level of difficulties in pre-school age children, after consideration of demographics, including area level deprivation.

Methods—Pre-school education staff completed Strengths and Difficulties Questionnaires (SDQ) on all children progressing to school from a local authority or partnership (local authority funded private) pre-school in Glasgow City between 2010 and 2012. These data were linked to individual (age, gender) and area level (deprivation) demographics from the City Council Education Services Department. Statistical models were fitted to the SDQ scores, adjusting for age, gender, area deprivation, year of school entry, pre-school establishment attended and electoral ward of residence. Correlation between neighbouring wards was incorporated to allow for clustering of scores.

Results—Boys and those living in more deprived areas had higher levels of difficulties. Children aged 5-5.5 years had fewest difficulties, while the oldest and youngest children had similar levels of difficulties. There were no significant secular trends by year of school entry. There remained differences between areas after adjusting for these variables, with children living in some areas having fewer difficulties than would be expected based on their socio-demographic characteristics.

Conclusions—There remained differences in children's levels of difficulties between areas after adjusting for age, gender, area deprivation and year of school entry. Children in some very deprived areas had fewer difficulties than might be expected, while those in relatively affluent areas had more difficulties than expected based on their deprivation level. There may be other, unmeasured, individual and area level reasons for children's level of difficulties and these require further exploration.

Introduction

Social, emotional and behavioural development in early to middle childhood has far reaching effects, for example in terms of school achievement, early pregnancy, and future employment, relationships, physical and mental health (Broidy et al., 2003; Aber, Brown, & Jones, 2003; Nagin & Tremblay, 1999; Huessman, Lefkowitz, & Walder, 1984; Marmot,

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2008). Although genetics play a role (Edelbrock, Rende, Plomin, & Thompson, 1995), the home, neighbourhood and school environment all contribute to social, emotional and behavioural development (Flouri, Tzavidis, & Kallis, 2010; Gennetian, Castells, & Morris, 2010; National Institute of Child Health, 2007). The extent to which each of these factors independently contributes to different aspects of child development has been subject to much debate in recent years. Whilst influences within the home, such as parenting, household poverty and material deprivation, are still thought to have the greatest impact on social, emotional and behavioural development, there is increasing evidence that place based influences, such as area deprivation, violence, and service provision may play a part (Schaefer-McDaniel, 2009; Cook, Herman, Phillips, & Settersten, 2002; Thomas, 2010; Reijneveld, Brugman, Verhulst, & Verloove-Vanhorick, 2005; Hertzman, 1999).

This paper looks specifically at the social, emotional and behavioural development of pre-school age children in Glasgow City. Glasgow is the largest city in Scotland (National Records of Scotland, 2012), and one of the most deprived areas in Scotland and the UK. A third of its population live in Scotland's 10% most deprived areas(Scottish Government, 2012). Children make up 16% of Glasgow's population(National Records of Scotland, 2012). In 2009, 34% of children in Glasgow were estimated to be living in poverty[i], in contrast to 19% in Scotland as a whole, and 21% in the UK (Glasgow Centre for Population Health, 2013). Although by UK standards, Glasgow is not ethnically diverse, in comparison with the rest of Scotland, Glasgow has the highest proportion of people from an ethnic minority at 5.5% (Glasgow City Council, 2012).

This paper explores pre-school education staff-rated scores of pre-school aged children's social, emotional and behavioural difficulties, linked to demographic data held by the City Council Education Services Department. This is a uniquely rich population dataset, combining staff views of children's difficulties across a population, rather than the more common approach of parent-rated scores in a sample of children. The analysis aims to investigate whether any geographical variation in social, emotional and behavioural scores for pre-school children between different areas (electoral wards) in Glasgow City remains unexplained after differences in area demographics are taken into account.

Methods

Study subjects

Pre-school education staff were asked to complete questionnaires on all children progressing to school from a local authority or partnership (local authority funded private) pre-school in Glasgow City between 2010 and 2012.

Data collected

Each child had a Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997) score and constituent domains recorded along with the pre-school establishment that they attended. These data were collected as part of a wider Evaluation of the Parenting Support

[i]Poverty defined as children in families receiving Child Tax Credit whose income is less than 60% of the median, or in families who received Income Support or (income-based) Job Seekers Allowance

Framework in Glasgow City. In 2010, data were completed using paper questionnaires, whilst in 2011 a mixture of paper and electronic forms were completed, moving to solely electronic completion by 2012. These data were linked to data held in the education services database on age, gender, deprivation status (based on the postcode of the child's home address – approximately 15 units share each postcode in the UK) and the datazone (DZ) and electoral ward in which the child lived.

Two versions of the SDQ are available for this age group: a version for 3-4 year olds and a version for 4-16 year olds. This study used the 4-16 version in 2010 and 2011, but changed to the 3-4 version in 2012, following interviews with pre-school staff (White, Connelly, Thompson, & Wilson, 2013). The difference between the two versions is relatively small and focuses on two questions in the 4-16 conduct scale, around lying, cheating and stealing, which were changed to slightly 'softer' and more age appropriate questions about being argumentative with adults and being spiteful. Staff may have more readily answered positively to these softer questions in 2012, rather than the previous versions, which were deemed by some to be inappropriate (White et al., 2013).

The SDQ total problems score ranges between 0 and 40 and covers four domains: emotional symptoms, conduct problems, hyperactivity, peer problems. There is also a prosocial behaviour subscale that is not included in the total problems score. A higher score indicates more problematic symptoms and behaviours. Scores were considered 'abnormal' if they were: total e16, conduct problems e4, hyperactivity e7, prosocial behaviour≤4, peer problems e5, emotional symptoms e6 (Goodman, 2013).

Since information on the socioeconomic status of individual children (e.g. household income or occupational social class of head of the household) was not available, deprivation status was based on the postcode of the children's home address and measured using the Scottish Index of Multiple Deprivation (SIMD) (Scottish Government, 2013).

