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Research article

The association between characteristics of fathering in infancy and depressive symptoms in adolescence: A UK birth cohort study



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ABSTRACT

Evidence suggests that the quality of fathers' parenting has an impact on psychological outcomes during adolescence, but less is known about which aspects of fathering have the strongest effects. This study, using the Avon Longitudinal Study of Parents and Children (ALSPAC), considers which paternal attitudes towards and experiences of child care in infancy are most strongly associated with depressive symptoms in adolescence, and whether father effects are independent of maternal influence and other risk factors. Primary exposures were fathers' attitudes to and experiences of child care at 8 weeks, 8 months and 21 months coded as continuous scores; the primary outcome was self-reported depressive symptoms at 16 years (Short Moods and Feelings Questionnaire score ≥ 11). Multivariable logistic regression models showed reasonably strong evidence that parental reports indicating potential paternal abuse when children were toddlers were associated with a 22% increased odds of depressive symptoms at age 16 (odds ratio [OR] 1.22 [95% CI 1.11, 1.34] per SD). There was some evidence for an interaction with social class ($p = 0.04$): for children living in higher social class households (professional, managerial and technical classes), an increase in the potential abuse scale increased the odds of depressive symptoms by 31% (OR 1.31 [1.13, 1.53] per SD), whereas there was no effect in the lower social class categories. The potential paternal abuse measure needs to be validated and research is needed on what circumstances predict anger and frustration with child care. Effective interventions are needed to help fathers cope better with parenting stress.

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1. Introduction

The importance of negative interactions with caregivers in early childhood for later outcomes is well established. Although there is debate about the extent to which children can recover from these damaging early influences (Allen, 2011; Wastell &

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White, 2012), there is strong evidence that the first years of a child's life have a profound effect on their later development and particularly on their emotional well-being (Agid, Kohn, & Lerer, 2000).

There is increasing awareness of the potential impact of father involvement specifically on the longer-term psychosocial functioning of children. Longitudinal research indicates independent positive effects of father involvement on child psychological (Culpin, Heron, Araya, Melotti, & Joinson, 2013; Flouri & Buchanan, 2003; Jorm, Dear, Rodgers, & Christensen, 2003) behavioural (Aldous & Mulligan, 2002) and cognitive outcomes (Rowe, Coker, & Pan, 2004).

Lamb (2010), in summarising the greatly expanded field of research on father influence, notes that the effects mothers and fathers have on children are more similar than they are different. Fathers' individual characteristics are less important in determining influence on child development than the quality of father-child relationship. The amount of time fathers spend with children appears to be less important than the quality of that contact and how it is perceived by fathers and their children.

Pleck's (2012) overview of father involvement research notes that work in the 1980s focused on three elements: engagement (i.e. direct interaction through hands-on care and play), accessibility (i.e. being available) and responsibility (i.e. ensuring that various parenting activities are carried out). In this early research, based largely on monitoring of time spent on activities via diary-keeping, no association was found between these dimensions of involvement and child outcomes. Pleck (2010) later presented a revised conceptualization of father involvement with three dimensions which drew on the wider knowledge about effective parenting: positive engagement activities, warmth and responsiveness and control.

Paternal attitudes may also be associated with father involvement. Bulanda (2004) found that men whose personal ideologies were more in line with gender equality were more involved with children than men with more traditional views. Some studies have questioned how closely attitudes are associated with practices (Wall & Arnold, 2007). For instance, Poortman and Van Der Lippe (2009) found paternal attitudes to child care to be associated with actual time spent on child care (self-report from time diaries) only when individual items were summed into an overall score. There seems to be a lack of evidence, however, on the relationship between paternal attitudes and quality of relationship with child and on the association between paternal attitudes and longer-term child outcomes.

Although there is evidence from the UK on the effects of father presence, little is known about fathers' attitudes to child care and their relationship with children. Most of this evidence is US-based. Despite their historical connections, there are social and cultural differences between the UK and the US and it cannot be straightforwardly assumed that findings in one country will apply to the other. Most existing evidence is also from cross-sectional rather than longitudinal studies. Another limitation of the existing evidence base is that father involvement studies examine mainstream fathering and do not consider the more extreme negative responses to children, which are considered in a separate body of research on child abuse.

Our study focuses on the long-term effects of early fathering. Specifically, it examines the association between fathers' attitudes towards and experiences of child care when their children are infants and subsequent depression in those children during adolescence.

