

**Title:** Maternal depressive symptoms and adolescent academic attainment: testing pathways via parenting and self-control

**Abstract:** Maternal depression is associated with reduced academic attainment in children, however, it is not clear how this association comes about. Depressive symptoms are associated with impairment in social roles including parenting. Children's self-control is an important contributor to academic attainment and is influenced by parenting. We therefore hypothesised that impaired parenting and children's self-control may mediate links between maternal depression and children's academic attainment. Data were from a brief longitudinal study (3 waves) of UK children aged 11-12 years and their mothers. Higher maternal depressive symptoms at baseline were associated with lower academic attainment in children assessed one year later. There was evidence to support an indirect effect of maternal depressive symptoms on children's academic attainment through the mother-child and the father-child relationship which, in turn, reduced children's self-control. These influences were independent of socio-economic deprivation. A direct effect of maternal depression on children's academic attainment was also observed.

**Keywords:** maternal depression; academic attainment; education; self-control; parenting.

Depressive disorder and depressive symptoms are common and associated with impaired functioning in close interpersonal relationships such as those with romantic partners and offspring (Backenstrass et al., 2006; Burke, 2003; Kessler et al., 2005; Lerner & Henke, 2008; Weissman, Paykel, Siegel, & Klerman, 1971). The children of depressed mothers are at increased risk of maladaptive developmental outcomes including mental health problems and lower educational attainment (Goodman & Gotlib, 1999; Rice, Harold, & Thapar, 2002; Shen et al., 2016). While many studies have assessed the link between maternal depression and children's mental health problems, there has been less work exploring *how* maternal depression may affect children's educational outcomes (Goodman et al., 2011).

Maternal depression has been shown to increase the likelihood of poor educational outcomes in children. Thus, compared to healthy controls or those reporting low levels of depressive symptoms, the children of mothers with depression have lower grade-point averages and test performance (Hammen et al., 1987; Tannenbaum & Forehand, 1994). Maternal depression has also been linked with lower child IQ which is an important contributor to educational attainment (Hay, Pawlby, Waters, & Sharp, 2008; Milgrom, Westley, & Gemmill, 2004). Most recently, in a sample of one million Swedish children, maternal depressive disorder at any point from birth to late adolescence was associated with lower grades in offspring at the end of compulsory education (Shen et al., 2016). That study found that girls' academic performance was affected more when offspring had a depressed mother (Shen et al., 2016). This finding contrasted with earlier literature based on smaller samples which found that boys tended to be more negatively affected by maternal depression (Ensminger et al., 2003; Hay et al., 2008; Milgrom et al., 2004; Murray et al., 2006).

It remains unclear *how* maternal depression increases the likelihood of poor educational outcomes in children. One possible contributory factor is the parent-child relationship. Depressed mothers may have difficulties establishing good quality relationships

with their children and adequately responding to their children's social and emotional needs (Beardslee, Versage, & Gladstone, 1998). Indeed, depressed mothers' interactions with their children tend to be less positive, warm and responsive and more negative and hostile (Lovejoy, Graczyk, O'Hare, & Neuman, 2000). Mothers experiencing depression and depressive symptoms are also more likely to use negative or unconstructive methods of control (e.g., Cummings, Keller, & Davies, 2005) and remission of maternal depression following effective antidepressant treatment is associated with greater warmth and acceptance exhibited towards children (Foster, Webster, Weissman, Pilowsky, Wickramaratne, Talati, et al., 2008; Weissman et al., 2015). Positive parent-child relationships in general, and warm-responsive parenting styles in particular, have been linked to higher academic attainment in children (e.g., Estrada, Arsenio, Hess, & Holloway, 1987; Hirsh-Pasek & Burchinal, 2006) and therefore impaired parenting may explain the negative effects of maternal depression on children's educational outcomes.

