EVIDENCE BASED PUBLIC HEALTH POLICY AND PRACTICE

Child care and social support modify the association between maternal depressive symptoms and early childhood behaviour problems: a US national study

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Objective: To investigate the presence and patterns of modification effects of the sex of the child, social support, and childcare on the relation between maternal depressive symptoms and child behaviour problems at two developmental stages.

Design: Analyses are based on prospective longitudinal data from the study of early child care.

Participants: A total of 1216 families were drawn from 10 locations across the USA. Mothers were age 18 or older at the time of the study child's birth and had completed outcome measures for at least one follow up time point (24 months, 36 months).

Main outcome measures: Child internalising and externalising behaviour problems assessed at the child's age of 24 months and 36 months, as reported by the mother.

Results: Results from generalised estimating equation analyses showed that the association between child externalising behaviour problems and maternal depressive symptoms varied according to the social support received by the mother ($p < 0.05$). Overall, social support mitigated the relation, but protective effects diminished at increasing levels of depressive symptoms. Associations between child internalising behaviour problems and maternal depressive symptoms varied according to whether or not the child received care from caregivers other than the mother ($p < 0.05$).

Conclusions: Health providers who are working with mothers with depressive symptoms may want to examine social support that is available to mothers, especially if mothers are not severely depressed. Furthermore, recommendations to begin, continue, or perhaps increase provision of childcare from other caregivers can provide respite for mothers and opportunities for children to engage in protective interactions with others.

Women, especially women of childbearing age, are at high risk for depression.^{1,2} In addition to the important implications for women's own health, maternal depression and depressive symptoms during her offspring's early childhood is a particularly important public health issue because of its potential impact on infants and young children. Maternal depression has been associated with a broad range of adverse outcomes in children,^{3–5} such as depressive behavioural styles, behaviour problems,^{6–8} poor cognitive development,^{7,9,10} and poor wellbeing of children.¹¹ Findings from previous studies have suggested that boys may be more vulnerable than girls to maternal depression. For example, compared with girls, boys show lower social competence¹¹ and poorer cognitive development¹² after exposure to maternal depressive symptoms. However, some studies have failed to replicate sex differences in children's adverse cognitive outcomes.^{13,14}

Research on relations between maternal depression and child behaviours cannot ignore the family context within which the mother-child relationship occurs. Researchers have emphasised the need to include family context variables, such as psychosocial stress and low socioeconomic status, when studying the effects of maternal depression on child development, because these factors may contribute to both maternal depression and poor child outcomes.^{15,16} In an early study, Paykel and colleagues reported that women with less social support are more likely to suffer from depression,¹⁷ partly because such women may be stressed by the need to cope alone with the baby's demands. Although relations among social support, child outcomes, and maternal depression have been investigated in previous studies,¹⁸ no research

has been done to explore the potential modification effect of social support on the associations between maternal depression and child behaviour outcomes. That is, how the associations between maternal depression and child behaviour problems vary depending on the contextual factor of level of social support mothers receive. Studies examining the effects of childcare provided by adults other than mothers on children's social and emotional development have shown negative,¹⁹ positive,²⁰ mixed,^{19–22} and no effects.²³ Unfortunately, no studies have been done to investigate how alternative childcare deters the impact of maternal depression on child behaviour problems.

Although the co-occurrence of maternal depression and poor child outcomes has been well established in previous research, most studies have examined this relation cross sectionally. Among longitudinal studies (such as Cutrona and Troutman²⁴ and Sugawara *et al*²⁵) none has analysed their longitudinal data using time varying measures of family context. This is an important omission because the interactions between mother, child, and their family environment are bi-directional, dynamic, and changing over time.^{26,27}

The objectives of this study are to examine, for the first time, the potential modification effects of child sex, childcare provided by other caregivers, and social support on the

Abbreviations: SECC, study of early child care; NICHD, National Institute of Child Health and Human Development; CES-D, Center for Epidemiologic Studies depression scale; MDS, maternal depressive symptoms; IBP, internalising behaviour problem; EBP, externalising behaviour problem; GEE, generalised estimating equation; CBP, child behaviour problem

Table 1 Distributions of selected demographic characteristics, childcare, and maternal social support at child age of 24 months