A range of studies have identified biological, genetic, demographic, familial, psychosocial and cognitive correlates of depression in adolescence (Birmaher et al., 1996). Focusing more specifically on demographic and familial factors, there is evidence of a social class gradient for adolescent depression (Goodman, 1999) and elevated risk of adolescent onset in girls (Cyranski, Frank, Young, & Shear, 2000) and following stressful life events such as divorce, bereavement and exposure to suicide (Birmaher et al., 1996). Higher levels of maternal depression are associated with adolescent depressive symptoms (Goodman et al., 2011). Paternal depression is also associated with a variety of emotional and behaviour problems in children and adolescents (Ramchandani et al., 2008, 2011).

Several of these risk factors for adolescent depression may also map onto patterns of fathering. There is some evidence that paternal involvement varies according to socio-economic status and is often limited in low-income families (Hango, 2007). Higher levels of maternal depression (Paulson, Dauber, & Liefman, 2006) and paternal depression (Wilson & Durbin, 2010) are associated with lower levels of father involvement.

The attachment bond between caregiver and infant is one plausible reason for the apparent importance of fathers to children's subsequent well-being. There has been limited empirical investigation of father-infant attachment. However, there is some evidence to suggest that it has a comparable effect to that of mothers on the development of depressive symptoms in adolescence (Ainsworth, 1989; Woodward, Fergusson, & Belsky, 2000). Low levels of paternal involvement during the sensitive developmental stage of early childhood may be associated with disrupted attachment (Belsky et al., 1996), which in turn constitutes a risk factor for the development of depressive symptoms in adolescence (Kenny, Moilanen, Lomax, & Brabeck, 1993). Another possible mechanism is marital conflict, which is associated both with lower levels of parental involvement (Erel & Burman, 1995) and higher risk of adolescent depression (Hanington, Heron, Stein, & Ramchandani, 2012). As Lamb (2012) has argued, regardless of how developmental mechanisms are conceptualised, the association between parental warmth and children's adjustment (at all ages) is one of the best evidenced in child development research.

The term 'fathers' is not restricted to biological fathers in this paper. The study is focused on the relationships between infants and men in a parenting role, regardless of biological status, because of the diversity of contemporary family structure (Mann, 2009) and because most evidence suggests that biological status is less important in predicting children's well-being. Lamb (2012) notes that children's adjustment is best predicted by quality of parenting, parent-child relationships, parental relationships and socio-economic resources, rather than by family structure, including biological relatedness.

The current study sets out to address some of the gaps in current research, namely the lack of UK studies which examine (1) how fathers' attitudes and experiences influence child outcomes (as opposed to simply noting the effect of father absence or presence); (2) the association between paternal child care attitudes/experiences and child outcomes; and (3) a range of attitudes including the more extreme negative responses. The main research question is: Which attitudinal and experiential characteristics of fathers of very young children are most strongly associated with depressive symptoms in adolescence? The hypothesis being tested is that characteristics of fathering in early childhood will be associated with depressive symptoms in adolescence. We also examine whether these effects are moderated by characteristics of the father, mother and child, such as social class, child's sex and parental depression.

2. Methods

2.1. Cohort

The sample comprised participants from the Avon Longitudinal Study of Parents and Children. Detailed information about ALSPAC is available on the study website (<http://www.bristol.ac.uk/alspac>), which includes a fully searchable dictionary of available data (<http://www.bris.ac.uk/alspac/researchers/data-access/data-dictionary>). Pregnant women resident in the former Avon Health Authority in south-west England, having an estimated date of delivery between 1/4/91 and 31/12/92 were invited to take part, resulting in a cohort of 14,541 pregnancies and 13,973 singletons/twins (7217 boys and 6756 girls) alive at 12 months (Boyd et al., 2013). Ethical approval for the study was obtained from the ALSPAC Law and Ethics committee and local research ethics committees.

Attrition is a limitation of using ALSPAC data from later waves. The published cohort profile papers (Boyd et al., 2013; Fraser et al., 2013) show that cohort members lost to follow-up are disproportionately from lower social class groups and have lower educational qualifications – this being true for both children and mothers. At baseline, mothers invited to the first study clinic who did not attend were more likely to be younger and already have two or more children.

The primary analysis for this study uses data from children who completed the depressive symptoms assessment at age 16 and whose fathers also completed questionnaires during early childhood. In a secondary analysis, we used multiple imputation to correct for potential biases in our measures of effect due to losses to follow-up.

