Maternal depression during and after pregnancy and associations with offspring behavioural problems: A systematic review, empirical study and critical evaluation.

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Thesis submitted to the South Wales Doctoral Programme in Clinical Psychology, Cardiff University in partial fulfilment of the requirement for the degree of Doctor of Clinical Psychology

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For my mother

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Thesis Abstract

This thesis was submitted for the partial fulfilment of the requirement for the degree of Doctor of Clinical Psychology. It comprises a systematic review and empirical study, which have both been prepared for submission to European Child and Adolescent Psychiatry, followed by a critical appraisal of the research as a whole.

The objective of the systematic review was to synthesise and evaluate the findings of longitudinal studies of maternal depression and offspring antisocial behaviour. Longitudinal studies, examining maternal depression during pregnancy and beyond, provide the opportunity to examine the independent and cumulative effects of exposure. Three databases were searched (Psychinfo, Web of Science, Medline) from the period of January 1900 to December 2017. Twenty of 5936 studies met the inclusion criteria. Overall, the findings indicated significant, independent effects of exposure to maternal depression during pregnancy, postnatal depression and exposure to maternal depression after the perinatal period on offspring antisocial outcomes. The few studies that examined the effect of cumulative exposure to depression found a significant effect on child behaviour. Several limitations in the literature were identified, including a reliance on maternal reports for both depression and child outcomes and a limited conceptualisation of the antisocial behaviour construct.

The empirical study examined maternal depression from pregnancy to age 7 years postpartum and the association with Callous-Unemotional (CU) behaviour. The study was embedded within a longitudinal study of a British birth cohort (the Cardiff Child Development Study); mothers (n = 249) were assessed for depression at pregnancy, 6 months postpartum and at 7 years postpartum using a diagnostic interview. CU behaviour was measured in children at 7 years old using primary caregiver and teacher reports on the Inventory for Callous-Unemotional Traits (ICU; Frick, 2004). Contrary to hypotheses, maternal depression during pregnancy and at 6 months postpartum was not associated with any aspect of the offspring's CU behaviour. However, regression analyses controlling for social adversity found that cumulative exposure to maternal depression from pregnancy to 7 years significantly predicted increased CU behaviour, according to the primary-caregiver but not teacher report. The preliminary evidence supports the need to intervene early to manage an often recurring depressive illness.

The final critical evaluation considers the research process undertaken in both the systematic review and empirical study as well as the research enquiry as a whole. Future research directions and implications for theory, policy, clinical practice and service development are discussed.

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Manuscript prepared in accordance with the guidance for

'European Child and Adolescent Psychiatry'.

The guidelines for authors can be found in Appendix A[1]

[1] Appendices included for the purpose of thesis and removed for journal submission

Abstract

Maternal depression is associated with adverse child outcomes including antisocial behaviour (ASB). Prospective longitudinal studies have focused on the timing (e.g., antenatal, postnatal and later) and recurrence of maternal depression as a way to further delineate the association and mechanisms of the effect. Longitudinal studies, examining maternal depression during pregnancy and beyond, provide the opportunity to examine the independent and cumulative effects of exposure. The objective of this systematic review was to synthesise and evaluate the findings of longitudinal studies of maternal depression and offspring antisocial behaviour. Three databases were searched (Psychinfo, Web of Science, Medline) from the period of January 1900 to December 2017. Twenty of 5936 studies met the inclusion criteria. Study quality was assessed by two reviewers using the Critical Appraisal Skills Programme [1] criteria, and disagreements resolved by consensus. Data extraction was conducted by one reviewer using a form designed for the purposes of the current study. Overall, the findings indicated significant, independent effects of exposure to maternal depression during pregnancy, postnatal depression and exposure to maternal depression after the perinatal period on child antisocial outcomes. The few studies that examined the effect of cumulative exposure to depression found a significant effect on child behaviour. Several limitations in the literature were identified, including a reliance on maternal reports for both depression and child outcomes and a limited conceptualisation of the ASB construct. Nevertheless, the findings point to the importance of early and also continued monitoring and intervention for mothers and their children.

Keywords; *Maternal depression; antenatal; postnatal; longitudinal; child antisocial behaviour.*

Introduction

Maternal depression is recurrent and particularly common in the childbearing years; affecting mothers during pregnancy and the postnatal period with a prevalence ranging from 8% -13% [2-3]. The importance of maternal mental health and the implications for children's development has gained increased recognition in recent years; guidelines in the United Kingdom (UK) have emphasised the importance of screening and improved intervention during the perinatal (pregnancy and early postnatal) period [4-6]. Interestingly, research that has examined maternal depression beyond the perinatal period show similar or even higher prevalence rates [7-9]. The impact of these recurring or new onset episodes on later child outcomes also require consideration [9].

Maternal depression has been associated with a range of adverse child outcomes including offspring antisocial behaviour. Antisocial behaviour in children is a serious public health concern; it incurs significant costs for society

and for the individuals involved who are at increased risk for substance use, chronic health problems and early mortality [10]; by examining early predictors of the behaviour it is hoped that more targeted and early intervention can be applied. Maternal depression in both the antenatal and postnatal period is associated with increased antisocial behaviour [11-15]; although debate exists as to whether effects are unique to these time periods or represent exposure to mother's lifelong episodic illness [e.g., 16]. Indeed, research on maternal depression and child psychopathology has turned its attention away from whether relationships exist to attempts to understand the specifics of the complex associations, including an examination of the potential mechanisms of the effect [17]. The timing of exposure to maternal depression is of interest as this provides an avenue through which to explore potential developmental mechanisms and also has implications for the appropriate intervention for mother and child [17].

Exposure to depression at different time points through a child's development is thought to exert effects via different mechanisms. For instance, depression during pregnancy is thought to influence the intra-uterine environment and foetal development, perhaps through higher levels of cortisol which affects the stress system of the developing child [15]. Postnatal depression, which has received the bulk of the research attention, is thought to lead to problems in children's development via negative maternal cognitions and the adverse impact on the mother-child relationship [18-19]. Research that examines depression beyond the perinatal period is rarer and there is less clear evidence on the extent to which depression that occurs after the postnatal period contributes an independent effect and/or whether cumulative exposure has an additive effect on children [9]. Furthermore, studies on later exposure have often been cross-sectional and have therefore not been able to control for the residual confounding of earlier exposure [15].

Longitudinal studies that examine maternal depression at multiple time points and begin during the pregnancy period are essential for examining the independent and cumulative effects of particular episodes and indeed the relative importance of specific periods. Longitudinal studies have found that antenatal depression and postnatal depression can have different effects on child and adolescent outcomes [20], others have demonstrated that perinatal depression predicts later child problems after controlling for the later effect of maternal depression [e.g. 21]; while others have found perinatal depression to be less important and stronger associations found for maternal depression in later childhood [22]. This emerging evidence on the complex relationships between exposure to antenatal, postnatal and later episodes of maternal depression and adverse offspring outcomes lacks cohesion; and while reviews exist on the relationship between maternal depression and child outcomes [e.g., 13, 15], there has been no systematic review of these emerging longitudinal studies that begin during the antenatal period.

Maternal depression has been associated with a range of adverse offspring outcomes with empirical studies and reviews often exploring and comparing a diverse set of outcomes. The present review seeks to focus in and examine the contribution of maternal depression to antisocial behaviour (ASB) in particular. ASB is a heterogeneous construct and the extent to which specific domains of ASB are implicated has not been given sufficient attention in these broader examinations of child outcomes. Indeed, ASB has been operationalised in diverse ways in the literature [23, 24]. Within empirical studies there is a tendency to use terminology related to the measures that are utilised; widely used questionnaires such as the Child Behaviour Checklist [25] refer to externalising behaviour/problems; another prominent approach is the examination of clinical diagnoses including Oppositional Defiant Disorder or Conduct Disorder; legal definitions such as delinquency are also relevant in older children. Also worthy of note here is the significant body of research that has focused on the presence of Callous-Unemotional traits (e.g., lack of guilt, remorse, shallow affect) as a way to identify a more severe and persistent subgroup of antisocial children [26, 27]. The aim of this systematic review is to be all encompassing through using the term ASB in the widest sense to capture evidence that incorporates any of these approaches to the measurement of offspring ASB.

More specifically, the aims of this systematic review were (i) to identify studies that have assessed maternal depression during the antenatal period and at least once following birth and examined the effect on child antisocial behaviour outcomes (ii) to evaluate whether these studies examine the independent and/or cumulative effects of antenatal, postnatal and subsequent episodes on child ASB and describe and synthesise the findings accordingly (iii) to describe the quality of the evidence found, consider study limitations and identify gaps in the existing evidence base (iv) describe the implications and make clinical, research and policy recommendations.

