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Depression in men in the postnatal period and later child psychopathology: a population cohort study

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Abstract

Objective—Postnatal depression in women is associated with adverse effects on both maternal health and children's development. It is unclear whether depression in men at this time poses comparable risks. The present study set out to assess the association between depression in men in the postnatal period and later psychiatric disorders in their children, and to investigate predisposing factors for depression in men following childbirth.

Methods—A population based cohort of 10,975 fathers and their children from the Avon Longitudinal Study of Parents and Children (ALSPAC) were recruited in the prenatal period and followed up for 7 years. Paternal depressive symptoms were assessed with the Edinburgh Postnatal Depression Scale, and later child psychiatric disorder (DSM-IV) with the Development and Well-Being Assessment (DAWBA).

Results—Depression in fathers in the postnatal period was significantly associated with psychiatric disorder in their children 7 years later (adjusted Odds Ratio 1.72, 95% confidence interval 1.07 to 2.77), most notably oppositional-defiant/conduct disorders (adj. OR 1.94, 95% confidence interval 1.04 to 3.61), after adjusting for maternal depression and paternal educational level.

A past history of severe depression, and high prenatal symptom scores for depression and anxiety were the strongest predictors of paternal depression in the postnatal period.

Conclusions—Depression in fathers in the postnatal period is associated with later psychiatric disorders in their children, independently of maternal postnatal depression. Further research is required into the risks associated with paternal psychopathology, as this could represent an important opportunity for public health intervention.

Keywords

Depression; Fathers; Psychiatric Disorder

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Introduction

The study of depression in women in the perinatal period has led to an increased understanding of its nature, course and causes, and has identified potential opportunities for screening and intervention. The importance of postnatal depression in women is now well recognised, in terms of its adverse effects on maternal health and also children's development 1-3. We do not yet know if depression in men at this time poses comparable clinical and public health concerns 4-6. Although direct evidence about the psychological well-being of men in this transition period is very limited, there are indirect indicators of increased risk. The most striking is the finding that the transition to parenthood is associated with a marked deterioration in marital quality 5, 7, 8. In addition, there is research suggesting that the mental health of fathers has an impact on children's psychosocial development 9, 10, but evidence is limited regarding the influence of paternal mental health in the early postnatal period 11, 12, which may be a time of particular vulnerability for the developing infant 13, 14. For example, we have previously shown in this cohort of families that depression in fathers in the postnatal period is independently associated with an increased risk of behavioral problems in their children at the age of 3 years 11. However, further systematic research on epidemiological samples is needed before intervention studies are pursued, because we do not yet know if the exposure to depression in fathers has persisting effects on children's development15, as has been found in mothers. This paper aims to test this novel developmental-clinical hypothesis by examining associations between depression in fathers in the postnatal period and children's psychiatric and wider psychological outcome at the age of 7 years. This is of particular significance in that it goes beyond considering behavioural problems in the early preschool years to examine diagnosable, and clinically significant, psychiatric disorder in older children.

Method

Subjects

The Avon Longitudinal Study of Parents and Children (ALSPAC) is a longitudinal cohort study set up to collect comprehensive data on a large population sample of children and their parents from early pregnancy through childhood16. Pregnant mothers were recruited from the Bristol area of the UK. This is a mixed urban and rural population of approximately 1 million, with both deprived and affluent communities represented. All pregnant women due to deliver their baby between April 1, 1991, and December 31, 1992, were eligible. There were 13,822 women with live children 28 days after birth. 13,351 mothers agreed to participate in the study and were sent a questionnaire 8 weeks after the birth of their child. 12,884 (96.5%) of the respondents had partners and more than 99% of these men were identified as the father of the child. Questionnaires were sent to mothers and fathers at regular points during and after pregnancy. Data were available for depressive symptoms for 10,975 (85.2%) men at one or more time point - 9,846 (76.4%) men pre-natally, 8,332 (64.7%) men at 8 weeks postnatal, 7,090 (55.0%) at 8 months and 6,101 (47.4%) at 21 months. Data were available for 4,792 (37.1%) men from all four time points, and analyses were undertaken for this group, and for the sample of 10, 975 by imputing missing data (see below). All participants provided informed consent, and the study was approved by the ALSPAC Ethics and Law committee and local research ethics committees.

