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Verkuijl, NE; Richter, L; Norris, SA; Stein, A; Avan, B; Ramchandani, PG (2014) Postnatal depressive symptoms and child psychological development at 10 years: a prospective study of longitudinal data from the South African Birth to Twenty cohort. *The Lancet Psychiatry*, 1 (6). pp. 454-60. ISSN 2215-0366 DOI: [https://doi.org/10.1016/S2215-0366\(14\)70361-X](https://doi.org/10.1016/S2215-0366(14)70361-X)

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DOI: [10.1016/S2215-0366\(14\)70361-X](https://doi.org/10.1016/S2215-0366(14)70361-X)

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Postnatal depressive symptoms and child psychological development at 10 years: a prospective study of longitudinal data from the South African Birth to Twenty cohort



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Summary

Background In high-income countries, maternal postnatal depression is associated with adverse outcomes in the child. However, few studies have investigated this relation in countries of low and middle income. Furthermore, to our knowledge, no studies have followed up cohorts into later childhood. We aimed to investigate whether maternal depression 6 months after birth is associated with psychological difficulties in a socioeconomically disadvantaged South African cohort of children at age 10 years.

Methods Birth to Twenty is a prospective, longitudinal, birth-cohort study based in the Soweto area of Johannesburg, South Africa. Mothers and children in this cohort have been followed up at timepoints ranging from before birth to age 10 years. Maternal mood was measured at 6 months with the Pitt depression inventory and at 10 years with the Centre for Epidemiologic Studies depression scale (CES-D). Child psychological functioning was assessed at 10 years with the South African child assessment schedule (SACAS). Our primary outcome was psychological development of children at age 10 years, measured by total score on the SACAS. Secondary outcomes were scores on externalising and internalising subscales of the SACAS. We used *t* tests to compare psychological outcomes between children whose mother had postnatal depression at 6 months and those whose mother did not have postnatal depression. We examined associations between maternal postnatal depression and child psychological outcomes by multivariate linear-regression analysis, adjusting for socioeconomic status and maternal depression at 10 years, and we used logistic regression to provide odds ratios for associations identified by linear regression.

Findings 1866 mothers completed the Pitt depression inventory 6 months after the birth of their child; of these, 453 (24%) had symptoms of postnatal depression. At the 10-year assessment, 1012 mothers completed the CES-D questionnaire, of whom 747 (74%) were judged to have depression. Sociodemographic characteristics did not differ between mothers with and without depression at both 6 months and 10 years. After adjusting for socioeconomic status and maternal depression at 10 years, children whose mothers had postnatal depression at 6 months were more than twice as likely to have significant psychological difficulties 10 years later compared with children whose mothers did not have postnatal depression at 6 months (adjusted odds ratio 2.26, 95% CI 1.23–4.16).

Interpretation Maternal postnatal depression is associated with adverse psychological outcomes in children up to 10 years later in countries of low and middle income. In view of the increased prevalence of postnatal depression in these settings, this finding has important implications for policy and interventions for children and their mothers.

Funding Wellcome Trust (UK), Medical Research Council of South Africa, Human Science Research Council (South Africa), University of the Witwatersrand.

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Introduction

The importance of maternal depression is well recognised, affecting not only the mother's health but also the wellbeing of her offspring.¹ In high-income countries, maternal postnatal depression is associated with an increased risk of cognitive, behavioural, and emotional difficulties in young children.² In longer term studies, the risk of anxiety disorders and depression is augmented among adolescents.³ Suggested mechanisms by which maternal postnatal depression adversely affects a child's psychological outcomes include the effect on the mother-child relationship and parenting difficulties, both of which are compounded by socioeconomic adversity.⁴

The prevalence of postnatal depression in countries of low and middle income—estimated at 20–30%—is twofold to threefold higher than that in high-income nations.^{5,6} Despite this increased prevalence, fewer studies have been done in countries of low and middle income to investigate the effects of postnatal depression on psychological outcomes in children, compared with high-income countries. Findings of available studies from low-income countries suggest that infants whose mother has depression have an augmented risk of developmental delay in their first year of life.^{7,8} In South Africa, a significant escalation in psychological difficulties was reported at age 2 years in children whose

Lancet Psychiatry 2014;

1: 454–60

Published Online

October 10, 2014

[http://dx.doi.org/10.1016/S2215-0366\(14\)70361-X](http://dx.doi.org/10.1016/S2215-0366(14)70361-X)

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mothers had postnatal depression.⁹ As far as we know, no studies have been done to investigate associations of postnatal depression with psychological outcomes of children beyond age 2 years from countries of low and middle income. Increased understanding of these associations is important because this knowledge could help to inform policy and clinical decision making and provide a greater impetus for interventions for both treatment and prevention of postnatal depression.