2.2. Primary outcome: depressive symptoms at 16 years

The Short Mood and Feelings Questionnaire (Angold et al., 1995) is a brief (13-item) questionnaire for depressive symptoms asking about the occurrence of depressive symptoms over the past 2 weeks. Study children completed the SMFQ when aged 16 years 6 months. The SMFQ correlates highly with more extensive depression rating scales such as the Children's Depression Inventory (Kovacs, 1992) and the Diagnostic Interview Schedule for Children (Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000). It has high internal reliability (Cronbach's alpha = 0.90; Costello, Benjamin, Angold, & Silver, 1991), and discriminates depressed from non-depressed children in general population samples (Angold et al., 1995).

A response of 'true' to an item was coded as 2, 'sometimes true' as 1 and 'not true' as 0. We dichotomized the SMFQ scale, defining high levels of depressive symptoms by scores at or above 11. This cut off has been shown to have a high sensitivity and specificity (Thapar & McGuffin, 1998) and has been applied in previous community samples (Angold, Erkanli, Silberg, Eaves, & Costello, 2002; Thapar & McGuffin, 1998). In ALSPAC this cut point led to high sensitivity, specificity and negative predictive power for an ICD-10 diagnosis of depression at 18 years (Turner, Joinson, Peters, Wiles, & Lewis, 2014).

2.3. Primary exposures: fathers' attitudes and experiences of child care

Paternal attitudes to and experiences of child care were derived from the questionnaires administered to the study mothers' partner at 8 weeks, 8 months and 21 months. Mothers decided who counted as their partner for the study. Almost all the respondent partners in infancy were reported by the mothers to be the biological fathers. For example, at 21 months, 6100 (99.1%) partner respondents were reported by mothers to be the biological father of the index child. The identity of the remaining 0.9% cannot be reliably determined and it is possible that some were women. The measures at 8 weeks were self-reports of practical tasks and attitudes to parenthood. These included: partner helping at home (range 7–28, based on 7 items), partner helping with child (range 7–42, based on 7 items); and partner's attitude to fatherhood (range 19–76, based on 19 items). The measures at other time points were attitudinal, describing a wide range of positive and negative responses to fatherhood and child care. These were: paternal enjoyment (range 5–20, based on 5 items) and confidence (range 6–24, based on 6 items) at 8 months; and paternal enjoyment (range 8–32, based on 8 items), confidence (range 5–20, based on 5 items), discipline (range 3–12, based on 3 items) and abuse (range 6–24, based on 6 items) at 21 months.

Responses at 8 weeks were coded as following: partner helping at home: 1 = no help at all, 2 = hardly any help, 3 = some help, 4 = A lot of help; and partner helping with child: 1 = never, 2 = less than once a week, 3 = once a week, 4 = once in every 4 days, 5 = every couple of days, 6 = every day. All other measures were coded: 1 = I never feel this way, 2 = this is sometimes how I feel, 3 = this is often how I feel, 4 = this is exactly how I feel.

Continuous scores were derived by adding the individual items. It should be noted that the ALSPAC measures of paternal enjoyment and confidence were similar, but not identical, at 8 and 21 months. For most of the measures, a higher score

indicates more positive attitudes. The exception is potential paternal abuse, where a higher score indicates more negative attitudes to the toddler, so this was reversed before it was included in the score. The decision was taken to use only waves with at least two measures of fathers' characteristics.

Because several different measurement scales are used, standardised z-scores were produced, that is, scales representing the number of standard deviations from the mean for each data point. The measures of father characteristics in the study are clearly not all based on the same constructs and their diversity is the justification for their inclusion. However, a Cronbach's alpha of 0.70 across all eight standardised scales (reversed where appropriate) suggests an acceptable level of consistency (Tavakol & Dennick, 2011).

2.4. Confounders

The following co-variables were selected as potential confounders in the light of their association with depression and depressive symptoms in adolescence (Birmaher et al., 1996).

2.4.1. Maternal depression in early childhood. For maternal depression, the mother's self-report that she has ever had serious depression was used, from the age 8 wave. The responses were recoded as a binary of ever-never.

2.4.2. Challenging life events in adolescence. A derived variable was created for challenging events since the age of 12 that were reported by children. The following variables were recoded as 0/1 and then summed to create a variable with a range of 0–9, i.e. a score of one for each challenging event reported.