Method

The systematic review was conducted following recommendations outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols [PRISMA-P] statement [28]. The PRISMA guidelines include a flow diagram to guide inclusion and exclusion of research articles and provide a 27-item checklist outlining appropriate standards for conducting a review [28]. The methods of analysis and inclusion criteria were specified in advance and documented in a protocol submitted via a university proposal prior to commencing.

Inclusion and exclusion criteria

Studies were included if (i) the exposure was maternal depression during pregnancy and at least one episode following birth (ii) the outcome was a measure of child antisocial behaviour that was assessed at any age from birth onwards (iii) the study was published in English (iv) it was a longitudinal prospective quantitative study (v) the study was a primary study that was published between January 1900 and December 2017. Studies were excluded from this review if (i) maternal depression was part of a composite variable and could not be distinguished from anxiety measures or general stress (ii) the exposure was a pharmacological intervention for maternal depression (iii) it was an animal study (iv) they combined mother and father data into parent's depression. In addition, grey literature and any articles that focussed on the maternal effects of maternal depression rather than child outcomes were also excluded.

Definitions

Maternal depression; studies of depression that included both self-report questionnaires and diagnostic interviews were included. Depression measured at any time from the antenatal period onwards with the antenatal period defined as any time during pregnancy up until the birth of the child. For the *postnatal period* the review adopts the widely used timeframe from birth to 12 months post birth [8, 29]; episodes of depression outside of this time were referred to as later exposure. *Concurrent depression* refers to the assessment of depression at the same time as the child outcome. *Cumulative exposure* refers broadly to exposure to maternal depression at more than one time point and encompasses reference to terms such as recurrence, chronicity and persistence. These terms are defined and operationalised in diverse ways in the literature and will be referred to and defined if and when they occur.

Child antisocial behaviour; as noted child ASB is heterogeneous and it was important to encompass as many different operationalisations of this construct as possible as well as allow for the capture of early manifestations of this (e.g., difficult temperament, aggression). There is substantial comorbidity among childhood problems [13, 30] and many studies used symptom checklists that result in scores on both internalising and externalising disorders. The main focus of the review is on the externalising element, so the studies were included only if an externalising measure was incorporated. If a study combined these broadband constructs into a total behaviour problem score this was included also. As well as the broad externalising construct, symptom ratings of aggression, conduct problems, violence, delinquency, diagnoses of conduct disorder, and oppositional defiant disorder were included.

Developmental periods are operationalised in numerous ways in the literature but for the current study purposes were defined as early childhood (between 2 and 6 years old), middle childhood (between 6 and 9 years old), late childhood (9-12 years old; [e.g., 31].

Information sources and search strategy

The search strategy was developed in consultation with an experienced university librarian. Three electronic databases relevant to the research aims were searched; Medline, Psychinfo (OVID) and Web of Science. The search encompassed the period from January 1st 1900 to December 31st 2017.

The search terms utilised were a combination of database-specific index terms (e.g., postnatal depression, child development) and individual terms located in the title, abstract or key words. These terms were combined with the necessary Boolean (AND; OR) proximity (ADJ3 or NEAR/3) truncation (*) and phrasing (" ") operators. More specifically, the maternal depression terms used included ("maternal depress*" OR "antenatal depress*" OR "postnatal depress*" OR "perinatal depress*" OR "postnatal depress*" OR "postpartum depress*" OR "antepartum depress*") combined with the child terms (child* OR infant* OR adolescen* OR teen* OR toddler* OR baby OR babies OR youth OR offspring) ADJ3 (behaviour* OR behavior* OR development OR externalis* OR conduct problem* OR conduct disorder* OR psychopathology OR callous-unemotional OR maladjust* OR aggress* OR violen* OR anger* OR disruptive behaviour disorder* OR oppositional defiant disorder* OR emotion* OR cognit* OR youth offend* or juvenile delinquency OR antisocial.* Please see Appendix B for the exact search strategy with all terms used in the Psychinfo database search.

In addition, the ancestory method was used in which any relevant references listed in empirical articles or review articles were retrieved. It is likely that other relevant studies exist and were not identified, however it is argued that the scope of the search was suitable for identifying a representative sample of the relevant papers. Furthermore, PROSPERO (International prospective register of systematic reviews) was examined to assess if any similar reviews were currently registered to be undertaken; personal communication with two of the principal investigators of two proposed studies confirmed that the current review was suitably distinct.

The papers identified in each of the databases and other sources were imported and combined within the Mendeley Reference Management System which automatically removed the majority of duplicates; the remainder of the duplicates were removed manually. The titles and/or abstracts of each journal article was reviewed by one individual based on the a priori inclusion and exclusion criteria; those meeting the inclusion criteria were selected for full text evaluation.

Quality appraisal, data extraction, analysis, ethics

The selected full text articles were appraised based on study design, potential for selection bias, confounding variables, attrition, follow up, blinding and measures of exposures and outcomes. The Critical Appraisal Skills Programme (CASP) guidance [1] recommended for the appraisal of observational cohort research was used to systematically review the quality of the studies. The particular framework provides a tool for appraising cohort studies across 12 domains (and includes a series of questions in relation to each domain that can be responded with a yes/no/can't tell). In order to compare studies more readily, for each domain, a score of 2 was given for yes 'criteria met'; 1 for 'partially met'; and 0 for 'not met' and the scores summed to give a maximum quality score of 24. A qualitative descriptor was then provided based on the score, number of criteria met and the risk of bias (following the Scottish Intercollegiate Guidelines Network framework [32]). The following descriptors were used; "High Quality" = majority of criteria met; little or no risk of bias; results unlikely to be changed by further research (a score of 18-24). "Acceptable" = most criteria met; some flaws in the study with associated bias (a score of 12 – 17) and "Low quality" = either most criteria not met or significant flaws relating to key aspects of study design (below a score of 12).

The quality of the full text articles was assessed by two independent reviewers with experience in critical appraisal. Disagreement was resolved by coming to a consensus. Following accepted procedures [33], the reliability between the raters was assessed based on agreement of the qualitative descriptors (low; acceptable; high) for 10 studies. Percentage agreement was 80% (Kappa = 0.6). Please see Table 1 for a summary of the quality ratings for each study.

Data extraction was completed by the first author using a standardised data extraction form developed for the purposes of this review. The main data points extracted are provided in the summary Table 2 for the study characteristics and Table 3 for the study results. A descriptive (qualitative) analysis of the findings was planned and studies were also reviewed for the potential to conduct a meta-analytical review. This review was exempt from ethics review approval.

----------Insert Table 1 about here----------

Results

Overview of studies

5936 studies were identified by the search terms after removal of duplicates; with 159 articles downloaded for additional screening and 139 excluded due to not meeting the inclusion criteria. This resulted in 20 studies for inclusion in the systematic review. Reasons for exclusion included wrong exposure (including distress/anxiety rather than depression being measured; not assessing depression on more than one occasion; no antenatal measure of depression etc.); wrong outcome (not a measure of ASB as defined above); and also design and/or analysis not focussed on the examination of timing of depressive episodes (e.g., combining episodes into depressed or not; depression used as a mediator/moderator for other off topic analyses). Please see Figure 1 for the PRISMA flow diagram and details of this screening process. The list of excluded articles is available from the first author.

----------Insert Figure 1 about here----------

The key study characteristics extracted from the 20 studies are summarised in Table 2. The study publication dates ranged from 2000-2017; with the majority (n = 13 studies) being published in the last five years. Of the 20 included studies; eight developed countries were represented (United Kingdom, Australia, United States, Finland, Germany, France, Norway, Singapore). The studies identified examined 10 different cohorts; five papers were based on the Avon Longitudinal Study of Parents and Children (ALSPAC), a large cohort study in Bristol, England; while three came from the South London Child Development Study (SLCDS); three from the Finland Tampere longitudinal study.

Design

By nature of the inclusion criteria all included studies were prospective longitudinal designs, with one study also embedded within a larger randomised controlled trial [34]. The families were followed longitudinally with the shortest follow up when the offspring were 24 months and the longest when the offspring were 16-17 years old. More specifically, the majority of studies (n = 10) followed offspring to the early childhood period [9, 22, 34 -39, 42, 44]; just 3 studies followed until the middle childhood period [40, 41, 43]; those going on beyond the middle childhood period tended to come from the same study cohorts; SLCDS [20, 21, 24], Finland studies; [45, 46] and ALPSAC studies [47, 48].

Participants

The studies had a wide range of sample sizes, ranging from 120 to 14,541 mothers recruited (median = 792 mothers). All studies included community samples, with mothers recruited during pregnancy from hospitals, antenatal clinics or via medical records. Mostly the mothers were white, partnered and middle class and the samples generally represented the population from which they were drawn (where the features could be extracted). There were some notable exceptions, with one study specifically recruiting young African American women [35]. Eleven studies reported the mother's mean age at birth of child; this ranged from 18.3yrs [35] to 32.8yrs [41].