Birth to Twenty is a longitudinal birth-cohort study based in South Africa, which was designed at a time of great social and political unrest to track the growth, health, wellbeing, and educational progress of children for the first 22 years of their life.¹⁰ Here, we report psychological outcomes of children in this cohort at age 10 years whose mothers had heightened symptoms of postnatal depression, controlling for socioeconomic status and reported maternal depression at 10 years. We postulate that maternal postnatal depression in the first year of a child's life has enduring effects on psychological development that will be measurable when the child is 10 years old, over and above the effects of socioeconomic adversity and current depression in the mother.

Methods

Study cohort

We obtained data for our study from the Birth to Twenty cohort,¹⁰ which includes singleton children born within a 7-week period, from March, 1990, to June, 1990, in the metropolitan Soweto area of Johannesburg in South Africa, and their mothers (henceforth, a mother-child pair is referred to as a dyad). The total cohort is roughly representative of the South African population, except for an under-representation of dyads of white ethnic origin; many white families use private health facilities at which participants were not recruited.

The Birth to Twenty researchers (who included LR and SAN) recruited mothers from antenatal clinics and assessed them with various clinical questionnaires before birth, at 6 months, 1 year, 2 years, 4 years, 5 years, 7 years, and 9–10 years. The researchers also obtained demographic information at these timepoints. Most assessment interviews took place in health or study facilities in Soweto and Johannesburg during a specific period allocated for data collection (termed a data wave). The Birth to Twenty researchers interviewed mothers in their home language; they translated questionnaires from English into Zulu, Sotho, and Afrikaans, then back-translated them to check accuracy.

The Birth to Twenty researchers could not complete interviews at every data wave because of financial and logistical constraints—eg, a hospital strike resulted in fewer women completing the prenatal assessment. Furthermore, not all dyads were present at every data wave because they had left the area, in a well established pattern of circular urban-rural temporary migration.^{10,11} Also, some cohort members could not be assessed

within the timeframe allocated for the data wave. Dyads who missed one data wave were usually seen in the next wave.¹²

The Committee for Research granted ethics approval for the Birth to Twenty cohort study at the University of the Witwatersrand, South Africa. The Birth to Twenty researchers obtained written consent from all participating female patients.

Procedures

For the present analysis, we used data obtained by the Birth to Twenty researchers at the 6-month and 10-year assessments. We recorded the mother's symptoms of depression at 6 months and 10 years and the child's psychological wellbeing at age 10 years. At the 6-month assessment, symptoms of maternal postnatal depression were measured with the Pitt depression inventory and, at 10 years, maternal depression was assessed with the Center for Epidemiologic Studies depression scale (CES-D). Researchers used the South African child assessment schedule (SACAS) to ascertain child psychological problems at age 10 years.

The Pitt depression inventory is used to assess a mother's current mood and anxiety and includes questions covering a range of postnatal depressive symptoms—eg, energy levels, sleep problems, concentration, and appetite.¹³ It comprises 24 items and every item is answered and coded as either yes (2), don't know (1), or no (0). Total scores range from 0 to 48; a score of 20 or higher indicates postnatal depression. The measure has been used in previous studies¹⁴ and correlates highly with the Edinburgh Postnatal Depression Scale.¹⁵ The CES-D is a 20-item, short, self-report questionnaire designed to measure symptoms of depression in the general population,¹⁶ with high internal consistency, acceptable test-retest reliability, and construct validity. Total scores range from 0 to 52; a score of 16 or higher is judged clinically significant.

The SACAS is a structured questionnaire for assessment of behavioural disorders, emotional dysregulation, social competence, and academic adjustment.¹⁷ This measure was based originally on the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV), the International Classification of Diseases, 10th revision (ICD-10), and child behaviour rating scales, then it was adapted idiomatically to the South African culture and translated into Zulu, Sotho, and Afrikaans. The final questionnaire consists of 85 items; parents are asked to rate the frequency with which their child manifests every behaviour or affect on a three-point scale (never, sometimes, often). The SACAS is split into subscales according to symptoms: an internalising subscale (32 items) assesses if a child is anxious or depressed, withdrawn or depressed, and has somatic complaints; an externalising subscale (35 items) ascertains if a child shows rule-breaking behaviour and aggressive behaviour; and three remaining subscales measure social difficulties,

thought problems, and attention deficits. The SACAS has proven reliability; in terms of validity, a clinical group had significantly higher mean scores than did a non-clinical group on all scales.¹⁷ No cutoff has been established for the SACAS: a dichotomised score was constructed using the top 10% of scores, creating a high-scoring group for psychological problems, which has been used in other studies.¹⁸

