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The relationship between father involvement and child problem behaviour in intact families: A 7-year cross-lagged study

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The relationship between father involvement and child problem behaviour in intact families: A 7-year cross-lagged study

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Abstract

This study investigated the cross-lagged relationship between father involvement and child problem behaviour across early-to-middle childhood, and tested whether temperament modulated any cross-lagged child behaviour effects on father involvement. It used data from the first four waves of the UK's Millennium Cohort Study, when children (50.3% male) were aged 9 months, and 3, 5 and 7 years. The sample was 8,302 families where both biological parents were co-resident across the four waves. Father involvement (participation in play and physical and educational activities with the child) was measured at ages 3, 5 and 7, as was child problem behaviour (assessed with the Strengths and Difficulties Questionnaire). Key child and family covariates related to father involvement and child problem behaviour were controlled. Little evidence was found that more father involvement predicted less child problem behaviour two years later, with the exception of father involvement at child's age 5 having a significant, but small, effect on peer problems at age 7. There were two child effects. More hyperactive children at age 3 had more involved fathers at age 5, and children with more conduct problems at age 3 had more involved fathers at age 5. Child temperament did not moderate any child behaviour effects on father involvement. Thus, in young, intact UK families, child adjustment appears to predict, rather than be predicted by, father involvement in early childhood. When children showed more problematic behaviours, fathers did not become less involved. In fact, early hyperactivity and conduct problems in children seemed to elicit more involvement from fathers. At school age, father involvement appeared to affect children's social adjustment rather than vice versa.

Keywords: child behaviour; emotional and behavioural problems; father involvement; reciprocal effects; temperament.

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A large body of research has shown that children whose fathers are present in the home have fewer behavioural and emotional problems than children with non-resident fathers (Amato, 2010; Burt, Barnes, McGue, & Iacono, 2008; Culpin, Heron, Araya, Melotti, & Joinson, 2013; Flouri, Narayanan, & Midouhas, in press; McLanahan, Tach, & Schneider, 2013). In recent years, what both resident and non-resident fathers do with their children, and how they do it, has also been explored in relation to these child outcomes, albeit to a lesser extent (Barber, Stolz, & Olsen, 2005; Boyce, Essex, Alkon, Goldsmith, Kramer, & Kupfer, 2006; Davidov & Grusec, 2006; Denham et al., 2000; Enns, Cox, & Clara, 2002; Flouri, 2008; Galambos, Barker, & Almeida, 2003). Although the evidence with respect to the role of non-resident fathers' parenting and involvement in children's emotional and behavioural outcomes is equivocal (Hawkins, Amato, & King, 2007; Sarkadi, Kristiansson, Oberklaid, & Bremberg, 2008) both paternal sensitivity/warmth and involvement appear to have positive effects on both younger and older children's behaviour and adjustment in resident father families, even after controlling for maternal sensitivity and involvement (Coley, Votruba-Drzal, & Schindler, 2008; Malmberg & Flouri, 2011).

Father involvement has been defined (and therefore measured) in many ways. For the past three decades, most empirical studies on father involvement have followed Lamb and colleagues' operational definition of involvement as engagement with, accessibility to, and responsibility for the child (Lamb, 2000). Researchers, less frequently developmental psychologists and more commonly quantitative sociologists, have also conceptualised father involvement in terms of the amount of time fathers spend in each of these categories of involvement (Hofferth & Anderson, 2003; Yeung, Sandberg, Davis-Kean, & Hofferth, 2001). A more recent view (Fagan, Day, Lamb, & Cabrera, 2014) is that researchers may want to

reconsider use of the term father involvement because underlying the term itself are the assumptions that fathers' parenting behaviour is conceptually different from mothers' and that paternal and maternal parenting do not predict child outcomes similarly - assumptions not supported by empirical findings or recent demographic trends. For example, fathers and mothers are becoming more similar in terms of both their roles and the types of behaviours with which they engage their children. Also, although mothers still spend considerably more time than fathers with their children in primary child care, there is evidence of convergence in the amount of fathers' and mothers' time spent with children, especially in Europe, Australia and North America (Raley, Bianchi, & Wang, 2012). Maternal and paternal roles therefore may be becoming more similar, but this should not imply that the differences in the nature and outcomes of father and mother involvement are becoming negligible. As the literature shows, the construct of father involvement still remains worthy of examination, and increases in father involvement are related to decreases in child problem behaviour in both earlier and later cohorts. The current study aimed to add to this literature by exploring the bidirectional relationship between child behaviour and father involvement, measured in terms of father's engagement in play and physical and educational activities with his child.

A key debate in this literature is whether differences in child behaviour according to father involvement are due to one or more of the following: a) a less than optimal home environment brought on (or reflected) by less father involvement, aligned with the standard family environment model; b) the shared genetic makeup of the father and the child, reflecting the passive genetic model (Plomin, DeFries, & Loehlin, 1977); or c) the child's problem behaviour itself, causing the father to engage less with the child (i.e., the child effects model). The majority of research follows and supports the standard family environment model. Few studies, however, have explicitly tested a transactional model of father involvement and child adjustment (essentially comparing the child effects model with

the standard family environment model) to assess the possibility of bidirectional effects (Coley & Medeiros, 2007; Coley et al., 2008; Hawkins et al., 2007). This is a significant limitation as child adjustment and parenting can mutually influence each other (Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000; Combs-Ronto, Olson, Lunkenheimer, & Sameroff, 2009). The research that does exist has primarily employed samples of adolescents in families with and without resident fathers, and has produced mixed findings. For example, one US study modelled cross-lagged relationships - a strong approach to testing bidirectionality using longitudinal data - of non-resident father involvement (contact and care) and minority ethnic adolescent delinquency (Coley & Medeiros, 2007). That study found that less father involvement was related to more delinquency, but delinquency did not predict subsequent changes in father involvement. Conversely, also using cross-lagged models, Hawkins et al. (2007) found only child effects; more active non-resident father involvement (i.e., more contact, shared activities, communication and emotional closeness) was not predictive of US adolescents' emotional or behavioural adjustment. Studies on resident father families have shown evidence for both reciprocal associations (Hawkins et al., 2007; Jia, Kotila, & Schoppe-Sullivan, 2012) and father effects (Sarkadi et al., 2008).

A problem with all those studies, however, is that they covered only a short period of development. For example, Coley and Medeiros (2007) and Hawkins et al. (2007) analysed data from only two timepoints about 1-2 years apart, allowing for only a brief picture of father and child effects at a specific point in adolescence. Capturing father and child effects at more than two timepoints and across longer time intervals would provide stronger evidence for any identified effects, but also the opportunity to test how the association between father involvement and child behaviour might differ depending on the age of the child. By modelling cross-lags of resident father involvement and child problem behaviour

in a large sample of UK children across ages 3, 5 and 7 years, our primary objective was to address these gaps in the literature.

