

Maternal Depressive Symptoms and Depressive Symptoms in Adolescents

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Abstract

The relationship between maternal depressive symptoms and rates of adolescent (15-16 years) depressive symptoms was studied in a birth cohort of 934 New Zealand children. There was a clear correlation between maternal depressive symptoms and subsequent depressive symptoms in adolescent females ($r = .44$) but no association ($r = -.01$) between maternal depressive symptoms and depressive symptoms in adolescent males. Subsequent analysis suggested that the correlation between maternal depression and depressive symptoms in adolescent females was largely explained by the associations of both measure with a series of social and contextual factors including social disadvantage, marital discord and family adversity. It is concluded that maternal depression is associated with social disadvantage, marital discord or family adversity.

Keywords: Longitudinal study, maternal depression, adolescent depression, social disadvantage, marital discord, family life events.

Introduction

Over the past two decades there has been continued interest in the extent to which parental psychopathology is associated with the development of problem behaviours and psychopathology in children and adolescents. One aspect of this interest has centred on the role of maternal depression in the development of disruptive behaviour problems and depression in children and adolescents (Downey & Coyne, 1990; Rutter, 1990).

A number of studies have found that children of depressed women have significantly higher rates of conduct/oppositional behaviours and attention deficit behaviours than children

whose mothers are not depressed (Billings & Moos, 1985; Conners, Himmelhoch, Goyette, Ulrich & Neil, 1979; Fergusson & Lynskey, 1993; Chodsian, Zajicek & Wolkind, 1984; Lee & Gotlib, 1989; Richters & Pellegrini, 1989; Rutter & Quinton, 1984). However, while consistent correlations have been found between maternal depression and risks of childhood disruptive behaviours, the evidence suggests that these correlations are likely to be non-causal and arise from the effects of confounding social and contextual factors (Downey & Coyne, 1990). In particular, maternal depression is frequently associated with a series of social and contextual factors including social disadvantage, marital discord, adverse family life events and similar factors which may also be associated with childhood disruptive behaviour problems (Birtchnell, Masters & Deahl, 1988; Brown & Harris, 1978; Coyne, 1990; Downey & Coyne, 1990; Rutter, 1990). Studies in which these contextual factors have been controlled have generally found that associations between maternal depression and childhood disruptive behaviour problems become statistically non-significant when these associations are controlled for such factors as social disadvantage, marital conflict and other similar factors (Billings & Moos, 1985; Fergusson & Lynskey, 1993; Rutter & Quinton, 1984). These results clearly suggest that the apparent correlations between maternal depression and childhood disruptive behaviours are likely to arise because both maternal depression and disruptive behaviours in children are symptomatic of families subject to social disadvantage, marital conflict, adverse family life events or other similar circumstances.

Research into the relationship between maternal depression and child depression has also found that the offspring of depressed women have higher rates of depressive symptoms (Beardslee, Bemporad, Keller & Klerman, 1983; Cytryn, McKnew, Bartko, Lamour & Hamovit, 1982; Decina et al., 1983; Gershon et al., 1985; Hammen et al., 1987; Klein, Clark, Dansky & Margolis, 1988; Klein, Depue & Slater, 1985; Orvaschel, Welsh-Allis & Weijai,

1988; Weissman, 1988). In reviewing this evidence Downey and Coyne (1990) note that a consistent finding that has emerged from all studies is that rates of depression are elevated in the children of depressed mothers. However, the majority of studies in this area have failed to take into account potentially confounding factors. Nonetheless, studies using matched control groups have generally found that even after such matching, children of depressed women have higher rates of depressive symptoms (Downey & Coyne, 1990). However, in these studies the control of confounding factors has not been as extensive as in a number of studies of disruptive child behaviours. Thus, it remains possible that the apparent correlations between maternal depression and child depression may be due to the effects of common confounding social and contextual factors which have not been adequately controlled in these studies. At the same time recent behavioural genetic research has suggested a possible genetic basis for mother/offspring correlations in depressive symptoms. Specifically these studies have suggested that about one third of the variance in depressive symptoms in adolescents may be genetic in origin (Rende, Plomin, Reiss & Hetherington, 1993; Wierzbicki, 1987). These results could imply that some component of mother/offspring correlation in depressive symptoms was genetic in origin rather than reflecting the effects of environmental factors.

Research into the relationships between maternal depression and childhood outcomes faces a number of recurrent methodological problems (Downey & Coyne, 1990). These problems are:

1. Sample selection. Many studies which have examined the effects of maternal depression on child outcomes have contrasted groups of psychiatric patients with a control group (eg Beardslee et al., 1987; Cytryn et al., 1982; Klein et al., 1988; Orvaschel et al., 1988; Richters & Pellegrini, 1989). This approach has the liability, however, that it may introduce

potential sample selection bias in the selection of cases (Downey & Coyne, 1990). In particular, psychiatric patients may be a self-selecting group with membership of this group reflecting not only levels of symptomatology but also the processes by which these individuals come to the attention of psychiatric services. To the extent that these selection processes may be correlated with child behaviour they may inflate the apparent correlations between maternal depression and adolescent depression as these correlations would reflect the joint effects of both maternal depression on adolescent depression and the correlated effects of selection processes that bring parents to psychiatric attention.