The Birth to Twenty researchers obtained demographic data at every data wave. During the period before birth, they asked mothers about current housing, household assets (television, car, refrigerator, washing machine, and telephone), medical aid cover or insurance, ethnic origin, marital status, age, and level of educational attainment. We created a socioeconomic index by principal component analysis and assigned standardised weights on the basis of household assets, housing quality, house ownership, and maternal education. With this method, we placed dyads

into one of five equally sized groups for socioeconomic status—ie, poorest, poor, middle, rich, and richest.^{9,19} We did not impute missing data; instead, we elected to use this measure of socioeconomic status close to the time of measurement of the exposure. This measure has been well developed and used previously in this cohort, allowing for easy comparability across studies. Dyads remain overwhelmingly within similar strata for socioeconomic status over time.

Statistical analysis

We compared sociodemographic characteristics of mothers with and without depression at 6 months. This comparison included maternal age, socioeconomic status, and other factors such as preterm birth. We analysed possible attrition bias by comparing sociodemographic variables of the group of mothers who remained in the study at 10 years with those who had dropped out before this point.

Our primary outcome was psychological development of children at age 10 years, measured by total score on the SACAS. Secondary outcomes were scores on the externalising and internalising subscales of the SACAS. We used independent *t* tests to compare child psychological functioning scores at 10 years across the depressed and non-depressed mother groups. We examined associations between maternal depression and child psychological outcomes by multivariate linear-regression analysis, adjusting for socioeconomic status and concurrent maternal depression. The β values given by linear regression models are difficult to interpret for clinical use. Therefore, we used logistic regression to provide odds ratios for associations identified by linear regression.

We tested for statistical interactions to assess whether any association identified by multivariate linear-regression analysis was moderated by sex. We could not control for treatment of maternal depression; very few public mental health services exist in the study setting and, if mothers accessed treatment for depression, it would have been through private services that few, if any, women were able to afford.

Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

The final Birth to Twenty cohort includes 3273 dyads. 1866 mothers completed the Pitt depression inventory 6 months after the birth of their child. Sociodemographic characteristics of these women are shown in table 1. Data for socioeconomic group were missing for 406 (22%) dyads. Most mothers were African, aged 20–38 years, had

	No outcome data at 10-year assessment (n=1190)	Outcome data at 10-year assessment (n=645)	p*
Ethnic origin			
African	874 (73%)	630 (98%)	<0.001
Asian	62 (5%)	0	
Coloured	168 (14%)	15 (2%)	
White	86 (7%)	0	
Maternal age (years)			0.20
≤20	250 (21%)	171 (27%)	
21–25	402 (34%)	184 (29%)	
26–30	285 (24%)	156 (24%)	
31–35	167 (14%)	95 (15%)	
>35	86 (7%)	39 (6%)	
Gravidity			0.017
1	406 (34%)	254 (39%)	
2–4	682 (57%)	347 (54%)	
≥5	102 (9%)	44 (7%)	
Gestational age (weeks)			0.971
≤36	134 (11%)	79 (12%)	
37–41	1000 (84%)	550 (85%)	
≥42	1 (<1%)	5 (1%)	
Unknown	55 (5%)	11 (2%)	
Socioeconomic group			0.019
Poorest	206 (17%)	76 (12%)	
Poor	186 (16%)	125 (19%)	
Middle	136 (11%)	131 (20%)	
Rich	144 (12%)	140 (22%)	
Richest	208 (17%)	108 (17%)	
Unknown	310 (26%)	65 (10%)	

Data are number of mothers (%) who also completed the 6-month assessment. Data are missing for 31 mothers. * χ^2 test was done to compare variables between mothers who completed the 10-year assessment and those who dropped out before this timepoint, adjusting for trend for all ordinal variables (except ethnic origin).

