

ONLINE FIRST

Incidence of Maternal and Paternal Depression in Primary Care

A Cohort Study Using a Primary Care Database

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Objective: To examine incidence, trends, and correlates of parental depression in primary care from 0 to 12 years of child age.

Design: Prospective cohort study.

Setting: Primary care records from more than 350 general practices in The Health Improvement Network database from 1993 to 2007.

Participants: A total of 86 957 mother, father, and child triads identified in The Health Improvement Network database by linking mothers and babies and then identifying an adult household man. Depressed parents were identified using Read code entries for depression and antidepressant prescriptions.

Main Exposures: Child age, parental age at the birth, and area deprivation quintile.

Main Outcome Measures: Incidence rates for maternal and paternal episodes of depression.

Results: Overall incidences of depression from the birth of the child up to age 12 years were 7.53 per 100 person-years for mothers and 2.69 per 100 person-years for fathers. Depression was highest in the first year post partum (13.93 and 3.56 per 100 person-years among mothers and fathers, respectively). By 12 years of child age, 39% of mothers and 21% of fathers had experienced an episode of depression. A history of depression, lower parental age at the birth of the child, and higher social deprivation were associated with a higher incidence of parental depression.

Conclusions: Parents are at highest risk for depression in the first year after the birth of their child. Parents with a history of depression, younger parents, and those from deprived areas are particularly vulnerable to depression. There is a need for appropriate recognition and management of parental depression in primary care.

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DEPRESSION IN PARENTS IS associated with adverse behavioral, developmental, and cognitive outcomes in their children.¹⁻⁴

While the maternal depression and child outcome literature is well established, there are fewer studies on paternal depression.

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There is evidence that paternal depression is not uncommon, with rates higher than those in the general adult male population; however, a wide range of prevalence rates for paternal depression have been reported.^{1,5,6} There remains a dearth of longitudinal research on both maternal and paternal depression. This is partly owing to the challenges in recruiting a large cohort of parents, especially fathers,⁷ for primary re-

search studies on parental depression. Primary care databases such as The Health Improvement Network (THIN) database (http://www.epic-uk.org/thin_data.htm) or the General Practice Research Database (<http://www.gprd.com>) are good sources of longitudinal data on families. Such longitudinal databases contain clinical entries made in the notes on patient diagnoses, signs and symptoms, prescribed drugs, preventive health information, routine health surveillance, and referrals to secondary care. If we are to use primary care databases to conduct research on parental depression and child outcomes, it is pertinent to first examine ways of identifying depressed individuals using the patient information available in primary care databases.

The objectives of the study were to assess the following in primary care: (1) ways of identifying depressed parents in primary care databases; (2) incidence rates for

maternal and paternal depression from the child's birth to when the child was aged 12 years, by parental age, and by calendar year, and (3) sociodemographic covariates associated with parental depression after the birth of the child.

METHODS

DATA SOURCE

We used the THIN database, which contained clinical data on approximately 5 million patients from more than 350 UK general practices. We used data from 1993 to 2007. The THIN database has been used widely in epidemiological research, including studies on mental health.^{8,9} It provides access to longitudinal medical and demographic data at an individual patient level. Read codes are a standard hierarchical classification system for recording patient medical information in UK primary care settings.¹⁰ Read codes distinguish diagnoses, symptoms, and referrals to secondary care, and the database also contains information on individual prescriptions received. Patient records also include sociodemographic information (including social deprivation indicators; further details are explained later) and information on dates for registration, transfer out, and death. Patients in the database have longitudinal data as long as they have not transferred out of the general practice or their practice has not ceased contributing data to THIN.

