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Socioeconomic status and antisocial behaviour among children and adolescents: A systematic review and meta-analysis

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HIGHLIGHTS

- Socioeconomic status (SES) is a major correlate of antisocial behaviour.
- Higher family's social status relates to lower levels of conduct problems.
- Informant and behavioural subtype moderate this relationship.
- Studies lack the consistency of antisocial behaviour conceptualisations.

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ABSTRACT

Previous research on the association between socioeconomic status (SES) and child and adolescent antisocial behaviour has produced mixed findings showing variation in the strength of association. This systematic review and meta-analysis aimed to summarise evidence on the relationship between socioeconomic status and broadly conceptualised antisocial behaviour, investigating variation across a range of antisocial subtypes and other potential moderators, including age, sex and informant. We identified 133 studies containing data suitable for effect size calculation, and 139 independent effect sizes were analysed (total N = 339 868). The global meta-analysis showed that lower family socioeconomic status was associated with higher levels of antisocial behaviour. Moderation analyses revealed this relationship was stronger where callous–unemotional traits were the outcome, and where antisocial behaviour was reported by parents or teachers rather than self-reported. The relationship between family SES and antisocial behaviour, however, was independent of higher-level constructs such as national income inequality. These results indicate that SES can be considered a robust correlate of broadly conceptualised antisocial behaviour but the strength of this relationship may depend on the antisocial subtype under investigation and the design of the study.

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1. Introduction

The relationship between SES and child and adolescent mental health is not well-established and research has produced mixed findings, particularly in the area of child and adolescent antisocial behaviour. Antisocial behaviour is a heterogeneous concept encompassing physically aggressive behaviours such as fighting and bullying; rule-breaking behaviours such as lying, stealing, vandalism, arson and running away from home; oppositional behaviours, including irritability and headstrongness; and more severe behaviours associated with lack of empathy and guilt. The construct of antisocial behaviour spans many disciplines, including sociology, criminology and psychology, with numerous context-dependent definitions, labels and assessment methods. For example, criminologists often focus on delinquency and violent or property offending described as a violation of legal or social norms. Psychologists and psychiatrists are more focussed on psychosocial functioning, often using the clinical symptom areas of Oppositional-Defiant Disorder and Conduct Disorder (American Psychiatric Association, 2013). Despite these distinct approaches and research traditions, antisocial subtypes show substantial overlap, for example with rule-breaking behaviours often being described as delinquent. The heterogeneity of operationalisations of antisocial behaviour creates problems for meta-analytic studies aiming to summarise evidence on antisocial behaviour (Rhee & Waldman, 2002).

Across definitions, antisocial behaviour is associated with high social, interpersonal and financial costs, not only to affected families and communities but across society (National Institute for Health & Care Excellence, 2013). The annual average financial cost per family of severe antisocial behaviour during childhood (i.e., symptoms within a psychiatric range) was estimated at £15382 in 1999 (inflation corrected for 2013, approximately £23260 and €29256), with 37% of the burden taken by families (Knapp, Scott, & Davies, 1999). As such, antisocial behaviour poses a significant challenge to policy-makers in many developed societies.

Numerous studies have found that children from low-SES backgrounds show higher prevalence rates or mean symptom counts of behavioural problems (Amone-P'Olak, Burger, Huisman, Oldehinkel, & Ormel, 2011; Costello, Compton, Keeler, & Angold, 2003). However, this relationship between SES indicators and antisocial behaviour measures has not always been reported and its strength has substantially varied across studies. Previous reviews have addressed the relationship between SES and child development (Bradley & Corwyn, 2002) and one other study has conducted a meta-analytic review (Letourneau, Duffett-Leger, Levac, Watson, & Young-Morris, 2013). This meta-analysis only included studies that employed composite measures of SES, such as the Hollingshead's Index (Hollingshead, 1975), and therefore excluded many studies that relied on a single SES indicator, such as family income or parental education. Consequently the review identified only eight studies, all addressing aggression, and reported overall a small significant relationship with SES (Hedges's $g = .06$). To date, therefore, a systematic and comprehensive meta-analysis of the relationship between SES and antisocial behaviour that includes all SES indices and can address the heterogeneity in antisocial behaviour has not been conducted. Here we summarise findings concerning the relationship between SES and child and adolescent antisocial behaviour, addressing both the broad antisocial construct and more specific antisocial subtypes. Given the comprehensive nature of this meta-analysis, heterogeneity within the results is expected. Therefore, certain study and sample characteristics that might moderate the strength of the SES–antisocial behaviour relationship were investigated as follows:

1.1. Sex

Significant sex differences in antisocial behaviour, with boys having higher prevalence rates or symptom levels than girls, have been consistently reported in the literature (Lahey et al., 2000; Maughan, Rowe, Messer, Goodman, & Meltzer, 2004; Odgers et al., 2008). More recently, it has been suggested that sex may act as a moderator of the relationship between SES and antisocial behaviour (Letourneau et al., 2013). However, evidence concerning this potential moderation effect is scarce and inconsistent, with a significant detrimental effect of low SES in increasing the likelihood of antisocial behaviour having been found in boys but not girls (Veenstra, Lindenberg, Oldehinkel, De Winter, & Ormel, 2006) but also in girls but not boys (Henninger & Luze, 2013). It remains unclear both whether, and how sex moderates the relationship between SES and antisocial behaviour, and a comprehensive study is needed.