There is evidence that current maternal depression results in lower quality support and less cognitive stimulation during joint parent-child tasks, such as homework, and that this may contribute to children's lower academic achievement (Murray et al., 2006; Murray et al., 2010). It seems likely therefore that the effect of maternal depression on children's cognitive ability arises, in part, due to disruptions to the social interactions between the mother and child that normally facilitate cognitive development including interactions that display and promote problem-solving and attentional control (Hay & Kumar, 1995; Jensen et al., 2014). For instance, children's self-control is related to the quality of the parent-child relationship and to children's academic success (e.g., Duckworth & Seligman, 2005; Moilanen, Rasmussen, & Padilla-Walker, 2014; Ng-Knight et al., 2016). Warm-responsive parenting is thought to facilitate self-control by providing a stable emotional base from which children can engage with difficult and challenging tasks, while also supporting the learning of socially

desirable behaviours by facilitating communication between parent and child (Alessandri & Lewis, 1996; Estrada et al., 1987). Conversely, hostile parents provide poor role-models for exercising self-control and hostility arouses negative emotions in children which interfere with the cognitive processes underlying self-control (Bandura, 1977; Moilanen et al., 2014; Pessoa, 2009). We set out to test the hypothesis that maternal depression influenced adolescent educational attainment through effects on the child's self-regulatory abilities which come about, at least partly, due to disruptions to the parent-child relationship, extending previous work by examining both mother-child and father-child relationships.

Research on maternal depression has largely focused on maternal parenting, but it is important to acknowledge that the mother-child relationship does not occur in isolation. A systems theory perspective suggests that the impaired interpersonal style associated with maternal depression will not only affect interactions with children, but also interactions among other family members (Cox & Paley, 1997). A significant component of the family system that is often overlooked in research into maternal depression is the father (e.g., Goodman & Gotlib, 1999). This is likely to be important because supportive parenting from fathers exerts effects independent of maternal parenting on children's cognitive development and academic achievement (Flouri & Buchanan, 2004). Studies of young children also show positive father-child relationships predicting higher self-control (Kochanska et al., 2008) pointing to the need to clarify if such associations exist in older samples. As such, while it has been established that features of the depressed mother's relationship with her partner, such as levels of conflict and support, will influence her own parenting (e.g., Shelton & Harold, 2008), here, we turn attention to how maternal depressive symptoms might affect the father's parenting ability.

Whilst fathers make an important contribution to children's cognitive and educational outcomes (Flouri & Buchanan, 2004; Kim & Hill, 2015) the limited literature available to

date has yielded mixed results on how mothers' depression influences fathers' parenting. Some research has found that children's interactions with their fathers may not be adversely affected by maternal depression (Hossain et al., 1994) and that fathers may even play a compensatory role by being more caring towards children when mothers are depressed (Hops et al., 1987). Other research has found that if one parent is depressed there are negative implications for the non-depressed parents' relationship with their child (Jacob & Johnson, 1997; Paulson, Dauber, & Leiferman, 2006). In sum, there is good reason to believe that maternal depression impairs mothers' parenting but further evidence is required to establish if there are negative effects on fathers' parenting of young adolescents.

### **The present study**

This study aimed to expand understanding of the association between maternal depressive symptoms and children's academic attainment in adolescence, by examining whether parenting and children's self-control act as mediating processes. We first tested the magnitude of the effect between maternal depressive symptoms and children's academic attainment and then tested two explanatory hypotheses:

- 1) The association between maternal depressive symptoms and children's academic attainment is partially mediated through *maternal* parenting and children's self-control (see conceptual model shown in figure 1).
- 2) The association between maternal depressive symptoms and children's academic attainment is partially mediated through *paternal* parenting and children's self-control.

We additionally examined the effect of: (i) socio-economic disadvantage, (ii) child sex, and (iii) whether fathers were resident in the family home. We ran additional models which controlled for the potential confounding influence of socio-economic disadvantage given its associations with higher levels of depression in women (Goodman & Gotlib, 1999),

more authoritarian parenting (Aunola, Nurmi, Onatsu-Arviolommi, & Pulkkinen, 1999), lower self-control (Ng-Knight & Schoon, 2016), and lower levels of academic attainment amongst offspring (Ermisch & Francesconi, 2001). We examined the effect of child gender given mixed evidence of gender differences in the relationship between maternal depression on educational attainment favouring girls (e.g., Hay et al., 2008) or boys (e.g., Shen et al., 2016). The main models presented included fathers regardless of whether they resided in the home, but we also carried out sensitivity analyses examining only intact families because theoretical approaches such as family systems theory and the family stress model suggest that maternal distress will have most influence within intact families (Conger, Conger, & Martin, 2010; Cox & Paley, 1997).