Our secondary objective was to explore the role of temperament in changing any cross-lagged effects of child behaviour on father involvement. We expected that difficult temperament and problem behaviour would interact in predicting father involvement, such that, for example, any adverse effects of child problem behaviour on father involvement would be stronger for children with more difficult temperaments. Temperament, according to some theorists, is the early substrate of childhood and adult psychiatric disorders (the epigenetic perspective). In operationalising temperament, however, most researchers usually refer to Rothbart's (1989) model, which defines temperament as "constitutional differences in reactivity and self-regulation, with 'constitutional' seen as the relatively enduring biological makeup of the organism influenced over time by heredity, maturation, and experience" (Rothbart & Derryberry, 1981, p. 37). This definition equates temperament to individual differences in reactivity to stimulation and in patterns of self-regulation. Temperamental difficultness is usually the combination of high emotionality, extreme activity and low sociability (Buss & Plomin, 1975). Although many clusters for temperament difficultness have been proposed, integral in all definitions is the concept of negative emotionality together with management problems for caretakers in social interactions. Researchers recognise that parents' behaviours are responsive to the child's temperament, with difficult children eliciting harsh or uninvolved parenting (Lengua, 2006). However, studies do not generally examine transactional and interactive models of parenting, temperament and child behaviour simultaneously (Kiff, Lengua, & Zalewski, 2011). To be sure, some studies have explored the interaction between child temperament and parenting on child adjustment, while allowing for reciprocal parenting and child adjustment effects (Kochanska & Kim, 2013; Mesman et al., 2009; van Zeijl et al., 2007). However, no study has investigated the interaction between child

temperament and adjustment on parenting, while allowing for parenting and child adjustment to mutually influence each other. By examining the cross-lagged association between child adjustment and father involvement (in line with the transactional model of parenting and child behaviour) and the interaction between child temperament and adjustment on father involvement, our study attempted to fill this gap.

The present study

Our study used four waves of longitudinal data and a cross-lagged design. Utilising data from the UK's Millennium Cohort Study (MCS), we examined the cross-lagged relations between father involvement and child problem behaviour at ages 3, 5 and 7 years. We also assessed differences in the cross-lagged effect of child problem behaviour on father involvement according to child temperament. Our control variables (measured at age 9 months) were known covariates of both child behaviour and father involvement. Specifically, we adjusted for family poverty (McLoyd, 1998), father's and mother's depressed mood (Klein, Lewinsohn, Rohde, Seeley, & Olino, 2005), father's education (Coley & Hernandez, 2006), the quality of the inter-parental relationship (Sturge-Apple, Davies, & Cummings, 2006), and child's sibship size (Hofferth, 2003), ethnicity (Deater-Deckard, Atzaba-Poria, & Pike, 2004) and gender (Lytton & Romney, 1991) on both father involvement and child problem behaviour at age 3. We also adjusted for mother's involvement as it can covary with both father's involvement and child's behaviour. To rule out the possibility of biases in the stability of father involvement over time and in the longitudinal association of father involvement and child behaviour, mother involvement at ages 5 and 7 was specified to predict both father involvement and child behaviour at ages 5 and 7.

Method

Sample

We used data from MCS (www.cls.ioe.ac.uk/mcs), a longitudinal survey of children born in the UK during 2000-2002. MCS was designed to over-represent areas with high proportions of ethnic minorities in England, areas of high child poverty, and the three smaller UK countries. Ethical approval was gained from NHS Multi-Centre Ethics Committees, and parents gave informed consent before interviews. Sweeps 1-4 took place when children were around 9 months, and 3, 5 and 7 years old. The complete MCS sample consists of 19,244 families, of whom 692 entered MCS at Sweep 2 (Plewis, 2007). Our analytic sample (n = 8,302) comprised MCS singletons and first-born twins/triplets who lived in families where both biological parents were co-resident at Sweeps 1, 2, 3 and 4. The 692 families who entered MCS at Sweep 2 were therefore not included in our sample. In all, the analytic sample comprised 50.3% boys and 90.4% white children [the ethnicity of the remaining children was mixed (2.1%), Indian (2%), Pakistani or Bangladeshi (3.4%), black (1.1%), and 'other' (1%)]. The children's mean age at Sweeps 2-4 was, respectively, 3.11, 5.20 and 7.22 years.

Measures

The main variables were father involvement and child problem behaviour, both measured at Sweeps 2-4. In MCS, father involvement was measured with four items at age 3 asking the father to assess the frequency with which he was looking after the child on his own, reading to the child, playing with the child, and putting the child to bed. At ages 5 and 7, it was measured with the nine items: "How often do you read to your child?", "How often do you tell stories to your child?", "How often do you do musical activities with your child?", "How often do you draw/paint with your child?", "How often do you play games/with toys indoors with your child?", "How often do you take your child to the park/playground?", "How often do you get your child ready for bed?", "How often do you play physically active games with your child", and "How often do you look after your child on your own?". All father

involvement items were measured on six-item scales, ranging 1 (*not at all*) to 6 (*every day*). As will be shown below ('Confirmatory factor analyses'), only two Sweep 2 father involvement items, frequency of reading to the child and playing with the child, loaded on a single factor. At both Sweeps 3 and 4, six items loaded on a single factor.

Child problem behaviour was measured with the biological mother-reported Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), a widely used and psychometrically valid measure of children's socio-emotional difficulties (Goodman, 2001). The subscales of emotional symptoms (e.g., "Nervous or clingy in new situations, easily loses confidence"), conduct problems (e.g., "Often has temper tantrums or hot tempers"), hyperactivity-inattention (e.g., "Constantly fidgeting or squirming"), and peer problems (e.g., "Picked on or bullied by other children") consist of five items each. The items measure children's difficulties or negative attributes, with responses ranging 0 (*not at all*) to 2 (*very true*).

As discussed, the manifest control variables were measured at Sweep 1 except for mother involvement which was measured at Sweeps 3 and 4. Family poverty was measured with a summary of four binary items indexing economic and material deprivation (Malmberg & Flouri, 2011): overcrowding (>1.5 people per room excluding bathroom and kitchen), not owning the home, receipt of means-tested income support, and income poverty (below the poverty line, set for equivalised net family income at 60% of the national median household income). Father's education was measured with a continuous measure of academic qualifications ranging higher degree (i.e., postgraduate degree) to no qualification[1]. Father's and mother's psychological distress was measured with the nine-item Malaise Inventory (Rutter, Tizard, & Whitmore, 1970). The Malaise Inventory assesses emotional disturbance and associated physical symptoms with *yes* or *no* responses to

[1] In MCS, there was an additional category, overseas qualifications (n = 175; 2.3% of the analytic sample), coded 'missing'.

questions such as "Do you often feel miserable or depressed?" Cronbach's alpha was .70 for mothers and .66 for fathers. Quality of the inter-parental relationship was measured with the mother-reported seven-item version of the Golombok Rust Inventory of Marital State (Rust, Bennun, Crowe, & Golombok, 1990). This measure, which includes items such as "I wish there was more warmth and affection between us", was administered to all MCS respondents with a full-time resident partner. Cronbach's alpha in our sample was .80. Mother involvement was measured at ages 5 and 7 with a summary score of the same six items used for latent father involvement at these ages. Cronbach's alphas in our sample were .67 (age 5) and .65 (age 7).