1.2. Age

Age of onset remains one of the best established methods to characterise the heterogeneity within antisocial behaviour, based on Moffitt's (1993) differentiation between the 'life-course persistent' (LCP) and 'adolescence-limited' (AL) antisocial subgroups. The two groups are hypothesised to have distinct aetiology, developmental course, and prognosis. Recently it has been argued that differences between the two groups are more quantitative than qualitative (Fairchild, Goozen, Calder, & Goodyer, 2013), as argued in Moffitt's original theory formulation. Later taxonomy studies indicated that there may exist an additional group of childhood-limited antisocial behaviour that does not persist into adolescence; the group consists of the so-called 'recoveries'-individuals who desisted from antisocial behaviour (Moffitt, Caspi, Dickson, Silva, & Stanton, 1996; Moffitt, Caspi, Harrington, & Milne, 2002). These three subgroups have rarely been operationalised in research on the relationship with SES. Nonetheless, age remains logically correlated with the original LCP and AL distinction (i.e., younger children must be early-onset and older children are a combination of early- and late-onset antisocial behaviour). Previous research suggests that age may moderate the relationship between SES and antisocial behaviour (Letourneau et al., 2013), and behavioural genetics studies showed that effects of environmental factors on antisocial behaviour decrease with age (for example, Burt & Neiderhiser, 2009). As such, it could be hypothesised that the strength of the relationship between SES and antisocial behaviour might decrease as children get older. This, however, has not been examined in relation to a wide range of antisocial subtypes.

1.3. Antisocial subtypes

Heterogeneous operationalisations of antisocial behaviour may be responsible for many discrepancies between studies. It remains unclear whether these behavioural subtypes show similar associations with SES or whether they moderate the nature or magnitude of the relationship. One classification system common to many disciplines differentiates between aggressive and non-aggressive antisocial behaviours; both psychological and criminological constructs map on to this classification. Previous research suggests there exist meaningful etiological

differences between aggressive and non-aggressive (i.e., rule-breaking) behaviours, with the former being highly heritable and the latter less heritable and including a contribution from shared environmental factors (Burt, 2009). Similarly, different developmental trajectories and distinct associations with cognitive ability have been found for these two subtypes of antisocial behaviour (Barker et al., 2007). These subtypes have also been shown to be more useful in predicting antisocial outcomes later in life than the age-of-onset classification (Burt, Donnellan, Iacono, & McGue, 2011).

More recently, it has been suggested that callous–unemotional (CU) traits may have independent diagnostic value (Frick, Ray, Thornton, & Kahn, 2013; Rowe et al., 2010; Viding & McCrory, 2012). As such, DSM-5 includes a limited prosocial emotion specifier of conduct disorder (American Psychiatric Association, 2013). CU traits are highly heritable (Viding, Blair, Moffitt, & Plomin, 2005) and are associated with a unique profile of emotional, cognitive, and personality characteristics in comparison to other antisocial groups (Frick & White, 2008). This includes reduced amygdala activity when processing fearful expression (Marsh et al., 2008) and slower reaction times for negative words, suggesting deficits in processing emotional stimuli (Loney, Frick, Clements, Ellis, & Kerlin, 2003). Although available research evidence does not permit formulation of strong hypotheses as to whether behavioural subtype moderates the relationship between SES and antisocial behaviour, it could be speculated that this relationship will be less pronounced when more heritable subtypes are considered.

1.4. Informant

The choice of informants in behavioural psychopathology research is a subject of a long-lasting debate. For example, Rubio-Stipec, Fitzmaurice, Murphy, and Walker (2003) have demonstrated discrepancies between parent and child reports of depressive and disruptive symptoms. Similarly, discrepancies have been found between parent and teacher reports, with a suggestion that they may be a function of socioeconomic and demographic factors such as income or maternal age (Stone, Speltz, Collett, & Werler, 2013). To our knowledge, no previous research has investigated whether the relationship between SES and child and adolescent antisocial behaviour is moderated by the type of informant.

We also address other potential moderators that may affect the relationship between SES and antisocial behaviour in young people. These include geographic location, the level of inequality and individualism in society, the distribution of SES in the sample studied (i.e., whether the sample was balanced or recruited from low-SES backgrounds), the extent statistical control variables were included in analyses estimating the SES–antisocial behaviour link, and whether investigating the SES–antisocial behaviour relationship was the primary aim of the study. The role of these factors in the relationship of interest has not been previously determined and it remains unclear whether the strength of the SES–antisocial behaviour relationship changes as a function of these factors.