Table 1: Sociodemographic characteristics of mothers and assessment of attrition at 10 years

	Mothers with postnatal depression at 6 months (n=164)	Mothers without postnatal depression at 6 months (n=481)	Regression score					
			Unadjusted		Adjusted for SES		Adjusted for SES and maternal depression at 10 years	
			β	p	β	p	β	p
Internalising subscale score	14.51 (6.84)	12.90 (6.23)	0.118	0.003	0.108	0.008	0.026	0.583
Externalising subscale score	18.69 (9.69)	15.37 (9.02)	0.191	<0.001	0.178	<0.001	0.110	0.021
Total SACAS score	49.39 (20.84)	41.61 (19.27)	0.211	<0.001	0.197	<0.001	0.120	0.012

Data are mean SACAS scores (SD), unless otherwise indicated. SACAS=South African child assessment schedule. SES=socioeconomic status.

Table 2: Linear-regression analysis of the association between maternal postnatal depression at 6 months and child psychological functioning at 10 years

between two and four children, and gave birth to babies at term. At the 10-year assessment, a total score for the SACAS was available for 1111 children, and 1012 mothers had completed the CES-D questionnaire. Data for both maternal depression at 6 months and child psychological outcomes at age 10 years were available for 644 dyads. Women who remained in the study until their children were 10 years of age were more likely to be African, have fewer children, and generally be from the middle or richer socioeconomic groups (table 1).

At 6 months, 453 (24%) of 1866 women scored above the threshold for symptoms of depression and were deemed to have postnatal depression; at 10 years, 747 (74%) of 1012 women scored above this threshold and were judged to have depression (appendix p 1). No difference was recorded in ethnic origin, maternal age, parity, gestational age, and socioeconomic status between mothers with and without depression at both 6 months and 10 years. Mothers who scored higher on the Pitt depression inventory when their child was 6 months old were more likely to score highly on the CES-D when their child was 10 years old (Pearson correlation coefficient, $r=0.092$, $p=0.04$).

Child psychological functioning at age 10 years differed significantly between children whose mothers had postnatal depression diagnosed at 6 months compared with those whose mothers were not depressed at this timepoint (total SACAS scores, mean 49.4 vs 41.6; mean difference 7.8, 95% CI 4.29–11.28; $p<0.001$; table 2). The multivariate linear-regression analysis showed that both socioeconomic status and maternal depression at 10 years were associated with maternal postnatal depression at 6 months and child psychological outcomes (data not shown); therefore, these variables were included in hierarchical regression analyses (table 2). Preterm delivery and maternal age were not associated with postnatal depression or child psychological outcome and were excluded from further analyses (appendix p 1).

By linear regression and adjusting for socioeconomic status, a significant association remained between maternal postnatal depression at 6 months and child psychological functioning at age 10 years ($\beta=0.211$,

	Mothers with postnatal depression at 6 months	Mothers without postnatal depression at 6 months	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)*
Total SACAS score in top 10%	26/164 (16%)	37/481 (8%)	2.56 (1.32–3.87)	2.26 (1.23–4.16)
Externalising subscale score in top 10%	25/177 (14%)	45/514 (9%)	1.92 (1.08–3.43)	1.71 (0.95–3.10)
Internalising subscale score in top 10%	24/175 (14%)	48/514 (9%)	1.59 (0.90–2.83)	1.38 (0.77–2.48)

Data are number of children/total number of dyads (%). Clinically significant psychological difficulties defined as an SACAS score in the top 10% of all scores. SACAS=South African child assessment schedule. * Adjusted for socioeconomic status and maternal depression at 10 years.

Table 3: Logistic-regression analysis of the association between maternal postnatal depression at 6 months and clinically significant psychological difficulties at age 10 years

$p<0.001$). When we corrected for maternal depression at age 10 years and socioeconomic status in the model, a significant association remained between postnatal depression at 6 months and child psychological functioning at age 10 years ($\beta=0.120$, $p=0.012$). No interaction with sex of the child was noted ($\beta=0.094$, $p=0.34$).

A significant association was noted between maternal postnatal depression at 6 months and internalising ($\beta=0.118$, $p=0.003$) and externalising ($\beta=0.191$, $p<0.001$) behaviour in the child at age 10 years (table 2). This association remained significant when we adjusted the analysis for socioeconomic status, but when we also corrected for maternal depression at 10 years, only the association with externalising behaviour remained significant ($\beta=0.110$, $p=0.021$; table 2). Maternal concurrent depression (at age 10 years) and socioeconomic status were both significant predictors of child outcome in all these models (appendix p 2).