STUDY POPULATION

We first identified all births in the THIN database from 1993 to 2007. Because the database does not provide an automatic link between babies and their mothers, we linked each baby to his or her mother using the family identification number (which is common to individuals living in the same household or family) and the delivery and birth dates for the mothers and babies, respectively. We selected 1 random child per mother if she had more than 1 child and/or pregnancy. We then linked the mother-baby dyads to an adult household man who could be the father. We included only households with a single registered adult man (40% and 10% of households contained either no or >1 resident adult man, respectively, and were excluded) and that had registered with the practice before the child was aged 1 year (this was to account for the potentially greater mobility of parents around the time of a birth and the possible delay in fathers registering with a new general practitioner after moving home). We excluded families where there was an age difference greater than 20 years between the mother and the identified adult man, and we excluded individuals younger than 15 years.

IDENTIFYING DEPRESSED PARENTS

We defined mothers and fathers as depressed if they had either a Read code entry for unipolar depression and/or a prescription for an antidepressant at the appropriate therapeutic dose for treatment of depression on a given consultation date. We compiled lists for Read codes for unipolar depression and for antidepressant drug codes by conducting relevant word and code searches in the Read code and drug code dictionaries, respectively¹¹ (code lists are available on request). For Read code searches, we excluded bipolar disorders and depression with psychosis. We included diagnostic Read codes and not symptom Read codes for depression (eg, low mood). To exclude parents who may have been prescribed antidepressants for anxiety instead of for depression, we eliminated those parents who had an entry for anxiety or a panic disorder but had never had an entry for depression in their entire computerized medical

records. However, we included parents who had a Read code for a mixed anxiety and depressive disorder given the high comorbidity in the literature.

For the mothers and fathers, we combined the Read and drug code lists with the patient records to identify parents who had a Read code entry for depression or who had received an antidepressant prescription in the period after the birth up to when the child was aged 12 years (where follow-up data were available).

We then identified the separate episodes of depression for each individual. To constitute a new episode of depression, there had to be a preceding gap of at least 1 year of no depression (ie, no coded entries for depression and no antidepressant prescriptions). We defined a history of depression as entries for Read codes for depression or antidepressant prescriptions prior to the birth of the child. In addition, we included Read code entries for a "history of depression." We used the Townsend deprivation index¹² to measure area deprivation based on information provided in the 2001 census. The deprivation index is based on patients' individual postcodes and is coded in the THIN database as quintiles of deprivation (1 = lowest deprivation and 5 = highest deprivation).

STATISTICAL ANALYSIS

We calculated incidence rates for parental depression episodes. We examined longitudinal trends for incidence rates for episodes of parental depression from the birth of the child as far as data were available up to a maximum of when the child was aged 12 years and by calendar year. As a sensitivity analysis, we calculated incidence for depression episodes defined using a reduced gap of at least 6 months (rather than 1 year) of no depression to distinguish the separate episodes of depression.

The median length of consecutive antidepressant prescribing was calculated after defining episodes of treatment.

We identified the first episode of depression for the mothers and fathers after the birth of the child and calculated hazard rates using Kaplan-Meier methods for individual maternal and paternal depression onset by child age. Poisson regression models were fitted to perform multivariable analyses of the first event of maternal and paternal depression after the birth of the child, adjusted by parental age at the birth of the child, and Townsend deprivation index social deprivation quintile.¹² We tested for interactions between parental age at birth and a parental history of depression (ie, prior to the birth of the child) using likelihood ratio tests; because the interaction was significant, we stratified our analyses by history of depression and no history of depression.

Data analyses were carried out using Stata version 11.0 statistical software (StataCorp LP, College Station, Texas).

The study was approved by the Cambridgeshire 4 Research Ethics Committee.

RESULTS

We identified a cohort of 86 957 mother, father, and baby triads with varying lengths of follow-up data from the birth of the child up to age 12 years. Among mothers, 72 306 (83%) had follow-up data at 1 year, 37 647 (43%) at 4 years, 14 539 (17%) at 8 years, and 4255 (5%) at 12 years after the delivery. Among fathers, 72 861 (84%) had follow-up data at 1 year, 38 134 (44%) at 4 years, 14 428 (17%) at 8 years, and 4120 (5%) at 12 years after the delivery.