2. Methods

2.1. Search strategy

The review was registered with PROSPERO (number CRD42012002193), and the study protocol was published (Piotrowska, Stride, & Rowe, 2012). As such the methodology is briefly described here with a focus on protocol adjustments. To identify studies with relevant data, we searched PsycInfo, Web of Knowledge, Scopus, Medline, CINAHL, Applied Social Sciences Index and Abstracts (ASSIA), Sociological Abstracts, Worldwide Political Science Abstracts, National Criminal Justice Reference Service, EconLit, System for Information on Grey Literature in Europe, UK National Statistics, and Education Resources Information Center (ERIC) databases, seeking articles published between 1960 and 2012 that investigated socioeconomic status and child and adolescent antisocial behaviour. The full search criteria and key words are available in the protocol (Piotrowska et al., 2012).

2.2. Selection and data extraction

Studies were included if they were: written in English; reported empirical results from samples of children and/or adolescents (≤18 years old) recruited from the general population; and measured both family social position (e.g., occupational/employment, income, or educational indicators) and any specific or global antisocial behaviour construct.

Two reviewers (PJP, SEC) extracted data in a standardised format, with 20% of selected studies being cross-verified. We contacted authors for additional data where needed. Where available, independent effect sizes were extracted for a number of potential moderators. Study and sample characteristics included in the following analyses as moderators were participants' sex and age (categorised into preschool = 0–6 years, childhood = 7–12 years or adolescence = 13–18, with some rounding error), the overall SES distribution in the sample studied (i.e. whether the sample was primarily recruited from low-SES backgrounds or whether it was balanced) as well as the informant reporting on antisocial behaviour (parent-, teacher- or self-report). We also classified studies according to their focus on behavioural subtypes of antisocial behaviour–mixed (i.e., focussing on global construct of antisocial behaviour including measures representing mixed subtypes such as conduct problems), aggressive (e.g., physical fighting, bullying, violent offending), non-aggressive (e.g., rule-breaking, delinquency) and callous–unemotional traits (including lack of guilt and empathy for victims); geographic location (i.e., continent), and study aim (i.e., whether a study was explicitly designed to investigate the relationship between SES and antisocial behaviour; aims were categorised into unrelated, broadly related, and focused on SES). Finally, three further moderators, specifically the levels of individualism at the national level (defined as the average level of individuals' integration into social groups; Hofstede Centre, 2014), inequality in society (measured using Gini coefficient), and the extent that statistical control variables were included in the estimated association were coded. Statistical control was coded as no controls imposed (0), study controlled for other SES indicators (1), study controlled other factors such as cognitive ability or parenting (2), both SES and other controls were included (3).

2.3. Data synthesis

Standardised effect sizes (r) were calculated for the included studies (DeCoster, 2012; Sánchez-Meca, Marín-Martínez, & Chacón-Moscoso, 2003). The choice of the effect size metric was dictated by the correlational nature of the majority of studies. Effect sizes were calculated for direct associations between SES indicator and an antisocial behaviour measure. Where multiple reports were based on the same dataset, the computable effect size was extracted from the report using the most representative sample (Amato & Keith, 1991). If the association of interest was provided for multiple indicators of SES, we made an a priori decision to retain income-based measures (e.g. income-to-needs ratio, benefit allowance, free lunch) and secondly, educational and occupational measures. If none of these were available, composite socioeconomic classifications such as the Hollingshead's Index of Socioeconomic Status (Hollingshead, 1975) were used. Similarly, when results from multiple informants were reported, primary caregivers (i.e., usually parents) were preferred, followed by self-reports, teachers, peers, and official data. If multiple antisocial behaviour constructs were measured in the same study, the estimates were pooled together via meta-analytic synthesis for our global meta-analysis (i.e., where all studies were included in a single meta-analysis). The same strategy was used when results were reported for multiple subsamples (e.g. age or sex groups), so that each study contributed one effect size to the final synthesis. In longitudinal studies where effect sizes were available at multiple waves, we followed Connell and Goodman (2002) in using only the first time

point to ensure independence of included effect sizes. Finally, when results were presented for more than two levels of SES, the effect sizes were calculated for the difference between the two extreme levels (i.e. the lowest and the highest level of SES reported) as suggested elsewhere (Conway et al., 2008; Lorant et al., 2003).

2.4. Analyses

Due to the expected heterogeneity in constructs and methodologies, both between and within studies, a random-effects model was used. Correlational effect sizes were converted to Fisher's z scale and the weighted average of transformed scores was calculated (Field & Gillett, 2010; Hedges & Vevea, 1998). Analyses were performed in SPSS v20 and R 2.12.1 (Field & Gillett, 2009). A forest plot created in MS Excel (Neyeloff, Fuchs, & Moreira, 2012), and the heterogeneity between studies was assessed using the Q statistic and I^2 index.