2. The assessment of the extent of maternal depressive symptoms. Depressive symptoms in parents are highly variable and heterogeneous in their course but frequently depression is a recurrent disorder in which patients may have multiple episodes over a period of years (Downey & Coyne, 1990). Since it is likely that the effects of parent depression will vary both with the duration and severity of depressive symptoms it is clear that studies that compare the offspring of depressed and non-depressed parents at a single time may be misleading to the extent that exposures to a depressed parent may vary in both their duration and severity. For these reasons it is useful to base analyses of the effects of maternal depression on childhood outcomes on longitudinally collected data that measure the duration and severity of depressive symptomatology during childhood (Fergusson & Lynskey, 1993).

3. Measurement errors and reporting bias in measures of child outcomes. A further problem that has emerged in a number of studies of the relationships between maternal depression and childhood outcomes is that both maternal depression and childhood outcomes have been measured on the basis of maternal reports (Billings & Moos, 1983; Ghodsian et al., 1984). The use of maternal report data to measure child behaviour raises the complex issue of the extent to which maternal depression colours the reporting of childhood behaviours and

thence leads to artefactual correlations between maternal depression and child behaviours. In general, the evidence tends to support the view that use of maternally reported measures of depression may introduce bias into estimates to the extent that a number of studies report that correlations between maternal depression and maternally reported child behaviours are consistently larger than the correlations between maternal depression and corresponding self report data (Fergusson & Lynskey, 1993; Richters & Pellegrini, 1989).

One solution to this problem is to use multiple indicator measures of childhood behaviours and Fergusson, Lynskey and Horwood (1993) have recently proposed a latent variable modelling approach in which childhood outcomes are assessed using multiple sources of reporting to develop a latent variable criterion against which the validity of maternal reporting behaviours can be compared and which can also be used to estimate the extent of bias arising from maternal mental state in the reporting of childhood behaviours.

4. The role of social and contextual factors. While many studies have reported significant associations between maternal depressive symptoms and adolescent depressive symptoms it is possible that these correlations may arise from the effects of various social, family and contextual factors that are associated with depressive symptoms both in parents and in their offspring. In particular, there are a range of social and contextual factors, such as social disadvantage, marital instability, marital discord and life events that have been shown to be related to maternal depression and that may also be related to adolescent depression (Downey & Coyne, 1990; Richters, 1992; Rutter, 1990).

5. Gender related heterogeneity in response to maternal depression. An issue which has received only limited attention in the literature concerns the extent to which child responses to maternal depression may be modified by the child's gender. Specifically, it is possible that

females may be more responsive to the effects of maternal depression during adolescence as it is well known that rates of adolescent depression are higher amongst females than males and in other areas (eg the effects of parental divorce) it has been claimed that the responses of females to family problems may differ from the responses of males (Emery, 1982; Hetherington, Cox & Cox, 1982; Wallerstein & Kelly, 1980).

Collectively, these considerations suggest that research designs for examining the associations between parental depression and childhood psychopathology are likely to be most informative if they are characterized by the following features: a) the analysis is based on a representative sample of the child population; b) measurement of maternal depression is based on longitudinally collected measures of depression gathered throughout childhood; c) measurement of outcomes is based on multiple sources of assessment thus reducing risks of reporting bias; d) associations between maternal depression and child behaviour are controlled for prospectively or concurrently measured confounding factors; e) comparisons are made of gender differences in the relationship between maternal depression and childhood outcomes.

The present study is the second in a series of reports examining the relationships between maternal depressive symptoms in middle childhood and problems of adjustment in adolescence using data from a New Zealand birth cohort. In the first paper we examined the associations between conduct disorder, attention deficit/hyperactivity disorder and maternal depressive symptomatology before and after control for a range of social and contextual factors (Fergusson & Lynskey, 1993). The results of this analysis suggested that when due allowance was made for social and contextual factors, maternal depression was uncorrelated with subsequent disruptive adolescent behavioural patterns.

In this paper we present a parallel analysis of the relationship between maternal depressive symptoms in middle childhood and depressive symptoms in cohort members at the age of 16 years. The aims of the analysis are to:

1. Examine the extent to which maternal depressive symptoms during middle childhood were associated with adolescent depressive symptoms.
2. Determine the extent to which any correlation between maternal depression and adolescent depression can be explained by common social and contextual factors that were associated with both outcomes.
3. Examine the extent to which associations between maternal depression and child depressive symptoms varied with the young person's gender.

The research design used contains a number of features that address the recurrent threats to validity in this area. These features include:

1. The analysis is based on data from a large and representative birth cohort thus reducing risks of sample selection bias.
2. Maternal depressive symptoms were assessed prospectively during the period from 8-13 years.
3. Assessment of adolescent outcomes was based on parallel maternal and self report thus making it possible to examine possible reporting biases in maternal reports of adolescent depressive symptoms.
4. The analysis includes a wide range of prospectively measured confounding factors including measures of social disadvantage, marital conflict, family life events and similar measures.
5. Analyses are stratified by gender to examine possible gender differences in response to maternal depressive symptoms.