<FIGURE 1>

## **Method**

### **Sample and procedure**

Informed consent (parents) or assent (children) was obtained from all participants.

Participants were recruited from 10 secondary schools in the South East of England. Data collected from school records show that the full sample is broadly representative of the local population of schoolchildren from which it was drawn in terms of indicators of socio-economic deprivation (16% this sample vs 14% in the local population), the proportion of individuals from minority ethnic groups (40% vs 33%, predominantly of Asian ethnicities), but the sample had slightly higher academic attainment levels than the national average as measured by the proportion of pupils achieving level 4 national curriculum levels at key stage 2 assessments (English 89% vs 82%; Maths 90% vs 81%) (Ng-Knight et al., 2016). Data were collected on three occasions, six months apart. Children were all in the same school year and an average age of 11 years ( $M = 134.63$  months,  $SD = 3.86$ ) at wave one. The

selection of primary school pupils took place via the secondary schools, with secondary schools' lists of prospective pupils forming the study sampling frame.

Data were collected from parents by post at wave one ( $n = 745$ , 34% of those eligible), children via in-school assessments at wave two ( $n = 1712$ , 88% of those eligible) and school records at wave three ( $n = 1796$ , 92% of those eligible). Response rates at wave one were lower due to an opt-in postal questionnaire format, whereas follow-up assessments were conducted in schools and used an opt-out procedure. The study design required only one parent to respond for each participating child. Of the 745 responding parents, this study only uses the data collected from mothers ( $n = 605$ ) due to our focus on maternal depressive symptoms (578 mothers provided information on their depressive symptoms). Non-participation at wave one was largely due to non-response, whilst non-participation and missing data at waves two and three were largely due to children being withdrawn from the study.

## Measures

**Maternal depressive symptoms.** At wave one, mothers reported on their own current depression symptoms by completing the depression subscale of the Hospital Anxiety and Depression Scale (HADS) which asks about symptoms in the past week (Zigmond & Snaith, 1983; seven items, e.g., 'I still enjoy the things I used to enjoy',  $\alpha=.77$ ). Responses were made on a four-point scale (e.g., 0 = definitely as much, 1 = not quite so much, 2 = only a little, 3 = hardly at all). Scores on all items were combined to create a total score (range 0–21). The HADS has been validated against 'gold-standard' clinical interviews for use in community samples and with various age groups (Spinhoven et al., 1997). This measure of maternal depressive symptoms reported in wave one was also used in waves two and three as 'auxiliary' variables in our analyses.

**Parenting.** At wave two, children's perceptions of warmth and hostility from mothers and fathers were assessed separately with children's reports to two scales (Melby et al., 1993): Warmth (six items, e.g., 'How often did your mum/dad let you know she/he really cares about you?'  $\alpha = .90/.92$  for mothers/fathers) and Hostility (four items, e.g., 'How often did your mum/dad get angry at you?'  $\alpha = .79/.82$  for mothers/fathers). Responses were made for the past month on a seven-point scale (1 = always, 7 = never). Total scores for each subscale were used with higher scores indicating higher warmth and higher hostility. These scales have been widely used to assess the parent-child relationship (e.g., Dogan et al., 2007; Ng-Knight et al., 2016).

Child reports often correlate more strongly with independently observed parenting compared to parent reports (Scott, Briskman & Dadds, 2011; Sessa, Avenevoli, Steinberg & Morris, 2001) and child reports also provide important information about children's appraisals of parent-child relationship quality, which is a key construct linking aspects of family functioning and children's psychological adjustment (e.g., Shelton & Harold, 2008). Using child-reports also reduces the impact of common method variance which can artificially inflate observed associations when the same informant reports on exposure (i.e. maternal depression) and explanatory (i.e. parenting) variables (Rutter et al., 2001).