DZs, formed from groups of output areas for the 2001 Census, are the key small-area statistical geography in Scotland (Scottish Executive, 2004). They are nested within local government boundaries (electoral wards), and where possible they have been defined in such a way as to respect physical boundaries and natural communities and contain households with similar social characteristics. There are 694 DZs in Glasgow City spread across 21 wards. For each DZ, the publicly available SIMD was obtained. The SIMD is a continuous measure of compound social and material deprivation, calculated using income, employment, health, education, housing, geographic access to services and crime data (Scottish Executive, 2006). The measure is updated approximately every four years. The current analysis used the 2009 measure. An individual child's deprivation status was taken to be the SIMD score of the DZ in which they lived and SIMD scores were grouped into quintiles. Due to Glasgow's relatively high levels of deprivation, we used 'Glasgow SIMD quintiles' for these analyses, which group the SIMD scores into quintiles within Glasgow City only, leading to similar numbers of individuals in each quintile. Spatial distribution was represented by local authority electoral ward.

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The exact age of each child was not available in the 2010 data and so the children's ages were grouped into categories (4-4.5/4.5-5/5-5.5/>5 years).

Study population

Data were collected on 11 487 children in Glasgow City Local Authority or Partnership preschool establishments. Data for a total of 1078 children were excluded from the analysis and their available characteristics are displayed in Supplementary Table 1. These children were excluded mainly because of incorrect or inadequate (postcode) geographical data (361 in 2010, 419 in 2011, 151 in 2012); while 13 (in 2010/2011) were missing age data and 333 were missing gender data (mostly in 2011). Seven children were missing SDQ scores (all in 2010). Some children (n=206) had a combination of variables missing.

Children between 4 and 4.5 years and over 5.5 years were included in the analysis, even though the usual primary school entry age range is between 4.5 and 5.5 years, because there is some flexibility in school starting age. The youngest child (with known exact age) was 4 years and 5 months of age, while the oldest child was 6 years and 7 months.

Children were not excluded from the analysis for missing data on ethnicity or statutory parental supervision, due to high levels of missing data.

Full data were therefore available for 10 409 children of at least 4 years of age (2964 children in 2010, 3573 in 2011 and 3872 in 2012). This represented 46.9%, 55.5% and 56.9% of the total cohort eligible to progress to primary school in the city in 2010, 2011 and 2012, respectively (53.2% overall). Over the 3 years the total numbers of included children living in each ward ranged from 263 to 784.

Ethics

As these anonymised data were collected by educational establishments as part of the routine documentation passed to primary schools (White et al., 2013), this study did not require ethical review.

Statistical methods

The SDQ total problem scores are presented in boxplots by age group, gender, Glasgow SIMD quintile and year of school entry. The SDQ total problems score along with subscale scores are also presented on maps of Glasgow City, as the percentage of children with 'abnormal' scores within each ward. The main research aim was to assess whether there remained discrepancies between electoral wards once their demographic distribution had been accounted for, i.e. the gender, deprivation and age distributions of the children living in the ward, year of primary school entry and the pre-school establishment attended by each child (which is not necessarily within the ward in which they live). Year of Primary School entry was included both to control for any 'cohort' effect (e.g. scores getting progressively worse over time) as well as to control for the change in questionnaire, from the 4-16 year old version used in 2010 and 2011, to the 3-4 year old version, used in 2012, as explained previously. We were also interested in the impact of available children's characteristics (e.g. gender, age, socioeconomic status) on their level of reported difficulties. Postcodes were

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used to calculate both the child's level of home area deprivation, using the Glasgow Index of Multiple Deprivation Quintiles, and the ward level of area deprivation.

We assessed these issues by fitting generalised linear mixed spatial convolution models assuming a negative binomial distribution for the response. The outcomes were the SDQ total problems score and the five SDQ subscale scores, and the fixed effects were gender, age group, Glasgow SIMD quintile and year of progression to primary school. The pre-school establishment attended was included as a random intercept. The electoral ward in which the child lived was included as a conditional autoregressive model (CAR) normal spatially correlated random effect, with the (log) mean SDQ score for each ward being allowed to depend on the scores of the wards immediately adjacent to it. Electoral ward was also included as a spatially uncorrelated random intercept. There are 21 wards in Glasgow City. The sum of the electoral ward random intercepts plus spatial terms were plotted on a map of the city to show the excess variation between wards after adjusting for demographic distributions.

The analyses were carried out in R version 2.15.0 (R Development Core Team, 2012) and WinBUGS, using the R2WinBUGS package (Sturtz, 2005).

Results

Characteristics of the study population

Baseline characteristics for the 10 409 included children are displayed in Table 1. Most children were in the usual age range for children entering primary school in Scotland, i.e. 4.5-5.5 years old, with about 7% of children being either younger or older than this range. Slightly more than half of included children were male, which corresponds to population estimates for the city as a whole (Glasgow Centre for Population Health, 2013). The distributions of age and gender were similar across the three years. Slightly more children in the most deprived quintile and fewer in the least deprived group were included in 2011 and 2012 than in 2010. Of those children with ethnicity data (over a third were missing ethnicity status), about 70% were white and from the UK, in line with 72.8% of the whole population in Glasgow City (Glasgow Centre for Population Health, 2013). Around 2% of children in the sample were under statutory parental supervision, compared with 3% in the child population in Glasgow City (Glasgow Centre for Population Health, 2013).

Table 1 shows the characteristics of the children excluded from the analyses due to missing geographical, age, gender or SDQ data. Included children tended to be more deprived than excluded children (amongst those for whom there were geographical data) ($p<0.01$). There was no difference in the gender ($p=0.20$) or age ($p=0.09$) distributions between included and excluded children. For those with ethnicity and statutory parental supervision status data available, the distributions across categories were similar between the included and excluded children.

SDQ and demographics

Figure 1 shows boxplots of the total SDQ scores by Glasgow SIMD quintile, age, gender and year. There is a clear gradation in difficulties across the deprivation quintiles, with

children in the most deprived 40% of areas having a median score 2 points higher (worse) than those in the least deprived 20% of areas. There was also less variability between children in the least deprived areas than in other areas.