Measures

Exposure: Maternal depression

The majority of studies used self-report questionnaires to assess for depression in mothers (n = 17 studies). The most frequently used (n = 11 studies) measure of maternal depression was the Edinburgh Postnatal Depression Scale [49], a 10 item self-report measure that has been validated for use in the antenatal and postnatal period [49, 50]. The other predominantly used self-report measure (n = 4 studies) was the Centre for Epidemiological Studies depression scale, a validated [e.g. 51, 52], 20 item, self-report scale. Less well validated measures were also infrequently used; the Delusions-Symptoms State Inventory [53] used by Brennan et al. [22] and the short form Symptom Checklist [54] used by Gjerde et al. [36]. In contrast to the use of self-report measures, three articles from one cohort (SLCDS) used standardised diagnostic interviews to assess depression and also used GPs/psychiatrists to interview and/or confirm the final diagnosis [20, 21, 24].

In terms of the timing of the assessment of depression; in the antenatal period assessments were conducted throughout the duration of pregnancy (earliest 14 weeks to the latest 36 weeks). Twelve studies examined depression once during pregnancy; seven studies examined depression twice during pregnancy. The Finnish PREDO cohort study [42] measured depression biweekly through pregnancy up to a total of 14 times.

Seven articles measured depression post birth on only one occasion; while the remainder ranged from 2 to 5 follow up assessments. Four studies measured in the postnatal period only [34, 37-39]; 5 studies examined in the later period only [35, 40, 41, 42, 44]; while 11 studies examined in both the postnatal and later period [9, 20, 21, 22, 24, 36, 43, 45, 46, 47, 48].

Outcomes: Child antisocial behaviour

All studies used maternal report to examine child outcomes; these were supplemented with additional informants in a limited number of studies. For instance, teacher report was used in a small number of studies i.e. Barker et al. [40] Hay et al. [24] ; Leis et al. [47] and older children also reported on their own behaviour in certain studies (in The Finnish studies; Korhonen et al. [45] and Korhonen et al. [46] and the SLCDS; Hay et al. [20, 21, 24]. Self-report questionnaires were used in the majority of cases (n = 16) and diagnostic interviews in much fewer studies (n = 4).

Of the questionnaire measures, the Child Behaviour Checklist (CBCL; [25]) was the most frequently used (n = 7). The CBCL contains externalising scales (which contains social problems, rule breaking behaviour and aggressive behaviour scales) and internalising scales which were also examined in the majority of cases (n = 6). Other measures included; The Brief Infant Toddler Social Emotional Assessment [55]; Antisocial Symptom Questionnaire [56]; the Rutter Revised Preschool Scales [57]; the Strengths and Difficulties Questionnaire [58] and the Youth Self-Report [59]. These measures tended to examine scales of externalising behaviour and also create diagnostic categories of Disruptive Behaviour Disorders (i.e., Conduct disorder; Oppositional Defiant Disorder). Four studies combined what are typically considered internalising and externalising behaviours into one total problem score (Brennan et al. [22]; Hannington et al. [37]; O'Connor et al. [38] Woolhouse et al. [9]), rather than looking at these constructs independently.

The SLCD studies [20, 21, 24] used a notably different approach for the assessment of antisocial behaviour, using a comprehensive diagnostic interview; The Child and Adolescent Psychiatric Assessment [CAPA; 60]. The CAPA was administered by trained assistants and generates clinical diagnoses of Disruptive Behaviour Disorders. The authors in one study [24] also combined items to construct a composite measure in an attempt to assess different aspects of the ASB construct, including the assessment of serious violent behaviour as opposed to normal range aggression or global externalising problems. Furthermore, Hay et al. [21] used police reports of arrests and violent arrests to create the dependent variable.

Summary of quality of studies

Table 1 shows the quality ratings given for each of the articles. The lowest score given was 12 and the highest was 20 out of 24. All were considered acceptable with 11 studies rated as high quality (a quality rating of 18 and above). All were longitudinal studies (given the nature of the inclusion criteria) and as such were generally well resourced and incorporating a powerful design that allowed for complex analyses including mediation analyses.

Furthermore, they included multiple assessment points and good follow up periods. Common limitations were those associated with longitudinal designs including the significant attrition that was not always random and the non- representativeness of the samples which sometimes made generalisation difficult [e.g., 34, 36]. Furthermore, the self-report nature of the majority of maternal depression measures reduced quality as this impacted on objectivity scores. Most measures were rated as valid and reliable although there were some exceptions which reduced the quality of those studies [e.g., 22]. In most cases mothers reported on their own behaviour and their children's behaviour and this limited the objectivity of the assessments and increased the risk of shared method variance.

Main findings and synthesis

All 20 studies reported significant associations between maternal depression assessed on at least one time point and child antisocial behaviour outcomes.

Association between antenatal depression and child outcomes

14 of 20 studies demonstrated significant associations between antenatal depression and child behavioural outcomes (one study used antenatal depression as a control measure and did not explore the independent effects [24]. The associations remained significant while taking later measures of maternal depression into consideration as well as other covariates (using different statistical and conceptual approaches). One study [36] found that after adjusting for confounds and rigid control for shared genetic variance, that the association between antenatal depression and externalising behaviour was no longer significant. In general, there did not appear to be clear distinctions between those studies that found an effect of antenatal depression versus those that did not, although there was a trend for those studies that failed to find an association to use more global measures of child outcomes that combined behavioural and emotional subscales.

More specifically, five studies did not find significant associations for antenatal depression and child ASB. Firstly, Brennan et al. [22] found that problem scores were higher for children whose mothers were depressed only at 6 months postpartum, or at 5 years (compared to those during pregnancy or at birth); the measure used to assess maternal depression in this study was brief and not well established. In addition, this study was rated as of relatively lower quality in comparison to a number of the studies (score of 14 out of 24). Similarly, Woolhouse et al. [9] found that depression in pregnancy was not significantly associated with behaviour problems (although combined pre and early postnatal i.e. perinatal was associated). Furthermore, O'Connor et al. [17] also failed to find an association between antenatal depression and child outcomes in early childhood (while antenatal anxiety

was associated). All three of these studies [i.e. 9, 17, 22] used combined measures of behaviour problems that included aspects of emotional problems (rather than a distinct or 'pure' measure of antisocial behaviour).

In a contrasting approach, Van de Waerden et al. [44] identified five trajectories of maternal symptoms of depression (no symptoms; persistent intermediate level symptoms; persistent high symptoms; high symptoms in pregnancy only; high symptoms in preschool only). Linear regression analyses exploring the relationships between the trajectories and behaviour problems showed that the persistent types (across all periods) showed increased behaviour problems. In addition, the offspring exposed to maternal depression during the preschool years only (but not pregnancy only) displayed elevated behaviour problems. Finally, Hay et al. [20] found that antenatal depression did not predict disruptive behaviour disorders in older children during the adolescent period and only cumulative exposure to depression beyond 3 months postpartum was predictive.

The findings on the relation between antenatal depression and subsequent exposure to depression and child behaviour are complicated by a diverse range of statistical analyses that have slightly different underlying principles. Certain studies [e.g. 40] controlled for postnatal or later depression statistically (e.g., in regression models) showing the independent effects of maternal depression at specific time points. Others explored postnatal and later depression as a mediator of antenatal depression and child outcomes. For instance, Edwards and Hans [35] demonstrated that the association between antenatal depression and behaviour problems at age 24 months was mediated by maternal sensitivity and maternal depressive symptoms at age 24 months.

Overall, the evidence appears to suggest a significant association between antenatal depression and child antisocial behaviour outcomes that remains significant when subsequent episodes of depression are taken into consideration. The 14 studies that found an association included outcomes of children across early childhood, middle childhood and later periods.

Association between postnatal and later depression and child outcomes

Postnatal Depression

In summary, 15 studies examined depression in the postnatal period (up until 12 months postpartum). Two studies did not report direct associations and used postnatal depression as a control variable in the examination of the effects of antenatal depression [47, 48]. Six of the 13 studies [9, 20, 21, 36, 43, 45] did not find significant associations, while 7 of the 13 studies found significant associations with child behavioural problems [22, 24, 34, 37, 38, 39, 46]. There were no clear distinctions in methodology between these studies (including age of the child at follow up). Of those that found significant associations, three controlled for earlier antenatal depression. For

instance, Hay et al. [24] showed that child violence at 11 years old was predicted by the mother's postnatal depression at three months even when antenatal, later depression and family characteristics were taken into account. Soe et al. [39] demonstrated that postnatal symptoms at 3 months independently predicted externalising behaviour (CBCL) at 24 months. Finally, O'Connor et al. [38], showed that 8 week postnatal depression remained a significant predictor of externalising behaviour (SDQ measure) at 47 months after controlling for antenatal maternal mood.