Procedures

Fathers were assessed in week 18 of their partners' pregnancy and at 8 weeks, 8 months and 21 months after the birth of their infant. Their children were assessed at ages 6 years (81 months) and 7 years (91 months) by maternal and teacher report. These two time points

were used to provide information about psychiatric diagnoses for children as well as their broader psychological functioning.

Main parental measures—The Edinburgh Postnatal Depression Scale (EPDS) was used to assess symptoms of depression in both fathers and mothers. The EPDS is a well validated, widely used, self-report questionnaire that consists of ten items17. Although the EPDS was developed to screen for depression in women postnatally, it has been shown to be useful in the assessment of mothers outside the postnatal period and has been validated in men18, 19. Although the scale does not provide a diagnosis, scores of more than 12 do identify a likely diagnosis of major depressive disorder in women with a high specificity (95·7%) and sensitivity (81·1%)18. The EPDS has been used in a number of studies with men, although there is more limited information available regarding suitable cut-off levels for men 19. Estimates of sensitivity range from 71% to 86% and specificities range from 75% to 94%. We therefore used the cut-off of above 12 for both mothers and fathers for comparability, and describe the group that scored more than 12 as the depressed group in each case.

The 8-item anxiety subscale of the Crown Crisp Experiential Index (CCEI) was used to assess anxiety symptoms. The CCEI is a validated self-report questionnaire and has been used in a number of studies 20, 21. A cut-off score of the top 15% has previously been used in research 21 and is used here to indicate a high level of anxiety.

Main child measures—A questionnaire measure of children's emotional and behavioral functioning (the Strengths and Difficulties Questionnaire) was used at age 6 years (81 months), and a structured psychiatric questionnaire (the DAWBA) at age 7 years (91 months).

The Strengths and Difficulties Questionnaire (SDQ) was completed by parents (mothers in 97.6% of cases). It is a widely used and validated screening questionnaire with reasonable internal consistency (Cronbach's alpha: 0.73), and retest stability (mean: 0.62)22, 23. It was developed from the Rutter questionnaires, which have been employed extensively since their use in a number of key epidemiological studies in the 1960's and 1970's 24. The SDQ consists of 25 questions, which divide into five subscales, (emotional problems, hyperactivity, conduct problems, peer problems, and a prosocial score). The first 4 subscale scores can be combined to give a total difficulties score, and all the subscales and the total score are used here. As the distributions of SDQ scores were significantly skewed in this population sample, the scores were categorized into strata of between 5 and 7 groups per subscale (the exact number of strata being dictated by the distribution of the data and the need to maintain the proportional odds assumption).

The Development and Well-Being Assessment (DAWBA) was completed by parents (mothers in 97.8% of cases) and teachers when the children were 7 years old. The questionnaires inquire about psychiatric symptoms and their resultant impact to generate DSM-IV psychiatric diagnoses 25, 26. As part of the questionnaires, parents and teachers are asked to provide written details of the nature of each of the symptoms, and how they impact on the child's functioning. The questionnaire responses are entered into a computer program that integrates the information and provides likely diagnoses where appropriate. These are then assessed by experienced clinical raters who decide whether to accept or overturn the computer diagnosis (or lack of diagnosis) in the light of their review of all the data. The DAWBA has been validated 25, and used in a National Survey of over 10,000 children and adolescents in the UK 26.

Other information obtained—Questions were also asked to obtain the following information: 1) Past history of severe depression and family history of depression – as

reported by affected parent (yes/no response). 2) The age of the father at the time of the child's birth. 3) Paternal educational level (measured as a binary response, degree level education or not). 4) Crowding: a measure of the degree of crowding in each family's home. 5) The number of other children in the family at the time of the child's birth.

Data analysis

The analysis was undertaken in five stages. First, we estimated the prevalence of depression using a cut-off score of over 12 on the EPDS, and calculated median scores for depression in fathers at the four time points. Second, we examined whether any characteristics of father, mother or family structure (i.e. family size) predicted depression in fathers soon after the birth of their child (8 weeks).