Method

The data reported here were gathered during the course of the Christchurch Health and Development Study. In this study a birth cohort of 1265 New Zealand children was studied at birth, at 4 months and at annual intervals up to the age of 16 years (for a description of previous findings see Fergusson, Horwood, Shannon & Lawton, 1989). As part of this research, information was gathered on the following aspects of the child's life history.

Maternal depressive symptoms. From the children's ages of 8 to 13 years, mothers were interviewed on a 37 item inventory based on the Levine-Pilowsky depression inventory (Pilowsky and Boulton, 1970; Pilowsky, Levine & Boulton, 1969). This measure has been shown previously (Fergusson, Horwood & Shannon, 1984) to represent a unidimensional variable reflecting the extent of depressive symptoms reported by the mother and has good reliability ($r = 0.91-0.93$). The data gathered during the course of the study were used to construct a general measure of the extent of the child's exposure to maternal depressive symptoms during the period from 8-13 years. This measure was constructed by summing the total number of depressive symptoms reported over the period and dividing this total by 6 to give an estimate of the per annum rate of depressive symptoms reported by the child's mother. This score was of high reliability ($\alpha = .98$). Maternal depressive symptoms were not measured after the age of 13 years since space within later interviews was at a premium and it was believed that the data gathered over the period from 8-13 would adequately summarise maternal tendencies to depression.

To provide internal validation of this measure it was compared with two alternative methods of representing symptom variation during the period. These methods were: a) a count of the number of years for which the mother had reported severe symptoms of

depression (13 or more symptoms) and b) classification of the sample into a series of groups ranging from children whose mothers were asymptomatic over the period studied to children whose mothers showed severe symptoms (13 or more) for at least four of the six years studied (Fergusson et al., 1993). These alternative measures were highly correlated with the per annum rate of depressive symptoms. The correlation between the per annum rate of depressive symptoms and number of episodes of severe depression was .79 whereas the correlation between the per annum rate of depressive symptoms with the fourfold classification of the sample was .82. Additionally, the analyses reported here were conducted using each of the measures of maternal depression and each analysis led to very similar conclusions. In this paper the per annum symptom rates are used to measure variation in maternal depressive symptoms since this measure gives a continuous measure of maternal depressive symptoms that is suitable for methods of structural equation modelling .

Adolescent depressive symptoms. At age 16 years symptoms of major depression in adolescents were measured using parent and self report versions of the Diagnostic Interview Schedule for Children (DISC: Costello, Edelbrock, Kalas, Kessler & Klaric, 1982) supplemented by further items from DSM-III-R diagnostic criteria for major depression. In these measures all symptoms occurring over the preceding year were recorded. In a previous paper (Fergusson, Horwood & Lynskey, 1993) we have described the use of these data to estimate the prevalence of depressive disorders using DSM-III-R criteria. In this study, however, depressive symptoms were represented as a dimensional variable in which the severity of depression ranged from none to severe. Scores for both maternal and self report measures were constructed for each subject by summing the number of depressive symptoms reported. The resulting symptom scores were of good internal consistency with both maternally reported and self reported symptom scores having alpha coefficients of .86.

Dimensional scoring was used in this study as the method of analysis employed (structural equation modelling) require dimensionally scored variables. Additionally, as shown later (see Table 1) there was evidence of continuous dose/response relationships between the extent of maternal depressive symptoms and the extent of adolescent depressive symptoms suggesting that a dimensional model was appropriate.

Social and contextual factors. To control the association between maternal depressive symptoms and adolescent depressive symptoms for the effects of family and social context during the period from 8-13 years, the following measures were used in the analysis.

1. Family social position. This index ranked families into five relatively homogeneous groups ranging from those with the most disadvantaged demographic profile to those with the most advantaged profile. The construction of this index has been described previously (Fergusson, Dimond, Horwood & Shannon, 1984) and is based on a weighted sum of parental education levels, family socio-economic status, maternal age, maternal ethnicity and the child's birth status (single parent or two parent family).

2. Changes of parents. As part of the study comprehensive data were collected on changes of parents (Fergusson, Horwood & Lynskey, 1992). This information was used to construct an index of family instability by summing the number of changes of parent figures that the child had experienced up to the age of 13 years.

3. Marital unhappiness. Each year mothers were asked to describe the happiness of their marriage on a five point scale ranging from very happy to very unhappy. An index of the extent of marital unhappiness over the period that the child was 8-13 years old was constructed by summing the number of years for which the mother reported an unhappy marital relationship.

4. Marital conflict. This measure was based on longitudinally collected items on reports

of parental arguments, assault by husband and sexual problems collected during the period from 8-13 years. The construction of this index has been described previously (Fergusson et al., 1992).