Overall, 19 286 depressed mothers had a total of 25 176 episodes of depression from the birth of the child to 12 years of child age. A total of 14 780 mothers (77%) had only 1 episode of depression, 3401 (18%) had 2 epi-

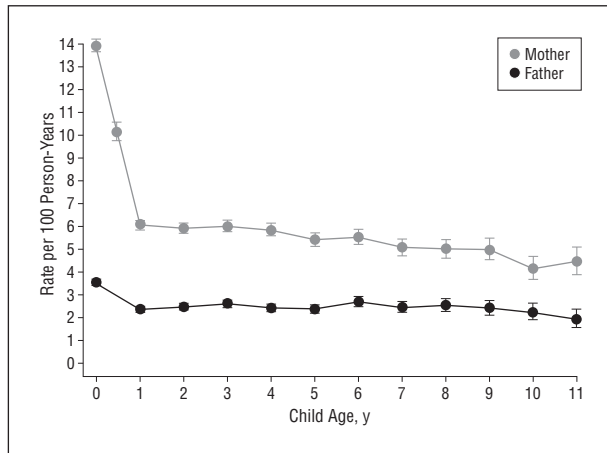


Figure 1. Incidence of parental depression episodes by child age.

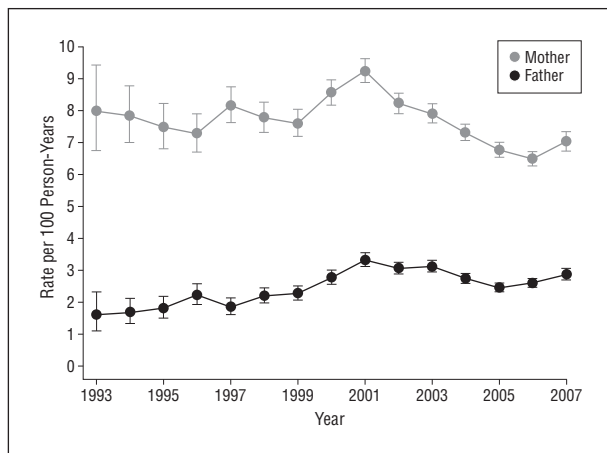


Figure 2. Incidence of parental depression episodes by calendar year.

sodes, and 1105 (5%) had 3 or more episodes. Among depressed fathers, 8012 had a total of 9683 episodes of depression from the birth of the child to 12 years of child age. A total of 6656 fathers (83%) had 1 episode of depression, 1098 (14%) had 2 episodes, and 258 (3%) had 3 or more episodes. Of the total 34 859 maternal and paternal episodes of depression, 1263 (4%) had both the mother and father depressed in the same year. Among mothers, 4928 episodes (20%) were defined by only a Read code for depression, 8515 (34%) were defined by only an antidepressant prescription, and 11 733 (47%) were defined by both a Read code for depression and an antidepressant prescription. Among fathers, 1500 episodes of depression (16%) were defined by only a Read code, 4732 (49%) were defined by only an antidepressant prescription, and 3451 (36%) were defined by both a Read code and an antidepressant prescription.

The median length of an episode of antidepressant prescribing was 105 days (10th-90th percentiles, 52-680 days).

INCIDENCE OF PARENTAL DEPRESSION

The overall incidences of depression were 7.53 per 100 person-years (95% confidence interval, 7.44-7.63) for mothers and 2.69 per 100 person-years (95% confi-