Third, we undertook univariable and multivariable analyses to examine the associations between postnatal depression (8 weeks) in fathers and later emotional and behavioral problems and psychiatric disorders in their children. We used logistic regression analyses to assess the association between paternal depression and child psychiatric outcome, and ordinal logistic regression to assess the association between paternal depression and the child's emotional and behavioral outcome (using SDQ scores). Prosocial scores were reversed (a higher score indicated fewer prosocial behaviors). Multivariable analyses were then undertaken for both sets of child outcomes to control for paternal educational level and depression in mothers. We also included other potential confounding variables in the preliminary models (socio-economic status, age of father, number of children in the family and crowding of accommodation), but these did not alter the associations seen over and above the effect of paternal educational level, and so were not used in the regression models presented here. We also conducted analyses separately for boys and girls, but no gender differences were found, and so results are presented for both genders combined.

Fourth, we examined the child outcomes controlling for the effect of later depression in fathers to see if the associations seen were explained by later depression. We selected the 21 month time point as this was the latest time for which we had data on paternal depression available. We undertook analyses for the whole sample and then separately for the sample with the small number of second twin births excluded (1%, n=114 of 10 024), to remove any effects of familial clustering. The results were not substantially different (1%-3% change in Odds Ratios), and so are reported for the whole sample.

In the multivariable models, missing data on the confounding variables resulted in a significant sample loss (between 9% and 30% depending on the model). To account for any potential bias in the final adjusted estimates due to this dropout, we used a missing data imputation technique known as MICE (Multiple Imputation by Chained Equations) 27 using the procedure in the STATA programme (Stata Corp) known as mvis 28. MICE uses an iterative multivariable regression technique to cycle through the dataset. Each variable in turn is treated as the ‘outcome’ and any missing data are predicted from the remaining variables, incorporating a random element to allow for the uncertainty in this variable's true value. The imputation was restricted to the confounding variables (maternal depression, paternal educational level, and later paternal depression). The main exposure (paternal depression at 8 weeks) and outcome variables (DAWBA or SDQ) were not imputed. Further detail on the MICE procedure is available on the Journal's Web site at www.jaacap.com through the ArticlePlus feature.

Finally, given our previous finding of an association between paternal depression in the postnatal period and high levels of behavioral problems in children at age 3 years, we examined the data for continuities from ages 3 to 7 years. For the main clinical outcome (psychiatric diagnosis) we were unable to determine whether there were “new onset” cases

following the earlier assessment at age 3 years, as similar psychiatric diagnostic assessment had not been undertaken at age 3 years. However, with the data available we were able to examine whether behavioral problems at age 3 mediated the relationship between paternal depression and Oppositional/Conduct disorder diagnoses at age 7 years.

Results

Questionnaires were completed about children's behavior at age 6 years for 8401 children; 6075 (72.3%) of these had fathers who provided data on depression at 8 weeks postnatally. Psychiatric diagnoses were available for 8195 children and 5924 (72.3%) of these had fathers who participated at 8 weeks. Compared to participating families, those families where fathers did not participate at 8 weeks were more likely to come from lower socio-economic groups (Chi^2 205.3, d.f. 6; $p<0.01$). The children in these families were no more likely to develop Oppositional/Conduct Disorders, although they did have higher rates of anxiety disorders (Odds Ratio 1.44, 95% Confidence Interval 1.11 to 1.87). The children of fathers with high depressive symptom scores 8 weeks postnatally were somewhat less likely to remain in the study at the 7 year follow-up (64.0% vs 70.5%; $p=0.016$), and this sub-group of fathers were more likely to be separated from their partners by the time their child was 8 months old (9.1% vs 2.4%; $p<0.001$). Depression scores in mothers and fathers were correlated at each time point ($r=0.26$-0.31; all p values<0.001).

The median scores on the depression scale, and the proportion of participants with high scores, are shown in Table 1. Median scores and the percentage depressed in the group that answered all four questionnaires, are shown in the first two columns. In the third column the percentage depressed is shown when data were imputed for missing depression scores where fathers answered one or more questionnaire (total n=10,975). Although the proportion of fathers scoring >12 did not change significantly across the period, median prenatal scores were higher than those at 8 weeks postnatal (Willcoxon Signed Rank Test, $Z=-7.821$; $p<0.001$).