5. Family life events. Each year from 8 to 13 years mothers were questioned about life events occurring in the previous year using a 49 item life event inventory based on the inventory developed by Henderson, Byrne & Duncan-Jones (1981). These measurements yield in the region of 300 items summarising the life event history of each family. To produce a global measure of the extent of family exposure to adverse life events, reports of life events over the six year period were summed and divided by six to yield an estimate of the per annum rate of exposure of the family to adverse life events.

Sample Size

The analysis in this paper is based on a sample of 934 subjects. These subjects represented 74% of the original birth cohort of 1265 children and 84% of all cohort members resident in New Zealand at age 16 years.

To examine the representativeness of the sample, comparisons were made of the socio-demographic characteristics of the 934 subjects entered into the analysis and the remaining subjects. This showed no significant ($p > .05$) differences between the sample analysed and those not analysed with respect to measures of maternal age, family size, ethnicity or gender. There were, however, small but statistically detectable ($p < .05$) tendencies for the sample to under-represent children from families of low socio-economic status, families in which the mother lacked formal educational qualifications and children who entered single parent families at birth, suggesting that the sample may have under-represented those from socially disadvantaged backgrounds.

To examine the effects of differential sample losses on the results reported in this analysis, the findings were corrected for possible sample selection bias using the methods described by Berk (1983). In this method, non-random sample losses are corrected using a two stage analysis method. In the first stage of the method, a sample selection hazard is estimated for each subject to estimate the hazard of his/her inclusion in the sample analysed. In the second stage of the method the sample selection hazard is entered into substantive regression equations to compensate for non-random sample losses. This analysis showed that the conclusions of this study were not materially changed when the results were corrected for non-random sample losses.

Results

The Associations Between Maternal Depressive Symptoms (8-13 Years) and Maternal and Self Reports of Adolescent Depressive Symptoms (15-16 Years)

Table 1 shows the relationship between the extent of maternal depressive symptomatology during middle childhood (8-13 years) and maternal and self reported symptoms of depression in the young person during the period 15-16 years. As explained in the Method section the extent of maternal depression was measured as a continuous variable representing the per annum rate of depressive symptoms reported by the mother each year over the period from 8-13 years. In the Table this measure has been classified into six class intervals ranging from young people whose mothers were asymptomatic throughout the six year period to those whose symptom levels placed them in the 5% of the sample with the greatest number of maternal depressive symptoms. Each comparison is tested for statistical significance using one way analysis of variance and the strength of the association is measured by the product moment correlation. Examination of the Table shows:

1. For males, there was a small but significant correlation ($r = .11$; $p < .05$) between maternal depressive symptoms and maternal reports of depressive symptoms in the young person. Young men whose mothers had high levels of depressive symptoms (13+ per annum) during the period from 8-13 years had mean maternally reported symptom scores that were approximately 3 times higher than those of young men whose mothers were asymptomatic. There was, however, no significant association ($r = .01$; $p > .70$) between extent of maternal depressive symptoms and self reports of depressive symptoms at age 16 years.

2. For females, there were significant ($p < .001$) correlations between maternal depressive symptoms during the period from 8-13 years and both maternally reported ($r = .28$) and self reported ($r = .17$) symptoms of depression in the young person. Young women whose mothers had high levels of depressive symptoms during the period from 8-11 years had mean symptom scores that were 2.8 to 7.6 times higher than those of young women whose mothers were asymptomatic.

3. The Table also shows that, as a general rule, the correlations between maternal depressive symptoms and symptoms in the young person were higher for maternally reported symptoms than for self reported symptoms. For males the correlation between maternal depression and maternally reported symptoms was .11 compared to the correlation of .01 with self reported symptoms. For females the correlation between maternal depression and maternally reported symptoms was .28 compared to the correlation of .17 with self reported symptoms.

INSERT TABLE 1. HERE

Estimating the Correlations Between Maternal Depressive Symptoms and Adolescent Depressive Symptoms Taking into Account Errors of Measurement

The results above suggest a) possible gender differences in the model linking maternal depressive symptoms to adolescent depressive symptoms and b) possible contamination of maternal reports of adolescent symptomatology in which depressed women may over report symptoms in their offspring. In addition, the data reported above may be subject to errors of measurement. To take account of these issues the correlations between maternal depression and adolescent symptoms were analysed using a structural equation modelling approach based on that developed by Fergusson, Lynskey and Horwood (1993).

Table 2 shows for males and females separately, the matrix of correlations between:

1. Split half measures of maternal depressive symptom. These measures were constructed by taking split half scores of the Levine-Pilowsky inventory at each year and combining these to form two split half measures of the extent of maternal depressive symptomatology during the period from 8-13 years.
2. Maternally reported symptoms of adolescent depression at age 15-16 years.
3. Self report symptoms of depression at age 15-16 years.

INSERT TABLE 2. HERE

To describe the relationships between maternal depressive symptoms and maternal and self reports of adolescent depressive symptomatology the data in Table 2 were analysed using a multiple group LISREL modelling approach (Joreskog & Sorbom, 1989) in which a common model structure was fitted to the data for both males and females. The model structure assumed:

1. That the split half measures of maternal depressive symptoms were indicator

measures of a latent variable reflecting the extent of maternal depressive symptomatology during middle childhood.