Later Depression

Of the 16 studies that examined later episodes of depression (beyond the postnatal period), 11 found significant associations with child behaviour outcomes [9, 22, 24, 35, 36, 40, 42, 43, 44, 45, 46]. Four studies did not report the findings of the later depression and were used as control measures and/or were bound up in cumulative variables [20, 21, 47, 48]. Therefore, just one study by Eichler et al. [41] clearly found a non-significant association between later depression and antisocial behaviour (in children between 6-9 years old), although it was predictive of child anxiety. As noted a number of studies found that later depression mediated the effects of antenatal depression but also added independent effects [35, 42]. Many of the studies used a measure of concurrent depression at the time of assessing child antisocial behaviour. The studies tended to use concurrent depression as a control measure in other analyses or did not look at the independent effect without the contribution of earlier episodes. In exceptions to this; Woolhouse et al. [9] examined the independent effect of concurrently measured depression (at 4 years old) and found it to be associated with child problems when perinatal (both antenatal and postnatal) depression was controlled for. In another study, when all covariates and perinatal episodes of depression were taken into consideration, concurrent depression (at age 5 years) remained the only significant predictor of child behaviour [36].

Postnatal and Later Depression

There were 11 studies that included both a postnatal and later depression measure which therefore potentially permitted the assessment of whether postnatal depression was a significant predictor while taking later episodes into consideration. Three studies revealed significant findings for postnatal depression [22, 24, 46] and of these, 2 demonstrated that postnatal depression remained significant when later episodes of depression were taken into consideration [24, 46]. As noted previously, Hay et al. [24] found that child violence was predicted by the mother's postnatal depression (at 3 months) even when depression during pregnancy, her later history of depression and family characteristics were taken into account. Korhonen et al. [46] found depressive symptoms (at 2 months

postnatal) was associated with externalizing symptoms which remained significant after controlling for concurrent depression.

Cumulative exposure to depression and child outcomes

Nine studies permitted the extraction of information related to cumulative exposure to maternal depression [9, 20, 22, 24, 45, 46, 42, 43, 44]. Variables related to cumulative depression were termed, defined and operationalised in diverse ways making comparison difficult. However, the evidence pointed towards mothers experiencing depression on multiple occasions and that this increased exposure resulted in increased difficulties for children. In some studies increased exposure was shown to be more important than the timing of depression. Certain studies combined just a measure of antenatal and postnatal depression and found that combined episodes resulted in increased difficulties. For instance, Lahti et al. [42] found that in particular having both pre and postnatal depression was associated with more problems. Woolhouse et al. [9] similarly found that depression both in pregnancy and postnatally combined to be associated with increased difficulties (rather than either period alone).

Other studies examined multiple episodes over a longer period; for instance Brennan et al. [22] used the term chronicity which was defined as the number of administrations (range 0-4) of the depression measure that the mother reported moderate/severe levels of depression. 'Chronicity' of maternal depressive symptoms as they termed it was associated with more behaviour problems (combined emotional and behaviour problems) and was found to be more important than the timing of episodes in predicting problems. Korhonen et al. [45] used different definitions for recurrent (referring to the number of administrations of the measure that mothers exceeded cut off) and chronicity (pattern of symptoms using trajectory analysis) and found in combined analyses that recurrent maternal depressive symptoms best explained adolescents' internalizing problems while the chronic pattern of maternal depressive symptoms best explained externalizing problems.

Luoma et al. [43] found that recurrent maternal depression (symptomatic on at least two occasions) was associated with the least favourable outcomes. Hay et al. [20] found that the relationship between maternal depression and Disruptive Behaviour Disorders was explained by the extent of exposure to depression post 3 months (again created by adding the number of time periods together that the children were exposed). Another approach to the examination of chronicity/recurrence is to use trajectory analysis; van de Waerden [44] found that compared with children whose mothers were never depressed, children whose mothers were in the "persistent high" or "persistent intermediate" symptom trajectory groups had increased levels of emotional and behavioural difficulties.

Mechanisms

The majority of studies focussed on exploring how depression at different time points contribute to (including mediate) the association between earlier depression and later outcomes. Only two studies explored additional possible mediators of the association [35, 37]. Edwards and Hans [35] found that the association between antenatal depression and toddler behaviour problems was mediated by maternal sensitivity as well as maternal depressive symptoms at 24 months. In another study marital conflict partially mediated the relationship between postnatal depression in both mothers and fathers and child outcomes. Parental depression (maternal and paternal) and marital conflict in the antenatal period were both associated with increased offspring anti-social behaviour which persisted even when postnatal stresses (postnatal depression and conflict) were taken into account [37].

Gender Differences

The majority of studies found similar patterns across boys and girls in initial analyses and so combined the results and controlled/adjusted for gender statistically in the analyses (rather than exploring separately). There were a few exceptions to this and these studies generally found boys to be more vulnerable to the effects of maternal depression. For instance, Edwards and Hans [35] found that associations between antenatal depressive symptoms, maternal sensitivity, and behaviour problems (combined emotional and behaviour) were especially strong among boys. Korhonen et al. [46] found sex differences depended on timing; maternal concurrent depressive symptoms were associated with adolescent behavioural and emotional problems in both genders, whereas maternal antenatal and postnatal depressive symptoms were associated with externalizing problems for boys only. In contrast, Hay et al. [21] did not find gender differences in their analyses on the impact of antenatal or cumulative exposure to maternal depression and the increased risk of offspring antisocial behaviour.

Discussion

The objectives of this review included the identification, evaluation and synthesis of longitudinal studies that examined maternal depression both during pregnancy and at least once following the birth of the child and offspring antisocial behaviour. Particularly with the aim of exploring the effect of timing of exposure and cumulative exposure to maternal depressive episodes. Twenty studies met the inclusion criteria and were systematically reviewed. All studies were rated as acceptable or of high quality and therefore appear to present convincing evidence for an association between exposure to maternal depression and increased offspring antisocial behaviour. In terms of timing and cumulative exposure to mother's depression, there was evidence that

antenatal, postnatal and later episodes of depression were all predictive of antisocial outcomes as well as evidence for the importance of cumulative exposure to maternal depression.

Nevertheless, the results of individual studies were highly varied, using diverse analytical approaches and not all studies explored the independent effects of different episodes. A particular time period of depression did not emerge as relatively more important in the prediction of child outcomes, although this was difficult to ascertain given the small number of studies. In addition, there were methodological and conceptual limitations to the studies and it will be argued that further research is required to disentangle the complex associations between maternal depression and offspring antisocial behaviour.

As noted, many of the studies came from the same larger cohorts with just 10 cohorts identified in total. Although it is likely that additional studies exist and were not included in this synthesis, this remains a relatively small number of longitudinal studies exploring the important associations between maternal depression and child ASB. The ALSPAC and SLCDS cohorts dominated the review findings and both are from England and therefore may not be generalizable to other countries. With the ALSPAC cohort in particular there was significant attrition and the subsamples used may not be representative and again this impacts on generalisability.

In addition, a significant limitation of this research in general is that mothers reported on both their own depressive symptoms and their child's problems with few studies supplementing with additional informants or using more objective assessment measures (e.g., diagnostic interviews). The mother reporting on both the independent and dependent variable could artificially inflate effect sizes. There is some evidence that depressed and/or anxious mothers have less accurate perceptions of their child's difficulties and may over report difficulties [e.g., 61, 62, 63]. Nevertheless, other evidence suggests that the associations remain independent of the effects of maternal depression on maternal reporting errors [61, 63]. Given the complex picture, studies that include multiple informants on child behaviour and more objective diagnostic interviews would strengthen the literature base and clarify the picture further.

Another limitation of the studies found is that most examined child outcomes up until early childhood with fewer going beyond this period and therefore there is a need to assess the extent to which the findings persist into middle to late childhood and adolescence. Furthermore, it is also important to note that despite the range of different measures of antisocial behaviour used there were few that went beyond looking at broadband constructs such as externalising problems or disruptive behaviour disorders. A small number combined typically considered internalising and externalising problems into one total score which could conceal important effects unique to ASB.

Most studies did not look at the subtleties of ASB and the different domains within the construct. ASB is a heterogeneous construct and attempts have been made to examine subgroups that may have different underlying causal pathways. The use of varied conceptualisations of ASB would be useful to more fully explore the association with maternal depression.

Furthermore, depression is also heterogeneous and the review has not examined factors such as the severity and duration of symptoms which are likely to influence outcomes in different ways [22]. Indeed a difficulty in the literature in general is disentangling these factors which are likely to be correlated and have differential impact. The studies included in this review generally allowed us to explore the recurrence of episodes; the studies had large and varying periods of time between assessment points and we cannot be sure on the duration of the child's exposure to symptoms of maternal depression between those time points.