**Self-control.** At wave two, the 13-item Brief Self-Control Scale (BSCS; Tangney, Baumeister, & Boone, 2004) was used to measure children's self-reported self-control (e.g., 'I am good at resisting temptation'). Items were rated on a five-point scale (1 = not at all, 5 = very much). The scale had good internal consistency ( $\alpha = .80$ ). A mean score for the 13 self-control items was used. The BSCS is a widely-used measure of self-control in adolescence (Duckworth & Seligman, 2005).

**Academic attainment.** At wave three, academic attainment data was measured using children's end of year Maths, English and Science assessments obtained from school records.



To account for differences in measurement systems between schools, academic attainment scores were standardised within schools ( $M = 0$ ,  $SD = 1$ ). Therefore, the academic attainment variable refers to academic attainment within schools, where 0 equals average levels within schools.

**Covariates.** An index of socio-economic deprivation was computed (range = 0–3) using parent reports of three indicators of socio-economic status (Adler et al., 1994). Low family income was defined as incomes below 60% of the median regional income in 2012 (i.e., <£20,000) in line with international definitions of poverty (25% of the sample met this criterion), low educational level was defined as both parents not completing secondary education (5%), and unemployment was defined where both parents were unemployed (6%).

### **Statistical Analysis**

Analyses were conducted in Mplus version 7 (Muthén & Muthén, 2012). The MLR estimator was used which provides maximum likelihood parameter estimates with standard errors and chi-square test statistics which are robust to non-normality. Indirect effects were assessed using bootstrapped significance tests (10,000 bootstraps; Hayes & Scharkow, 2013). Gender differences were assessed with a scaled chi-square difference test where a baseline model with no constraints was compared to models where individual paths were constrained to equality (one at a time) across boys and girls.

Full-information maximum-likelihood (FIML) estimation was used to treat missing data, FIML uses all of the available information for each participant rather than deleting participants or imputing values (Schafer & Graham, 2002). Unit non-response was 66% at wave one, 12% at wave 2, 8% at wave3. Item non-response was 4.5% for maternal depressive symptoms, 4.4% for maternal warmth, 4.4% for maternal hostility, 13.7% for paternal warmth, 13.3% for paternal hostility, and 6.4% for self-control. Wave one respondents were slightly more academically able ( $t(1594) = -3.55$ ,  $p < .001$ ) and had higher

self-control ( $t(1422) = -3.56, p < .001$ ) than wave one non-respondents, but there was no evidence of differences in maternal depressive symptoms based on wave one participation (see supplementary analyses in appendix). This dependence of missingness on observable characteristics indicates that data are more likely to be missing at random (MAR) rather than missing completely at random (MCAR), underscoring the importance of using an analytic approach which accounts for missing data (Allison, 2001; Enders & Bandalos, 2001; Graham, 2009; Schafer & Graham, 2002). FIML can provide unbiased estimates in the presence of missing data, particularly when the statistical model includes ‘auxiliary’ variables that correlate highly with the variables that have missing data (e.g., we include maternal depressive symptoms measured at waves two and three to reduce bias where wave one is missing; Graham, 2009). Nonetheless, results were very similar for complete case analyses ( $n = 419\text{--}504$ ; results available from the first author). Sensitivity analyses run with regression paths from socio-economic deprivation on to all mediator and outcome variables are presented in the appendix.

## Results

### Descriptive statistics

Of the 578 mothers who reported their depressive symptoms at baseline, 42 (7.3%) met the criteria for ‘possible caseness’ (scores 8–10) and 17 (2.9%) met the criteria for ‘caseness’ (scores  $\geq 11$ ) (Snaith, 2003). The average score on the depressive symptoms scale was 3.38 (range = 0–16). These rates of ‘caseness’ and the mean score are very similar to those reported in other UK community samples (e.g., 3.6% ‘caseness’,  $M = 3.68$ ; Crawford, Henry, Crombie, & Taylor, 2001).

Correlations in table 1 show higher levels of maternal depressive symptoms were associated with lower academic attainment and lower self-control in adolescents, as well as lower child-reported warmth from mothers and fathers and higher child-reported hostility

from fathers. Self-control and academic attainment were positively correlated. Perceptions of higher parental warmth and lower parental hostility were correlated with higher self-control in adolescents.