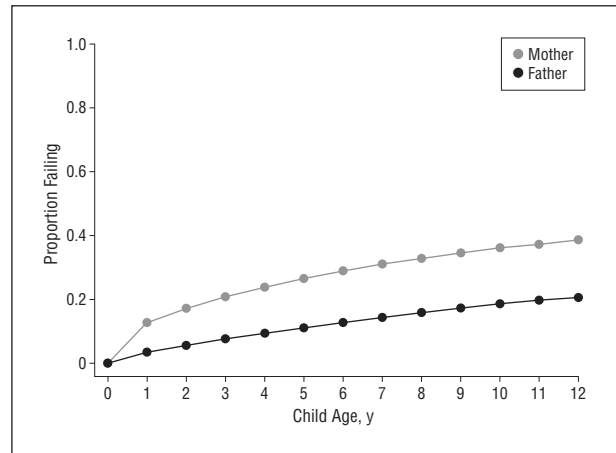


Figure 3. Kaplan-Meier failure curves (hazards) for the first event of parental depression after the birth of the child.

dence interval, 2.64-2.75) for fathers from the child's birth up to age 12 years.

SENSITIVITY ANALYSIS

Using a reduced gap of at least 6 months of no depression between the separate episodes of depression, the overall incidences of depression were 8.47 per 100 person-years (95% confidence interval, 8.37-8.57) for mothers and 2.99 per 100 person-years (95% confidence interval, 2.93-3.04) for fathers.

Figure 1 shows incidence rates for parental depression by child age (0-12 years). Among mothers, the depression episode incidence rate was 13.93 per 100 person-years in the first year after the child's birth. The rate then reduced to 6.07 per 100 person-years after the first year and remained fairly steady across the course of childhood, decreasing slightly with increasing child age. Among fathers, the episode incidence rate for depression was 3.56 per 100 person-years in the first year after the child's birth and then ranged between 1.95 and 2.72 per 100 person-years up to the child's age of 12 years.

When examined by calendar year (**Figure 2**), incidence rates for paternal depression generally increased steadily over time from 1.61 per 100 person-years in 1993 to 2.87 per 100 person-years in 2007, but for mothers the incidence rates remained at around 7 to 8 per 100 person-years.

Figure 3 shows the cumulative failure pattern (hazard rates) for the first event of maternal and paternal depression after the birth of the child up to age 12 years. One year after delivery, 13% of mothers who were still registered with the practice had experienced an episode of depression. By the time their child was aged 4 years (preschool-aged), 24% of mothers had experienced an episode of depression; by 8 years of child age, this increased to 33% of mothers. By the time their child was aged 12 years, 39% of mothers had experienced an episode of depression. Among fathers (**Figure 3**), 3% had experienced an episode of depression when their child was aged 1 year; this increased to 10%, 16%, and 21% of fathers who had experienced an episode of depression by the time their child was aged 4, 8, and 12 years, respectively.

Table 1. Multivariable Analysis of Incidence of Depression Episodes in 86 957 Mothers After Birth of the Child

Variable	Events, No.	Person-Years at Risk	Incidence Rate Ratio (95% CI)		Adjusted Incidence Rate Ratio (95% CI) ^a	
			Unadjusted	Adjusted ^a	No History of Depression	History of Depression
Maternal age at birth of child, y						
15-24	3540	32 050	1.77 (1.70-1.84)	1.56 (1.50-1.62)	1.18 (1.13-1.23)	1.14 (1.05-1.23)
25-34	11 702	187 352				
≥35	4109	79 167	0.83 (0.80-0.86)	0.85 (0.82-0.88)	1.01 (0.97-1.06)	1.11 (1.04-1.19)
Townsend deprivation index quintile						
1, Least deprived	4555	90 861				
2	3543	63 006	1.12 (1.07-1.17)	1.10 (1.06-1.15)	1.01 (0.96-1.06)	1.03 (0.94-1.13)
3	3803	55 620	1.36 (1.31-1.42)	1.30 (1.25-1.36)	1.06 (1.00-1.11)	1.06 (0.97-1.17)
4	3630	43 907	1.65 (1.58-1.72)	1.51 (1.44-1.58)	1.15 (1.09-1.21)	1.10 (1.00-1.20)
5, Most deprived	2660	26 876	1.97 (1.88-2.07)	1.70 (1.61-1.78)	1.20 (1.13-1.27)	1.12 (1.02-1.23)
Missing	1160	18 298	1.27 (1.19-1.35)	1.22 (1.14-1.30)	1.26 (1.17-1.36)	1.42 (1.25-1.62)
History of depression						
No	14 534	30 882	NA	NA	NA	NA
Yes	4817	5241	1.95 (1.89-2.02)	NA	NA	NA

Abbreviations: CI, confidence interval; NA, not applicable.