Predictors of depression in fathers in the postnatal period

A range of factors were found to independently predict depression in fathers in the postnatal period (see Table 2). These were: a past history of severe depression (as measured by father self-reported history), prenatal depression, prenatal anxiety, lower educational level, having other children, and maternal prenatal depression.

Depression in fathers in the postnatal period and children's subsequent psychiatric disorders and emotional and behavioral functioning

Depression in fathers in the postnatal period (8 weeks postnatal) was strongly associated with later psychiatric diagnoses in their children at age 7 years (see Table 3). The potential clinical significance of this is illustrated by the finding that 12% of the children of depressed fathers developed a psychiatric disorder, compared to 6% of those children whose fathers had not been depressed. Of the specific categories of disorder examined, a significant association was seen with Oppositional/Conduct Disorders. Following adjustment for maternal depression in the postnatal period and fathers' educational level, there remained a 66% increase in the odds for any psychiatric diagnosis (OR 1.66 (1.05, 2.63); $p=0.030$) and a near doubling of the odds of oppositional/conduct disorders (OR 1.97 (1.08, 3.58); $p=0.026$) for children of depressed fathers. The comparable effects associated with maternal depression were a doubling of the odds for both outcomes - any psychiatric diagnosis (OR 2.31 (1.73, 3.08)); oppositional/conduct disorders (OR 2.21 (1.47, 3.31)).

Depression in fathers in the postnatal period was also associated with increased scores on the prosocial (reverse-scored), hyperactivity, conduct problems, peer problems and total problems scales of the Strength and Difficulties Questionnaire at age 6 years (see Table 4). Following adjustment for the potential confounding effects of maternal depression and paternal educational level the associations with social difficulties remained: peer problems (OR 1.46 (1.13, 1.90);p=0.004) and prosocial problems (OR 1.29 (1.01, 1.66);p=0.045). This represents the increased odds ratio across each step-increase in score. By including questions on peer problems and prosocial behaviors, the SDQ gives a broader index of behavioral and social adjustment, and so complements the psychiatric diagnoses available from the DAWBA. In those domains where associations with paternal depression were found, the magnitude of effect was either smaller than that seen for maternal depression (e.g. Effect Sizes 0.19 vs 0.4 for conduct problems) or, in the case of peer problems, the same (ES 0.28).

We then controlled for the effects of later depression in fathers (at 21 months). Adjusting for this later depression (and imputing these data where missing) led to little attenuation in the associations between depression in the postnatal period and child psychiatric disorders (any psychiatric disorder (OR 1.72 (1.07, 2.77)) and specifically oppositional/conduct disorders (1.94 (1.04, 3.61)). A robust association with peer problems scores on the SDQ also remained (1.37 (1.04, 1.80)).

Finally, we tested for continuity from behavioral problems at age 3 years to psychiatric diagnosis at age 7 years, and whether behavioral problems at age 3 mediated the relationship between paternal depression and Oppositional/Conduct disorder diagnoses at age 7 years. Children with Oppositional/Conduct Disorders at age 7 years had higher mean behavioral problem scores at age 3 years compared to those without these disorders - of about one full standard deviation difference in magnitude (Rutter conduct scale means (5.89 (S.D. 2.87) vs 3.50 (2.27); p<0.001), and they were more likely to be in the group identified as having high levels of problems at age 3 years (39.8% vs 10.3%; OR 5.78 (4.39, 7.60); p<0.001). In addition, the relationship between paternal depression in the postnatal period and Oppositional/Conduct problems at age 7 years, was substantially mediated by child behavioral problems at age 3 years (adj. OR 1.58 (0.78, 3.19)).

Discussion

To our knowledge this is the first population cohort study to demonstrate a clear association between depression in fathers in the postnatal period and later psychiatric disorders in their children. This association is independent of maternal postnatal depression, psychosocial risk, and depression in fathers after the postnatal period, at 21 months.