<TABLE 1>

**The association between maternal depressive symptoms and children's academic attainment.**

Maternal depressive symptoms at wave one were associated with children's academic attainment at wave three ( $\beta = -.12, p < .01$ ). This association appeared somewhat stronger for girls ( $\beta = -.17$ ) than boys ( $\beta = -.09$ ), but this difference was not statistically significant ( $\chi^2_{diff}(1) = 0.81, p = .37$ ). Results were similar after controlling for the effects of socio-economic deprivation ( $\beta = -.09, p < .05$ ) suggesting that the observed effects of maternal depressive symptoms on children's academic attainment were not due to socio-economic deprivation.

**Are associations between maternal depressive symptoms and children's academic attainment partially mediated through parenting and children's self-control?**

The path model was a good fit to the data,  $\chi^2(5) = 21.06, p = .001, RMSEA = .04, CFI = .99, sRMR = .02$  (table 2). Maternal depressive symptoms were associated with less maternal warmth but not with maternal hostility (table 2). Lower maternal hostility was associated with better self-control in children, but maternal warmth was not. Maternal depressive symptoms were associated with lower paternal warmth and higher paternal hostility. Lower paternal hostility and higher paternal warmth were both associated with higher self-control. Higher self-control was associated with higher academic attainment and there was also a direct effect of maternal depressive symptoms on academic attainment (table 2). Results did not change after controlling for the effects of socio-economic deprivation (see supplementary table S2). The observed pattern of results was very similar when only resident fathers were included (results available from first author).

## &lt;TABLE 2&gt;

There was a significant total indirect effect from maternal depressive symptoms to academic attainment through measures of maternal and paternal parenting and the child's self-control ( $\beta = -.006, p = .040$ ).

Two substantive gender differences were observed. First, maternal warmth was a positive predictor of girls' self-control ( $\beta = .15$ ) but not boys' self-control ( $\beta = -.05$ ) ( $\chi^2_{diff}(1) = 9.83, p = .002$ ). Second, paternal warmth was a positive predictor of boys' self-control ( $\beta = .27$ ) but not girls' self-control ( $\beta = -.02$ ) ( $\chi^2_{diff}(1) = 37.08, p < .001$ ).

### Discussion

The results support existing evidence that maternal depression is associated with educational attainment in offspring (Hammen et al., 1987; Shen et al., 2016; Tannenbaum & Forehand, 1994). Maternal depressive symptoms at baseline were associated with their adolescent children's academic attainment assessed one year later. We did not find evidence that maternal depressive symptoms differentially affected the academic attainment of boys and girls.

One of the ways maternal depression is believed to adversely influence children is via impairments in mothers' parenting behaviour (Goodman & Gotlib, 1999). Our results support this view as we found a significant association between maternal depressive symptoms and children's perceptions of maternal warmth but not maternal hostility. These findings are consistent with other research (e.g., Gordon et al., 1989; Murray et al., 2006) that suggests the effects of maternal depression on children's functioning come about by reducing positive maternal parenting such as warmth, support and responsiveness, rather than by increasing negative maternal affect towards the child. Importantly, the associations between maternal depression and children's perceptions of maternal parenting and children's self-control remained when controlling for socio-economic deprivation. This suggests that these

associations are not driven by socio-economic disadvantage and that there is a similar pattern of processes through which maternal depression affects adolescent outcomes across socio-economic groups. Nonetheless, in addition to this effect via children's perceptions of parenting, there remained a direct effect of maternal depressive symptoms on children's academic attainment which suggests that there are other processes linking these factors (e.g., exposure to other stressful life events).

Our findings about the role of fathers' parenting within the context of maternal depressive symptoms offer insight into an area of uncertainty. Two competing perspectives characterise the relationship between maternal depression and fathers' parenting: (i) fathers compensate for depressed mothers by being more caring towards children, (ii) fathers are adversely influenced by maternal depression and this impairs their parenting. This study provides some evidence in support of the second perspective, that is, children perceive their fathers to be more hostile and less warm when mothers reported higher depressive symptoms. The association between maternal depression and child perceptions of father hostility was not explained by socio-economic disadvantage. Taken together, these findings suggest that maternal depressive symptoms disrupt the family system beyond simply impairing the mother's own parenting and highlight the importance of examining children's wider support networks (Bronfenbrenner & Morris, 2006).