Following exclusion of outliers (i.e., studies with a z-score larger than 3), the global meta-analysis summarised the relationship between broadly conceptualised antisocial behaviour and SES by combining effect sizes from all included studies. Moderation analyses tested whether effect sizes varied as a function of sample and study characteristics (multiple levels of a moderator could be coded in one study). These were conducted in two steps; firstly, each moderator was tested on its own (univariate) and in the second step, significant moderators from step 1 were entered simultaneously into a multivariate model. Publication bias was assessed in multiple ways; Rosenthal's 'fail-safe N' was computed indicating the number of studies that must have been missed with the mean effect size of 0 to reduce the overall effect size to a negligible level. The funnel plot of effect sizes plotted against standard errors was inspected and the association between effect sizes and their variances was assessed using Kendall's τ method.

3. Results

3.1. Global analyses

The initial search returned 9770 unique records. Abstracts were assessed and 952 papers underwent in-depth review. We excluded 792 records (details available from the corresponding author) with the remaining 160 meeting the inclusion criteria. Of these, 133 contained the necessary data for effect size calculations, allowing inclusion in the meta-analysis. The flow diagram of the selection process is presented in Fig. 1 using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff, & Altman, 2009). One study (Low, Sinclair, & Shortt, 2012) with an outlying effect size ($Z = -5.2$) was removed from the analysis. The final sample for the global meta-analysis therefore included 132 studies which provided 139 independent effect sizes (total $N = 339868$). The majority of these studies were conducted in the USA ($N = 85$) and published after 2000. Most of the effect sizes in the meta-analysis were calculated on the basis of income-related SES indictors such as income-to-needs ratio, free lunch program or welfare status. A small subset of effect sizes ($N = 14$) was based on composite SES measures. In relation to antisocial behaviour measures, the majority of studies used well-established and reliable measures of antisocial behaviour such as the Development and Well-Being Assessment (DAWBA; Goodman, Ford, Richards, Gatward, & Meltzer, 2000), the Child Behaviour Checklist (CBCL; Achenbach & Rescorla, 2001) or the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). Detailed study characteristics are presented in Appendix A.

The global meta-analysis ($k = 139$) yielded an overall population effect size of -0.099 (95% CI: -0.116 to -0.082, $Z = 11.29$, $p < 0.001$), indicating a significant relationship between socioeconomic status and child and adolescent antisocial behaviour, such that antisocial behaviour was more likely to occur when socioeconomic status was low. The forest plot of the distribution of effect sizes under the random-effects model is presented in Fig. 2 and study references are provided in Appendix B. In order to evaluate the existence of publication bias, we inspected the funnel plot (Fig. 3). It did not appear perfectly symmetrical which may indicate the existence of publication bias. However, a number of studies outside the funnel plot were concentrated around mean effect size of 0 indicating that publication bias resulting from non-significant results remaining unpublished is unlikely. This is supported by a non-significant Kendall's $\tau = -0.043$ ($p = 0.45$) which suggests no association between the effect size and the sample size in studies included in the meta-analysis. Furthermore, the Rosenthal fail-safe analysis indicated

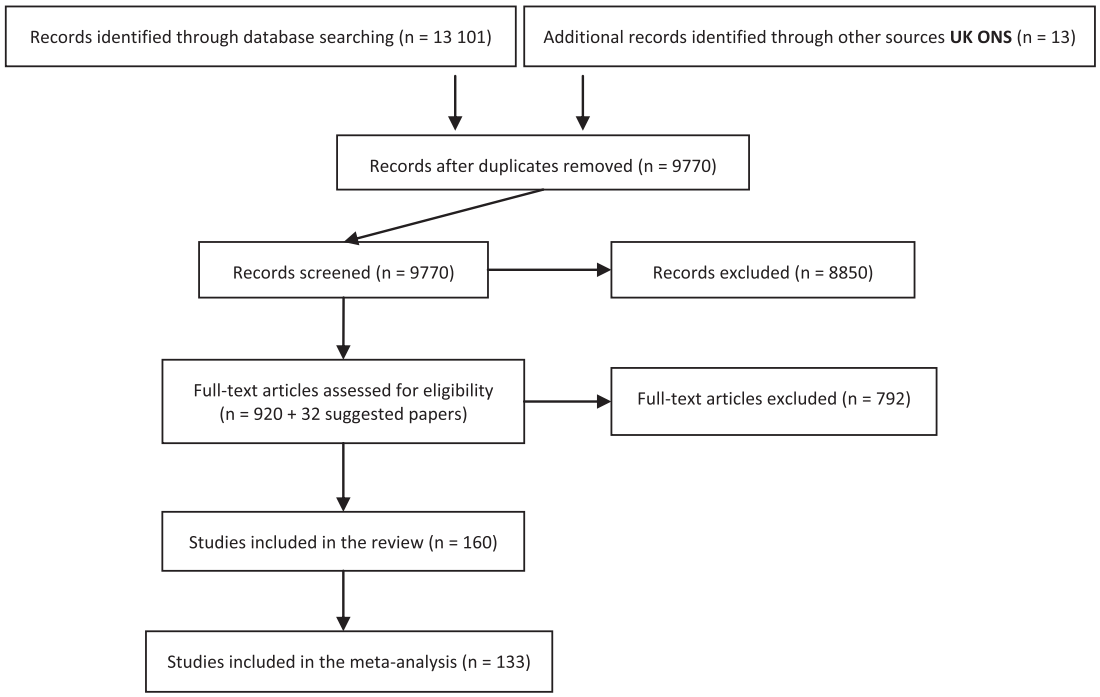

Fig. 1. Study selection.