Children aged 5-5.5 years had fewest difficulties on average, while those in the youngest and oldest age ranges had median scores of 2 points higher. Boys tended to have more difficulties than girls, with an overall median score 2 points higher.

Children entering primary school in 2010 had slightly better scores, on average, and more variability between children than those in either 2011 or 2012, while children in the latter two years had very similar distributions of scores.

Variability between electoral wards

There were substantial differences across electoral wards in terms of their demographics, as shown in the supplementary PDF table 2. Though the percentage of boys in a ward varied from 47% to 57%, this was not a statistically significant difference ($p=0.32$). The percentage of children outside the normal primary school entry age range, from under 5% to almost 13%, did vary significantly across wards ($p<0.01$), as did the percentage of highly deprived datazones (i.e. in the two most deprived quintiles), ranging from 0% in Langside to almost 88% in Calton ($p<0.01$). The percentage of children under statutory parental supervision did not significantly vary across wards ($p=0.50$). The standardised ‘locality weighting’ (unweighted mean of the z-scores of the demographics for each ward, standardised to overall z-scores), displayed in the supplementary PDF table 2, showed Canal and Calton to be the wards with highest proportion of children with of disadvantages, i.e. high percentage of boys, children outside the normal primary school entry age range, and level of area deprivation; whilst Langside ward had the lowest proportion of boys, older children and lower area deprivation. In general, SDQ scores decreased as area deprivation decreased, but there was substantial variability in SIMD score both within and across wards; see supplementary PDF web Figure A for details.

Figure 2 shows the total and subscale SDQ scores on a map of the city, represented by the percentage of children with ‘abnormal’ scores in each ward. ‘Abnormal’ scores on the SDQ have been evidenced to predict later diagnoses: of children with an ‘abnormal’ score, had odds 15 times higher of going on to have a psychiatric diagnosis, compared with children who score in the ‘normal’ range. Teachers have been found to be better at predicting externalising problems, whereas parents were better at predicting internalising problems (Goodman, 2001). It may be therefore, that by just using teacher rating, some of these internalising symptoms are being missed. Shettleston has the highest percentage of children with abnormal total scores. There may be some clustering between wards in the northeast of the city, with North East, Springburn, Baillieston and East Centre having similar proportions of children with abnormal scores for the total SDQ and some of the subscales. The central areas of Hillhead and Pollokshields tend to have the lowest proportions of children with difficulties.

Figure 3 (upper) shows the distribution of deprivation across the city, using median (across datazones) Glasgow SIMD quintile. It is worth noting that SIMD also varies within electoral

ward (web Figure A), but it is shown only by ward here since that is the level at which we are interested. The central area of Hillhead which contains children with fewest difficulties on average is also one of the least deprived areas. Drumchapel/Anniesland and Canal are notable for being the most deprived wards on average but having relatively low proportions of children with abnormal scores. Figure 3 (lower) shows the total SDQ score represented by the median score for each ward, which has a similar pattern to the percentages of children with abnormal scores, except that Springburn, rather than Shettleston, comes out as the ward containing children with most difficulties using this measure.

Modelling SDQ

Figure 4 shows the model-adjusted maps of unexplained variation across wards, after accounting for age, area deprivation, gender and year. The map for the total score shows a distinct clustering of wards in the northeast which have children with more difficulties than would be expected based on the area's socio-demographic distribution. In contrast, the central wards and those in the northwest tend to be doing as well as or better than expected given their socio-demographic distribution. There is less clustering on the south side of the city, with more variability between wards. Langside is particularly notable as an area with low deprivation (for example the most deprived datazone in Langside is ranked at 3436 out of 6505 in Scotland – where number one is the most deprived- and the area has no datazones in the lowest 15% of area deprivation rankings) but with more difficulties on the SDQ than would be expected. Indeed, Langside has the lowest proportion of children being supported by social work services in the city (Glasgow Centre for Population Health, 2013). The maps for the subscales show similar patterns to that of the total score, with children living in wards in the northeast tending to have more difficulties than expected and elsewhere generally doing better than expected.

Figure 5 shows the model effects estimates and 95% confidence intervals (CIs) for the demographics. The effects estimates are represented in terms of the relative ratio (RR) increase in total SDQ. The results show that boys have total scores that are 40% higher (worse) than girls. There is a gradation in deprivation, in that children in the least deprived 20% have significantly better scores than all others, with the most deprived 40% having scores that are 20-30% worse than the least deprived children. Children aged 4.5-5 years and >5.5 years performed similarly to the youngest (4-4.5 years) children on total SDQ, while children aged 5-5.5 years had significantly fewer difficulties than the youngest. There were no significant differences between 2012 and 2010 in their average level of total difficulties, while the scores from 2011 were marginally worse than those from 2010.

Supplementary PDF web Figure B shows even more extreme gender differences for conduct problems, hyperactivity and prosocial behaviour. On the hyperactivity, prosocial behaviour and peer problems subscales, the 4.5-5 years age group performed significantly better than the youngest group, while the oldest children had significantly more conduct problems than the youngest. There were some marginal differences between years in the subscales, with hyperactivity and emotional symptoms scores being slightly worse in 2011 than in 2010.

Discussion

This work sought to investigate whether geographical differences remained in the social, emotional and behavioural difficulties among pre-school children living in different areas after accounting for demographics such as age, gender, Looked After status and deprivation. Our sample of children consisted of about half of the children eligible to start school in Glasgow City across three years (based on those living in the city at birth), and was geographically representative of that population.