Consistent with previous studies (e.g., Duckworth & Seligman, 2005), self-control was found to be an important antecedent of academic attainment. Furthermore, maternal depressive symptoms were associated with lower academic attainment, in part, via children's self-control. This association may have implications for attempts to reduce the impact of maternal depression on children's academic attainment, because intervention efforts aimed at increasing school attainment have had reasonable success when targeting children's self-control (Diamond, 2012). Thus, this work extends previous research by identifying self-

control as one process through which maternal depressive symptoms disrupt children's academic attainment.

Future research is needed to examine other possible systems where intervention may be possible in order to reduce the impact of difficulties in the family arena (Bronfenbrenner & Morris, 2006). For instance, teaching methods that enhance self-control (e.g., Diamond, 2012) might partly remediate some of the adverse effects of maternal depression on children's academic attainment. Nevertheless, interventions aiming to reduce the impact of maternal depression on children's educational outcomes would also need to directly tackle parental difficulties by treating maternal depression, supporting positive parenting, and reducing poverty.

More work is required to disentangle the effects of maternal depression and socio-economic disadvantage on adolescents' self-control and academic achievement. Due to the well-established links between maternal depression and poverty, we controlled for the effects of socio-economic deprivation to rule out potential confounding. However socio-economic disadvantage can itself be viewed as an important contextual factor rather than a mere control variable as prior research has shown the importance of socio-economic disadvantage in relation to academic achievement (Guttman & Eccles, 1999) and that there are SES effects over and above maternal depression for young children's self-control (Ng-Knight & Schoon, 2016). More nuanced relations are therefore likely at play, for example, a large body of work has found support for the "Family Stress Model" which suggests the effects of financial hardship on children's functioning act via increases in maternal distress (Conger et al., 2010). Effects of socio-economic disadvantage on children's adjustment may also act via environmental risk exposures (Goodman & Gotlib, 1999; Bifulco et al., 2002). It is also worth noting that there were socio-economic differences between the 10 schools in the current study, for example the proportion of school pupils qualifying for free school meals (a

common index of socio-economic disadvantage in the UK) ranged between 4% and 26% (sample average = 16%; national average = 16%). This is important, because schools with larger disadvantaged populations face additional challenges including under-resourcing and difficulties recruiting high-quality teachers (Sutton Trust, 2016). Therefore, further work is required to establish whether self-control is universally promotive or acts as a compensatory factor in disadvantaged groups or only provides cumulative advantage to socio-economically privileged youth (see Shanahan et al., 2014 or Ng-Knight & Schoon, 2017 for similar work on young adults).

We found that children's perceptions of maternal warmth more strongly predicted girls' self-control, whilst children's perceptions of paternal warmth more strongly predicted boys' self-control. This is consistent with the social cognitive theory of gender development, which posits that children's behaviour is shaped by modelling the behaviours of their same-sex parents (Bussey and Bandura, 1999). This may be because fathers are more involved with their adolescent son's lives (Harris, Furstenberg, & Marmer, 1998; Lasko et al., 1996; Videon, 2005) and because adolescent girls report more intimacy with their mothers (Field, Lang, Yando, & Bendell, 1995). Our findings are also consistent with those showing that longitudinal changes in adolescents' well-being are more strongly related to the parent-child relationship within father-son and mother-daughter dyads (Videon, 2005). Others have speculated that differences may be due to mothers and fathers acting differently with their children, where mothers engage in more caregiving and comforting whilst fathers engage in more high-intensity play (Kochanska et al., 2008; Lamb, 1997; Parke, 2002), such interaction styles may make father-son and mother-child dyads a better fit (on average) and therefore facilitate parental socialization. The current study provides evidence for the importance of mother-daughter and father-son relationships in relation to child perceived parental warmth and children's self-control. However, it should be noted that perceived hostility from either

parent was found to have negative effects on children's self-control regardless of the child's sex. Overall, these findings point to a role for fathers as well as mothers in fostering children's self-control during early adolescence.