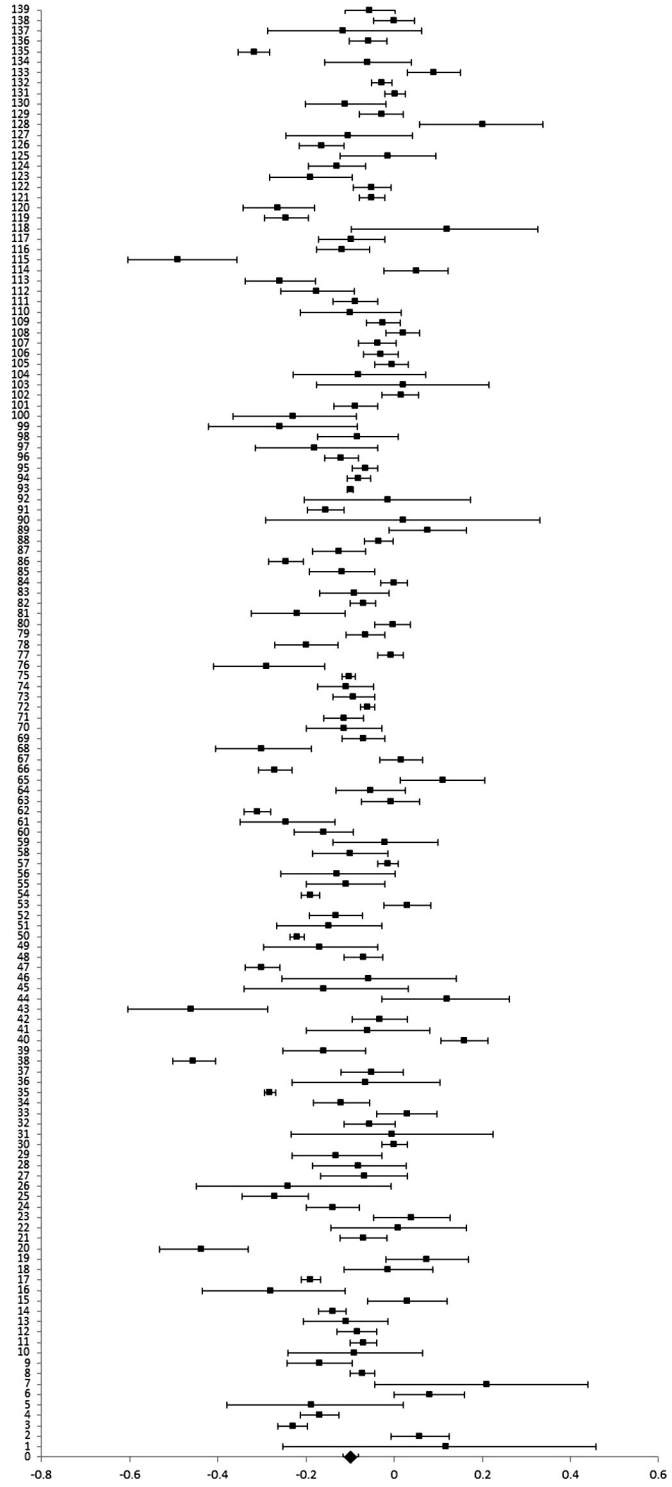

Fig. 2. Forest plot for random-effect meta-analysis of the association between socioeconomic status and antisocial behaviour.

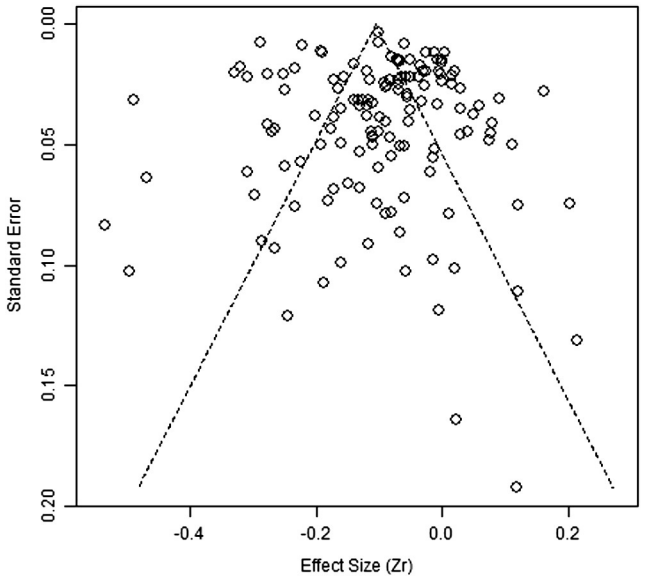

Fig. 3. Funnel plot of publication bias.

that 97303 studies with a mean effect size of 0 would be required to reduce the observed association to non-significance. These results indicate that publication bias did not substantially influence our meta-analysis.