The evidence from the review suggests that there are independent effects of different maternal episodes. It is not within the scope of this review to disentangle the highly complex potential causal pathways of the effects; the effects of the antenatal period may imply biological pathways affecting the foetus directly; the postnatal period may influence mother-child relations as well as later episodes having a negative impact on child socialisation and relationship development [9, 22, 45]. Longitudinal designs are powerful designs that allow pathways to be examined, but correlation does not imply causation and the studies cannot assess the causal relations between maternal depression and child antisocial behaviour. The effects likely reflect a multifactorial process that include biological and genetic mechanisms, factors such as stress, parent-child relations, as well as bidirectional relationships [22]. However, what is clear is the vulnerability of depressed mothers and their children and therefore the need for support and intervention [9].

It must also be noted that this review focussed specifically on the relationship between maternal depression and child antisocial behaviour so that the complex associations between the constructs could be examined; however, the wider literature shows that maternal depression is associated with a range of emotional and behavioural outcomes in children, not only antisocial behaviour [e.g. 13]. It would be interesting to examine the extent to which these findings replicate for associations with emotional problems and whether particular time periods of maternal depression differentially relate to different child outcomes. For instance, there is some evidence that antenatal depression is more consistently associated with antisocial behaviour than emotional or cognitive outcomes [e.g., 15] and this may imply a biological contribution.

Strengths and limitations of the systematic review

The findings of the review are the result of a rigorous, systematic attempt to synthesise a large body of research; systematic criteria (i.e. PRISMA) were used to identify studies and a quality assessment tool was used to critically appraise the studies. Nonetheless, the findings must be considered in view of a number of limitations; only English articles were included therefore running the risk that important articles published in other languages may have been missed. Unfortunately, a quantitative synthesis of the papers was not possible because of the diversity of offspring outcomes. Furthermore, although an independent reviewer was able to examine the full texts for quality, limited resources permitted another reviewer from independently reviewing, selecting articles and extracting the necessary information.

Future direction and recommendations

Several recommendations relating to research, clinical practice, and policy development arise from this systematic review.

Research recommendations

As alluded to, further research is required that includes multiple informants on the measures of interest rather than the mother as sole informant on the child's behaviour. In addition, more objective observable measures of ASB as well as maternal depression would be a useful addition to research in this area. Furthermore, an exploration of mechanisms of effect would also increase understanding and point to potential avenues for intervention. Finally, ASB is heterogeneous and although in the wider literature it has been explored in diverse ways this has not transferred into the literature exploring maternal depression over time. Future research should attempt to explore how maternal depression at different time points relates to different aspects of antisocial behaviour as this may facilitate the development of more targeted and effective interventions.

Clinical/Policy recommendations

The evidence from this review convincingly demonstrates that maternal depression at each stage of motherhood has an impact on child development and this begins early from at least the antenatal period. Antenatal maternal depression has adverse outcomes on children that persist even into adolescence and even when other episodes and covariates are taken into account [e.g., 49]. We also know that intervention for child antisocial behaviour is often ineffective in later years and early intervention is imperative [64]. The findings from the review provide further support for early detection of difficulties and intervention for both mothers and their children. This is consistent

with NICE guidance [65] for antenatal and postnatal mental health that argues for early detection and management of mental health during pregnancy and in the first year postnatally. Many women still do not have access to perinatal mental health services with a cost of an estimated £8.1 billion for each one-year cohort of births in the UK to the public sector [4]. This review provides additional support for the importance of providing services during this time.

Interestingly, the findings also advocate for the importance of continued monitoring and support for mothers and their children beyond the perinatal period. There were independent associations between maternal depression and child antisocial behaviour beyond the first year of life and some studies find higher rates of depression outside of the perinatal period [9]. Woolhouse et al. [8, 9] argue for the rethinking of current policy frameworks as many women may fall through the gaps as they do not reconnect with mental health services beyond the perinatal period. Finally, the evidence also suggests that for some women depression is recurrent and this cumulative exposure is problematic for children. Unfortunately, it is not clear to what extent mothers in these studies had received treatment for depression during the perinatal period, nevertheless the evidence would suggest that some mothers need intervention early specifically on how to manage chronic illness rather than advice on short term reduction of their current difficulties [20].

Conclusions

The evidence that exists suggests that maternal antenatal depression, postnatal depression and depression beyond the perinatal period is associated with increased rates of offspring antisocial behaviour. Nevertheless, the studies that are able to investigate this are small in number and limited in a number of respects including being based on the same cohorts, limited by shared method variance and examining a relatively narrow conceptualisation of the ASB construct. Further research is required that seeks to improve on methodological limitations and assess whether replication is possible.

The authors declare that they have no conflict of interest

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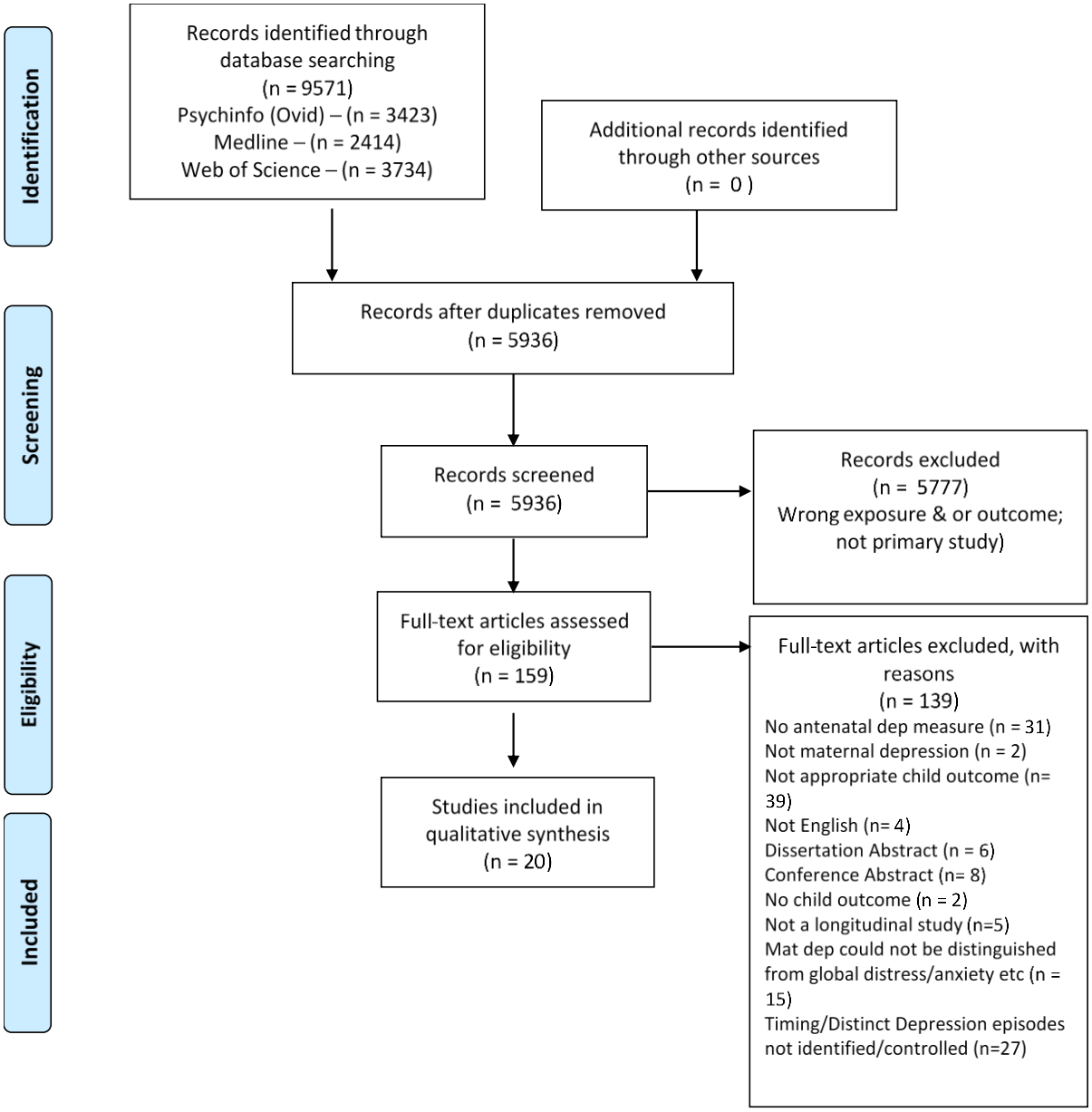

Figure 1. PRISMA flow chart

Table 1. CASP Quality Ratings (n = 20)