2. Maternal and self reports of adolescent depressive symptoms were fallible indicator measures of the young person's extent of depressive symptomatology.

3. The extent of maternal depressive symptomatology could influence the accuracy of maternal reports of adolescent symptoms.

4. When due allowance was made for errors of measurement in report data the extent of maternal depressive symptoms and adolescent depressive symptomatology were correlated variables.

This model produced a good fit to the data in Table 2 ($LR\chi^2 = 2.59$, $df = 4$, $p > .60$) and Figure 1 gives estimates of the standardised model parameter estimates for males and females.

For males (Figure 1a) the model shows:

1. The coefficients linking the split half measures of maternal depressive symptoms to the latent construct of depressive symptoms were in excess of .97. The squares of these coefficients measure the reliability of maternal symptom reports.

2. The coefficients linking maternal and self reports of adolescent depressive symptoms with the latent construct of adolescent depressive symptoms represent the correlations between the latent factor and the observed tests given: a) multiple informant reports and b) correction for the effects of maternal depressive symptoms on maternal reporting. These coefficients thus represent the internal validity of the observed report data as measures of the young person's predispositions to depressive symptoms.

3. The model also permitted maternal depressive symptomatology to influence maternal

reporting of child behaviours and the estimated coefficient of .11 suggests a modest and marginally significant ($p = .06$) tendency for maternal depressive symptomatology during middle childhood to be associated with maternal reporting of depressive symptoms in their offspring.

4. Finally, the fitted model shows that when due allowance was made for errors of measurement in report data, maternal depressive symptomatology and depressive symptoms in adolescent males were uncorrelated ($r = -.01$, $p > .80$).

Figure 1b shows the corresponding model for females. In all but one respect the parameters of this model are similar to the model for males. The major difference between the models is that while the models for males suggested that maternal depression and adolescent depressive symptoms were uncorrelated, there was evidence of a clear correlation ($r = .44$, $p < .001$) between maternal depressive symptoms and depressive symptomatology in females.

INSERT FIGURE 1 HERE

The Association Between Maternal Depressive Symptoms and Adolescent Depressive Symptoms Taking into Account Social and Contextual Factors

The results above suggest that maternal depressive symptoms were associated with adolescent depressive symptoms for females but not for males. This could suggest that maternal depressive symptomatology is associated with increased vulnerability to depression in the same sex offspring. An alternative account is that the apparent correlations between maternal depressive symptoms and symptoms of depression in adolescent females arise from social and contextual factors that are: a) associated with increased risks of maternal depressive symptoms and b) independently associated with increased risks of depressive symptoms in adolescent females.

To examine this possibility the structural equation model for females in Figure 1b was extended to include a series of social and contextual factors measured during the period from 8-13 years. These factors included measures of family social position, changes of parents, parental conflict, marital unhappiness and adverse family life events. The results of these analyses are given in Table 3 which shows:

1. Estimates of the bivariate correlations between maternal depressive symptoms, family social position, changes of parents, marital conflict, marital unhappiness, family life events and adolescent depressive symptoms. The Table shows there were consistent associations between adolescent depressive symptoms and a range of social and contextual factors. These correlations ranged from .15 to .58 and in all cases were statistically significant ($p < .05$), indicating that rates of depressive symptoms were elevated in young women whose mothers reported higher levels of depressive symptoms, who came from more socially disadvantaged families, who had experienced parental change or parental conflict, whose mother reported greater marital unhappiness or increased rates of family life events during the period from 8-13 years.

2. Estimates of the standardised regression coefficients linking maternal depressive symptoms, family social position, changes of parents, marital conflict, marital unhappiness and family life events to adolescent depressive symptoms. These coefficients show: a) that when due allowance was made for the effects of other social and contextual factors, maternal depressive symptoms were not significantly related to adolescent depressive symptoms ($\beta = .08$, $p > .50$); b) the significant predictors of adolescent depressive symptoms were: family life events ($\beta = .30$, $p < .01$), marital conflict ($\beta = .27$, $p < .05$) and family social position ($\beta = .20$, $p < .05$).

These results imply that the apparent correlation between maternal depressive symptoms and adolescent depressive symptoms in females arose because maternal depressive symptoms were correlated with a series of social and contextual factors (notably family life events, marital conflict and social disadvantage) which were independently related to increased rates of depressive symptoms in adolescent females.

INSERT TABLE 3. HERE

The Linkages Between Maternal Depression and Subsequent Family Adversity

The results in Table 3 suggest that when due allowance was made for social and contextual factors (notably social position, adverse family life events and marital conflict), maternal depression during middle childhood was not directly related to depressive symptoms in adolescent females. This result may be interpreted in one of two ways. First, the result could suggest that the apparent association between maternal depressive symptoms and adolescent depressive symptoms was spurious and arose from the correlated effects of a series of confounding factors. Alternatively it might be argued that maternal depressive symptoms are indirectly related to adolescent depression by a causal chain process in which: a) maternal depression increases the likelihood of family adversity; b) family adversity increases the likelihood of depressive symptoms in adolescent females.