1. A parent or sibling has had a serious injury.
2. Parents have divorced or separated.
3. A parent or sibling has died.
4. A grandparent has died.
5. A parent has been in trouble with the police.
6. The young person has experienced serious injury to themselves.
7. A parent has lost a job.
8. The young person has experienced bullying.
9. Someone in the family has hurt themselves on purpose.

2.4.3. Parental social class. For social class, an average of maternal and paternal social class as reported at enrolment was used. Where the average lay between classes, the higher was used. The measure of social class used in ALSPAC is the six-category 1990 Standard Occupational Classification known as SOC90 (Office of Population and Census Statistics, 1991). The categories are I (professional), II (managerial and technical), IIIa (skilled manual), IIIb (skilled non-manual), IV (semi-skilled) and V (unskilled). Because of small numbers, I and II were combined into a single category, as were IIIa, IV and V, leaving three social class categories.

2.4.4. Paternal depression in infancy. Paternal depression was hypothesised to be especially strongly associated with the exposures, but also with the outcome (Ramchandani et al., 2008, 2011), so measures were identified from the same waves as the primary exposures. At each of these waves, the Edinburgh Post-natal Depression Scale, which has been validated for use in men (Matthey, Barnett, Kavanagh, & Howie, 2001) was administered to mothers' partners. The linear scale was used in the analysis, converted to a standardised z-score.

2.5. Ethics

Ethical approval for ALSPAC data collection was obtained from the ALSPAC Ethics and Law Committee (IRB00003312) and Local Research Ethics Committee. No identifiable data are used in the analysis so no additional ethical issues are raised beyond those covered in the original ALSPAC approval process.

2.6. Statistical methods

We used logistic regression to investigate associations between paternal parenting and adolescent depressive symptoms as a binary outcome. On the basis of the univariable associations of primary exposures with the outcomes, a decision was taken about which variables to take forward into multi-variable regression models. These were adjusted for several a priori confounders, namely: sex of child, maternal depression, paternal depression, challenging life events, and household social class. Each of these a priori confounders was also tested as a possible effect modifier, using likelihood ratio tests to compare models with and without interaction terms. For this purpose, continuous variables were dichotomised: for social class, this was a division of class I–III (1) vs. class IV–VI (0); for challenging family experiences, responses up to and including the median were coded as 0, and responses above the median were coded as 1. Performing only complete-case analyses (omitting children with any missing data) can result in bias, hence we fitted our final multi-variable model using imputed

datasets. We generated 75 imputed datasets based on the outcome, primary exposure and confounder variables, and any interaction terms. The number of imputations required to achieve convergence of parameter estimates was determined by checking the estimate of the Monte Carlo error in relation to the standard error of the coefficient being estimated, with the number of imputations being increased incrementally until the Monte Carlo error achieved a value which was <10% of the standard error of the estimate (White, Royston, & Wood, 2011). The sample after imputation was 13,978, which represents those ALSPAC children who were alive at 1 year and who were either a singleton or twin. We imputed the data under a logistic regression model using an imputation sampling method (implemented in Stata's uvis command (Royston, 2007)). We combined imputed estimates using Rubin's rules (Rubin, 1987). We investigated pairwise correlations between aspects of paternal parenting using Pearson's correlation coefficients. Analyses were performed using Stata (StataCorp, 2013).

3. Results

Outcome data were available for 3634, 3265 and 3024 adolescents who had paternal data at 8 weeks, 8 months and 21 months, respectively. Children whose data were analysed were more socially advantaged than children who were lost to follow-up. Children in the current study included a lower proportion living in social rented housing ($\chi^2 = 411.33, p < 0.001$), a lower proportion with mothers from manual social classes ($\chi^2 = 180.63, p < 0.001$) and a higher proportion whose mothers have degrees ($\chi^2 = 461.15, p < 0.001$).

3.1. Characteristics of fathers

The median (IQR) age of fathers at the time of birth of the child was 31 (28–34). When the study children were aged 21 months, 49% of 7415 fathers responding ($n = 3631$) were in households categorised as having professional, managerial and technical occupations; 33.3% ($n = 2471$) were in skilled non-manual households, and 17.7% ($n = 1313$) were in skilled manual, semi-skilled or unskilled households. Responses by fathers to questions about their attitudes to, and experiences of parenting, when the child was 21 months old, are shown in Table 1 (see Supplementary Tables 1 and 2 for responses

Table 1
Responses to questions about fathering at 21 months.