Characteristics	Number (1216)	
Maternal ethnicity: number (%)		
White	1024	84.21
Black	137	11.27
Asian	27	2.22
Other	28	2.30
Maternal education level (in year): mean (SD)	14.52	2.38
Missing n = 23		
Number of children living in home: number (%)		
1	414	34.05
2	490	40.30
3	202	16.61
4+	87	7.15
Missing	23	1.89
Mother's age at subject child birth: mean (SD)	28.30	5.56
Mother hours/week at work or school: number (%)		
0	363	29.85
1–19	127	10.44
20–39	277	22.78
40 and over	426	35.03
Missing	23	1.89
Child sex (male): number (%)	624	51.3
Childcare (hours/week): number (%)		
0	188	15.46
1–19.9	336	27.63
20–29.9	156	12.83
30–39.9	163	13.40
40 and over	373	30.67
Maternal social support: number (%)		
Low	147	12.09
Median	373	30.67
High	595	48.93
Missing	101	8.31

associations between maternal depressive symptoms and child behaviour problems over time.

METHODS

This study was reviewed and approved by the University of North Carolina School of Public Health Institutional Review Board.

Study design

This study analysed data that were collected by the study of early child care (SECC), a longitudinal study started by the National Institute of Child Health and Human Development (NICHD) in 1989. The SECC is characterised by a comprehensive study design that assessed many indicators of child development across time. Phase I of the SECC began in 1991 and was completed in 1994. Data were collected at 10 locations across the USA.

Study sample and recruitment procedures

Participants for the SECC were recruited from 24 designated hospitals at 10 data collection sites. Mothers giving birth in the study hospitals during the sampling time period, January to November 1991, were screened for their eligibility. Families who were eligible and completed all data collection during the one month interview were officially enrolled. For families who agreed to participate in the one month interview but did not keep the appointment, other families were selected from the same site to replace them. As a result, a total of 1364 families with a newborn were recruited in the selection process. Data from 1216 families who had completed measures of depression and child behaviour problems

at either 24 month, 36 month, or both time points were included in this study.

The retention rate of the SECC by the three year follow up is high (1233 of 1364 = 90.4%). Detailed descriptions of the SECC designs and procedures can be found in other NICHD Early Child Care Research Network publications.^{9, 28, 29}

Variables measured

Most of the variables in the study were measured at each time point (24 month and 36 month) using maternal interviews, except for child sex and maternal ethnicity, which were assumed to be time independent and were only obtained at the time the mother was enrolled.

Maternal depressive symptoms (MDS)

Maternal self reported depressive symptoms were measured using the Center for Epidemiologic Studies depression (CES-D) scale, a 20 item self report rating scale that was developed by the National Institute of Mental Health Center for Epidemiologic Studies to assess the current level of depressive symptoms.³⁰ Each item assesses the severity and frequency of a depressive symptom during the past week on a four point scale: score = 0, rarely or none of the time (less than one day); and score = 3, most or all of the time (5–7 days). The total score may range from 0 to 60. Internal consistencies (coefficient α values) of the CES-D range from 0.85 to 0.92 for clinical samples, and range from 0.83 to 0.88 for community samples across different ethnic groups. The test-retest correlation for community samples is 0.51 at the two week interval, 0.67 at the four week interval, 0.59 at the six week interval, and 0.59 at the eight week interval. Consistent with recommendations based on score stability and consistency, we analysed depressive symptoms as a continuous variable.^{30, 31}

Child behaviour problems (CBP)

The child behaviour checklist for ages 2–3 (CBCL/2–3) was completed by mothers at child's ages of 24 months and 36 months to measure child behaviour problems.³² The CBCL/2–3 is designed to assess, in a standardised format, the behaviour/emotional problems of young children as reported by parents or caregivers. Mothers were asked to rate the subject child for how true each item is now or within the past two months using a 3 point scale: 0 = not true (as far as you know), 1 = somewhat or sometimes true, and 2 = very true or often true. We analysed CBP by using the internalising and externalising problem scales, which were derived from second order factor analyses.^{32, 33} To take account of the full range of variation in the scales, raw scores were used instead of normalised t scores. The coefficient α values for the internalising behaviour problem (IBP) were 0.79 and 0.83 at 24 months and at 36 months respectively; for externalising behaviour problem (EBP) were 0.87 and 0.88 at 24 months and at 36 months respectively.