To examine the plausibility of these alternative explanations further analysis of the longitudinal relationships between maternal depressive symptoms and family adversity was conducted. In this analysis the relationships between maternal depressive symptoms and family adversity at ages 8-10 years and the same measures at 11-13 years were analysed using multiple regression methods. The results of these analyses are shown in Table 4 which gives estimates of standardised regression coefficients (and tests of significance) linking maternal

depressive symptoms at age 8-10 years to measures of family change, marital conflict, family life events, marital unhappiness during the period from 11-13 years after adjustment for measures of family adversity during the period from 8-10 years. This analysis shows that when due allowance was made for pre-existing family adversity during the period 8-10 years, maternal depression during the period 8-10 years was only weakly related to subsequent parental change, marital conflict, family life events or marital unhappiness. In three of the four regressions reported there were small ($\beta = .10$ to $.14$, $p < .01$) but statistically significant associations between previous maternal depressive symptomatology and later outcomes when due allowance was made for family adversity during the period 8-10 years.

These findings are consistent with the conclusions that there may be a very weak indirect effect of maternal depression on adolescent depressive symptoms which arises because maternal depression is associated with a small tendency to increased parental conflict, adverse life events or marital unhappiness and these factors in turn are associated with increased vulnerability to depressive symptoms in adolescent females.

INSERT TABLE 4. HERE

Discussion

In this paper we have used longitudinal data gathered during the course of a 16 year study of a birth cohort of New Zealand children to examine the associations between maternal depressive symptoms during middle childhood and rates of depressive symptoms in adolescence. This study was characterized by a number of features aimed at reducing recurrent threats to validity in research designs examining the relationships between maternal depression and childhood outcomes. The major findings and conclusions of this study are reviewed below.

Maternal Depression and Maternal Reporting Behaviours

There have been recurrent concerns about the extent to which maternal depression may colour the reporting of childhood behaviours thus producing misleading correlations between maternal depression and behavioural symptoms in children (eg Panaccione & Wahler, 1986; Rickard, Forehand, Wells, Griest & McMahon, 1981; Schaughency & Lahey, 1985). The present analysis supports these concerns and suggests that maternal mental state may influence reporting behaviours in a way which leads to inflated correlations between maternal reports of child behaviour and maternal depression. Two lines of evidence support this conclusion.

First, the correlations between maternal reports of depression and maternally reported symptoms were consistently larger than the corresponding correlations with self reported symptoms. For females, the correlation between maternal depression and maternally reported adolescent symptoms was .28 compared to the correlation of .17 between maternal depression and self reported symptoms. Similarly for males, the correlation between maternal depression and maternally reported symptoms was .11 compared to a correlation of .01 for self reported symptoms.

Second, the structural equation model fitted to the data suggested that independently of the correlation between maternal depression and depressive symptoms in adolescents, there was evidence to suggest that maternal mental state influenced maternal reporting behaviour relative to a latent criterion measure defined on the joint properties of maternally and self reported symptoms.

Both lines of evidence suggest that relative to the reports of non-depressed women, depressed mothers tend to report more symptoms in their offspring and these differences in

the reporting behaviours of depressed and non-depressed women lead to the correlations between maternal depression and maternally reported adolescent behaviours overestimating the association between maternal depression and childhood outcomes. These findings have typically been interpreted as suggesting that depressed women show a tendency to over report symptoms as a result of maternal depression colouring maternal reporting behaviours (Panaccione & Wahler, 1985; Rickard, Forehand, Wells, Griest & McMahon, 1981; Schaughency & Lahey, 1985). However, Richters (1992) has pointed out that these results could be equally well interpreted as suggesting that depressed women are more accurate in their reports than non-depressed women or other reporting sources. Whilst this interpretation is consistent with the data reported here, it is important to note that irrespective of whether the bias in maternal report data arises because: a) depressed women over report symptoms or b) non-depressed women are less accurate in their reports, the structural equation model fitted to the data in this study provides an estimate of the correlation between maternal depressive symptoms and childhood outcomes which is corrected for any bias in maternal reports. This follows since the model takes into account the possibility that variations in maternal mental state may influence reporting behaviours independently of the correlation between maternal depression and adolescent symptoms.

The Associations of Maternal Depression and Adolescent Depressive Symptoms

The most marked finding to emerge from the analysis was evidence of very clear gender differences in the associations between maternal depression and adolescent depressive symptoms. For females there was evidence of a clear and highly significant correlation between the extent of maternal depressive symptoms during middle childhood and symptoms of depression in females at age 16 years ($r = .44$). On the other hand, maternal depressive symptoms were virtually uncorrelated with depressive symptoms in adolescent males ($r = -$

.01). There are two possible explanations for these marked gender differences in the association between maternal depression and adolescent depressive symptoms. First, it may be that females are more responsive to maternal depression or to factors associated with maternal depression and this leads to stronger associations between maternal depression and depressive symptoms in adolescent females.