Below are some opinions that some people have about being a parent. Please indicate what your feelings are	This is exactly how I feel	This is often how I feel	This is how I sometimes feel	I never feel this way	Missing data
	n (%)				
<i>Paternal confidence scores at 21 months</i>					
Parenthood is something a man learns naturally	1820 (29.6%)	1841 (29.9%)	1674 (27.2%)	717 (11.6%)	104 (1.7%)
I often worry whether my child is eating enough	208 (3.4%)	422 (6.9%)	1808 (29.4%)	3677 (59.7%)	41 (0.7%)
Trying to get my child to eat the right food makes me very anxious	89 (1.4%)	236 (3.8%)	1597 (25.9%)	4193 (68.1%)	41 (0.7%)
I feel pretty sure that I'm doing the right thing for my child	3297 (53.6%)	2435 (39.6%)	326 (5.3%)	56 (0.9%)	42 (0.7%)
I feel anxious if someone else is looking after my child	423 (6.9%)	683 (11.1%)	2629 (42.7%)	2372 (38.5%)	49 (0.8%)
<i>Paternal enjoyment scores at 21 months</i>					
Having a young child is absolutely exhausting	658 (10.7%)	1377 (22.4%)	3361 (54.6%)	725 (11.8%)	35 (0.6%)
Toddlers are fun	3656 (59.4%)	2149 (34.9%)	304 (4.9%)	15 (0.2%)	32 (0.5%)
I really love my toddler	5813 (94.4%)	271 (4.4%)	34 (0.6%)	15 (0.2%)	23 (0.6%)
I am glad that we had this child when we did	5286 (85.9%)	548 (8.9%)	211 (3.4%)	65 (1.1%)	46 (0.7%)
My toddler never gets on my nerves	700 (11.4%)	2067 (33.6%)	2412 (29.2%)	925 (15.0%)	52 (0.8%)
I don't mind the mess that surrounds a toddler	1719 (27.9%)	2227 (36.2%)	1763 (28.2%)	394 (6.4%)	53 (0.9%)
It is a great pleasure to watch my child grow	5502 (89.4%)	528 (8.6%)	80 (1.3%)	14 (0.2%)	32 (0.5%)
My child gives me great joy	5341 (86.8%)	669 (10.9%)	102 (1.7%)	10 (0.2%)	34 (0.6%)
<i>Paternal discipline scores at 21 months</i>					
The best way to calm a child is to cuddle him/her	2500 (40.6%)	2489 (40.4%)	1110 (18.0%)	30 (0.5%)	27 (0.4%)
Toddlers should be allowed to eat whenever they ask for food	705 (11.5%)	1324 (21.5%)	2809 (45.6%)	1276 (20.7%)	42 (0.7%)
A smack is the best way to discipline a child	229 (3.7%)	527 (8.6%)	3654 (54.9%)	1695 (27.5%)	51 (0.8%)
<i>Potential paternal abuse scores at 21 months</i>					
There are times when a child's continuous whining can make a parent want to hit him/her	191 (3.1%)	331 (5.4%)	3020 (49.1%)	2582 (41.9%)	32 (0.5%)
Parents can feel exasperated when they want to calm the child down and nothing works	1046 (17%)	1349 (21.9%)	3006 (48.8%)	675 (11.0%)	80 (1.3%)
I really cannot bear it when my child cries	254 (4.1%)	682 (11.1%)	3389 (55.1%)	1790 (29.1%)	41 (0.7%)
I am afraid to be left alone with the toddler because I think I might be violent	17 (0.3%)	14 (0.2%)	67 (1.1%)	6019 (97.8%)	39 (0.6%)
I feel desperate when my child goes on complaining and being difficult	54 (0.9%)	274 (4.5%)	2378 (38.6%)	3396 (55.2%)	54 (0.9%)
My child's demands sometimes bring intense feelings of anger	42 (0.7%)	106 (1.7%)	1631 (26.5%)	4337 (70.5%)	40 (0.6%)

Table 2

Results of Short Moods and Feelings Questionnaire (Angold et al., 1995) for whole sample responding at 16 years.