This study has a number of strengths, including the use of multiple informants; temporal separation of the independent, putative mediator and dependent variables; measures relating to perceptions of both mothers' and fathers' parenting; and, a relatively large sample that allowed the examination of gender differences and complex indirect effects over three study waves.

There are also some limitations to note. Findings may not apply to the families of mothers with depressive disorder because depressive symptoms were measured using a questionnaire in a community sample. These analyses also provide only partial coverage of the family environment because fathers' mental health was not assessed. Studying mothers' and fathers' mental health simultaneously would shed light on whether there are true effects of maternal depressive symptoms on paternal parenting or if the associations found here are possibly due to paternal depressive symptoms (Kim-Cohen et al., 2004). There was a low response rate at wave one and this may have resulted in a sample of mothers where clinically significant levels of depressive symptoms were slightly under-represented although it should be noted that the mean observed in this sample was similar to those reported in previous community samples and supplementary analyses suggested the available data were not biased towards lower depression scores.

It is important to note that the measures of parenting in this study refer to children's perceptions of parent-child relationship quality. It was not within the scope of this school-based study to collect observational measures of parent-child interactions and parent-reports were deemed less appropriate due to common-rater bias that would likely have inflated associations with maternal depressive symptoms (Rutter et al., 2001). Whilst observational



assessments are generally considered the ‘gold-standard’ because they are not biased by the mood or responding tendency of the participants, it is also important to note that child-reports (and parent-reports too) have their own strengths because these respondents have access to a much broader range of naturalistic experiences on which to base their assessments (Feinberg et al., 2001). Future research should test the extent to which these associations are replicated using different measurement methods.

The size of the indirect effect found here was modest and there remained a substantial direct relationship between maternal depressive symptoms and children’s academic attainment even after controlling for socio-economic deprivation that is yet to be fully explained. Other factors that might be important in explaining this association include children’s own mental health and exposure to other stressful life experiences, both of which are associated with having a depressed parent (Goodman & Gotlib, 1999) and have been shown to relate to academic attainment (DuBois, Felner, Brand, Adan & Evans, 1992; Riglin, Petrides, Frederickson, & Rice, 2014). To examine the possibility that child’s mood could influence their perceptions, we examined this variable in a post-hoc analysis (see supplementary table S4). Specifically, there were small-to-medium correlations between children’s depressive symptoms and their perceptions of parenting (average correlation = .29, see supplementary table S4) but these were not large enough to suggest children’s perceptions of their parents were coloured entirely by their own mood. Furthermore, it is important to note that the mediating effect of self-control was not explained by children’s symptoms of depressed mood, and that the child’s level of depressive symptoms was not associated with academic attainment in our sensitivity analyses.

### **Conclusion**

Maternal depression has both direct and indirect associations with adolescents’ academic attainment. Maternal depressive symptoms are negatively associated with children’s

perceptions of mother-child and father-child relationships which, in turn, appear to reduce children's capacity to exercise self-control and succeed academically.

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Table 1.

*Descriptive statistics and correlations for main study variables.*

Study variable	<i>M</i>	<i>SD</i>	1.	2.	3.	4.	5.	6.	7.	8.
1. Maternal depressive symptoms	3.38	2.98	1							
2. Maternal warmth	37.00	6.67	-.13*	1						
3. Maternal hostility	10.65	5.01	.07	-.39***	1					
4. Paternal warmth	35.33	7.96	-.13**	.62***	-.32***	1				
5. Paternal hostility	10.40	5.36	.11*	-.28***	.66***	-.43***	1			
6. Childs self-control	3.69	0.73	-.16**	.26***	-.40***	.28***	-.37***	1		
7. Childs academic attainment	0.00	0.88	-.14**	.07*	-.11***	.03	-.14***	.18***	1	
8. Socio-economic deprivation	0.45	0.59	.16**	-.08	.00	-.12*	.01	-.12*	-.24***	1