Social support

This 11 item scale was developed by Marshall to measure psychological social support from spouse/partner, family, and friends,³⁴ rather than other forms of support, such as instrumental support or resource provision. Respondents were asked to rate their important relationships over the past months on a 6 point scale from 1 = "none of the time" to 6 = "all of the time." Sample questions include: "The people who are important to me encourage me when I feel discouraged or down." "The people I care about help me out." Analysing data from a random sample of 300 two-earner couples, Marshall and Barnett reported the Cronbach α for this scale to be 0.91 and the test-retest correlation over four months to be .68.³⁴ In our analyses, a three level ordinal

Figure 1 Fitted lines for externalising behaviour problems against maternal depressive symptoms by social support level when other variables were held constant as follows: girl, no other childcare provided by other people, maternal education at 12 years, income to need ratio at 2, poor child health, and mother aged 18 at subject child's birth.

variable was created based on the distribution of average scale scores; they are "low social support" (average score <4), "median social support" (average score ≥ 4 –<5), and "high social support" (average score ≥ 5).

Maternal education

Maternal education was measured in years.

Family income to needs ratio

The family income to needs ratio was computed based on total family income divided by the poverty threshold of the year. The poverty threshold for a household was determined by the total family income, number of members in the household, and the number of children living in the household. The poverty threshold used in this analysis is the published poverty thresholds for 1991–1995 from the US Census Bureau, current population survey. More detailed descriptions of family income to needs for this population can be found elsewhere.³⁵

Childcare provided by other caregivers

The distribution of average hours/week of childcare from other adults (rather than from mother) was examined. A five level ordinal variable, 0 hour, more than 0 to 19.9 hours, 20 to 29.9 hours, 30 to 39.9 hours, and 40 hours or more, was created based on the distribution. Most alternative care was provided at childcare centres outside of the home (72% at 24 month and 79% at 36 month); the rest was at the child's home or at a relative's home.

Child's general health

The child's general health was assessed by asking the mother "Would you say your child's health has been poor, fair, good,

or excellent in the last few months?" Specific coding is poor = 0 and excellent = 3.

Mother's age at subject child's birth

This is a continuous variable with age in years.

Statistical analysis

The outcomes for the analyses were child externalising and internalising behaviour problems based on the CBCL, and the main exposure was maternal depressive symptoms (MDS) that were measured by CES-D. Descriptive statistics were shown to examine the characteristics of the study sample. Means and standard deviations (SD) were calculated for continuous variables, while frequencies and percentages were computed for categorical variables. Bivariate linear regression was conducted to examine unadjusted associations between covariates and outcomes.

After examination of univariate and bivariate distributions, a generalised linear model that adjusted for repeated measures on each child was fitted to the data. Specifically, the multivariate analyses were performed by using the generalised estimating equation (GEE) approach,^{36,37} which resembles standard multiple regression but does not assume observations are independent; in other words, it adjusts for auto-correlation within the same subject. The GEE approach is appropriate for this study because we are interested in the overall between-subject association between MDS and CBP. In addition, GEE accommodates both time dependent (for example, social support measured at 24 months and 36 months) and time independent (for example, child's sex) covariates. With the exception of child's sex, mother's ethnicity and mother's age at birth of the subject child, repeated assessments are available for all factors (that is,

Table 2 Effect of maternal depression on externalising behaviour problems

	β (SE)	95% Confidence limits	p Value
Intercept	22.97 (1.41)	20.21, 25.73	<0.0001
Mother's education	-0.27 (0.08)	-0.43, -0.11	<0.001
Income to needs ratio	-0.07 (0.06)	-0.19, 0.04	0.22
Child health (per level)	-0.61 (0.18)	-0.95, -0.26	<0.001
Mother's age at child birth	-0.13 (0.04)	-0.20, -0.05	<0.01
Maternal depressive symptom (MDS)	0.02 (0.05)	-0.08, 0.12	0.70
Boy (v girl)	0.41 (0.45)	-0.47, 1.28	0.36
Childcare (per level)	0.09 (0.14)	-0.19, 0.36	0.52
Social support (per level)	-1.24 (0.28)	-1.80, -0.69	<0.0001
MDS×Child sex	0.04 (0.03)	-0.03, 0.10	0.30
MDS×Childcare	-0.00 (0.01)	-0.03, 0.02	0.71
MDS×Social support	0.04 (0.02)	0.00, 0.08	0.04