The findings highlight three important factors regarding depression in men in the postnatal period. First, depression in men is relatively common. Overall, the rates of depression found in this study are comparable with prevalence estimates from other studies using 30-day rates (e.g. 2.4% in men in the Australian National Survey 29), although lower than in studies that have used longer time frames (such as the 12 month prevalence rates of 6% seen in the National Comorbidity Study 30). There is a suggestion from these findings that depressive symptoms are even more common in the prenatal period than postnatally, although the proportion of fathers with very high scores changes little across this period. There has been limited previous work investigating the course of depression during the perinatal period, although some research suggests that men experience higher levels of stress prenatally, and that there is not a significant increase in symptoms thereafter 5. Similar patterns of depression have also been seen in women31.

Second, depression in fathers in the postnatal period was strongly predictive of increased rates of psychiatric disorders, particularly oppositional defiant or conduct disorders, in their children 7 years later, as well as increased rates of social difficulties. These findings complement and contrast with the large number of studies examining the effect of postnatal depression in mothers on children's social, emotional and cognitive development 13, 15. Although our understanding of the father's role in child development has increased significantly in recent years 32, 33, there has been very little longitudinal research examining the association between paternal depression early in children's lives and their subsequent development 11, 12. This study is the first to demonstrate an association with psychiatric disorder, particularly oppositional defiant or conduct disorders. It is also notable that these are findings from a large, prospective study using a community sampling frame, and that maternal depression effects were controlled for in the analyses.

Previous work has pointed to an increased risk of behavioral problems in children of fathers with depression 11, but the current findings point to a persisting, and clinically significant level of disturbance, with more significant implications for the future functioning of the children, and for society. Conduct problems at this age are strongly predictive of later serious conduct problems, increased criminality, and significantly increased societal costs34. Depression in fathers seems specifically related to behavioral and peer relationship difficulties, whereas maternal depression appears to be associated with a broader spectrum of child disturbance 3. This relative specificity of the link between paternal depression and more antisocial behavior in the child may reflect the father's role in socializing children, or an association between depression in fathers and more disruptive parenting. Depression, with core symptoms of low mood, lack of energy and loss of interest, is likely to severely disrupt the ability of any parent to undertake the tasks of parenting, particularly affecting the day-to-day interactions of parent and child 3, 9. It is unclear whether the very early days of a child's life are a particularly sensitive period during which the infant is more vulnerable to the effects of stressors such as parental depression 13, 35. The finding from this study, that paternal depression early in the child's life is associated with these persisting problems, even controlling for later paternal depression, raises the intriguing possibility that such a sensitive period might be operative, particularly in relation to the effects of parental depression. However, we were not able to control for concurrent depression at age 7 years, and so further research is required to test this question in more detail.

Third, factors including a past history of depression (as measured by father self-reported history), and symptoms of depression and anxiety in the prenatal period, are strongly predictive of depression in the postnatal period in men. Prenatal depression in the female partners of these men was also related to an increased risk of postnatal depression in the men. The co-occurrence of depression in partners 11, 36 and the consequences of depression in one partner for the other are important factors for family functioning and the developing child 37. It may be that effects previously attributed solely to maternal depression are, in fact, partly accounted for by paternal effects or factors related to both parents38. The difficulties often experienced in researching men's health, such as relatively high attrition rates, lead to an under-involvement of men in research and so a poorer understanding of many men's health issues. This is perhaps particularly the case for psychiatric research (which has tended to ignore men's – and fathers' - health) and the study of family life and child development, undermining our understanding of these important issues.

This study has a number of key strengths. It is based on a large population cohort study and so is free of the selection biases inherent in studying clinical populations. The data were collected prospectively. The psychiatric diagnoses in the children were based on a structured clinician assessment incorporating questionnaire data from parents and teachers. There are limitations to consider. First, the assessment of depression in the fathers was based on a