Second, it may be that the different associations reflect the age at which the sample was studied. In particular, it is known that there is a more marked increase in depressive symptoms in adolescent females than in adolescent males (Rutter, 1986) and it may be that the stronger correlation between maternal depression and adolescent depressive symptoms in females arises because females had, at the age of 16 years, clearly expressed tendencies to depression whereas the same was not true of males. This could lead to a situation in which the correlations between depression in mothers and depressive symptoms in adolescent females were more clear and marked than the correlations for adolescent males.

The Causal Effects of Maternal Depression on Adolescent Depressive Symptoms

Whilst this study produced evidence of a quite substantial correlation between maternal depression and depressive symptoms in adolescent females, the weight of the evidence suggests that this correlation was likely to be largely non-causal in its origins. In particular, when the association between maternal depressive symptoms and adolescent depressive symptoms in females was controlled for family adversity (notably social disadvantage, marital discord and adverse family life events) the associations between maternal depression and depressive symptomatology in adolescent females became small ($\beta = .08$) and statistically non-significant. These results lead to the conclusion that maternal depression was associated with depressive symptoms in adolescent females only insofar as maternal depression was

associated with family social disadvantage, marital conflict and family adversity.

These results are consistent with two interpretations. First, it may be suggested that the apparent correlations between maternal depression and depression in adolescent females were largely spurious and arose from the fact that the social and family factors (social disadvantage, marital discord, family adversity) that led to increased rates of depression in mothers were also associated with increased vulnerability to depression in adolescent females. The alternative explanation is that maternal depression may indirectly influence vulnerability to depression in adolescent females as a result of a causal chain process in which: a) maternal depression leads to increased risks of family conflict and adversity; b) exposure to family conflict and adversity increased risks of depressive symptoms in adolescent females.

This issue was examined using longitudinal data collected during the course of the Study to assess the extent to which maternal depression during the ages 8-10 years was associated with increased marital conflict and adverse family circumstances at ages 11-13 years when due allowance was made for pre-existing family circumstances. This analysis showed the presence of very weak associations ($\beta = .07$ to $.14$) between earlier maternal depression and later family outcomes. Whilst this evidence is consistent with the view that maternal depressive symptoms may provoke subsequent family problems, the linkages between maternal depression and subsequent outcomes were generally very weak. These results suggest that it is likely that most of the apparent correlation between maternal depression and depressive symptoms in adolescent families is spurious and arises from the fact that the family and social circumstances that lead to depression in mothers are also associated with increased vulnerability to depressive symptoms in adolescent females. Nonetheless, the results suggest that there may be very weak indirect effects in which maternal depression

during childhood leads to increased rates of family adversity which in turn increases subsequent vulnerability to depression in adolescent females.

The conclusions of this study are superficially in conflict with the findings of behavioural genetic research that has suggested some degree of heritability in early onset depressive disorders (Rutter, MacDonald, Le Couteur, Harrington, Bolton & Bailey, 1990; Rende, Plomin, Reiss & Hetherington, 1993). The findings of that research would imply that there should be detectable parent/offspring correlations in levels of depressive symptoms even when due allowance was made for confounding social and contextual factors. Specifically a recent study by Rende, Plomin, Reiss and Hetherington (1993) has suggested that whilst genetic factors account for about one third of individual variation in depressive symptomatology, environmental factors make an overwhelming contribution to extreme symptom scores. They propose that genetic factors contribute to a broad vulnerability to depression with the expression of extreme scores being influenced by environmental factors. This conclusion is not entirely consistent with our finding that common environmental factors explain mother/offspring correlations of depressive symptoms.

The reconciliation of our findings with those of Rende et al. is by no means clear but two points may be relevant: a) mother/offspring correlations are likely to be fallible indicators of heritability and b) the relationships between genetic factors and environmental factors in the expression of depressive symptoms is likely to be complex and this complexity is not fully represented in either our analysis or that reported by Rende et al. When these considerations are taken into account there is no necessary inconsistency between our findings that common environmental factors explain a large amount of mother/offspring correlation in depressive symptoms and the conclusion that there is moderate heritability of tendencies to depression.

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Table 1: Mean maternal and self report ratings of adolescent depressive symptoms (15-16 years) by extent of maternal depressive symptomatology (8-13 years) and gender

		Males (N = 465)			Females (N = 469)		
Maternal Depressive Symptoms 8-13 Years							
(Average symptoms per annum)	N	Maternal Report	Self Report	N	Maternal Report	Self Report	
Asymptomatic	82	0.22	0.67	88	0.32	1.09	
1 - 2 symptoms	151	0.31	0.72	156	0.40	1.45	
3 - 4 symptoms	70	0.47	0.54	77	0.47	1.64	
5 - 8 symptoms	93	0.43	0.81	80	0.86	1.63	
9 - 12 symptoms	38	0.58	0.58	46	0.87	2.24	
13 + symptoms	31	0.68	0.87	22	2.45	3.00	
r		.11	.01		.28	.17	
p		<.05	>.70		<.001	<.001	