	Barker et al. (2011)	Brennan et al. (2000)	Edwards & Hans (2016)	Eichler et al. (2017)	Gjerde et al. (2017)	Hannington et al. (2012)	Hay et al. (2003)	Hay et al. (2010)	Hay et al. (2008)	Korhonen et al. (2012)	korhonen et al. (2014)	lahti et al. (2012)	Leis et al. (2014)	Luoma et al. (2001)	O'connor et al. (2002)	O'Donnell et al. (2014)	Raskin et al. (2016)	Soe et al. (2016)	van de Waerden et al. (2015)	Woolhouse et al. (2016)
Ref No:	**40**	**22**	**35**	**41**	**36**	**37**	**24**	**21**	**20**	**47**	**46**	**42**	**48**	**43**	**17**	**49**	**34**	**39**	**45**	**9**
1. Did the study address a clearly focused issue? In terms of…	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Is the population studied clear?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Are the factors studied clear?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Are the outcomes clear?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2. Was the cohort recruited in an acceptable way? (selection bias)	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1
Was the cohort representative of a defined population?	P	P	N	N	P	P	Y	Y	Y	P	P	P	P	P	P	Y	N	P	P	P
Was everybody included who should have been included?	P	N	P	P	N	P	P	P	P	P	P	P	P	P	P	P	N	N	N	N
3. Was the exposure accurately measured to minimise bias?	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Did they use objective measurements?	N	N	N	N	N	N	P	P	P	P	P	P	P	P	N	P	N	N	N	N
Do the measurements truly reflect what you want them to?	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4. Was the outcome accurately measured to minimise bias?	1	1	1	0	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1
Did they use objective measurements?	P	P	P	P	P	P	Y	Y	Y	P	P	P	P	P	N	P	N	N	N	N
Do they measures truly reflect what you want them to	Y	P	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	P	Y	Y	Y
Was there blinding to exposure?	N	N	N	N	N	N	P	Y	Y	P	P	P	P	P	?	P	N	N	P	P
5. Have the authors identified all important confounding factors?	2	2	1	0	2	2	2	2	2	0	0	2	2	1	1	2	1	2	2	2

Have they taken into account the confounding factors in design/ analysis?	Y	Y	P	P	Y	Y	Y	Y	Y	N	N	Y	Y	P	P	Y	P	Y	Y	Y
6. Was the follow up of subjects complete enough?	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Was the follow up of subjects long enough?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
7. What are the results of the study? Are they reported clearly?	2	2	1	1	2	2	2	2	2	1	2	2	2	2	1	1	1	2	2	2
Have they reported the rate or the proportion between exposed	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
8. How precise are the results?	1	2	1	1	2	2	1	1	2	2	2	2	1	2	2	1	1	1	2	2
Were confidence intervals given?	N	Y	N	Y	Y	Y	N	N	Y	Y	Y	Y	N	Y	Y	N	N	N	Y	Y
9. Do you believe the results?	2	1	2	1	2	2	2	2	2	1	1	2	2	2	2	2	1	1	2	2
Could it be due to bias, chance or confounding?	N	P	N	P	N	N	N	N	N	P	P	N	N	N	P	N	N	N	N	N
Are the design/methods of this study flawed to make the results unreliable?	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
10. Can the results be applied to the local population?	2	0	0	0	1	2	2	1	1	1	1	1	1	1	1	1	0	0	1	1
Was the cohort the appropriate method?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
11. Do the results of this study fit with other available evidence?	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	0	2	1
12. Implications of this study for practice? Are they justified?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overall Score	19	14	14	12	18	20	19	19	20	15	16	19	18	18	17	17	12	13	19	18
Qualitative Descriptor (0 unacceptable; + acceptable; ++ High Quality)	++	+	+	+	++	++	++	++	++	+	+	++	++	++	+	+	+	+	++	++

Notes: **The main questions in bold are the 1-12 coloured in grey (score 0 = criterion not met, 1 = mixed evidence, 2 = criterion met). The questions coloured in white are prompts to the main questions to aid scoring (y = yes; n = no; p = partial).**

Table 2. Study Characteristics (n =20)

Study	Location & Study	Participants	Mean maternal age	Measures (Mother/Child) (Timing of administration)	Tests of gender
(Barker, Jaffee, Uher, & Maughan, 2011) **Ref:40**	England ALSPAC	3,298 mothers	During pregnancy = 28 yrs	**Mothers:** **Prenatal:** Mother report, EPDS, 32 weeks **Postnatal**: None **Later**: Mother report, EPDS, 1.5 years **Child:** Parent and teacher report, DAWBA, Externalizing disorders (CD; ODD; ADHD), **7 years 8 years.**	**No**
(Brennan et al., 2000) **Ref:22**	Australia	4,953 mothers 92% Caucasian	At birth = 25.4 yrs	**Mothers:** **Prenatal:** Mother report, seven items of Delusions-Symptoms-States Inventory, pregnancy **Postnatal**: Mother report, seven items of Delusions-Symptoms-States Inventory, 3-4 days after birth, 6 months **Later:** Mother report, seven items of Delusions-Symptoms-States Inventory, 5 yrs. **Child:** Mother report, CBCL, total behaviour problems (aggression, oppositional behaviour, hyperactivity, anxiety, withdrawal, and depression), **5 yrs.**	**No**
(Edwards & Hans, 2016) **Ref:35**	United States	196 mothers Low income All African American	At birth = 18.3yrs	**Mother:** **Prenatal**: Mother's report, CES -Depression Scale. during pregnancy (not specified which trimester) **Postnatal**: None **Later:** Mother's report, CES -Depression Scale, 24 months **Child:** Mother report on BITSEA – Toddler behaviour problems (internalizing, externalizing, dysregulation, atypical behaviours, and maladaptive behaviours), **24 months.**	**Yes** boys more susceptible to effects of mat sensitivity.
(Eichler et al., 2017) **Ref:41**	Germany Franconian Cognition and Emotion Studies	204 mothers	At birth = 32.8yrs	**Mother** **Prenatal**: Mother report, EPDS, third trimester **Postnatal**: None **Later**: Mother report, EPDS, 6-9 years **Child:** Mother report, Antisocial behaviour symptoms questionnaire, items of the diagnostic system for psychiatric disorders ICD-10 , **6-9yrs.**	Yes More significant for boys than for girls.

(Gjerde et al., 2017) **Ref:36**	Norway Norwegian Mother and Child Cohort Study(Mo Ba)	11,599 mothers	-	**Mother**: **Prenatal:** Mother report on depression, short form of the SCL,17 wks, 30 wks **Postnatal:** Mother report on depression, short form of the SCL, 6 months **Later**: Mother report on depression, short form of the SCL, 1.5, 3 and 5 yrs **Child**: Mother report on CBCL (internalizing and externalizing scales) **1.5, 3, 5 yrs.**	No
(Hanington, Heron, Stein, & Ramchandani, 2012) **Ref:37**	England ALSPAC	14,541 mothers 97.4% white; 50.6% skilled workers.	-	**Mother**: **Prenatal:** Mother completed the EPDS 2nd trimester **Postnatal:** Mother completed the EPDS, 8 months **Later:** None **Child**: Mother report on Rutter Revised pre-school scales (emotional, conduct, and total problems) **42 months.**	No
(Hay, Pawlby, Angold, Harold, & Sharp, 2003) **Ref:24**	England SCLDS	122 mothers 72% White British; 89%working class	At birth = 25.8yrs	**Mother:** **Prenatal:** Trained doctors conducted the Clinical Interview Schedule, 14 wks, 36 wks **Postnatal:** CIS at 3months, 1 year **Later:** Trained research assistants administered Schedule for Affective Disorders and Schizophrenia at 4 yrs, 11 yrs **Child**: Mother, teachers and children reported on violent symptoms using SDQ, research assistants conducted the CAPA with mother's at aged **11 yrs.**	Yes
(Hay, Pawlby, Waters, Perra, & Sharp, 2010) **Ref:21**	England SCLDS	120 mothers 65% married at birth; 88% working class; 72% white	At birth = 26.7yrs	**Mothers:** **Prenatal:** Two doctors interviewed mothers using the Clinical Interview Schedule to generate ICD-9 diagnoses of depression at 14 wks, 20 wks, 36 wks. **Postnatal**: Two doctors interviewed mothers using the CIS at 3 months, 12 months. **Later:** Researchers in consultation with the lead psychiatrist in the team interviewed mothers using the Schedule of Affective Disorders and Schizophrenia at 4, 11, 16 years. **Child:** Parent's interviewed separately using the CAPA. Police report on arrests **11 yrs, 16 years.**	No no sex differences in ASB so whole sample analysed