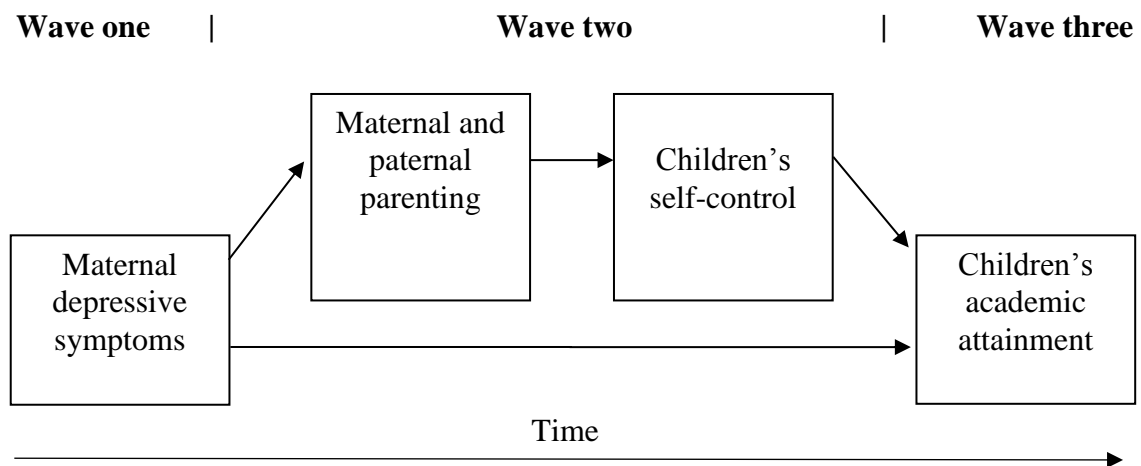
Notes. \* =  $p < .05$ , \*\* =  $p < .01$ , \*\*\* =  $p < .001$

Table 2.

*Standardised regression coefficients for path models including parenting and self-control, for whole sample and by gender.*

Hypothesis/Model	Whole sample		Boys only		Girls only	
Path	<i>B</i>	<i>p</i>	$\beta$	<i>p</i>	$\beta$	<i>P</i>
MD → AA	-.12	.004	-.08	.190	-.17	.023
MD → MH	.07	.080	.01	.875	.13	.052
MD → MW	-.13	.009	-.08	.307	-.16	.017
MD → PH	.14	.003	.18	.007	.11	.112
MD → PW	-.12	.010	-.15	.018	-.11	.072
MH ↔ MW	-.39	<.001	<b>-.32</b>	<b>&lt;.001</b>	<b>-.46</b>	<b>&lt;.001</b>
MH ↔ PH	.66	<.001	.67	<.001	.64	<.001
MH ↔ PW	-.31	<.001	<b>-.26</b>	<b>&lt;.001</b>	<b>-.37</b>	<b>&lt;.001</b>
PH ↔ PW	-.42	<.001	-.37	<.001	-.49	<.001
PH ↔ MW	-.28	<.001	<b>-.20</b>	<b>&lt;.001</b>	<b>-.37</b>	<b>&lt;.001</b>
MW ↔ PW	.62	<.001	.60	<.001	.63	<.001
MH → SC	-.25	<.001	-.30	<.001	-.22	<.001
MW → SC	.04	.286	<b>-.05</b>	<b>.268</b>	<b>.15</b>	<b>.006</b>
PH → SC	-.14	<.001	-.08	.141	-.15	.006
PW → SC	.13	.001	<b>.27</b>	<b>&lt;.001</b>	<b>-.02</b>	<b>.727</b>
SC → AA	.17	<.001	.16	<.001	.16	<.001

*Notes.* MD=maternal depressive symptoms; SC=child's self-control; AA=child's academic attainment; MH=maternal hostility; MW=maternal warmth; PH=paternal hostility; PW=paternal warmth; →=regression path; ↔=correlation. Significant gender differences ( $p<.05$ ) are shown in bold.



*Figure 1.* Conceptual model showing the hypothesised pathways from maternal depressive symptoms to children's academic attainment via parenting and self-control.