After adjusting for demographics, there remained differences in difficulties between wards. Some geographical clustering was evident, with higher levels of difficulties located primarily in areas in the northeast of the city, independently of deprivation and other demographics, whilst children in central areas and the west tended to have fewer difficulties than might be expected based on their demographics. Canal, Carlton and Drumchapel/ Anniesland are among the most deprived areas in the City, for example, 24.6% of people in Carlton and Bridgeton and 36.4% in Drumchapel live in income poverty, but their children had similar levels of difficulties as those in some less deprived wards, suggesting that there are other, as yet unmeasured reasons for the differences between wards. Govan is another interesting area, since it is well known for being an area of high deprivation and falls into most deprived 40% of areas in Glasgow – 35.4% of children in Greater Govan live in poverty (Glasgow Centre for Population Health, 2013). However, the total SDQ scores of children living in the area were considerably better than would be expected from their demographic distribution. We do not know the reason for this, although it could be speculated that strong family networks might exist in Govan, and it has a relatively stable population, both factors that might be expected to have been associated with better than expected SDQ scores. This contrasts with areas in the northeast of the city, which have scores that are worse than would be expected. This may be due to these areas containing pockets of deprivation and of high crime, including violent crime, and of children who the police deem to be ‘vulnerable’ (living in a household when a domestic, racist or homophobic incident had taken place) (Public Health Research Unit, 2007). Evidence from other studies suggests that being exposed to violence or having low social support, increases the likelihood of adult depression and anxiety, which could in turn impact on child development, whilst other studies have indicated that community social control and cohesion may be factors which are important in determining mental health outcomes for children, over and above the level of deprivation which they experience (Stockdale et al., 2007; Xue, Leventhal, Brooks-Gunn, & Earls, 2005).

The current findings are in line with results from previous research, which has found the individual and family differences may play a larger role in social, emotional and behavioural outcomes in childhood than area based deprivation (Nagin & Tremblay, 1999; Cook et al., 2002). Tremblay’s models, for example, which were based on Canadian 2-11 year olds also found that individual level differences accounted for 66% of variance in child outcomes, with just under 30% of variation between families, and the remainder between neighbourhoods(Romano, Tremblay, Boulerice, & Swisher, 2005).

Most areas had 5-7% of children with an abnormal Total Difficulties score. This was lower than the UK average of 8% of 5-10 year olds (Green, McGinnity, Meltzer, Ford, & Goodman, 2005), but is likely explained by the younger age of the children in our sample. It may also be that a threshold effect is present, whereby the staff in some pre-schools who are routinely exposed to a higher proportion of children with difficult behaviours and social and emotional deficits, use their experience as the 'norm' for children of that age, and therefore unintentionally down-rate children's difficulties, making some area scores appear better than they were in reality. There is also evidence from studies with parents that their own mental health may colour their view of children's behaviour (Najman et al., 2001). It is entirely possible that this may also happen with preschool staff, though the author is not aware of any literature to support this at present. We attempted to account for this in the analysis by adjusting for the pre-school establishment of each child. The Growing Up in Scotland cohort study used parent-rated SDQs to explore social, emotional and behavioural difficulties at entry to primary school. In that study 5% of children had abnormal SDQ Total Difficulties scores (Bradshaw & Tipping, 2010), similar to the proportions in our study.

Conclusions

This work enabled us to assess the factors associated with the levels of difficulties that children have in a relatively large metropolitan area. Gender, age of child and area deprivation were all significantly related to social, emotional and behavioural development at preschool, in line with previous research (Broidy et al., 2003; Aber et al., 2003; Nagin & Tremblay, 1999; Hertzman, 1999). City wards varied in the proportions of boys, ages of children and area deprivation. However, not all variation between wards could be explained simply by these socio-demographic differences. The results highlighted areas whose children had more difficulties than expected based on their socio-demographic profiles, and those whose children were doing particularly well, despite living in very deprived areas. Given the finding that some children do better or worse than expected given the deprivation levels of their neighbourhood, our next step is to explore potential contextual factors related to the children's area of residence such as access to amenities and facilities that may support children and their carers in their day to life e.g. play areas, libraries, community centres, food shops. We will also be exploring facets of the neighbourhoods which may be detrimental to children (and their carers) such as density of alcohol outlets, crime, population density and structure, housing type and tenure.

Strengths and Limitations

The study was limited by the data that Education Services were able to supply. For some children geographical or demographic data were missing, and these children had to be excluded from the analyses. However, the sample remained extremely large, consisting of around half of the eligible population across each of three years. Children in our sample were slightly more deprived than the overall population of eligible children in the city but we nonetheless found difficulties levels that were similar to other studies. Given that the other demographics of the children included and excluded were similar, we do not believe that the inclusion of these children would have substantially changed our conclusions.

There may have been other demographic characteristics that were not collected which may have further explained the differences between wards across the City. In particular, there was a substantial amount of ethnicity status data missing and this may have been a useful factor in explaining the differences between areas. We used the data that was available, and we believe that the characteristics collected are those that are most important to explain differences in strengths and difficulties between children.

This is the first study attempting to describe the strengths and difficulties of children within a city and it includes a large sample of children. Glasgow is a particularly interesting area to analyse in this way due to the high level of socioeconomic variation within the city. The study was further enhanced by the collection of data through pre-school establishments, arguably more objective than using parent-rated scores.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key messages

- This is the first study to attempt to detail the strengths and difficulties of the population of preschool children within a whole city
- Gender, age of child and area deprivation were all significantly related to social, emotional and behavioural development at preschool, in line with previous research
- Within the city, differences in social, emotional and behavioural problems could be seen between geographical areas, even once demographic variables were controlled for
- Some areas, such as Govan in the South of the city, were doing better than expected, given their demographic characteristics, compared with similar areas in the North East
- Further work is required to attempt to explain this variance in SDQ scores between similarly deprived areas.