These questions are about how you may have been feeling or acting recently. For each question, please say how much you think you have felt or acted this way in the past two weeks. Whole sample responding at 16 (<i>n</i> = 5126)	True	Sometimes true	Not true	Missing
	<i>n</i> (%)			
I felt miserable or unhappy	1093 (21.3%)	2533 (49.4%)	1459 (28.5%)	41 (0.8%)
I didn't enjoy anything at all	172 (3.4%)	778 (15.2%)	4134 (80.6%)	42 (0.8%)
I felt so tired I just sat round and did nothing	591 (11.5%)	2243 (43.8%)	2253 (44.0%)	39 (0.8%)
I was very restless	507 (9.9%)	2204 (39.1%)	2577 (50.3%)	39 (0.8%)
I felt I was no good any more	352 (6.9%)	974 (19.0%)	3766 (73.5%)	34 (0.7%)
I cried a lot	446 (8.7%)	990 (19.3%)	3650 (71.2%)	40 (0.8%)
I found it hard to think properly or concentrate	627 (12.2%)	2193 (42.8%)	2267 (44.2%)	39 (0.8%)
I hated myself	401 (7.8%)	772 (15.1%)	3914 (76.4%)	39 (0.8%)
I was a bad person	319 (6.2%)	872 (17.0%)	3901 (76.1%)	34 (0.7%)
I felt lonely	644 (12.6%)	1492 (29.2%)	2943 (57.4%)	41 (0.8%)
I thought nobody really loved me	362 (7.1%)	727 (14.2%)	4001 (78.1%)	36 (0.7%)
I thought I could never be as good as other kids	422 (8.2%)	964 (18.8%)	3701 (72.2%)	29 (0.8%)
I did everything wrong	329 (6.4%)	892 (17.4%)	2863 (75.4%)	42 (0.8%)

to questions about parenting attitudes and experience at 8 weeks and 8 months). Fathers were largely positive about the experience of parenting, but some fathers did acknowledge finding parenting very difficult. For example, 98 men (1.6%) declared themselves to be at least sometimes afraid to be left alone with the toddler because they were afraid that they might be violent. Pairwise correlations for all the father-related measures are presented in [Supplementary Table 3](#). The most consistent correlations across time points were between paternal confidence and enjoyment, and these aspects of parenting were also correlated with potential paternal abuse at 21 months.

3.2. Depressive symptoms at age 16 years

[Table 2](#) shows the distribution of responses to the SMFQ at age 16. Eighteen per cent (901/4998) were classified as having high levels of depressive symptoms (SMFQ score ≥ 11). Depressive symptom scores were higher in children whose fathers had not taken part in the survey in earlier waves. For example, the mean total score for those with no data provided by fathers at 21 months was higher than the mean for those whose fathers did provide data at this wave (6.26 [SD 5.91] compared with 5.67 [SD 5.44], $p < 0.001$).

3.3. Association of fathers' parenting with depressive symptoms in adolescence

Measures of paternal parenting at 8 weeks and 8 months were not associated with offspring depressive symptoms (SMFQ score ≥ 11) at age 16 years ([Table 3](#)). Higher levels of paternal confidence and enjoyment at 21 months were weakly associated with lower odds of depressive symptoms. Potential paternal abuse at 21 months was strongly associated with an increase in the odds of depressive symptoms (odds ratio [OR] for increase in one standard deviation on the scale = 1.22 [95% CI 1.11, 1.34], $p < 0.001$).

Table 3

Crude associations of paternal characteristics in infancy and early childhood with depression in children at age 16.

Paternal characteristics	<i>N</i>	Mean (SD) for depressed adolescents	Mean (SD) for non-depressed adolescents	Logistic regression ^a (SMFQ ≥ 11)	
				OR (95% CI)	<i>p</i> -value
<i>8 weeks</i>					
Helping at home	3575	15.67 (4.92)	15.26 (4.82)	0.94 (0.86, 1.03)	0.19
Helping with child	2148	20.62 (7.19)	20.47 (7.00)	1.08 (0.95, 1.22)	0.22
Attitude to fatherhood	3468	38.22 (5.23)	38.49 (4.91)	0.95 (0.86, 1.04)	0.27
<i>8 months</i>					
Paternal confidence	3265	15.09 (2.30)	15.23 (2.08)	0.93 (0.85, 1.03)	0.16
Paternal enjoyment	3255	13.17 (2.19)	13.09 (2.23)	1.04 (0.94, 1.14)	0.45
<i>21 months</i>					
Paternal confidence	3015	11.44 (2.17)	11.62 (2.09)	0.92 (0.83, 1.01)	0.09
Paternal enjoyment	3023	18.77 (2.69)	19.00 (2.78)	0.92 (0.84, 1.01)	0.09
Paternal discipline	3058	3.37 (1.49)	3.45 (1.49)	0.95 (0.86, 1.05)	0.31
Potential paternal abuse	3024	4.29 (2.43)	3.83 (2.23)	1.22 (1.11, 1.34)	<0.001

^a Using standardised scores for paternal characteristics.