A logistic regression model was done to yield more clinically relevant results (table 3). Children were judged to have clinically significant psychological difficulties at age 10 years if they scored in the top 10% of the SACAS or its subscales (internalising and externalising behaviours). After adjusting for socioeconomic status and maternal depression at 10 years, children whose mother had postnatal depression at 6 months were more than twice as

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likely to have clinically significant psychological difficulties 10 years later (odds ratio 2·26, 95% CI 1·23–4·16; table 3). Furthermore, these children had an increased risk for externalising problems, although the risk was attenuated after adjustment for maternal depression at 10 years. No increased risk for internalising problems was recorded.

Discussion

Our findings in a cohort from South Africa show that maternal postnatal depression 6 months after birth has a sustained negative association with child psychological outcomes 10 years later. The association is especially noticeable for overall psychological difficulties and the externalising symptom domain. No interaction was noted with sex of the child. Importantly, these associations were robust when adjustments were made for concurrent maternal depression at 10 years and for socioeconomic status. Therefore, maternal depression in the postnatal period has important implications for later child development. These findings accord with those from high-income countries, where postnatal depression in particular is associated with psychological difficulties in both childhood and adolescence.²³ To our knowledge, our study is the first to investigate the long-term effects of

postnatal depression on child development beyond age 2 years in a country of low-to-middle income (panel).

Our findings suggest that maternal depression early in a child's life has a continuing effect on the developing child that is still evident at age 10 years, even after adjustment for concurrent maternal depression. Several different mechanisms could account for this association. First, most mothers who develop postnatal depression have much more societal, partner, and family stress and a lower mood during pregnancy than do non-depressed mothers.¹⁸ Highly stressful events and depression during pregnancy are more likely to lead to adverse developmental outcomes in childhood.²⁰ Second, a mother's preoccupation with her own negative thoughts, her irritability, low mood, and lack of sleep while she is depressed might affect her ability to parent and relate to her infant sensitively on both an emotional and cognitive level.^{21,22} In particular, she will encounter difficulties supporting her infant's developing emotional regulation. Disturbances in emotional regulation are in turn associated with both behavioural (externalising) and emotional problems. Postnatal depression is also associated with difficulties in maternal sensitivity during interactions, potentially increasing the likelihood of the child forming an insecure attachment.²³ In a meta-analysis, insecure attachment was associated with increased externalising behaviour in later childhood, particularly among boys.²⁴ Finally, postnatal depression is linked strongly to couple conflict.^{14,25} Partner disharmony can directly affect the ability of parents to attend to their child sensitively and, furthermore, exposure to couple conflict is associated with behavioural difficulties in later childhood.²⁶

In addition to these possible direct effects of postnatal depression, we considered three potential alternative explanations for our findings. First, our data cannot exclude the possibility that child psychological functioning at age 10 years is affected by persistent maternal depression throughout childhood, rather than by maternal depression during the child's first year of life. However, we adjusted for the presence of maternal depression at 10 years (we did not have data for the intervening period) and an association still existed between maternal depression at 6 months and overall child psychological difficulties and externalising symptoms (although, not internalising difficulties). Moreover, in other studies in which continuing maternal depression was accounted for, depression in the postnatal period had an independent effect on children's adjustment in late adolescence.²⁷ Second, shared genetic factors possibly underlie both maternal depression and the behavioural and emotional difficulties we noted in children. However, although the existence of genetic components contributing to these outcomes is not in doubt, study findings indicate that environmental effects are more important at this point in the life course.²⁸ Third, both maternal depression and adverse child outcome are much more typical in situations of adversity. Although we accounted for socioeconomic status in our analyses, other unmeasured family or wider social adversities might have

Panel: Research in context

Systematic review

In a 2012 systematic review⁸ of postnatal depression and child development studies, data were obtained mainly from high-income countries. No studies investigated the enduring effects of postnatal depression on children beyond age 2 years, in countries of low and middle income. We searched Pubmed between 1990 and April 1, 2014, with the terms: "low income countries", "postnatal depression", "child outcomes", "attachment", "postpartum depression", "mother child interaction", and "child behaviour". We did not restrict our search by language. We did not retrieve any studies published after 2012 that were not included in the systematic review.

Interpretation

Our study is the first from a country of low and middle income to show that maternal postnatal depression is associated with adverse child psychological outcomes up to age 10 years, even after controlling for socioeconomic status and concurrent maternal depression. In view of the increased prevalence of postnatal depression in countries of low and middle income (twofold to threefold higher than in wealthier nations) and the enduring effects of maternal depression on a child's internalising and externalising behaviour, this finding has important implications for local and global policies addressing the distribution of wealth and health. Furthermore, our study findings emphasise the importance of implementing locally adapted prevention and treatment programmes for perinatal depression.

accounted for some of the association between maternal depression and child psychological outcome.