Table 2: Correlations between split half measures of maternal depressive symptoms (8-13 years) and maternal and self reports of adolescent depressive symptoms (15-16 years) for males (correlations below leading diagonal) and females (correlations above leading diagonal)

Measure	Maternal Depressive Symptoms		Adolescent Depressive Symptoms	
	First Half	Second Half	Maternal Report	Self Report
Maternal Depressive Symptoms				
First Half	1.000	.971	.276	.168
Second Half	.971	1.000	.294	.166
Adolescent Depressive Symptoms				
Maternal Report	.110	.102	1.000	.201
Self Report	-.001 ^a	-.007 ^a	.254	1.000

^a All correlations are significantly ($p < .05$) different from zero except those indicated

Table 3: Estimated bivariate correlations and standardised regression coefficients linking adolescent depressive symptoms (15-16 years) to maternal depressive symptoms (8-13 years) and measures of family adversity for female sample

Measure	Bivariate Correlation		Standardised Regression Coefficient	
	r	p	β	p
Maternal depressive symptoms (8-13 years)	.44	<.001	.08	>.50
Changes of parents (8-13 years)	.37	<.0001	-.05	>.50
Parental conflict (8-13 years)	.46	<.001	.27	<.05
Adverse family life events (8-13 years)	.58	<.001	.30	<.01
Marital unhappiness (8-13 years)	.39	<.001	-.03	>.50
Family social position	.15	<.05	.20	<.05

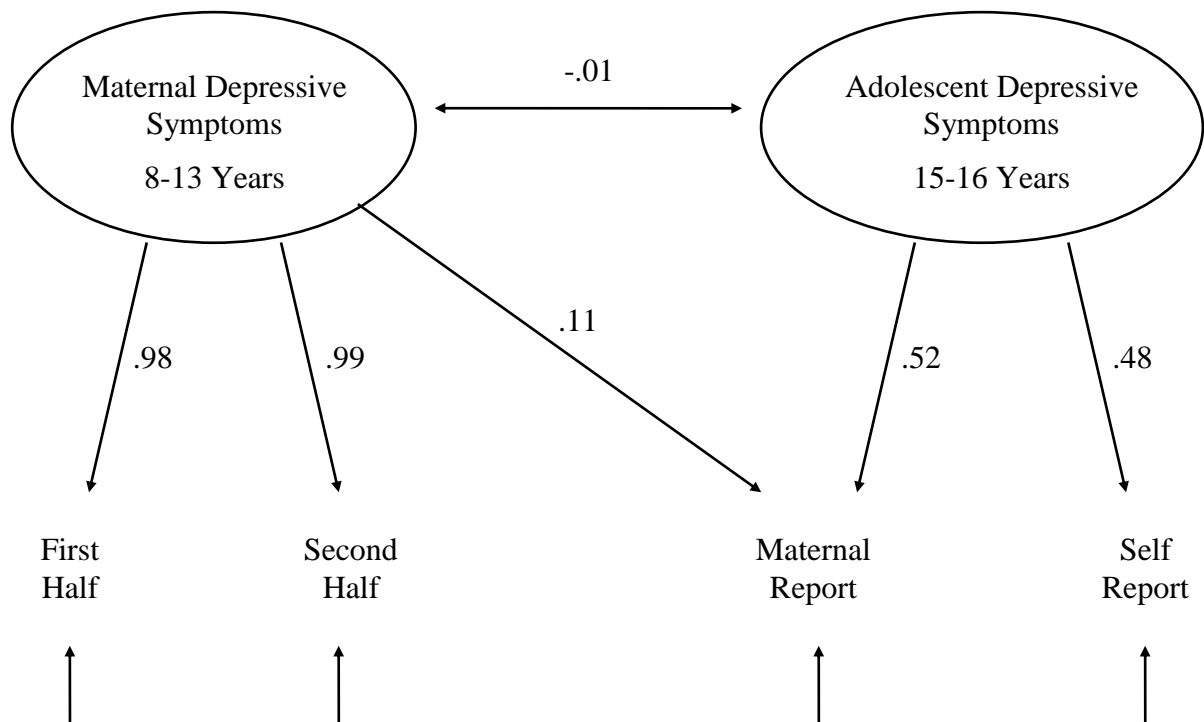
Table 4: Standardised regression coefficients linking maternal depressive symptoms (8-10 years) with changes of parents, marital conflict, family life events and marital unhappiness (11-13 years), after adjustment for measures of prior family adversity

Outcome (11-13 Years)	Effect of Maternal Depressive Symptoms (8-10 Years) on Outcome ^a	
	β	p
Changes of parents	.07	>.05
Marital conflict	.12	<.01
Family life events	.14	<.001
Marital unhappiness	.10	<.01

^a Adjusted for measures of prior family circumstances including: Changes of parents (8-10 years), marital conflict (8-10 years), family life events (8-10 years), marital unhappiness (8-10 years), family social position.

Figure 1: Fitted model of maternal depressive symptoms (8-13 years) and adolescent depressive symptoms (15-16 years) for males and females (all model coefficients are standardised).

a) Males



b) Females