(Hay, Pawlby, Waters, & Sharp, 2008) **Ref:20**	England SLCDS	121 mothers 64% married; 88% working class.	At birth = 26.2yrs	**Mother:** **Prenatal:** GPs interviewed mothers, using the CIS, 14-20 wks, 36 wks **Postnatal:** GPs interviewed mothers using CIS, 3 months, 12 months **Later**: Mother's interviewed using the Schedule of Affective Disorders and Schizophrenia at 4, 11, 16 years **Child**: Parents and children interviewed separately using the CAPA, **11 yrs and 16 yrs.**	Yes
(Korhonen, Luoma, Salmelin, & Tamminen, 2012) **Ref: 46**	Tampere, Finland	191 mothers 82% married; 59% upper class	At latest assessment = 44 yrs.	**Mother:** **Prenatal:** Mother report, EPDS, last trimester **Postnatal:** Mother report, EPDS, 2 months **Later:** Mother report, EPDS, 16-17 yrs old **Child:** Mother reported , CBCL; Adolescents completed YSR, **16-17 yrs.**	Yes
(Korhonen, Luoma, Salmelin, & Tamminen, 2014) **Ref: 45**	Tampere, Finland	191 mothers 82% married; 59% upper social status	At latest assessment = 44 years.	**Mother:** **Prenatal:** Mother report, Finnish translation of EPDS, last trimester **Postnatal:** Mother report, EPDS, 1 week, 2 months, 6 months **Later:** Mother report, EPDS, 4-5 years, 8-9 years, **16-17 yrs old** **Child:** Mother reported, CBCL; Adolescents completed the YSR, **16-17 yrs.**	No
(Lahti et al., 2017) **Ref:42**	Finland Prediction of Preeclampsia (PREDO)	2296 mothers	At birth = 31.9 years	**Mother:** **Prenatal**; Mother report on the CES-Depression Scale, biweekly up to 14 times throughout pregnancy beginning 12 wks **Postnatal**: None **Later:** Mother report on the BDI (1.9-5.9yrs) **Child:** Mother report on the CBCL (**1.9-5.9yrs**)	No
(Leis, Heron, Stuart, & Tamar, 2014) **Ref:47**	England ALSPAC	2891 mothers 98.9% white 83.5% married 42.5% skilled non manual	At birth = 29.1ys	**Mother:** **Prenatal:** Mother report, EPDS at 8 wks, 32 wks **Postnatal:** Mother report, EPDS, 21 **Later:** Mother report, EPDS 33, 61, 73 months, 11 years **Child:** Mother and teacher report, SDQ, 11 years.	No

(Luoma et al., 2001) **Ref:43**	Finland	270 mothers	At last assessment = 37.4yrs	**Mother:** **Prenatal:** Mother report , using EPDS at late pregnancy **Postnatal:** Mother report using EPDS, 1 week, 2 months, 6 months **Later**: Mother report using EPDS, 8-9 yrs **Child:** Mother report, CBCL, 8-9 yrs	Yes
(O'Connor, Heron, & Glover, 2002) **Ref:38**	England ALSPAC	7442 mothers 45% first time mothers	During pregnancy 28 yrs.	**Mother** **Prenatal:** Mother report, EPDS, 18 wks, 32 wks **Postnatal**: Mother report, EPDS, 8 wks, 8 months **Later:** None **Child:** Parent report, SDQ (total scale), 47 months	Yes
(O'Donnell, Glover, Barker, & O'Connor, 2014) **Ref:48**	England ALSPAC	7944 mothers	At birth 28.22 yrs	**Mother:** **Prenatal:** Mother report, EPDS, 18 wks, 32 wks **Postnatal:** Mother report, EPDS, 8 wks, 33 months **Later:** Mother report, EPDS, 33 months **Child:** Mother report, SDQ, 4 yrs, 7 yrs, 9 yrs, 11.5 yrs, 13 yrs	Yes
(Raskin, et al., 2016) **Ref:34**	United States	400 mothers 35% White	At assessment = 18.46 yrs	**Mother:** **Prenatal:** Mother report, CES-D, pregnancy **Postnatal:** Mother report, CES-D, 12 months **Child:** Mother report, Brief Infant Toddler Social and Emotional Assessment, **2yrs.**	No
(Soe et al., 2016) **Ref:39**	Singapore GUSTO	258 mothers	-	**Mother:** **Prenatal:** Mother report, EPDS, 26 weeks. **Postnatal:** Mother report, EPDS, 3 months **Child:** Mother report, CBCL, 24 months	Yes
(van der Waerden et al., 2015) **Ref:44**	France EDEN	1183 mothers	Age at birth = 30.13yrs	**Mother:** **Prenatal:** Maternal reports, CES-depression, pregnancy **Postnatal**: Maternal reports, EPDS, 4 months, 8 months, 12 months **Later:** Maternal reports, CES-D, 3 yrs, 5 yrs	No

				Child: Maternal report, SDQ, 5 yrs.	
(Woolhouse, Gartland, Mensah, Giallo, & Brown, 2016) **Ref:9**	Australia	1507 60.7% married’	Age at birth = 30.9yrs	**Mother:** **Prenatal:** Mother report, EPDS, 15 weeks **Postnatal**: Mother report, EPDS, 3 months, 6 months, 12 months **Later**: Mother report, EPDS, , 4 years. **Child:** Mother report, SDQ, 4 yrs.	No

Notes: MD = Maternal Depression; Q= quality rating; EPDS = Edinburgh Postnatal Depression Scale; DAWBA = Development and Wellbeing Assessment; CBCL = Child Behaviour Checklist; CES= Centre for Epidemiological Studies-Depression Scale; CIS = Clinical Interview Schedule. SADS = Schedule for Affective Disorders and Schizophrenia: SCL = Symptom Checklist. SDQ = Strengths and Difficulties Questionnaire: CAPA = Child and Adolescent Psychiatric Assessment: YSR= Youth Self Report; BDI = Beck Depression Inventory. BITSEA = Brief Infant Toddler Social and Emotional Assessment. ALSPAC = Avon Longitudinal Study of Parents and Children: CD = conduct disorder; ODD = Oppositional Defiant Disorder; ADHD = Attention Deficit Hyperactivity Disorder.

Table 3. Study Results (n = 20)

Study	Covariates	Data Analysis	Primary results				Main limitations
			Prenatal Depression	**Postnatal Depression (Birth to 12 months)**	**Beyond Perinatal Depression (After 12 months)**	**Recurrence/ Chronicity/ Cumulative Exposure**	
(Barker, Jaffee, Uher, & Maughan, 2011) **Ref:40**	Maternal prenatal risk; cumulative score of SES; marital status; teenage mother; substance use; cigarette smoking; crime/trouble with police.	Single path analytic model	After controlling for prenatal anxiety, depression and risk factors; Prenatal MD (32 wks) independently predicted externalizing difficulties (β = .09) **(S)**	N/A	Later MD (1.5yrs) independently (of prenatal) predicted externalizing difficulties (β = .09) **(S**)	N/A	**Sample**: low rates of ethnic minorities. Substantial attrition over time. **Measures**: most measures based on maternal report. Self-report measures of depression. Depression not measured concurrently.
(Brennan et al., 2000) **Ref:22**	Gender and birth order of child, mother's age and education, family income, and number of changes in marital status.	Multiple regression ANCOVA	After controlling for demographics; Main effect of timing of MD on child behaviour (*F*= 2.87, *d* = .19) Problem scores higher for children whose mothers were depressed only at 6 months, or at 5 years (compared to those during pregnancy or at birth) **(NS**)	Problem scores higher for children whose mothers were depressed only at 6 months, or at 5 years (compared to those during pregnancy or at birth) **(S)**	Problem scores higher for children whose mothers were depressed only at 6 months, or at 5 years (compared to those during pregnancy or at birth) **(S)**	Chronicity (number of administrations reached depression threshold) of depression significantly positively associated with child behaviour outcomes after controlling for covariates (β **= .25)** **(S)**	**Sample:** lower SES than the population. Attrition over time may be biased (those lost differed in a number of ways from those retained). **Measures**: self-report depressive symptoms. Shortened version of the CBCL; total behaviour problems score used.
(Edwards & Hans, 2016) **Ref:35**	Neonatal problems; maternal sensitivity (parent-child observation guide coded video interaction); Mother- father relationship.	Path analyses	After controlling for mother-father relationship; association between prenatal depression and toddler behaviour problems was mediated by maternal sensitivity and maternal depressive symptoms at age 24 months (β = .52**)** **(S)**	N/A	Association between prenatal depression and toddler behaviour problems was mediated by maternal sensitivity and maternal depressive symptoms at age 24 months. (path from 24 months to behaviour problems (β = .22) **(S)**	N/A	**Sample**: Small homogenous sample not representative. Young mothers. **Measures:** Self-report maternal depression and child outcomes. Behaviour score was a total score did not distinguish between externalizing and internalizing.