Child's ethnicity was included as a set of binary dummy variables comparing mixed, Indian, Pakistani/Bangladeshi, black, and 'other' ethnicities to the white reference group. Child's number of siblings and gender were also included as control variables. Temperament was assessed with a summary score of 14 items of the Carey Infant Temperament Scale (Carey & McDevitt, 1978). These items index three dimensions of the baby's temperament, namely, mood, adaptability and regularity or rhythmicity. The internal consistency of the scale in our sample was $\alpha = .65$. Temperamental difficultness was indicated by low mood, adaptability and regularity.

Analytic approach

To investigate whether father involvement predicts child problem behaviour, and vice versa, at ages 3, 5 and 7 years, we estimated cross-lagged structural equation models (SEMs) in Mplus 7.0 (Muthén & Muthén, 1998-2012). SEMs allowed us to model variables as latent factors, thereby reducing measurement error. We modelled father involvement as a latent construct using each sweep's available items, and we modelled the four specific domains of child problem behaviour as latent constructs loading on their scales' items. Prior to fitting our SEMs, we tested for measurement invariance in our two latent constructs

across the three timepoints to determine whether comparing constructs over time was acceptable. After fitting each of the four cross-lagged models, we examined whether it provided a better fit to the data than either the equivalent model including only paths from father involvement to child adjustment (the father effects model) or that including only paths from child adjustment to father involvement (the child effects model).

For our main models, we used the weighted least squares estimator with robust standard errors and corrections for means and variances (WLSMV). SDQ items are categorical and WLSMV is the default estimator in Mplus for categorical dependent variables. Therefore, our models were probit models. To account for the clustered stratified sampling design of MCS, we used probability weights with the TYPE = COMPLEX analysis command. This command computes standard errors and a chi-square test of model fit taking into account stratification and unequal probability of selection. We used several criteria to assess goodness of model fit to the data. The Comparative Fit Index (CFI) and the Tucker Lewis Index (TLI) measure the proportional improvement in fit by comparing the hypothesised model with a less restricted nested model. The values range 0-1, and a value greater than .90 indicates good fit (Brown, 2006). The Root Mean Square Error of Approximation (RMSEA) assesses the error of approximation in the population, with a value less than .05 indicating good fit (Brown, 2006). As can be seen in Figure 1, our main model was specified to estimate the cross-lagged effects of latent father involvement and latent child behaviour between ages 3 and 5, and between ages 5 and 7, while allowing for the stability of both father involvement and child behaviour over time. It also allowed for residual covariances of the within-sweep latent variables. Our manifest control variables, measured at age 9 months, were included to predict latent father involvement and latent child problem behaviour at age 3. Our manifest mother involvement variables at ages 5 and 7 were included to predict latent father involvement and latent child problem behaviour at

ages 5 and 7. When WLSMV is used, missingness is allowed to be a function of the observed covariates but not the observed outcomes. To keep cases with missingness on our control variables in the model, we specified their variances. Therefore, our complete sample size of 8,302 was maintained in all models.

(Figure 1)

To investigate whether the cross-lagged effect of child behaviour on father involvement was moderated by child temperament, we tested the effects of the interactions of the latent child behaviour variables with the manifest temperament variable using the XWITH command. Testing interactions with latent factors in MPLUS cannot be done using the WLSMV estimator. It requires the use of the Maximum Likelihood (ML) estimator and a Monte Carlo integration. As temperament (measured in MCS at age 9 months) is considered to be moderately stable in the first few years of life (Shiner et al., 2012), and thus might change as children enter early childhood, we decided to examine its moderator role in the relationship between child behaviour and father involvement only between ages 3 and 5 (not between ages 5 and 7). We therefore tested the effect of the interaction between temperament and each latent problem behaviour at age 3 on father involvement at age 5.

Sample bias analysis and descriptives

Families where both biological parents lived at home across all four sweeps - those in our analytic sample (n = 8,302) - differed from families with other parent/carer structures in at least one of the sweeps (n = 10,250) on most of our study variables, showing sample selection bias. More specifically, the parents in our sample were more involved with their children, had lower levels of depression and higher levels of relationship quality, and were more privileged, with higher educational levels and incomes. Moreover, the children in these families had lower levels of emotional and behavioural problems and were more likely to be girls and from white or Indian backgrounds.

Missingness in the analytic sample at Sweeps 2, 3 and 4 was, respectively, 16%, 10% and 13% for father involvement, and, ranging across sweeps, 5-11%, 7-16%, 6-11%, and 13-21% for conduct problems, hyperactivity, emotional symptoms and peer problems, respectively.

(Table 1)

Results

Correlations

As expected, baseline father involvement and child problem behaviour were significantly (negatively) related in the analytic sample, albeit the correlations were somewhat weak (Table 1). Correlations between father involvement and child behaviour at ages 5 and 7 were also significant but weak. At age 5, the correlations were -.09 (conduct problems), -.08 (hyperactivity), -.07 (emotional symptoms) and -.04 (peer problems). At age 7, they were -.06 (conduct problems), -.03 (hyperactivity), -.03 (emotional symptoms) and -.05 (peer problems). All of our control variables at age 9 months were generally related to both child problem behaviour and father involvement at age 3 years. The correlations between the six-item measures of mother involvement and father involvement at ages 5 and 7 were moderate at .29 and .28, respectively. As with father involvement, mother involvement at ages 5 and 7, respectively, was significantly but weakly related to problem behaviour at age 5 (conduct problems: -.12, hyperactivity: -.12, emotional symptoms: -.04, and peer problems: -.04) and age 7 (conduct problems: -.08, hyperactivity: -.07, emotional symptoms: -.02, and peer problems: -.03).

Confirmatory factor analyses (CFAs)

We carried out a confirmatory factor analysis (CFA) of both the SDQ items and those of the MCS items assessing father involvement to decide on the variables for the constructs. The SDQ subscale items loaded on their respective constructs well (results available from the

authors). As for latent father involvement, we eliminated items with low factor loadings or high inter-correlations. As can be seen in Table 2 which presents the CFA results for father involvement, only two Sweep 2 father involvement items loaded on a single factor: frequency of reading to the child and playing with the child. At both Sweeps 3 and 4, six items loaded on a single factor. The items were: frequency of reading to the child, telling stories to the child, doing musical activities with the child, drawing/painting with the child, playing games/with toys indoors with the child, and taking the child to the park/playground. As shown, fathers tended to report moderate to high levels of involvement at all sweeps, especially in some activities (e.g., reading and playing games). The measurement model for father involvement fitted the data well (Table 2). Also, sufficient metric measurement invariance for father involvement between sweeps was achieved; the change in CFI and RMSEA was about .01 or less (Chen, 2007; ΔCFI = .011, ΔRMSEA = .006). For child problem behaviour, we achieved partial metric invariance (ΔCFI = .017, ΔRMSEA = .005). We established invariance between Sweeps 3 and 4 (ΔCFI = .001, ΔRMSEA = .002), but not between Sweep 2 and the two later sweeps.