Table 3 Effect of maternal depression on internalising behaviour problems

	β (SE)	95% Confidence limits	p Value
Intercept	16.33 (1.10)	14.17, 18.48	<0.0001
Mother's education	-0.29 (0.06)	-0.41, -0.17	<0.0001
Income to needs ratio	-0.04 (0.04)	-0.12, 0.04	0.38
Child health (per level)	-0.41 (0.13)	-0.66, -0.16	<0.01
Mother's age at child birth	-0.09 (0.03)	-0.15, -0.04	<0.001
Maternal depressive symptom (MDS)	0.05 (0.04)	-0.03, 0.14	0.23
Boy (v girl)	-0.64 (0.31)	-1.25, -0.02	0.04
Childcare (per level)	0.10 (0.10)	-0.10, 0.29	0.34
Social support (per level)	-0.87 (0.22)	-1.30, -0.45	<0.0001
MDS×Child sex	0.05 (0.03)	-0.00, 0.10	0.07
MDS×Childcare	-0.02 (0.01)	-0.04, -0.00	0.02
MDS×Social support	0.03 (0.02)	-0.00, 0.06	0.06

MDS, CBP, mother's education, income to needs ratio, child health, child care, and social support).

RESULTS

Table 1 provides descriptive information about demographic characteristics and family context variables of interest. Of the 1216 families in our sample, most mothers were white (84.2%), had at least two children at home (64.1%), and had a mean of 14.5 years of education (SD 2.4). The proportion of boys and girls in the sample was about the same (boys 51.5%). Regarding family context, 188 (15.5%) children received maternal childcare only and 373 (30.7%) had full time childcare (average hours per week were 40 or over) from other caregivers rather than mothers. Almost half (48.9%) of mothers received high social support from family, friends, and partners.

MDS and child externalising behaviours

Table 2 displays results from the GEE model of externalising behaviour. Of the control variables, maternal education, maternal age at childbirth, and child health are each inversely associated with the child's EBPs. Mothers with more education, who were older at the child's birth, and whose child is in better physical health, reported fewer EBPs. Child sex did not modify the relation between maternal depression and child's externalising behaviours. Of the family context variables, only social support was a statistically significant modifier of MDS. Figure 1 illustrates the pattern of this interaction. At lower levels of MDS, high social support is associated with fewer EBPs. However, as the level of maternal depression increases, the protective effect of social support disappears. Because the three lines (high, median, and low social support) cross over at a MDS score 32,

What does this study add?

- High social support buffers the adverse effects of maternal depressive symptoms (MDS) on child externalising behaviour problems even when mothers are clinical depressed, but not when MDS are extremely severe. The apparent moderation effect of social support disappears when MDS are extremely severe.
- Alternative childcare lessened the harmful effect of MDS on internalising behaviour problems.
- Different mechanism underlying the links between MDS and child externalising and internalising behaviour problems.

we further investigated this pattern by conducting analyses of variance to find out the externalising behaviour scores in the three social support groups were significantly different at the depression score ≥ 32 level and at the depression score < 32 level. A total depression score of 16 or higher has been considered as an indicator of clinical depression. Cases who had a depression score ≥ 32 could be seen as severely depressed. The results (not shown here) confirmed that the three social support groups were not significantly different when mothers were severely depressed (that is, at the depression score ≥ 32 level), but they were significantly different at the depression score < 32 level ($p < 0.001$). We found a similar pattern when we examined differences above and below the clinical cut off point of depression score 16—EBPs were not significantly different in three social support groups when mothers were clinically depressed (that is, at

Figure 2 Fitted lines for internalising behaviour problems against maternal depressive symptoms by childcare level when other variables were held constant as follows: girl, low social support, maternal education at 12 years, income to need ratio at 2, poor child health, and mother aged 18 at subject child's birth.

Policy implications

- Facilitating the provision of social support and alternative childcare for mothers with depressive symptoms are ways to promote the wellbeing of their young children.
- Health care providers who wish to provide effective intervention for families coping with maternal depression and/or child behaviour problems need to include services targeting social support and childcare.

the depression score ≥ 16 level), while they were significantly different at the depression score < 16 level ($p < 0.001$).