Nonetheless, the finding of an association between maternal postnatal depression and adverse child psychological outcomes at age 10 years is pertinent because it shows the importance of delivering effective treatment to the mother, not only to improve her health but also to prevent psychological difficulties for her offspring. Very few studies have been done to investigate whether treatment of antenatal depression can improve maternal mood.^{20,29} However, much more evidence is available to support treatment of postnatal depression in women living in countries of low and middle income. Therapeutic interventions provided by supervised, non-specialist, health and community workers targeting maternal postnatal depression and maternal sensitivity can boost maternal mood, augment the maternal-infant interaction, and improve infant health and development.³⁰ In a large randomised controlled trial from rural Pakistan,³¹ the importance of addressing maternal debt—a strong moderator of depression—as part of a therapeutic intervention was noted. Group problem-solving therapy also raised maternal mood more than did use of antidepressants in HIV-positive mothers with postnatal depression in Zimbabwe.³²

Our study has several limitations. First, although the overall attrition rate in the Birth to Twenty cohort is low, only a subsample of participants had data available at the two timepoints studied here, attributable to several factors. Circular migration (rural-urban temporary migration)^{10,11} meant that some people were not present during a data wave, but returned back to the study area and were traced at a later stage. Furthermore, some interviews were unable to be done either because the researcher was unable to trace the family or because of scant resources at that period of the study. Moreover, absolute attrition happened with death of the child; mortality data were obtained from family members and neighbours at the last known address. Exact numbers and reasons for attrition in the Birth to Twenty study are detailed elsewhere.¹⁰ Attrition might mean that results are not generalisable to the white population or people living at extremes of the socioeconomic scale (who are under-represented in the final sample).

Second, child psychological questionnaires at the 10-year assessment were completed by the mother, and information from other potential informants—eg, fathers, schoolteachers, and the children themselves—was not included in this part of the study. Mothers with depression might report on their child's behaviour more negatively than might a mother without depression.³³ However, this idea is contentious, with findings of other studies showing no difference between child psychological scores obtained from mothers with depression and teacher ratings.³⁴ Nevertheless, we corrected for potential maternal reporting bias to some extent when we adjusted for concurrent maternal depressive symptoms: the significant association between

maternal postnatal depression and child psychological difficulties at age 10 years remained.

Third, the method used to measure symptoms of maternal depression at 10 years—the CES-D—yielded high scores, with three-quarters of women scoring above the cutoff for depression. This finding could reflect the high level of socioeconomic adversity in the population, but it might suggest a weakness of the CES-D in this setting. Future studies in countries of low and middle income should consider using a method with higher specificity.

Fourth, the association between child psychological difficulties and postnatal depression could be attributable in part to early or persisting maternal mood disturbance or stress—eg, during pregnancy. Increasing evidence suggests that high levels of prenatal stress can affect key aspects of child development. However, separating out antenatal and postnatal depression is probably a false dichotomy, because most mothers experience both.³⁵ Finally, we only included maternal mental health in our study; in future work, the mental health of fathers and other family members who might care for a child should be taken into account.

A strength of our study is its prospective cohort design, with a large sample that is fairly representative of the population, and with follow-up over a long period. Although the attrition rate was quite high, it was lower than that reported in other cohort studies in countries of low and middle income.³⁶ The research methods we used were established measures, and care was taken to adapt them to the local setting.

In conclusion, in a setting of low-to-middle income, postnatal depression was associated with adverse psychological effects in children beyond preschool years. In view of the fairly high rates of postnatal depression in countries of low and middle income, public health policies looking to promote health in South African children should include a focus on the prevention and treatment of maternal depression.

Contributors

NEV undertook the analyses and wrote the report. LR and SAN had the idea for the longitudinal study and jointly supervised the overall study. BA did preliminary analyses. AS and PGR had the idea for the paper and reviewed the report. PGR supervised analyses. All authors approved the final report.

Declaration of interests

We declare no competing interests.

Acknowledgments

This study was funded by the Wellcome Trust (UK; grant 077210), the Medical Research Council of South Africa, the Human Science Research Council (South Africa), and the University of Witwatersrand, Johannesburg. PGR was funded by the Wellcome Fellowship (grant 078434). We thank the Birth to Twenty study team and all participants who enable this research to continue. We thank Elizabeth Rapa for help preparing the report.

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