(Table 2)

SEM results

All four cross-lagged models, unadjusted for covariates, fitted the data very well, with CFI and TLI values at or above .97, and RMSEA values below .02. The fit of each of the four cross-lagged models was then compared both with the fit of the equivalent model including only paths from father involvement to child adjustment (the father effects model), and with that of the equivalent model including only paths from child adjustment to father involvement (the child effects model). In general, the cross-lagged model for hyperactivity was a better fit to the data than either the father or the child effects model, and the cross-lagged model for conduct problems was a better fit than the father effects model. For both emotional and peer

problems, however, adding paths for cross-lagged relationships did not improve model fit compared to either the father or the child effects models (results available from the authors). For consistency, and since all four cross-lagged models fitted the data well, we present below the findings from the cross-lagged models for all four adjustment domains.

Adjusting for covariates, the models for conduct problems, hyperactivity and emotional symptoms (Table 3; Supplementary Figures 1-4) fitted the data well and the model for peer problems fitted the data adequately. In the models for conduct problems (CFI = .92; TLI = .91, RMSEA = .02) and hyperactivity (CFI = .94; TLI = .94, RMSEA = .02), we found child effects in the early years and no father effects. Specifically, having more conduct problems at age 3 was related to an increase in father involvement at age 5, and more hyperactivity at age 3 was associated with an increase in father involvement at age 5. For peer problems (CFI = .89; TLI = .88, RMSEA = .02), the more involved the father was at age 5 the fewer peer problems the child displayed at age 7, adjusting for peer problems at age 5. No child effects were found for the peer problems model. There were no child or father effects in the model for emotional symptoms (CFI = .90; TLI = .89, RMSEA = .02). With regard to concurrent relationships between father involvement and child problems (Supplementary Figures 1-4), these were found to be significant (and negative) at age 3 for conduct problems and hyperactivity. At age 5, there was a significant cross-sectional relationship between father involvement and emotional problems. Temperament did not moderate the cross-lagged effect of any of the four child problems at age 3 on father involvement at age 5 (results available from the authors).

Reflecting the results of the bivariate analysis, most of the control variables at age 9 months were related to both father involvement and child problem behaviour at age 3 years[2].

[2] We also explored marital status, father-reported quality of the inter-parental relationship and maternal education as possible control factors at age 9 months. Marital status was not significantly related to father

Father's lower education and higher psychological distress, lower quality of the inter-parental relationship and greater number of children in the home were all related to less involvement. Fathers were less involved with girls and Indian, Pakistani/Bangladeshi, black, and other minority ethnic (compared to white) children. Family poverty was unrelated to father involvement at age 3. Family poverty, difficult temperament, low paternal education, maternal psychological distress, paternal psychological distress (except in the peer problems model), and low quality of the inter-parental relationship were significant predictors of all four problem types. Sibship size was associated with more hyperactivity, emotional symptoms and peer problems but not conduct problems. Girls were less likely to have conduct problems, hyperactivity and peer problems. There were also ethnic differences, depending on the problem type. Pakistani or Bangladeshi (relative to white) children had higher scores in all four problem types. Black (relative to white) children had fewer conduct problems.

(Table 3)

Discussion

Most of the research exploring the relationship between resident father involvement and child adjustment in the early years assumes causal effects for father involvement, and does not consider possible child adjustment effects on father involvement or mutual influences. Furthermore, the role of temperament in moderating any child adjustment effects

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involvement at age 3, and was only weakly related to (only few) problem behaviours at age 3. In total, 78% of the analytic sample's families were married at Sweep 1. Maternal and paternal reports of the quality of the inter-parental relationship were correlated (.42), and including both also reduced the models' fit. We decided to use the maternal report only as it was related more strongly to both father involvement and child adjustment at age 3. As for maternal education, there was a correlation between mother's and father's education in our sample (.52), so we decided to use father's education only as it was a stronger predictor of his involvement at age 3.

on father involvement is unknown. Our study - using a large sample of children in intact families in the UK followed at ages 9 months, and 3, 5 and 7 years - attempted to fill both gaps. It sought to investigate the bidirectional association between fathers' involvement in play and physical and educational activities with their children (controlling for mothers' involvement) and children's emotional and behavioural adjustment at ages 3-7 years. It also explored the role of temperament in modifying any child adjustment effects on subsequent changes in father involvement.

In general, we found very little evidence to support the role of father involvement in child behaviour, even in such a large representative sample where one might expect to find significant associations by chance. Our findings showed support for two child effects in the early years and one father effect at school age, and suggested the importance of considering transactional models of father involvement and child behaviour. In the early years, the direction of association was from higher levels of conduct problems and hyperactivity to higher levels of father involvement. Hyperactivity and conduct problems in children at age 3 appeared to result in increased involvement from fathers at age 5, but father involvement at age 3 did not reduce hyperactivity or conduct problems at age 5. Temperament did not moderate child adjustment influences on subsequent changes in father involvement. Therefore, temperament did not exacerbate or inhibit the cross-lagged child behaviour effects we found on father involvement. We do acknowledge, however, that our null findings may be due to the relatively poor psychometric properties of our temperament measure. In addition, parental reports of temperament are not particularly stable in infancy, when temperament was measured in MCS. They become fairly stable once children reach age 3 (Shiner et al., 2012).

These child effects were in the opposite direction to that predicted by evolutionary and ecological models of determinants of men's and women's parenting effort (Belsky,

1984), which expect fathers to withdraw from their children when they become more difficult to manage or less pleasant to interact with. Although there is certainly evidence in support of these predictions (McBride, Schoppe, & Rane, 2002), our findings are in line with those from other recent studies showing that fathers may be called upon to assist more with caregiving activities when children are difficult (Brown, McBride, Bost, & Shin, 2011; Jia et al., 2012; Zhang, 2013), suggesting that fathers may increase the quantity of their behaviours with challenging children. As for the timing of these effects, our findings are in line with those from research examining reciprocal relationships from early to middle childhood between child problem behaviour and father absence (Flouri et al., in press). This showed that severe hyperactivity, conduct and peer problems, but not emotional symptoms, increased the likelihood of subsequent father non-residence, but again only in early childhood, not later in development. It seems, therefore, that the family life cycle may be important to consider when investigating child behaviour effects on fathers' commitment to their children and families. According to life cycle theory (Carter & McGoldrick, 1989), stress is at its highest point in the family system when moving between family life cycle stages. Most families with young children are in the beginning of a new stage in the family life cycle. Fathers, whose family roles are significantly determined by contextual influences, including their children's characteristics (Belsky, 1984), may be more affected by child behaviour in such transitional periods. It is possible that the stress associated with caring for a challenging child may increase the possibility of non-residence for some fathers, but may also increase the commitment of the fathers who remain co-resident to their children. We do acknowledge, however, that these child effects were quite small in absolute terms. Specifically, conduct problems and hyperactivity were related to an increase of 0.04 and 0.06 standard deviations in father involvement. However, comparing child behaviour to other child characteristics we

modelled, these effects were similar in size to the gender effect and larger than the effects of temperament and ethnicity.