^aAdjusted for maternal age at birth of the child and deprivation.

MULTIVARIABLE ANALYSIS

Table 1 shows a multivariable analysis of the first incidence of maternal depression since the birth of the child. In the stratified analysis, mothers aged 15 to 24 years at the birth were significantly more likely to be depressed compared with mothers aged 25 to 34 years whether they had a history of depression or not. Mothers aged 35 years or older, however, were significantly more likely to be depressed than mothers aged 25 to 34 years *only* if they had a history of depression (Table 1). The likelihood of depression generally increased with increasing area deprivation, but this association was strongest among mothers with no history of depression compared with those with a history of depression. Our results also suggest that among mothers with a history of depression, those with the highest level of deprivation quintiles were significantly more likely to be depressed compared with those least deprived.

When stratified by a history of depression, fathers aged 15 to 24 years at the birth were more likely to be depressed than fathers aged 25 to 34 years only among those with no history of depression. Likelihood of depression by parental age did not significantly differ among fathers with a history of depression. Increasing paternal area deprivation was associated with an increased likelihood of a depressive episode among fathers with no history of depression (**Table 2**). Among fathers with a history of depression, only those with the highest deprivation were significantly more likely to be depressed compared with those least deprived.

COMMENT

To our knowledge, this is the first study assessing the incidence of depression in both parents recorded in general practice across the course of their offspring's childhood. In particular, it provides a unique insight into the

trajectory of paternal depression across the course of childhood, which has been lacking in the research literature. We identified parents who had consulted their general practitioner for depression, using Read code entries for depression and by identifying prescriptions for antidepressants. The overall incidences of depression were 7.53 per 100 person-years and 2.69 per 100 person-years among mothers and fathers of children aged 0 to 12 years, respectively. A sensitivity analysis where new episodes of parental depression were defined by a preceding gap of at least 6 months of no depression showed the rates to be only marginally higher compared with episodes defined by a preceding gap of at least 1 year (see rates earlier). Hence, we favor our original definition for episodes, which was likely to capture incident rather than existing episodes of depression. Incidence of depression for both mothers and fathers was highest in the year after the birth of the child and then decreased sharply when the child reached age 1 year. Among mothers and fathers, a history of depression, a lower age at the birth of the child, and higher social deprivation were associated with a higher incidence of depression.

Because most patients with episodes of depression received an antidepressant prescription, reliance on only Read code entries for depression would have underestimated the incidence of parental depression substantially. Eliminating those individuals who had both a Read code for anxiety and an antidepressant entry reduced the risk of including individuals who had been prescribed an antidepressant for anxiety rather than for depression. Furthermore, we included only antidepressants prescribed at the therapeutic dose for treatment of depression.

We found a higher incidence of depression among mothers (7.5 per 100 person-years) compared with fathers (2.7 per 100 person-years). Cross-cultural studies indicate that women are more likely to have depression than are men.¹³⁻¹⁷ In a previous study,¹ we found a 3.3% prevalence for a paternal *Diagnostic and Statistical Manual*

Table 2. Multivariable Analysis of Incidence of Depression Episodes in 86 944 Fathers After Birth of the Child