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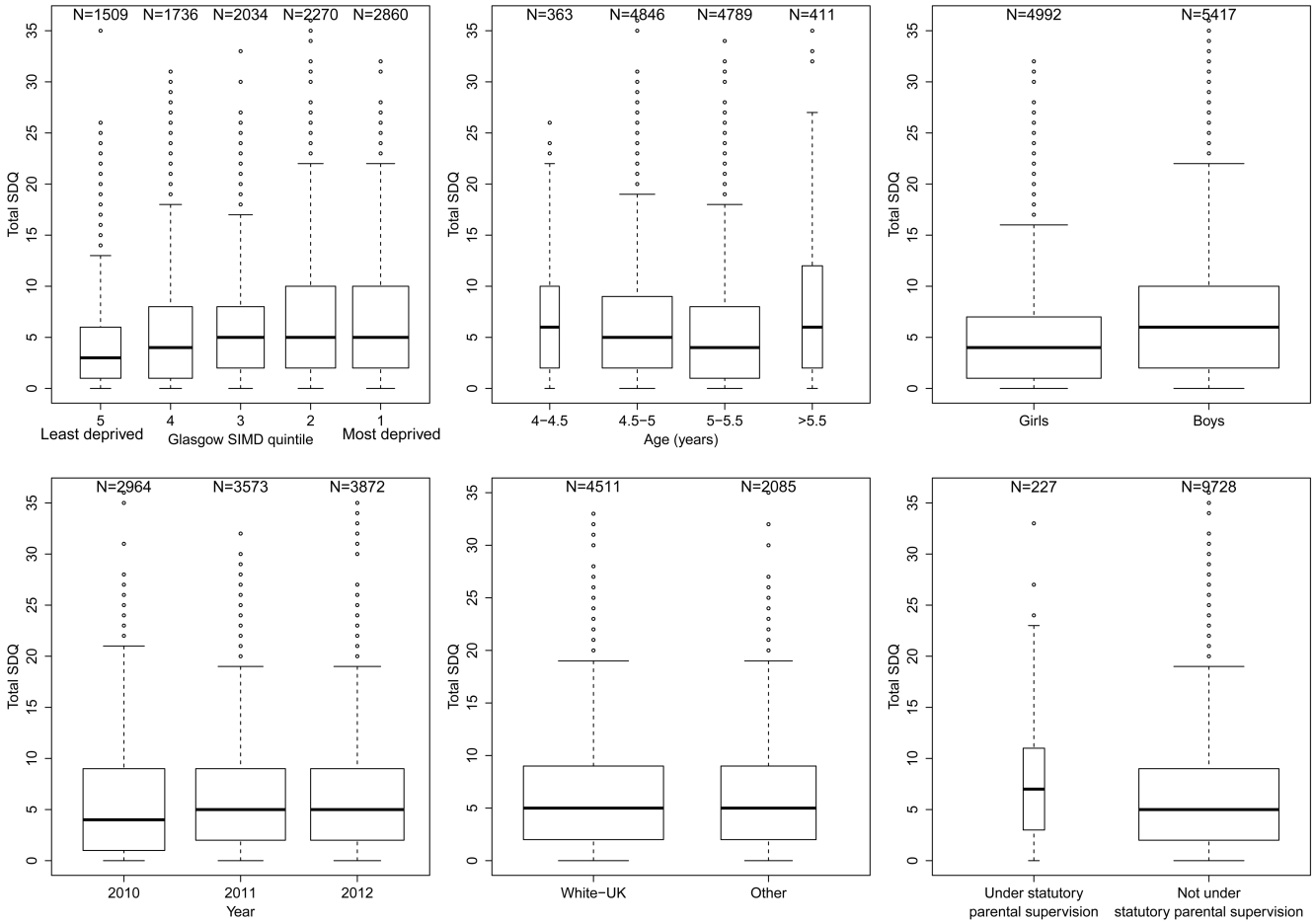

Figure 1.

Boxplots of total Strengths and Difficulties Questionnaires (SDQ) score for included children across all years, by deprivation (Glasgow Scottish Index of Multiple Deprivation) quintile, age group, gender and year. The width of each boxplot is proportional to the number of children in the corresponding category.

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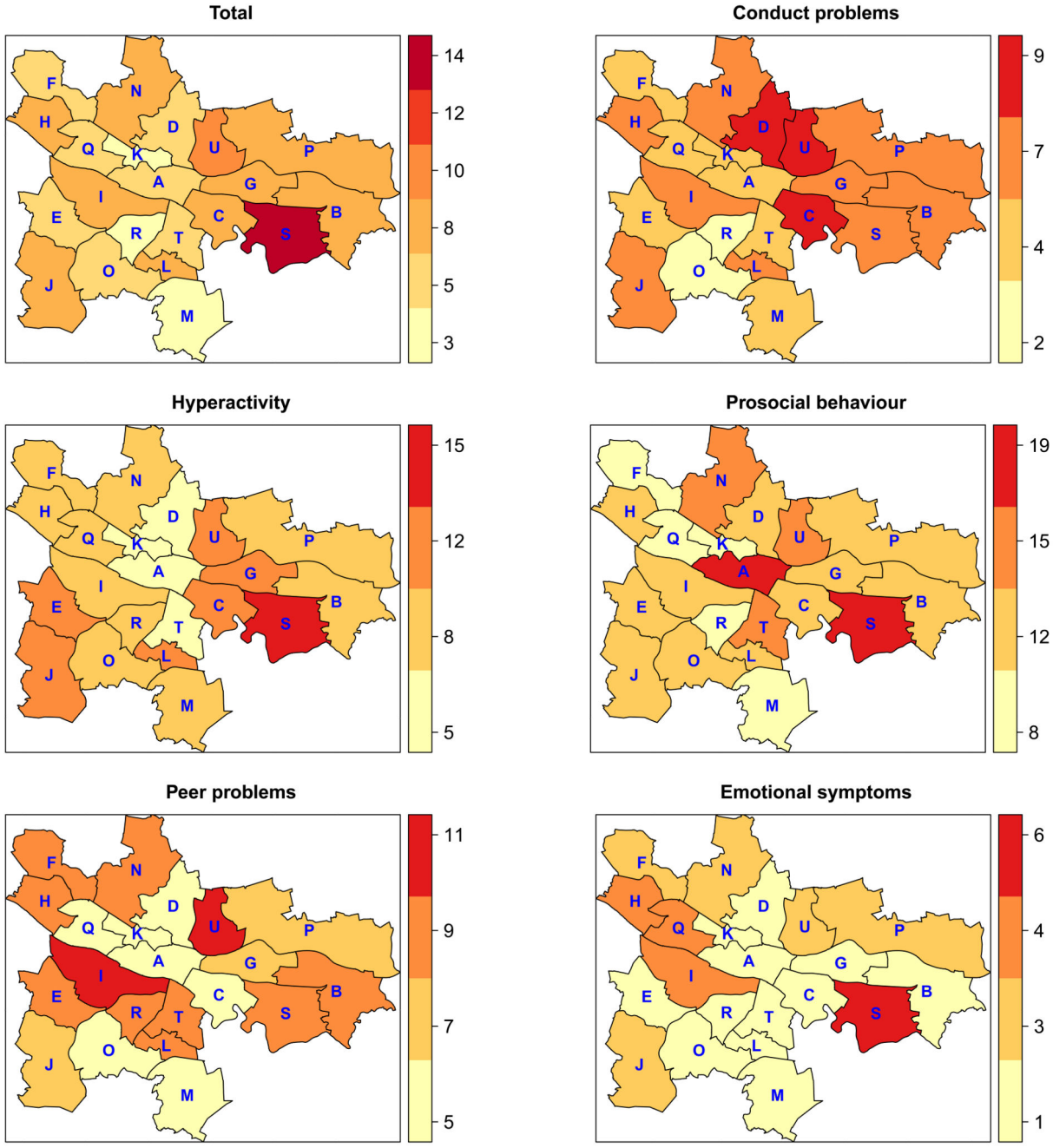