As for father effects, our cross-lagged models showed significant (albeit weak) concurrent correlations between child behaviour and father involvement, indicating that more father engagement was related to fewer externalising problems. However, they did not show that father involvement benefited children's adjustment in the early years, or that it reduced hyperactivity, conduct problems or emotional symptoms at school age, even with such a large sample. We did find that fathers' engagement in play and physical and educational activities with their children was related significantly, albeit weakly, to fewer peer problems when children were of school age. At school age, fathers tend to increase the time they spend playing and engaging in educational activities with their children, and their time involvement in these activities resembles or exceeds that of mothers. In the US, for example, for school-aged children in intact families, fathers' time in most active play and leisure activities is greater than that of mothers (Yeung et al., 2001). Any father involvement benefits, therefore, should be more likely to show after children start school. Our study indeed found that an increase in father involvement at age 5 predicted a decrease in peer problems at age 7. Fathers who actively play and participate in physical and educational activities with their children may demonstrate the characteristics of a healthy relationship, and, by spending time with them, reduce their involvement with unmonitored, more deviant peers, thereby helping them form healthy peer attachments. Research has demonstrated the centrality of the father-child relationship in promoting positive patterns of engagement in social activities and healthy affiliations with others, and in supporting children's social development more generally (Cabrera, Shannon, & Tamis-LeMonda, 2007; Tamis-LeMonda, Shannon, Cabrera, & Lamb, 2004). It will be important to examine if transactional models such as ours demonstrate similar social benefits of father involvement

when it is measured more globally (i.e., when measured to include dimensions other than engagement). Again, the effect we found was small in absolute terms (0.05), but was larger than that of father's psychological distress and not much smaller than those of family poverty, father's education and mother's psychological distress.

Our study has some additional limitations. First, the cross-lagged model that we adopted has some disadvantages despite its many strengths, including that it does not explicitly consider the passage of time. Second, our measure of father involvement at age 3 years, although acceptable, was fairly weak, as it was based on only two items. It is therefore possible that the difference in our father involvement measures at ages 3 and 5 may be the reason for the lack of significant father effects in early childhood. Third, and related to this, at all three ages our involvement measure captured only engagement in play and physical and educational activities with the child. Paternal parenting, including involvement, encompasses more than participation in play and physical and educational activities with children - what others have labelled 'father engagement' (Cabrera, Hofferth, & Chae, 2011) - but we were limited by the type of father involvement data that were available in MCS. Nevertheless, this aspect of involvement, however narrow, is associated with positive child outcomes in both the cognitive (Bronte-Tinkew, Carrano, Horowitz, & Kinukawa, 2008; Pancsofar & Vernon-Feagans, 2010) and the socio-emotional domain (Flouri & Buchanan, 2003). Fourth, our father involvement measure did not capture the quality of the interactions between fathers and their children. Fifth, accounting for maternal involvement is a strength of our study, but unfortunately we did not have a measure at age 3 comparable to the measure of father involvement at that age. Finally, as mentioned, some measures, such as temperament and father's psychological distress had inadequate reliability. Despite these limitations, our study has important strengths. Even after taking into account reverse causality and factors related to father involvement and child problem behaviour, our study documented some effects of

externalising child behaviour on father involvement in early childhood and of father involvement on child peer relations in the primary school years. Together, these findings suggest the importance of considering the dynamic relationship between father involvement and child adjustment, while also examining developmental stage differences in how this relationship manifests itself.

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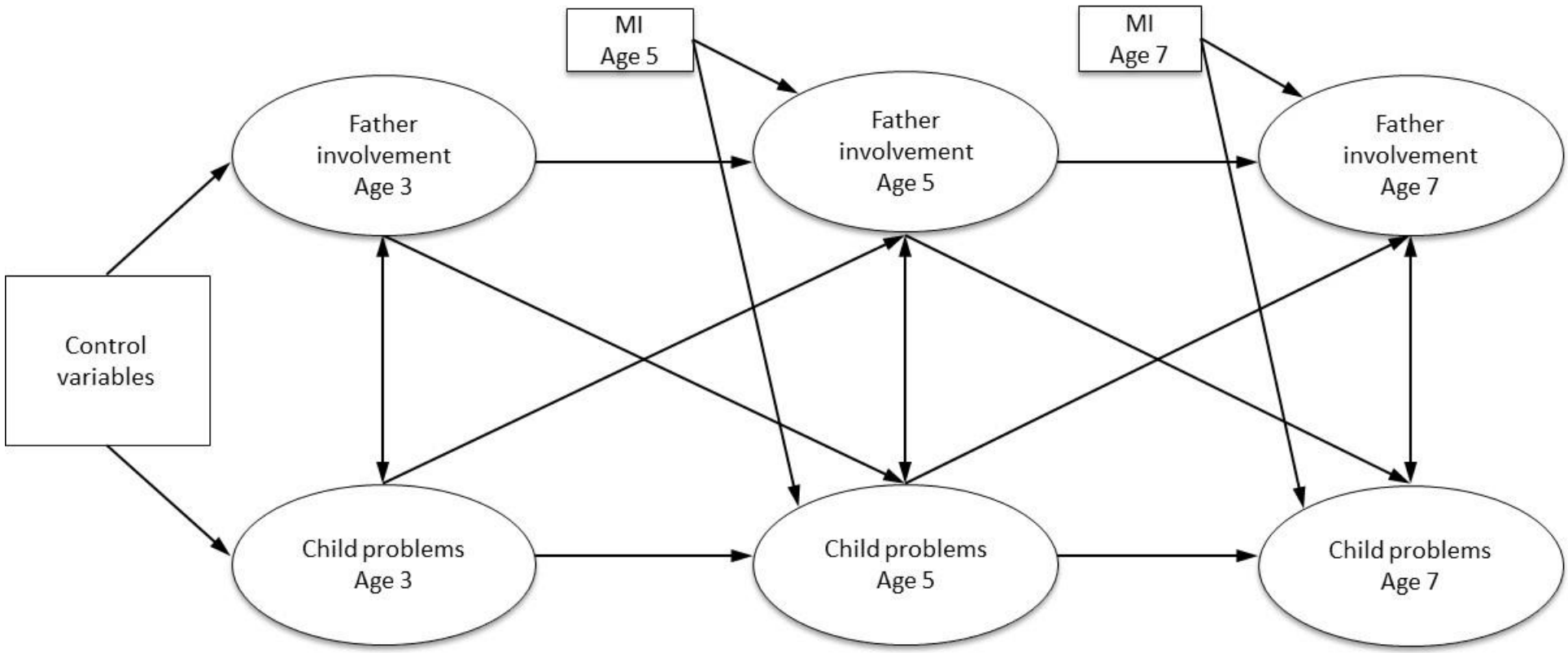

MI
Age 5
MI
Age 7
Father
involvement
Age 3
Father
involvement
Age 5
Father
involvement
Age 7
Control
variables
Child problems
Age 3
Child problems
Age 5
Child problems
Age 7

Figure 1. Cross-lagged model of father involvement and child problem behaviour.