Table 4

Multivariable logistic regression model predicting children's depression at age 16 (SMFQ ≥ 11) from potential paternal abuse scale at 21 m, controlling for other risk factors and with an interaction term added for household social class. Complete case analysis.

<i>n</i> = 2250	<i>n</i>	Odds ratio (95%CI)
Potential paternal abuse ^a in professional, managerial and technical households	1401	1.31 (1.13, 1.53)
Potential paternal abuse ^a in skilled non-manual households	623	0.97 (0.78, 1.23)
Potential paternal abuse ^a in skilled manual, semi-skilled and unskilled social class households	226	0.95 (0.65, 1.39)

Controlling for sex of child, maternal depression, paternal depression and challenging life events.

^a z-score.

Analysis of potential confounders showed the following associations with depressive symptoms at age 16 years: female child (OR 2.50 [2.12, 2.94], $p < 0.001$), maternal depression before the child is age eight (OR 2.06 [1.62, 2.60], $p < 0.001$), paternal depression at 21 months (z-score) (OR 1.15 [1.05, 1.26], $p = 0.003$), lower parental social class (average of both parents, five categories) (OR 1.12 [1.03, 1.23], $p = 0.007$) and challenging events in adolescence (linear scale 0–9) (OR 1.52 [1.43, 1.62], $p < 0.001$). Sex of child, maternal depression before the child is eight, paternal depression at 21 months and challenging events in adolescence were associated with at least one of the paternal attitudes at 21 months.

Social class was found to be a modifier of the effect of potential paternal abuse on depression at age 16 ($p = 0.04$). The association found in univariable analysis was evident only in the professional, managerial and technical stratum (OR for an increase in one standard deviation on the scale = 1.31 [1.13, 1.53], $p < 0.001$), after adjusting for sex of child, maternal depression, paternal depression and family-related challenging life events (see Table 4). There was no evidence that the other risk factors, including child's sex, modified the effect of potential paternal abuse on adolescent depression.

In a multivariable logistic regression model adjusted for the same confounders, neither paternal enjoyment (OR = 0.90 [0.80, 1.02]) nor paternal confidence (OR 0.99 [0.87, 1.13]) were associated with depression, and there was no interaction of these variables with social class. Potential paternal abuse was correlated with paternal enjoyment of parenting ($\rho = -0.42$, $p < 0.001$), and these two exposures could be considered to be on the same causal pathway to adolescent depression, hence it is probably inappropriate to include both in the same model.

When the final multivariable model shown in Table 4 was fitted using imputed datasets ($N = 13,978$), the interaction between potential paternal abuse and social class was evident ($p = 0.02$), and the association between potential paternal abuse and depression for 16-year-olds from professional, managerial and technical social class households (OR = 1.30 [1.13, 1.49] per SD of potential abuse) was the same as that obtained in our primary analysis (OR = 1.31 [1.13, 1.53]).

4. Discussion

Multivariable regression models showed that paternal questionnaire responses indicating potential abuse when children were toddlers were associated with increased levels of depressive symptoms in children aged 16. This effect was similar in boys and girls, but there was evidence of interaction with social class suggesting that children living in professional, managerial and technical households had a 31% increase in the odds of depressive symptoms for each standard deviation increase in the potential paternal abuse scale. There was no effect for children in other social class categories. There was no evidence that paternal enjoyment and confidence at 21 months were associated with depressive symptoms in children at age 16, once confounding by other risk and protective factors was taken into account.