Variable	Events, No.	Person-Years at Risk	Incidence Rate Ratio (95% CI)		Adjusted Incidence Rate Ratio (95% CI) ^a	
			Unadjusted	Adjusted ^a	No History of Depression	History of Depression
Paternal age at birth of child, y						
15-24	757	23 633	1.38 (1.27-1.49)	1.13 (1.04-1.22)	1.12 (1.02-1.22)	0.92 (0.77-1.10)
25-34	4196	180 056				
35-44	2796	128 255	0.94 (0.89-0.98)	0.98 (0.93-1.02)	1.04 (0.98-1.10)	1.09 (0.99-1.21)
≥45	329	13 661	1.03 (0.92-1.16)	1.06 (0.94-1.18)	1.15 (1.00-1.31)	1.00 (0.81-1.23)
Townsend deprivation index quintile						
1, Least deprived	1675	102 809				
2	1422	72 716	1.20 (1.12-1.29)	1.20 (1.12-1.28)	1.02 (0.94-1.10)	0.91 (0.77-1.07)
3	1578	64 592	1.50 (1.40-1.61)	1.49 (1.39-1.60)	1.10 (1.02-1.19)	0.94 (0.81-1.10)
4	1618	52 155	1.90 (1.78-2.04)	1.88 (1.75-2.01)	1.18 (1.09-1.27)	1.10 (0.95-1.28)
5, Most deprived	1297	31 919	2.50 (2.32-2.68)	2.43 (2.26-2.62)	1.24 (1.14-1.35)	1.19 (1.01-1.39)
Missing	488	21 413	1.40 (1.27-1.55)	1.39 (1.26-1.54)	1.30 (1.15-1.45)	1.43 (1.15-1.77)
History of depression						
No	6257	20 285	NA	NA	NA	NA
Yes	1821	2065	NA	NA	NA	NA

Abbreviations: CI, confidence interval; NA, not applicable.

^aAdjusted for paternal age at birth of the child and deprivation.

of *Mental Disorders* (Fourth Edition, Text Revision)¹⁸ major depressive syndrome (assessed using the Patient Health Questionnaire¹⁹) among a community sample of fathers of 4- to 6-year-old children recruited via primary care. This is comparable to the rate observed in the present study, which included individuals who had sought help from their general practitioner for their condition and hence are likely to represent the more severe cases of paternal depression. Several longitudinal studies on maternal depression have reported rates of 7% to 31%.²⁰⁻²² However, there is much measurement heterogeneity among these studies as some have used screening and others have used diagnostic measures of depression and because a mixture of point and period prevalence rates for depression have been reported. Furthermore, these are mainly epidemiological studies on community samples and report rates among mothers of children of varying ages. A study on incidence and diagnostic labeling of depression in primary care that also used THIN data reported incidence rates for diagnosed depression (based on diagnostic Read code entries) of 2.33 per 100 person-years and 1.09 per 100 person-years among females and males aged 16 years and older, respectively.²³ Our higher rates are expected because we defined episodes of parental depression using antidepressant prescription entries as well as Read codes. Moreover, higher rates of depression are expected among parents compared with the general population.^{5,6}

Rates of parental depression were highest in the first year after the birth (13.9 and 3.6 per 100 person-years among mothers and fathers, respectively). A meta-analysis of maternal postpartum depression found rates to be 13%,²⁴ which is similar to our observed rate. A large population-based study found the prevalence of postpartum depressed mood among fathers to be 4%,⁵ which also agrees with our observed rate. These high rates of depression in the postpartum period are not surprising owing to the potential stress associated with the birth of

a baby, eg, poor parental sleep,²⁵ the demands made on parents and the change in their responsibilities, and the pressure this could place on the couple's relationship.²⁶⁻²⁸ The high rate of parental depression in the first year after delivery may also be partly due to a resumption of antidepressant use following a break during pregnancy and breastfeeding. The decline in depression incidence in the second year after delivery could be due to postpartum depression settling.