Control variables (measured at age 9 months) are family poverty, paternal education, maternal and paternal psychological distress, mother-reported quality of the inter-parental relationship, and child's sibship size, temperament, gender and ethnicity (Mixed, Indian, Pakistani/Bangladeshi, Black or 'Other' compared to White). MI = mother involvement.

Table 1. Correlations among father involvement, problem behaviour and continuous control variables in the analytic sample

	1	2	3	4	5	6	7	8	9	10	11	12
Age 3 years outcomes												
1. Conduct problems	1											
2. Hyperactivity	.46***	1										
3. Emotional symptoms	.25***	.21***	1									
4. Peer problems	.23***	.23***	.30***	1								
5. Father involvement	-.10***	-.10***	-.05***	-.08***	1							
Age 9 months control variables												
6. Family poverty	.18***	.15***	.13***	.15***	-.19***	1						
7. Number of siblings	.05***	-.01	.03*	.03*	-.16***	.21***	1					
8. Low father's education	.15***	.14***	.10***	.12***	-.29***	.31***	.16***	1				
9. Relationship quality	-.16***	-.13***	-.11***	-.14***	.09***	-.09***	-.08***	-.11***	1			
10. Psychological distress (M)	.20***	.17***	.16***	.14***	-.07***	.12***	.06***	.07***	-.35***	1		
11. Psychological distress (F)	.12***	.08***	.09***	.03*	-.07***	.13***	.05***	.09***	-.18***	.18***	1	
12. Easy temperament	-.17***	-.14***	-.21***	-.19***	.03	-.15***	-.12***	-.05***	.18***	-.19***	-.06***	1

* $p < .05$, *** $p < .001$.

Note. M = Mother; F = Father.

Table 2. Standardised factor loadings of CFA of father involvement at ages 3, 5 and 7, and descriptive statistics (raw data)

	Descriptives					CFA (standardised factor loadings)			
Items	**N**	**Min**	**Max**	**M**	**SD**	**Age 3**	**Age 5**	**Age 7**	**R^2**
Age 3									
Reads to child	7007	1	6	4.40	1.33	0.44			0.20
Plays with child	7007	1	6	5.17	0.89	0.43			0.18
Age 5									
Reads to child	7506	1	6	4.37	1.21		0.50		0.25
Tells stories to child	7504	1	6	3.48	1.47		0.50		0.24
Does musical activites with child	7506	1	6	4.05	1.45		0.51		0.26
Draws/paints with child	7506	1	6	3.37	1.20		0.63		0.40
Plays games/with toys indoors with child	7506	1	6	4.44	1.09		0.64		0.40
Takes child to park/playground	7505	1	6	3.42	0.97		0.38		0.15
Age 7									
Reads to child	7236	1	6	4.15	1.31			0.46	0.21
Tells stories to child	7234	1	6	3.26	1.51			0.48	0.23
Does musical activites with child	7234	1	6	3.80	1.59			0.47	0.22
Draws/paints with child	7236	1	6	2.92	1.18			0.64	0.41
Plays games/with toys indoors with child	7235	1	6	4.07	1.18			0.60	0.36

Takes child to park/playground	7233	1	6	3.31	1.03			0.37	0.14

Note. Model fit: $\chi 2[76] = 392.13$; $p < .001$, RMSEA = 0.023; SRMR = .026; CFI = .978, TLF = .974. CFA model uses ML as the items of father involvement were not categorical. Standardised correlations between latent constructs ranged $\varrho = .73$ to $\varrho = .85$ across sweeps.

Table 3. Results (unstandardised coefficients and standard errors and standardised coefficients) of cross-lagged models of father involvement and child problem behaviour

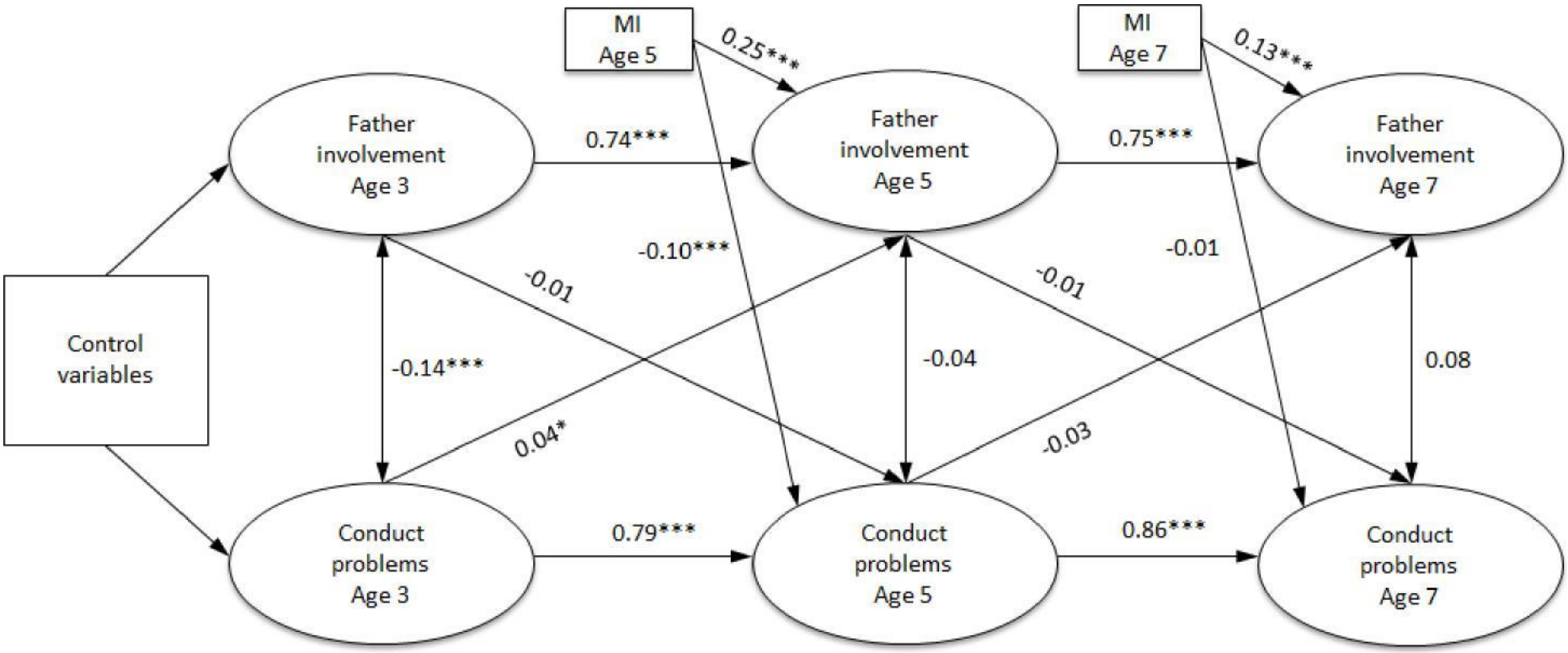
Regression paths	Conduct problems			Hyperactivity			Emotional symptoms			Peer problems		
	B	SE	B Std.	B	SE	B Std.	B	SE	B Std.	B	SE	B Std.
Stability in father involvement over time												
Age 3 → Age 5	0.62***	0.03	0.74	0.60***	0.03	0.73	0.61***	0.03	0.74	0.61***	0.03	0.73
Age 5 → Age 7	0.76***	0.02	0.75	0.76***	0.02	0.75	0.76***	0.02	0.75	0.76***	0.02	0.75
Stability in child problems over time												
Age 3 → Age 5	0.83***	0.04	0.79	0.76***	0.03	0.79	0.70***	0.06	0.72	0.77***	0.05	0.74
Age 5 → Age 7	1.02***	0.03	0.86	0.97***	0.02	0.88	0.84***	0.03	0.76	0.94***	0.04	0.82
Cross-sectional relationships between father involvement and child problems												
Age 3	-0.08***	0.02	-0.14	-0.10***	0.02	-0.14	-0.02	0.01	-0.06	-0.02	0.02	-0.04
Age 5	-0.01	0.01	-0.04	-0.001	0.01	-0.01	-0.02**	0.01	-0.16	0.01	0.01	0.03
Age 7	0.02	0.01	0.08	0.003	0.01	0.01	0.001	0.01	0.004	-0.002	0.01	-0.01
Cross-lagged relationships between father involvement and child problems												
$F_{age3} \rightarrow C_{age5}$	-0.01	0.03	-0.01	-0.03	0.03	-0.02	0.02	0.01	0.03	-0.03	0.03	-0.03