3.2. Influence of moderators on the relationship between SES and antisocial behaviour

A homogeneity of variance test revealed significant heterogeneity across studies, Q(df) = 190.0(138), p = 0.002. However, the proportion of total variability explained by heterogeneity was low to moderate, $I^2 = 27.37\%$. In the univariate analyses, sex, level of individualism and inequality as well as the SES distribution in the sample and the level of statistical control did not significantly moderate the relationship between SES and antisocial behaviour (all ps > 0.05).

Univariate moderation analyses yielded, however, five significant factors as shown in Table 1. Due to a small number of studies from Asia, Australia/New Zealand and South America, geographical comparison was only made between studies from North America (k = 91) and Europe (k = 35). Both mean effect sizes were significantly different from 0 with European studies exhibiting the stronger correlation between SES and antisocial behaviour. The studies from North America, however, were significantly heterogeneous as indicated by the Q statistic. There were significant differences in effect size between the three age groups with the strongest correlation found amongst preschoolers, followed by older children and then by adolescents. Effect sizes were significantly heterogeneous in the latter category. Significant differences were also found between behaviours categorised as mixed antisocial behaviours, aggressive and non-aggressive behaviour, and callous–unemotional traits. The mean effect size for studies of mixed antisocial behaviour was close to the overall result of the global meta-analysis. Smaller correlations were found for aggressive and non-aggressive behaviour studies, paired with significant heterogeneity within these subtypes. The strongest correlation was found for studies of CU traits. When study aim was considered as a moderator, the mean effect size of unrelated studies (i.e., not designed to investigate the relationship between SES and antisocial behaviour) was larger than in the studies with broadly related study aim (i.e., considering the role of demographics) or those focusing specifically on the relationship between SES and antisocial behaviour. Finally, there was significant moderation by informant type; the relationship between SES and antisocial behaviour was stronger when parents or teachers reported on young people's antisocial behaviour relative to self-report. There was significant heterogeneity within the self-report category (p < 0.05).

There were a number of bivariate relationships between the significant moderators assessed above, namely the association between the type of informant and both the age of participants [k = 104, χ^2(df) = 59.47(4), p < 0.001], and the study aim [k = 113, χ^2(df) = 10.66(4), p = 0.031].

We examined the feasibility of entering all significant moderators into a meta-regression model simultaneously, so that their independent effects could be estimated. Behavioural subtype could not be included in

Table 1
Random-effects models of significant moderators.

	k	Mean r	95% CI		z	p value	Q statistic	p value	Univariate		Multivariate k = 104	
			Lower	Upper			χ^2(df)		χ^2(df)	p value	χ^2(df)	p value
Continent	126								4.924(1)	0.026	N/A	N/A
North America	91	−0.084	−0.103	−0.066	9.087	<0.001	139.744(90)	0.001				
Europe	35	−0.128	−0.163	−0.093	7.101	<0.001	44.081(34)	0.12				
Age	121								10.983(2)	0.004	0.747(2)	0.688
Preschool	24	−0.133	−0.183	−0.081	5.026	<0.001	22.051(23)	0.52				
Childhood	38	−0.109	−0.149	−0.069	5.309	<0.001	41.579(37)	0.28				
Adolescence	59	−0.066	−0.083	−0.049	7.443	<0.001	100.681(58)	<0.001				
Construct	178								22.634(3)	<0.001	N/A	N/A
Mixed	68	−0.123	−0.152	−0.093	8.11	<0.001	68.831(67)	0.42				
Aggressive	50	−0.065	−0.085	−0.045	6.438	<0.001	84.221(49)	0.001				
Non-aggressive	55	−0.059	−0.081	−0.037	5.297	<0.001	91.195(54)	0.001				
CU traits	5	−0.236	−0.368	−0.094	3.218	0.001	3.314(4)	0.51				
Aim	139								7.82(2)	0.02	N/A	N/A
Unrelated (0)	37	−0.136	−0.18	−0.092	5.991	<0.001	41.84(36)	0.232				
Broad (1)	55	−0.091	−0.119	−0.063	6.348	<0.001	71.216(54)	0.058				
SES-related (2)	47	−0.076	−0.097	−0.055	7.118	<0.001	56.142(46)	0.145				
Informant	113								33.44(2)	<0.001	16.418(2)	<0.001
Parent (0)	45	−0.138	−0.17	−0.106	8.459	<0.001	49.16(44)	0.274				
Self (1)	54	−0.049	−0.065	−0.033	5.97	<0.001	71.534(53)	0.046				
Teacher (2)	14	−0.137	−0.206	−0.066	3.758	<0.001	15.266(13)	0.291				

the multivariate model due to a substantially different number of effect sizes (i.e., multiple subtypes may have been tested in the same study). Moderators were missing for a number of studies, and only 95 studies provided the full set of data that could be included in the meta-regression. Therefore, we checked that the univariate moderator effects identified above were maintained when repeated on this reduced number of studies. The effects of age and informant remained substantially unchanged at this stage (ps < 0.05). However, the effects of geographic location and study aim were not significant in univariate models based on the reduced set of studies and were excluded from the multivariate meta-regression model. Therefore, this model included only age and informant as moderators. As shown in Table 1, type of informant remained significant while participants' age did not independently moderate the SES–antisocial behaviour relationship (p > 0.05). The association between these two moderators indicated that parent data were more often provided for younger children and self-report data collected from adolescents.