MDS and child internalising behaviours

A parallel model predicting IBPs showed similar inverse relations between control variables and internalising problems (table 3). However, in this model there was a significant interaction between MDS and childcare hours; interactions between MDS and child sex and MDS and social support did not quite reach significance at the 0.05 level ($p = 0.07$ and $p = 0.06$, respectively). Figure 2 plots the interaction between depression scores and childcare. In this case, as depression scores increase, more hours of others provided childcare are consistently associated with lower levels of IBPs. Notably, the IBP scores of children who had full time childcare (≥ 40 hours per week) were consistently low regardless of the level of MDS.

DISCUSSION

Results from GEE analyses showed that the associations between MDS and child behaviour problems, externalising and internalising, are not statistically different in boys and in girls. However, high social support buffers the adverse association between maternal depression and child EBP even when mothers are depressed. Unfortunately, the apparent moderation effect of social support disappears at the level of severe depressive symptoms. Our results suggest that interventions should have both contextual and therapeutic elements. For example, when the severity of depression increases, more therapeutic activities and/or medical (for example, pharmaceutical) treatment may be indicated.

The provision of childcare lessened the harmful effect of MDS on IBPs; these modification effects were more dramatic as the level of MDS increased. Furthermore, there was no association between MDS and child IBPs when full time childcare was provided by other people. Recommendations from health care providers to begin, continue, or perhaps increase provision of childcare from other caregivers can both provide respite for mothers and opportunities for their children to engage in constructive, protective interactions with others.

The different patterns of modifying effects of family context suggest that different mechanisms may play important parts in the development of externalising and internalising behaviour problems. More research is needed to explore this possibility, and to identify other modifiable factors (for example, marital conflict, instrumental social support, and parenting) that may alleviate negative effects of maternal depressive symptoms on child outcomes. Studies with longitudinal design and more intensive follow ups are desirable to capture rapid developmental changes during early childhood.

There are some methodological limitations to this study. The utilisation of several exclusion criteria in the SECC sampling process makes the study sample subject to bias by

selection of "healthy" participants. For example, the study tended to enrol healthy infants and their families by excluding sick babies who stayed in the hospital after birth and mothers who had poor health or adverse health behaviours. Families who lived in neighbourhoods that police considered too dangerous for visitation were not included. As these exclusion criteria are often risk factors for MDS and/or child behaviour problems as well, the exclusion of high risk populations may have caused selection bias, which would limit generalisability of study findings.

Another concern is measurement errors from maternal report. The validity of parent reports (particularly depressed parents) of child behaviours has been noted as a concern. It is unclear whether the more negative attributions about their children's behaviour made by depressed parents reflect a bias in parents' ratings or accurately capture true differences in children's functioning.^{38 39}

Another limitation is the lack of information about measured variables between follow up time periods. Some scales and variables included in this study only measure the state or conditions currently or over a comparatively short time period around the time of interview and therefore are not able to reflect all states or conditions between the follow up time points.

This study has also multiple strengths. Firstly, the large sample size makes it possible to explore modification effects of external variables with confounding variables controlled over time. Because the sample is sufficiently large, it provides a good chance to estimate the effects precisely. Secondly, the sampling plans of the SECC were designed to ensure adequate representation of various subgroups, which provides adequate heterogeneity for research analysis. Thirdly, to our knowledge, this is the first study that has examined the potential modification effects of these contextual variables using time dependent measures in a prospective, longitudinal analysis.

These findings suggest that health care providers who wish to provide effective intervention for families coping with maternal depression and/or child behaviour problems need to include services targeting social support and childcare. Clinicians and health care providers who care for depressed mothers (in clinics such as psychiatry, family planning, postpartum check up, or primary care) and paediatric care providers who care for children with behaviour problems need to be aware of the intertwined associations between maternal depression and child behaviour development. Health care providers should screen for children's behaviour problems when they care for mothers who are depressed; likewise, health care professionals who provide care for children with behaviour problems should screen for maternal depression. A brief discussion about how social support and other child care options might be helpful to the mother and the child could be carried out during a clinic visit. Providing educational brochures and a list potential resources to interested families would also be helpful.

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