$F_{age5} \rightarrow C_{age7}$	-0.02	0.02	-0.01	-0.01	0.02	-0.01	-0.01	0.01	-0.02	-0.07***	0.02	-0.05
$C_{age3} \rightarrow F_{age5}$	0.03*	0.02	0.04	0.03**	0.01	0.06	0.05	0.03	0.04	0.03	0.02	0.03
$C_{age5} \rightarrow F_{age7}$	-0.02	0.01	-0.03	0.01	0.01	0.01	0.02	0.02	0.01	-0.01	0.02	-0.01

* p < .05, ** p < .01, *** p < .001. B Std. = standardised beta coefficient.

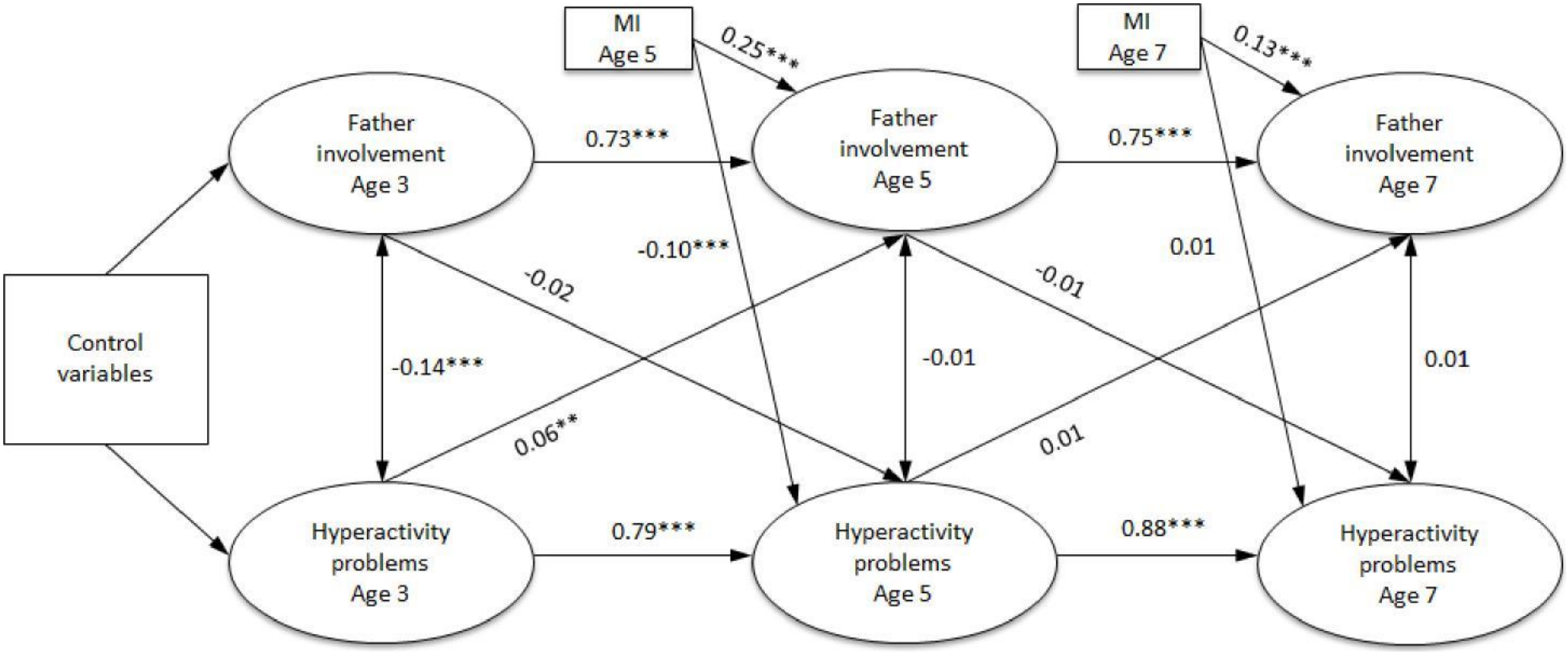
Father involvement and child behaviour cross-lags