Finally, we wanted to test the study aim and the type of informant simultaneously as these two moderators were also associated. Data were available on both of these moderators in 113 studies. However, study aim was no longer a significant univariate moderator (p > 0.05) with the reduced number of effect sizes available for this analysis; hence the multivariate model with both moderators entered simultaneously was not conducted.

4. Discussion

A meta-analysis of 132 studies contributing 139 independent effect sizes based on 339868 individual observations was conducted to summarise research on the link between socioeconomic status and child and adolescent antisocial behaviour. Given the extensive data included in the review we were able to precisely estimate a composite effect size in our global meta-analysis with a narrow confidence interval. The observed association between SES and antisocial behaviour is small according to Cohen's (1992) definition, but regarded as reliable. Our findings indicate that SES is associated with child and adolescent antisocial behaviour, so that lower SES relates to higher levels of antisocial behaviour. As previously described, publication bias was not found in the current study. The funnel plot indicated a concentration of studies in the top, close to the mean effect size of zero. It seems plausible that our study avoided publication bias due to the nature of the question under review and data available which facilitated publication of non-significant results, i.e., many studies reported relevant results when the SES–antisocial behaviour link was not the primary focus.

As expected, significant heterogeneity was also observed across the studies and meta-regressions examined the role of a priori hypothesised moderators. The relationship between SES and antisocial behaviour was significantly moderated by the type of informant. Stronger relationships were found when antisocial behaviour was reported by parents or teachers, and these resembled the mean effect size found in the global meta-analysis; the smallest effect size was found using self-reports. Our study is the first to show that the strength of the relationship between SES and antisocial behaviour may be a function of the type of informant reporting antisocial behaviour. It should be noted that the SES measure was largely collected from primary caregivers/parents. As parents were often reporting on both SES status and child antisocial behaviour it is possible that parent-reported associations were inflated by shared method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). However, similar mean effect size was estimated for teacher reported antisocial behaviour, suggesting that shared method inflation was not substantial. An alternative possibility is that the difference in the strength of the relationship between parents or teachers and self-reports could be largely due to an 'expectancy effect', specifically that both parents and teachers perceive children from low-SES background as more likely to exhibit antisocial behaviour. This finding requires further investigation and replication in primary studies.

Notably, the type of informant was related to participants' age and when both moderators were included in the same model, age was no longer a significant moderator (as reported in univariate analyses). Parent-reports were more likely to be used for young children, and self-reports for adolescents. This may in part reflect difficulties in obtaining reliable data from younger children.

There was a significant moderation effect of antisocial behavioural subtype. This analysis revealed a stronger effect of SES in studies focussing on mixed antisocial behaviour (i.e., the global antisocial construct) than on aggressive or non-aggressive behaviours. Further exploration showed that the mixed subtype was more likely to be measured in younger children than adolescents which, in line with the age moderation results, could explain the stronger effect in studies measuring mixed behaviours. This suggests that broadly operationalised antisocial behaviour is more often measured amongst children, whereas behavioural subtypes are distinguished amongst older children and adolescents. We were unable to run a multivariate meta-regression to test

this hypothesis due to substantial difference in number of effect sizes available for these moderators. Another possibility is that the mixed group included an undifferentiated subtype (e.g., irritability, oppositionality) that could have driven the strong relationship with SES. Furthermore, no difference was noted between aggressive and nonaggressive subtypes, suggesting their similar association with socioeconomic status. This finding may be seen to contrast with past studies showing that environmental factors play a more important role in nonaggressive behaviours (Burt, 2009). However, there was significant heterogeneity within effect sizes estimated for both constructs. This may be the result of the coding and classification system adopted in our review, or may reflect often inconsistent operationalisations of antisocial behaviour in the literature. The strongest effect was present for studies in which callous–unemotional traits were the primary focus. Previous research suggested that CU traits are highly heritable (Viding et al., 2005) and associated with a number of nuerocognitive deficits (e.g., Marsh et al., 2008), hence our finding of a strong association between SES and CU traits was unexpected. However, given the small number of studies in this group, caution must be applied. Furthermore, CU traits are correlated with antisocial behaviour (Rowe et al., 2010); hence the effect reported in the current meta-analysis may not be independent of global antisocial behaviour. One of the issues emerging from these findings is that primary studies are inconsistent in measurement and conceptualisation of antisocial behaviour (Rhee & Waldman, 2002). Work to refine the most optimal method of categorising antisocial behaviour is required to provide the field with a standardised method of measuring antisocial behaviour subtypes.