Figure 2.

Map of Glasgow City split into electoral wards, with the colours representing the percentage of children living in each ward who had ‘abnormal’ Strengths and Difficulties Questionnaires (SDQ) score (total e16; conduct problems e4, hyperactivity e7, prosocial behaviour d4, peer problems e5, emotional symptoms e6). A, Anderston/City; B, Baillieston; C, Calton; D, Canal; E, Craigton; F, Drumchapel/Anniesland; G, East Centre; H, Garscadden/Scotstounhill; I, Govan; J, Greater Pollok; L, Langside; M, Linn; N, Maryhill/

Kelvin; O, Newlands/Auldburn; P, North East; Q, Partick West; R, Pollokshields; S, Shettleston; T, Southside Central; U, Springburn.

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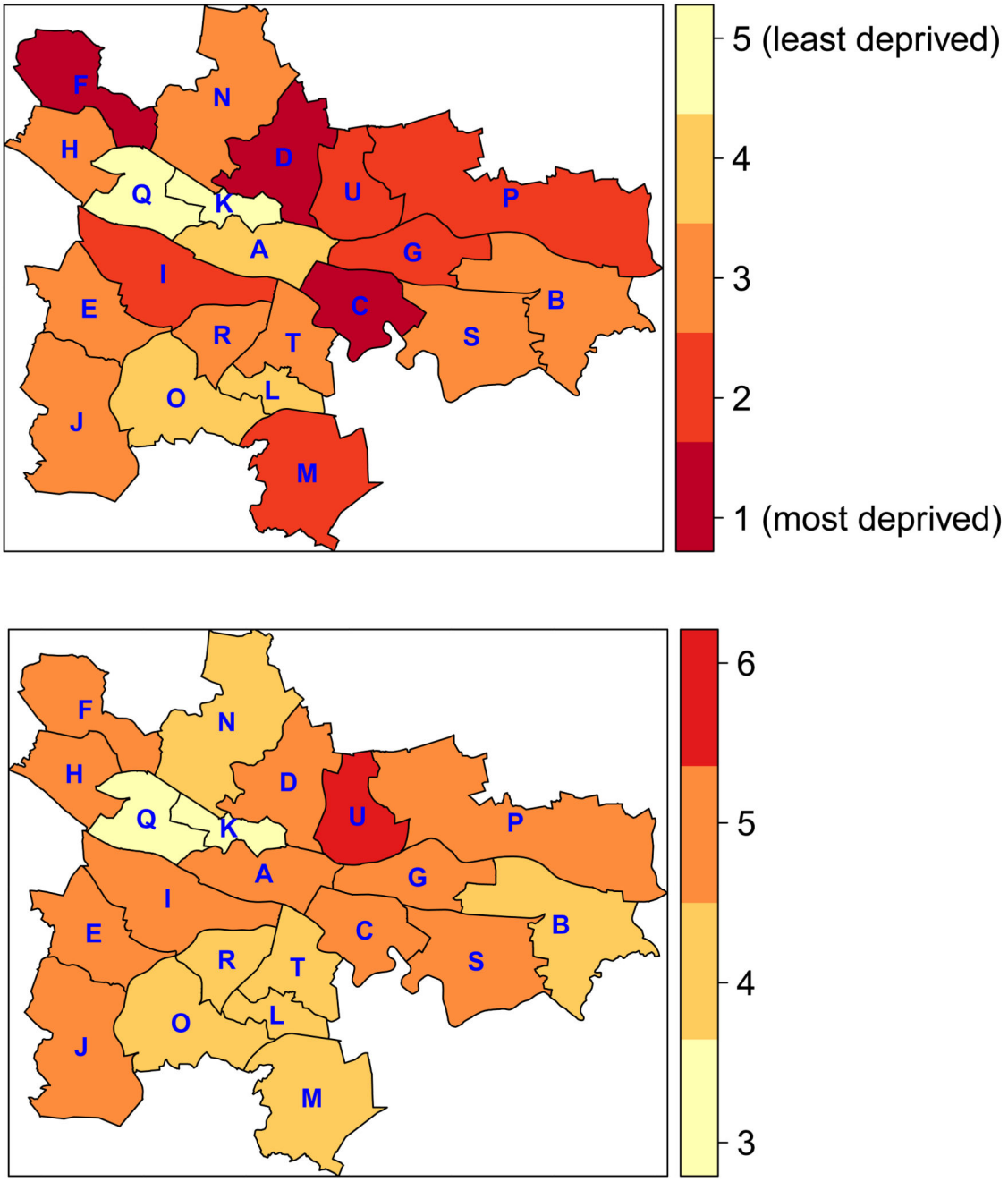

Figure 3.