questionnaire report (the Edinburgh Postnatal Depression Scale (EPDS)). However, the EPDS is the most widely used and validated questionnaire for depressive symptoms in the postnatal period, and has been validated in men as well as women. Misclassification is unlikely to be related to the outcome in such a way that a systematic bias would be introduced. Second, although the associations seen were robust when controlling for some important potential confounding variables, it remains possible that the findings are in part due to some other (unmeasured) confounding factors, such as early marital difficulties. Similarly, we were unable to control for depression in the father at ages 6 and 7 years, and so it is possible that some of the effect seen was due to concurrent effects of depression rather than depression early in the child's life. We were able to overcome this to some extent by controlling for depression at a later time point (21 months), and also by having mothers report on the children's functioning. While a later report of depression would have been ideal, the minimal attenuation seen when depression at 21 months was controlled for, does suggest that this may not have altered the findings. Third, there was significant attrition from the study over the time period studied. This is common across most longitudinal studies, but may have had an effect on the results seen. Fathers from lower socio-economic groups were less likely to participate in the study and so this may limit somewhat the generalizability of the findings. In addition those fathers with higher levels of depressive symptoms were more likely to provide incomplete data. However, this should have had the effect of making it more difficult to identify associations with paternal depression. We have attempted to overcome this problem by imputing missing data on confounding variables, including later depression. Such a strategy provides more robust estimates, and it is reassuring that similar findings were obtained when the same analyses were undertaken with and without the use of imputation. However, the attrition seen in this study does highlight an important point about researching men's health. It is generally more difficult to involve fathers (and men in general) in medical research, perhaps particularly that which involves the study of psychological factors. This has been one of the factors that have led to men being left out of many studies of child development, with a consequent under-estimation of their role and importance in family life.

Overall this study highlights the importance of depression in men in the postnatal period. The findings suggest that depression may have an impact not only on the men themselves but also on the development of their children. Perinatal services, where they exist, currently focus on mothers. While we recognize the primacy of the maternal role, it is important to consider broadening the focus of such services. A wider family focus would encompass the common co-occurrence of depression in mothers and fathers. Although fathers do not have as much contact with perinatal services, such as obstetric and primary healthcare, it would be possible to involve them more actively – something that may have positive spillover effects for the mother. Screening questionnaires, such as the Edinburgh Postnatal Depression Scale, used here, are reasonable screening tools in men, as well as women. If the findings of the present study are confirmed in other populations, then the identification of depression in fathers could represent an important opportunity for prevention: to improve fathers' health, family functioning, and children's future psychiatric and social functioning39, 40. Given the strong association of postnatal depression in men with previous depression and depressive symptoms during their partner's pregnancy, fathers at risk could be identified.

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Table 1

Depression scores and percentage depressed across the prenatal and postnatal periods (using EPDS).

Time point	Depression score (range 0-30) Median (IQR)[1]	Depression - percent scoring >12 (95% C.I.)[1]	Depression - percent scoring >12 (95% C.I.)[2]
18 weeks prenatal	3.0 (1.0, 6.0)	2.88 (2.41, 3.35)	3.88 (3.52, 4.24)
8 weeks postnatal	2.5 (1.0, 5.0)	2.55 (2.10, 3.00)	3.64 (3.29, 3.99)
8 months postnatal	2.0 (0.0, 5.0)	2.32 (1.89, 2.75)	3.44 (3.10, 3.78)
21 months postnatal	3.0 (0.0, 6.0)	3.05 (2.56, 3.54)	3.87 (3.51, 4.23)

[1] Sample with data at all 4 time points (n=4,792)

[2] Prevalence using imputed data for those with data on at least one time point (n=10,975)

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Table 2

Predictors of postnatal depression in men (n=8332)