Our univariate analyses indicated that there was significant moderation of the relationship between SES and antisocial behaviour by geographic location (i.e., continent) and study aim. Estimates were stronger in European studies and when the study was not explicitly designed to investigate the association between SES and antisocial behaviour. These moderators, however, could not be tested in the multivariate analyses since they were no longer significant in univariate models calculated on the subset of studies for which data on all moderators were available. Importantly, geographic location was unrelated to other moderators, which supports its unique effect. This finding, however, should be interpreted with caution due significant heterogeneity in effect sizes from North American studies.

Unexpectedly we found that effect sizes tended to be smaller in studies aiming to investigate the relationship between SES and antisocial behaviour than those that included the analysis as a component of another purpose. This finding provides evidence against biases having inflated the strength of the association reported in the literature. Also, study aim was related to the type of informant, with the studies designed to explore the SES–antisocial behaviour relationship more likely to use self-reported data. This confounding may explain the univariate link between study aim and association strength. We were unable to test this in our multivariate analyses as the effect of study aim was no longer significant in a univariate model when the sample was constrained to the reduced number of studies with sufficient data available for inclusion in a multivariate model. This in itself provides further evidence that the moderation of the study aim at univariate level should be considered with caution. It seems that the univariate result is driven by small number of studies as the effect was no longer significant once 26 studies were removed. Further research will be required to explore this issue fully.

Finally, levels of individualism in society and income inequality as well as SES of the sample were did not moderate the relationship between SES and antisocial behaviour. Similarly, the level and type of covariates included did not significantly moderate the strength of the relationship. It seems possible that the lack of a significant effect resulted from the small number of controlled studies in our meta-analysis so that this effect size was not well estimated. Moreover, the correlation did not significantly differ across boys and girls, suggesting that despite the higher prevalence of conduct problems amongst boys (Maughan et al., 2004), the relationship between SES and antisocial behaviour is independent of sex.

Our primary aim was to comprehensively review cross-disciplinary research on the association between socioeconomic status and child and adolescent antisocial behaviour. The scale of our review, which includes 132 studies with 339868 participants, has provided a strong basis for solid conclusions to be drawn. The strength of this set of studies, however, is limited by the methodological quality of the primary studies and data available, especially in choice of moderators. For example, only 12 studies included separate effect sizes for boys and girls. Moreover, our search was restricted to papers published in English, which may have resulted in a bias towards research in developed countries. Also, the majority of studies included in the meta-analysis examined linear associations between SES and antisocial behaviour or the differences between low- and high-SES groups. It is possible, however, that this relationship is non-linear, for example some work has indicated a cubic (Piotrowska, Stride, Maughan, Goodman, & Rowe, under review) or U-shaped relationship (Åslund et al., 2013). Finally, broadly conceptualised antisocial behaviours have been shown to co-exist with other disorders such as anxiety, depression, and ADHD (Angold, Costello, & Erkanli, 1999; Maughan et al., 2004). The issue of comorbidity of these disorders is an important limitation of many studies in the field as it is often difficult to disentangle whether the form of psychopathology under study is driving the relationships identified, or whether another correlated form of psychopathology is responsible. Careful attention to this issue in primary studies is required.

Our meta-analysis provides a strong foundation for further research investigating mechanisms underlying the association between SES and antisocial behaviour. These may include socialisation processes, parental well-being or poor parenting (Dodge, Pettit, & Bates, 1994), language ability (Petersen et al., 2013), or maternal depression and father-child interactions (Violato, Petrou, Gray, & Redshaw, 2011). A comprehensive meta-analysis of twin and adoption studies found moderate effects of genetic, shared and non-shared environmental factors on antisocial behaviour (Rhee & Waldman, 2002). It remains important to further explore the role that genetic and environmental factors play together in explaining the relationship between SES and antisocial behaviour. For example, Tuvblad, Grann, and Lichtenstein (2006) showed that heritability of antisocial behaviour changes as a function of SES. Specifically, they found that genetic factors influencing one's antisocial behaviour were more important in better-off environments, whereas shared environmental factors played a major role in less advantaged settings. Similarly, interactions between a serotonin transporter genotype and family SES in prediction of adolescent delinquency have been found (Åslund et al., 2013). These studies highlight that it is important to study the interplay between biological and environmental factors to understand the role of SES in the development of antisocial behaviour (Cadoret, Cain, & Crowe, 1983; Koenen, Uddin, Amstadter, & Galea, 2010; Raine, 2002).

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Contributors

PJP and RR designed the study and developed the search strategies. PJP conducted literature searches and provided summaries of previous research studies. PJP and SEC extracted and coded the data. PJP conducted the statistical analysis in collaboration with RR and CBS, and wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.cpr.2014.11.003.

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