Median Glasgow Scottish Index of Multiple Deprivation (SIMD) Quintile (upper plot) and median Total Strengths and Difficulties Questionnaires (SDQ) score (lower plot) for each electoral ward. A, Anderston/City; B, Baillieston; C, Calton; D, Canal; E, Craigton; F, Drumchapel/Anniesland; G, East Centre; H, Garscadden/Scotstounhill; I, Govan; J, Greater Pollok; L, Langside; M, Linn; N, Maryhill/Kelvin; O, Newlands/Auldburn; P, North East; Q, Partick West; R, Pollokshields; S, Shettleston; T, Southside Central; U, Springburn.

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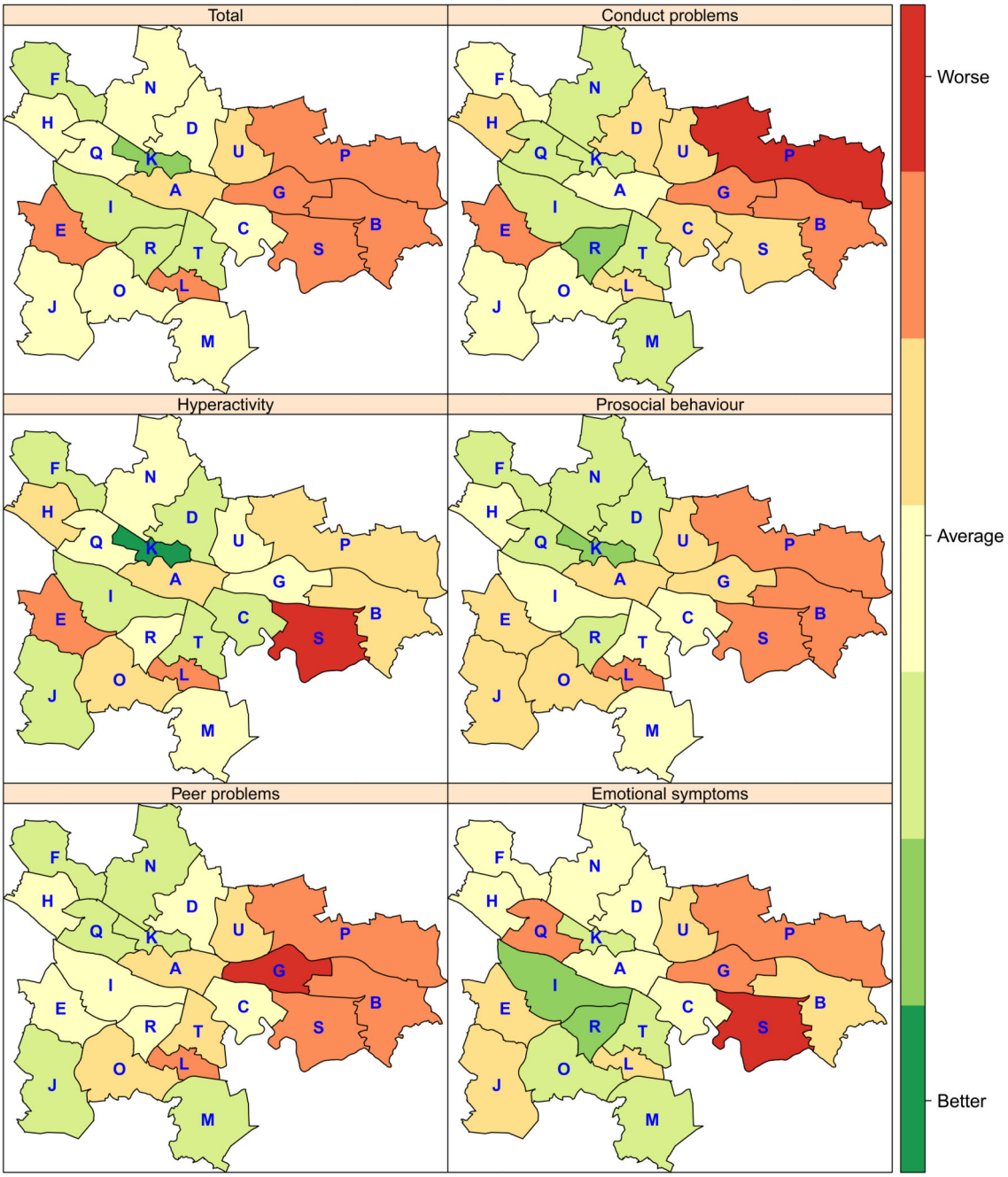

Figure 4.

Unexplained variation in total Strengths and Difficulties Questionnaires (SDQ) across electoral wards in terms of mean ward-level model residuals, following adjustment for age group, gender, Glasgow Scottish Index of Multiple Deprivation (SIMD) quintile, year of primary school entry and nursery establishment. 'Average score' means that on average the total SDQ score in the ward is as expected based on its demographics; while wards that are worse/better than average have worse/better SDQ scores than expected based on their covariates. A, Anderston/City; B, Baillieston; C, Calton; D, Canal; E, Craigton; F,

Drumchapel/Anniesland; G, East Centre; H, Garscadden/Scotstounhill; I, Govan; J, Greater Pollok; L, Langside; M, Linn; N, Maryhill/Kelvin; O, Newlands/Auldburn; P, North East; Q, Partick West; R, Pollokshields; S, Shettleston; T, Southside Central; U, Springburn.