Factor	% in PND	% non-PND	Odds Ratio (95% C.I.)	Adj. Odds Ratio* (95% C.I.)
Past history of severe depression	28.7	5.1	6.07 (4.42, 8.33) p<0.001	2.34 (1.58, 3.36) p<0.001
Prenatal Depression (fathers)	34.5	2.4	19.36 (14.41, 26.02) p<0.001	4.93 (3.46, 7.01) p<0.001
Own father was depressed	10.9	6.4	1.71 (1.15, 2.57) p<0.009	1.08 (0.68, 1.71) p=0.755
Own mother was depressed	29.0	18.1	1.81 (1.34, 2.44) p<0.001	1.14 (0.82, 1.58) p=0.437
Prenatal Anxiety (fathers)	65.9	14.1	9.37 (7.14, 12.30) p<0.001	5.03 (3.64, 6.94) p<0.001
Maternal prenatal depression	26.1	11.3	2.76 (2.09, 3.64) p<0.001	1.50 (1.01, 2.23) p=0.043
Maternal Prenatal Anxiety	30.1	14.6	2.37 (1.80, 3.12) p<0.001	1.20 (0.81, 1.77) p=0.359
Age (>30)	48.3	45.0	1.14 (0.90, 1.44) p=0.265	1.17 (0.90, 1.53) p=0.235
Educational Level (% post 16 qualification)	37.9	50.7	0.60 (0.47, 0.76) p<0.001	0.64 (0.49, 0.85) p=0.002
Other children	64.5	52.9	1.61 (1.26, 2.06) p<0.001	1.40 (1.07, 1.82) p=0.015

* adjusted model includes all variables listed in the table.

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Table 3

Depression in fathers and later child psychiatric diagnoses

Diagnosis	% in depressed fathers group	% in non-depressed group	O.R. (95% C.I.) n=5924	Adj. OR (95% C.I.) n=5924*
Any diagnosis	11.9	6.3	2.01 (1.28, 3.14)	1.66 (1.05, 2.63) p=0.030
Any ADHD disorder	3.1	1.9	1.63 (0.71, 3.76)	1.35 (0.58, 3.16) p=0.488
Any oppositional / conduct disorder	6.7	2.9	2.41 (1.34, 4.32)	1.97 (1.08, 3.58) p=0.026
Any anxiety disorder	4.6	2.7	1.74 (0.87, 3.46)	1.33 (0.66, 2.70) p=0.421
Any depressive disorder	0.5	0.4	1.34 (0.18, 10.02)	0.94 (0.12, 7.26) p=0.954

* adjusted for effects of paternal educational level, and effect of depression in partner using Multiple Imputation with Chained Equations (MICE).

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Table 4

Depression in fathers and later emotional and behavioral problems in children

SDQ scale (n=6092)	Strata	Proportion of fathers with depression in each strata n (%)	Odds Ratio (95% C.I.)	Adj. Odds Ratio* (95% C.I.)
Prosocial (reverse-scored)	1 2 3 4 5 6	83/2485 (3.34) 62/1805 (3.43) 55/1479 (3.72) 33/1051 (3.14) 30/808 (3.71) 40/803 (4.98)	1.33 (1.04, 1.71)	1.29 (1.01, 1.66) p=0.045
Hyperactivity	1 2 3 4 5	113/3409 (3.31) 90/2520 (3.57) 59/1585 (3.72) 26/660 (3.94) 15/257 (5.84)	1.31 (1.02, 1.69)	1.13 (0.87, 1.45) p=0.354
Emotional	1 2 3 4 5 6 7	98/2990 (3.28) 67/2106 (3.18) 51/1352 (3.77) 34/838 (4.06) 20/565 (3.43) 16/321 (4.98) 17/259 (6.56)	1.15 (0.89, 1.49)	1.03 (0.80, 1.34) p=0.806
Conduct	1 2 3 4 5 6	64/2260 (2.83) 81/2328 (3.48) 67/1888 (3.55) 45/1097 (4.10) 21/497 (4.23) 25/361 (6.93)	1.35 (1.05, 1.74)	1.21 (0.94, 1.57) p=0.133
Peer Problems	1 2 3 4 5 6	122/4060 (3.00) 66/2023 (3.26) 44/1107 (3.97) 30/641 (4.68) 19/304 (6.25) 22/296 (7.43)	1.63 (1.26, 2.11)	1.46 (1.13, 1.90) p=0.004
Total Problems	1 2 3 4 5	76/2537 (3.00) 73/2309 (3.16) 56/1687 (3.32) 43/1001 (4.30) 55/897 (6.13)	1.47 (1.14, 1.91)	1.25 (0.97, 1.62) p=0.087

* adjusted for depression in mother and paternal educational level using Multiple Imputation with Chained Equations (MICE). Odds Ratios in this table represent the odds per each stratum increase.