Some important limitations of the study need to be acknowledged. There is potential selection bias insofar as those lost to follow-up are disproportionately from lower socio-economic positions and therefore more likely to show depressive symptoms. However, the similarity of estimates from raw and imputed datasets suggests that these differential losses to follow-up did not impart substantial bias. It is also the case that levels of depressive symptoms were higher in children who did not have data provided by fathers at 8 weeks, 8 months or 21 months. It is difficult to admit to feeling anger towards a toddler and being worried you might be violent, so socially desirable responses are quite likely. In the light of this, the true association of the potential paternal abuse responses and children's depression risk could be underestimated. The evidence for interaction of potential abuse and social class was relatively weak ($p = 0.04$) and interactions with five variables were tested so it is possible that this was a chance association.

An important caveat is that although the outcome measure is widely recognised as a valid screening tool for depression, the measures of paternal characteristics have not yet been validated. The wording of the response items can be questioned: 'this is exactly how I feel' is conceptually different from 'this is often how I feel' insofar as 'exactly' suggests how close to the feeling the respondent is, whereas 'often' refers to frequency of feeling that way. These responses are therefore not directly comparable and the first response really should have been about feeling that way 'always', rather than 'exactly'. Furthermore, the individual items which make up the potential paternal abuse measure have not been validated for measuring this risk. They are, however, in line with evidence that men who abuse children are resentful of them and have low tolerance levels (Cavanagh, Dobash, & Dobash, 2007). We recommend further research to validate the father-related measures. A further possible limitation is that maternal depression when the child is aged 8, whilst selected because of plausible association with adolescent depression, could be regarded as on the causal pathway between potential paternal abuse in infancy and

depression in adolescence. This was a self-report binary measure of maternal depression (ever-never) so cruder than the measure used for adolescent depressive symptoms.

In the light of the skewed distribution of SMFQ scores, a decision was taken to limit the analysis to the binary outcome of depressed vs. not depressed, employing a validated widely used cut-off (SMFQ score >11). There is, however, some debate about the appropriate cut-off point for SMFQ. Some researchers have argued for empirically determined cut-offs for particular populations (e.g. McKenzie et al., 2011) and some psychiatrists debate the relative virtues of dimensional vs. categorical approaches to depression diagnosis (Kraemer, Noda, & O'Hara, 2004).

The interaction with class is very interesting and worthy of exploration in future research. There may possibly be reporting bias which could affect the results, for example if higher social class men, perhaps because of educational background, are more likely to acknowledge feelings of frustration with child care when completing a questionnaire – i.e. there could be a difference in levels of honest reflection rather than a difference in potential to abuse. However, it is also possible that the tendency in practice for child welfare services to focus on materially deprived families is misplaced if in fact when fathers' attitudes to child care suggest potential for abuse there is a higher risk of subsequent depression in children from higher social class households than in lower social class households. The reasons for a connection between frustration with the care of toddlers and subsequent adolescent depressive symptoms are certainly worthy of further exploration. It may be that the potential abuse score is indicative of a poor relationship between child and father, which may continue throughout childhood.

There are potential implications for behaviour change work with fathers who are struggling with child care. Practical skills of parenting and stress reduction can be taught and learned (Furlong et al., 2013). One implication of our study is that targeted interventions may be more relevant than universal ones, given that it was only the more intense difficulties with child care that were associated with depressive symptoms at age 16. Targeted interventions can be difficult to run effectively, however, because of iatrogenic effects (Evans, Scourfield, & Murphy, 2015). Whether targeted or not, there is a need to develop effective prevention programmes for paternal anger and frustration with child care. There is very little evidence of the effectiveness of interventions with fathers to prevent child maltreatment. Smith et al.'s (2012) systematic review unearthed 15 studies of interventions for parents, but only two of these reported father-specific outcomes. All except two of the programmes were mostly attended by women or there was little follow-up data on men. Most of the studies only used pre-post testing of those who received the intervention, with no comparison group. It may be that toddlerhood is a more important stage for intervention than babyhood, although the same measure of potential abuse was not used with fathers at other waves so this is unclear.

5. Conclusion

The apparent association of the self-reported potential paternal abuse measure when children are toddlers and depressive symptoms at age 16 is plausible in the light of other evidence on the damaging outcomes of child maltreatment, especially in the early years. Child abuse and neglect have serious and costly implications for children's health, behaviour, growth and development (Rees, 2011). Abuse prevention may be more of a priority than help for parents experiencing low-level difficulties, although it should be acknowledged that these potential abusers are a challenging group of men to involve in interventions. More studies are needed to explore what leads to the level of child care-related anger and frustration revealed in the potential paternal abuse score. The measure itself needs to be validated.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.chiabu.2016.06.013>.