We saw a general increase in the incidence of paternal depression over time from 1993 to 2007. This may reflect, in part, a trend in increased prescribing of antidepressants by general practitioners.^{8,29}

An adjusted analysis showed that higher area deprivation was associated with a higher incidence of depression, and this association was greatest among parents with no history of depression. There is a well-established link between depression and social and economic deprivation both in the general population^{30,31} and among parents.^{6,32} This finding may reflect the stresses of poverty, unemployment, low employment grade, and lower social support among people of lower socioeconomic status.^{6,31} In particular, unemployment among fathers may lead to higher involvement in childcare, and the associated stress³³ may be a risk factor for depression.⁶

Younger parental age (15-24 years) at the birth of the child was associated with a higher risk of maternal depression and with a higher risk of paternal depression among fathers with no history of depression. The risk of psychopathology to young mothers has been well documented^{34,35} as has the protective effect of being an older parent.⁶ Younger parents may be less prepared for parenthood with more unplanned pregnancies and may be less able to deal with the stresses of parenthood compared with older parents.

It is well established that a personal history of depression is a strong risk factor for subsequent episodes of depression. Our study shows that it is a key factor in pre-

dicting later episodes of depression among parents of young children, particularly among fathers.

STRENGTHS AND LIMITATIONS

A significant strength of the study was use of the large THIN database, which provided longitudinal primary care data on a cohort of almost 87 000 mother-father dyads, giving high statistical power to assess incidence of parental depression in primary care.

Several limitations should be noted. First, the identified adult man may not be the father of the child. We attempted to minimize the risk of including nonpaternal men in our cohort by including households with only a single resident adult man and by restricting the cohort to mother-father dyads where the age difference was no more than 20 years. With these criteria, we believe the risk of including nonpaternal men was minimal. Second, our definition of depression was based on entries for depression made by the general practitioner and did not represent diagnoses based on either the *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition, Text Revision)¹⁸ or the *International Statistical Classification of Diseases, 10th Revision, Classification of Mental and Behavioural Disorders*³⁶ classification of depression. However, we maximized the likelihood of obtaining a cohort of clinically depressed parents by including only individuals with diagnostic and not symptom Read codes for depression and/or those who had received treatment with antidepressants at the appropriate therapeutic dose. Third, we were not able to examine some other potential factors associated with parental depression such as partner's depression,³⁷ couple's relationship quality,³ and stressful life events^{38,39} owing to the structure of information in the THIN database. Finally, this was a study on parents seen in general practice and the results cannot be generalized to the general population of parents in the community.

CLINICAL IMPLICATIONS

There is a significant risk of mothers and fathers becoming depressed soon after the birth of their child, and this requires awareness by the clinician. The UK National Institute for Health and Clinical Excellence recommends routine screening for depression among postnatal mothers⁴⁰; however, no such policy exists for fathers. There is a need for appropriate detection of depression among fathers. Clinicians should be aware that parents with a history of depression, younger parents, and those from more deprived environments are at particular risk for depression and should be assessed appropriately.

RESEARCH IMPLICATIONS

Further longitudinal research on parents should be carried out to confirm the data emerging from this study. This should include primary research on other factors potentially associated with parental depression such as the couple's relationship quality and stressful life events. This information will enable general practitioners to appropriately identify and treat vulnerable parents at risk

for depression. The merits and appropriate timing of screening fathers for depression should be assessed. Finally, longitudinal research assessing the effects of both individual and cumulative maternal and paternal depression on child health, development, and behavior is recommended.

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Author Contributions: Drs Davé and Petersen had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Davé, Petersen, Sherr, and Nazareth. *Analysis and interpretation of data:* Davé, Petersen, Sherr, and Nazareth. *Drafting of the manuscript:* Davé and Sherr. *Critical revision of the manuscript for important intellectual content:* Davé, Petersen, Sherr, and Nazareth. *Statistical analysis:* Davé and Petersen. *Obtained funding:* Nazareth. *Administrative, technical, and material support:* Nazareth. *Study supervision:* Sherr and Nazareth.

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