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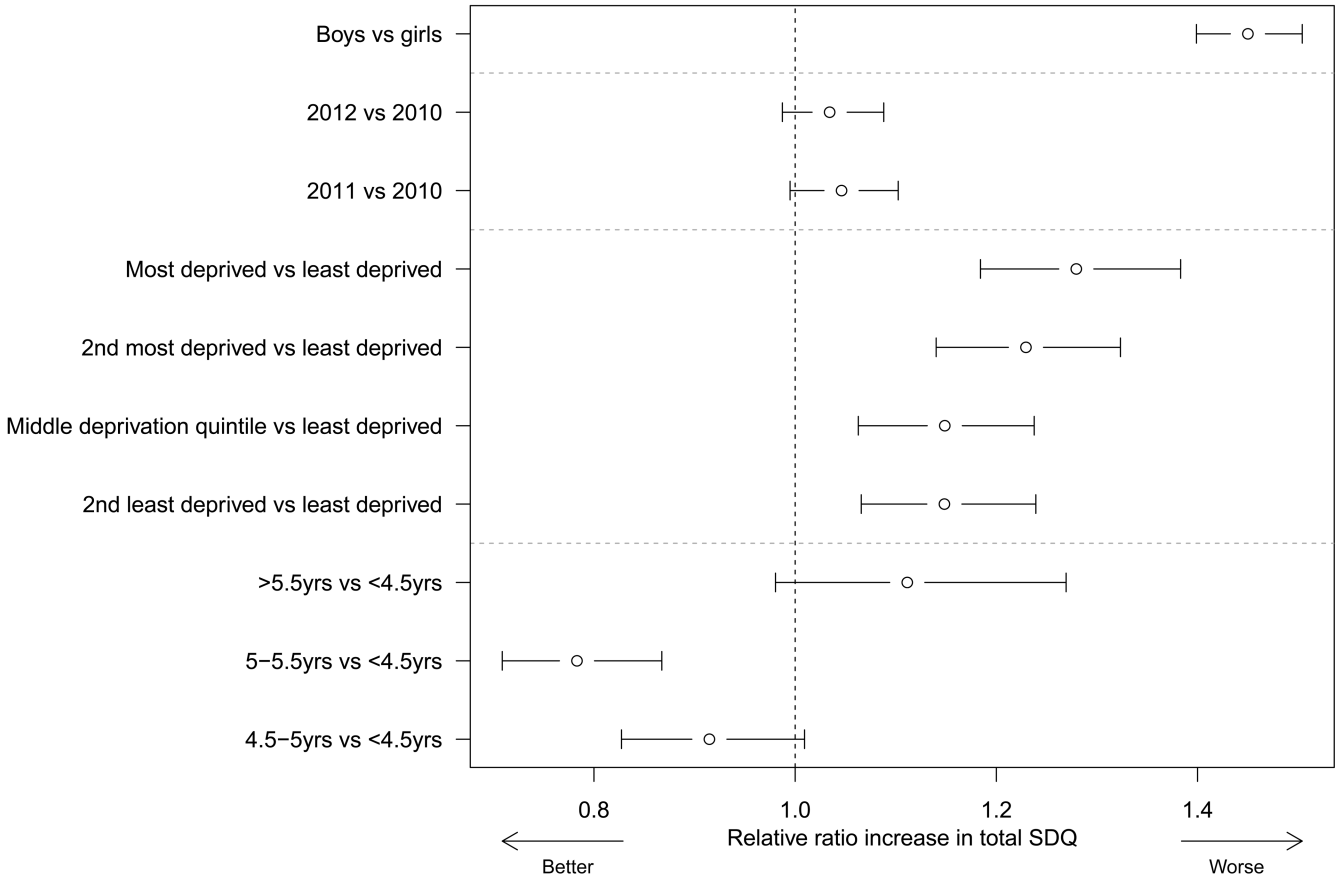

Figure 5.
Effects estimates for the impact of individual and datazone level covariates on total Strengths and Difficulties Questionnaires (SDQ).

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Table 1

Baseline characteristics (N (%)) of children included in the analysis, overall and by year of entry to primary school

		All	2010	2011	2012
	N	**10409**	**2964**	**3573**	**3872**
Age (years)	4-4.5	363 (3.5%)	159 (5.4%)	102 (2.9%)	102 (2.6%)
	4.5-5	4846 (46.6%)	1336 (45.1%)	1708 (47.8%)	1802 (46.5%)
	5-5.5	4789 (46.0%)	1368 (46.2%)	1623 (45.4%)	1798 (46.4%)
	>5.5	411 (3.9%)	101 (3.4%)	140 (3.9%)	170 (4.4%)
Gender	F	4992 (48.0%)	1388 (46.8%)	1740 (48.7%)	1864 (48.1%)
	M	5417 (52.0%)	1576 (53.2%)	1833 (51.3%)	2008 (51.9%)
Glasgow SIMD quintile	5 (least deprived)	1509 (14.5%)	507 (17.1%)	480 (13.4%)	522 (13.5%)
	4	1736 (16.7%)	525 (17.7%)	561 (15.7%)	650 (16.8%)
	3	2034 (19.5%)	568 (19.2%)	729 (20.4%)	737 (19.0%)
	2	2270 (21.8%)	625 (21.1%)	777 (21.7%)	868 (22.4%)
	1 (most deprived)	2860 (27.5%)	739 (24.9%)	1026 (28.7%)	1095 (28.3%)
Ethnicity	Ethnicity missing	3813	1474	1473	866
	White-UK	4511 (68.4%)	1026 (68.9%)	1470 (70.0%)	2015 (67.0%)
	Other	2085 (31.6%)	464 (31.1%)	630 (30.0%)	991 (33.0%)
Under statutory parental supervision	Statutory parental supervision missing	454	0	454	0
	Under statutory parental supervision	227 (2.3%)	62 (2.1%)	97 (3.1%)	68 (1.8%)
	Not under statutory parental supervision	9728 (97.7%)	2902 (97.9%)	3022 (96.9%)	3804 (98.2%)