Supplementary Material



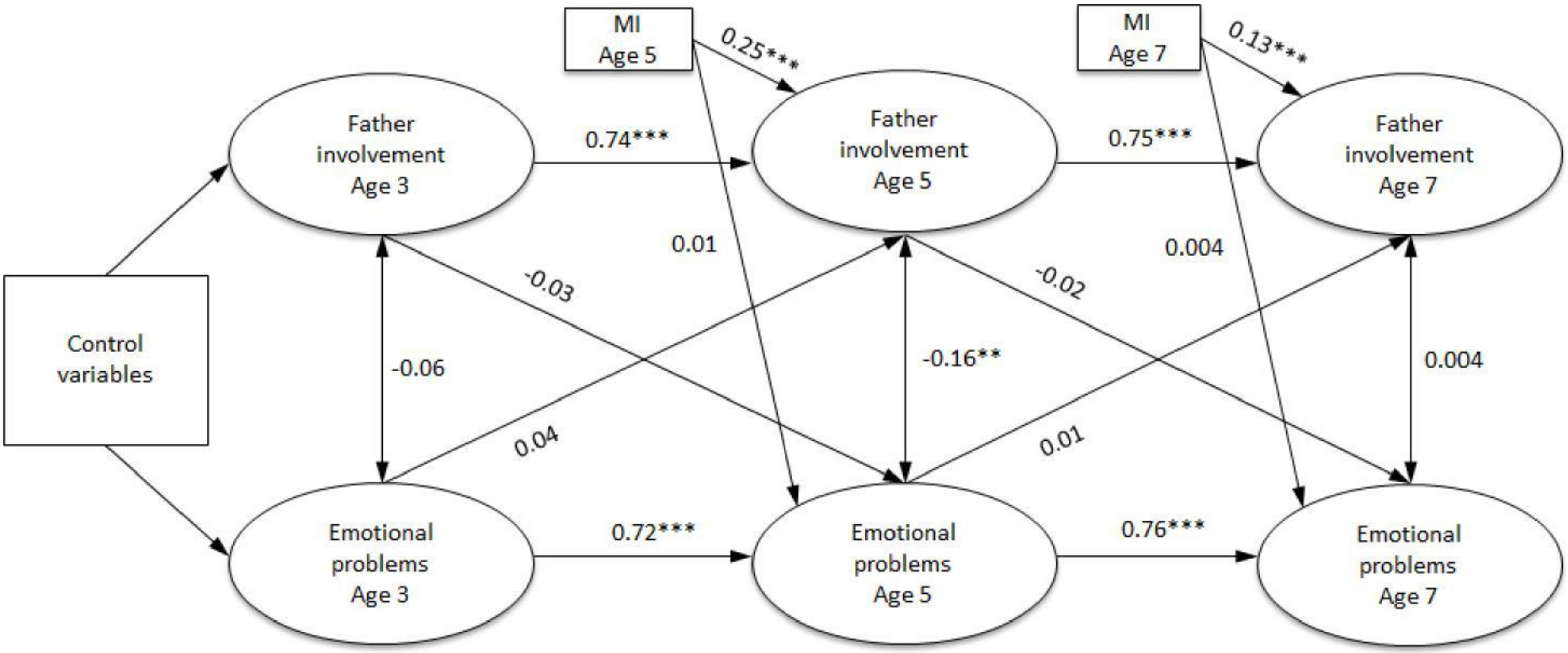
Supplementary Figure 1. Cross-lagged model of father involvement and conduct problems.

Control variables (measured at age 9 months) are family poverty, paternal education, maternal and paternal psychological distress, mother-reported quality of the inter-parental relationship, and child's sibship size, temperament, gender and ethnicity (Mixed, Indian, Pakistani/Bangladeshi, Black or 'Other' compared to White). MI = mother involvement. Regression coefficients are standardised.



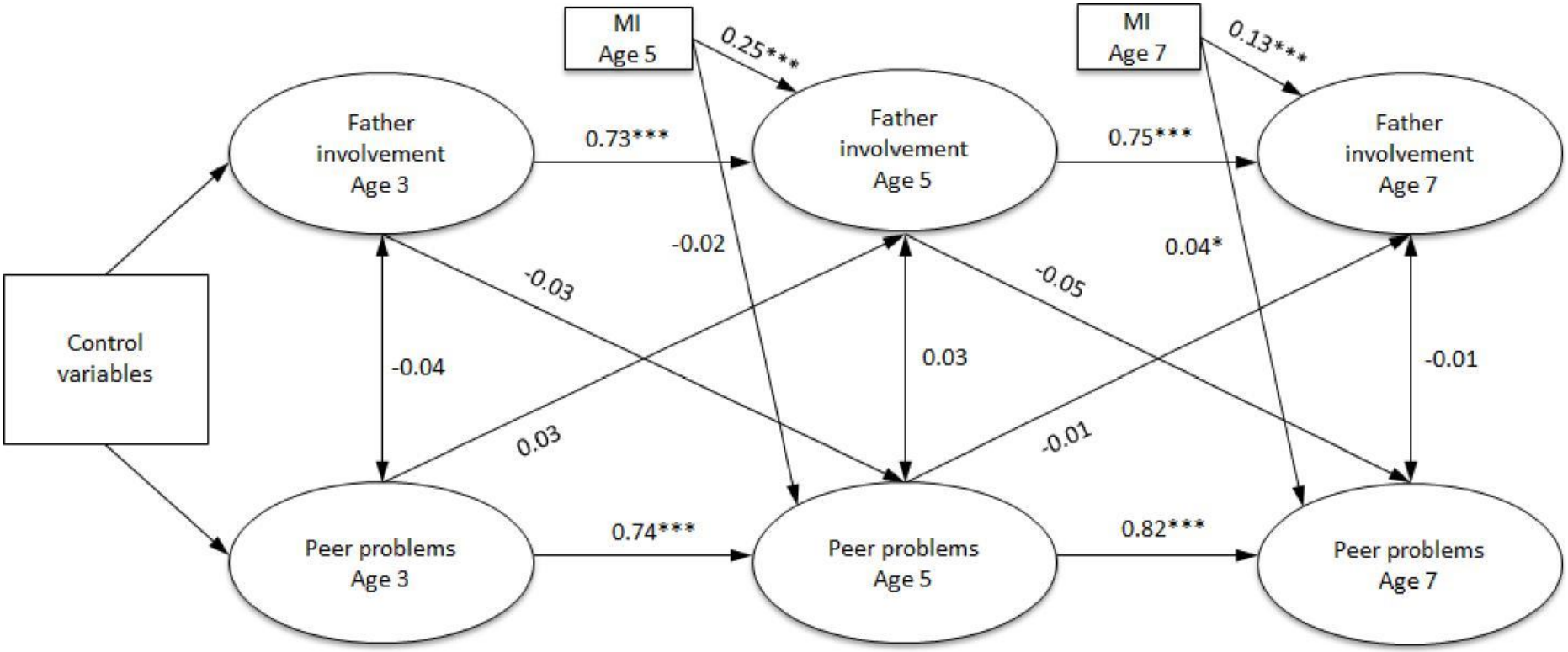
Supplementary Figure 2. Cross-lagged model of father involvement and hyperactivity problems.

Control variables (measured at age 9 months) are family poverty, paternal education, maternal and paternal psychological distress, mother-reported quality of the inter-parental relationship, and child's sibship size, temperament, gender and ethnicity (Mixed, Indian, Pakistani/Bangladeshi, Black or 'Other' compared to White). MI = mother involvement. Regression coefficients are standardised.



Supplementary Figure 3. Cross-lagged model of father involvement and emotional problems.

Control variables (measured at age 9 months) are family poverty, paternal education, maternal and paternal psychological distress, mother-reported quality of the inter-parental relationship, and child's sibship size, temperament, gender and ethnicity (Mixed, Indian, Pakistani/Bangladeshi, Black or 'Other' compared to White). MI = mother involvement. Regression coefficients are standardised.



Supplementary Figure 4. Cross-lagged model of father involvement and peer problems.

Control variables (measured at age 9 months) are family poverty, paternal education, maternal and paternal psychological distress, mother-reported quality of the inter-parental relationship, and child's sibship size, temperament, gender and ethnicity (Mixed, Indian, Pakistani/Bangladeshi, Black or 'Other' compared to White). MI = mother involvement. Regression coefficients are standardised.