(Eichler et al., 2017) **Ref:41**	Family status; child birth outcomes; Child depression, anxiety, social-emotional competence; sex.	ANCOVAs	Children of prenatally depressed mothers (3rd trimester) had more antisocial behaviour after controlling for confounding variables including current maternal depression. $\eta p^2 = .026$ **(S)**	N/A	Current (child 6-9 years) MD was only a significant predictor of child anxiety not ASB **(NS)**	N/A	**Sample:** Significantly higher education, makes generalization difficult. Relatively small sample size. **Measures**: Mother self-report on depression and child outcomes, potential shared method variance and lack of objective measures.
(Gjerde et al., 2017) **Ref:36**	Child age, sex, maternal parity, education.	Latent growth curve model	Adjusting for unmeasured confounding; Prenatal (17 wks; 30 wks) not associated with child outcomes. **(NS)**	Adjusting for unmeasured confounding all effects attenuated. Postnatal (6 months) not associated **(NS)**	Adjusting for unmeasured confounding; only concurrent (1.5, 3, 5 yrs) MD had significant effect on child outcome (internalizing and externalizing) (estimate = 2.40 (1.56–3.23, 95% CI)]. **(S)**	N/A	**Sample:** Significant attrition. **Measures:** Mother reports on own depressive symptoms and child behaviour problems.
(Hanington, Heron, Stein, & Ramchandani, 2012) **Ref:37**	Marital conflict Paternal depression	Regression Logistic Regression Mediation analyses	Antenatal dep (2nd trimester)was associated with conduct problems when postnatal risk was controlled for **(S)**	Maternal postnatal depression (8 months) predicted later conduct outcomes after adjusting for marital conflict (OR 2.34, 95% CI 1.88–2.91) **(S)**	N/A	N/A	**Sample**: low rates of ethnic minorities. Substantial attrition over time. **Measures:** Maternal report for depression and child measures.
(Hay, Pawlby, Angold, Harold, & Sharp, 2003) **Ref:24**	SES variables events during pregnancy. Parental antisocial personality disorder; father's criminal activity; family characteristics. Cognition, problems with attention and activity, child sex.	Structural Equation Modelling	None of the other variables or interactions made a significant contribution to the prediction of violence (including interaction between prenatal and postnatal depression) (**NS**)	Child violence was predicted by the mother's postnatal depression (at 3 months) even when her depression during pregnancy, her later history of depression and family characteristics were taken into account. (β = .34) **(S)**	Current psychological functioning associated with child violence. The analysis revealed that well-functioning mothers had children who were significantly less violent than other 11-year-olds (β .27), but postnatal depression on violence remained significant (β .30) **(S)**	Planned contrasts showed that the risk for violence was greatest in the group of children whose mothers were depressed in the postpartum period and at least once thereafter	**Sample**: Relatively, small sample size. **Measures:** Some retrospective accounts of depression.

(Hay, Pawlby, Waters, Perra, & Sharp, 2010) **Ref:21**	SES risk factors (mother's social class, maternal education, cultural background, mother's age at birth of index child, mother's marital status, two-parent family structure; mother's intellectual ability; mother's smoking and drinking; mother's antisocial behavior;	Logistic Regression	Antenatal depression significantly predicted violence in adolescence after controlling for the family environment, and child's later exposure to maternal depression **(**OR = 3.70) **(S)**	ASB was not associated with MD at later points (3 months, 12 months) **(NS)**	Not reported		**Sample:** Focusses on families for whom complete information was available on all variables. Relatively small sample size and disadvantaged sample. **Measures:** No information on foetal growth and neuroendocrine factors.
(Hay, Pawlby, Waters, & Sharp, 2008) **Ref:20**	Measures of intrauterine environment; breastfeeding; mother's intellectual ability; mother's symptoms of juvenile conduct disorder. Adolescent IQ.	Logistic Regression	No effects **(NS)**	When antenatal maternal depression and subsequent episodes were taken into account, early postnatal depression had a significant effect on IQ but did not predict psychopathology **(NS**)	Not reported	Emotional disorders and disruptive behaviour disorders in adolescence was predicted by the extent of exposure to maternal depression after 3 months postnatal. β = .50 **(S)**	**Samples**: Relatively small sample size.
(Korhonen, Luoma, Salmelin, & Tamminen, 2012) **Ref:46**	Mother's education; marital status; number of biological children; gender; maternal age.	Linear regression Logistic regression	Maternal prenatal depressive symptoms (last trimester) were associated with externalizing problems on the YSR *(p=0.041*) and remained significant after controlling for concurrent MD *(p=0.034)* **(S)**	Maternal postnatal depressive symptoms (2 months) was associated with externalizing symptoms *(p=0.012)* again remained significant after controlling for concurrent *(p=0.008)* **(S)**	Maternal concurrent depressive symptoms (16-17 yrs) was associated with adolescent externalizing problems (*p=0.009)* **(S)**	Recurrence (number of times scored over the EPDS cut point) was associated with externalizing problems *(p < .001)* **(S)**	**Sample**: Number of symptomatic mothers and children was low; Attrition was high. Relatively moderate sample size. **Measure:** Self report measures of depression. Limited control for sociodemographic and other risk factors.

(Korhonen, Luoma, Salmelin, & Tamminen, 2014) **Ref:45**	Sociodemographics	Trajectory analysis t tests Kruskall Wallis Ordinary Linear Regression	Initial exposure to antenatal MD was associated with more externalizing symptoms in adolescence. CBCL *($p < 0.037$;* indicatively in the YSR *($p < 0.092$)* **(S)**	Initial exposure at 2 months postnatally with internalizing problems not externalizing **(NS)**	Initial exposure in early childhood with social competence problems not externalizing **(NS)** and concurrently (at 16-17 yrs old) with externalizing problems **(S)**	Recurrent (number of times exceeding EPDS cut off) better explained internalising problems while chronic (a high stable trajectory of symptoms) MD better explained externalising problems.	**Sample**: Number of symptomatic mothers and children was low , attrition is high. Relatively moderate sample size. **Measure:** Self report measures of depression. Initial exposure to MD was used as a measure (the first time at each time point that a mother exceeded cut off for EPDS, rather than the independent effect).
(Lahti et al., 2017) **Ref:42**	Pregnancy disorders: maternal age at delivery; smoking during pregnancy; parity; chronic hypertension; type 1 diabetes; child's sex; gestational length; birthweight; family structure at childbirth	Linear/Tobit regression analyses. Mediation analyses	MD during pregnancy predicted higher internalizing, externalising (SD unit by unit increase) 0.26 [0.23_0.30])and total problems 0.31 [0.27_0.35]). Prenatal effects not accounted for my postnatal. **(S)**	N/A	MD symptoms after pregnancy (at time of evaluating the child) was also associated (unstandardized regression coefficients in fourth regression models = *0.22_0.47, p <.001* Postnatal effects partially mediated the prenatal effects. **(S)**	Children of mothers with both prenatal and postnatal had highest internalising and total problems. **(S)**	**Sample**; homogenous sample; attrition. **Measures**: single informant on maternal and child outcomes.
(Leis, Heron, Stuart, & Tamar, 2014) **Ref:47**	Maternal anxiety symptoms; sociodemographic variables including marital status; maternal age at birth; child birthweight; child gender; maternal education achievement; cigarette smoking;	Multivariate regression	Increased prenatal MD predicted an increase in total offspring emotional and behavioural problems *($\beta = 0.20$)* even after controlling for exposure to later maternal mental health problems. for mother reports **(S)** not teacher reports **(NS)**	not reported	not reported	**N/A**	**Sample**: High attrition **Measures:** Mother self-report on depression and child behaviour. Self report measures

(Luoma et al., 2001) **Ref:43**	Sociodemographic variables (mother's education, marital status, family SES, number of children in the family) and child gender. Mother age and concurrent depression.	Logistic regression	The presence of prenatal MD predicted child externalizing (38% proportion compared to those without*; p < .005)* and total problem levels (56% proportion compared to those without; *p < .005*). **(S)**	Postnatal effects was slight **(NS)**	Current MD predicted total problems **(S)**	Prenatal as well as recurrent MD associated with least favourable child outcomes. **(S)**	**Sample:** Moderate-sized sample; Attrition. **Measures**: Mother self report on depression and child outcomes.
(O'Connor, Heron, & Glover, 2002) **Ref:38**	Maternal anxiety; Socioeconomic status;	Hierarchical logistic regression	Antenatal anxiety but not antenatal depression was also independently associated with child outcomes. **(NS)**	After controlling for several covariates, postnatal depression at 8 weeks (OR = 2.27 [1.55–3.31]) and 8 months (OR = 1.68 [1.12–2.54]) was associated with child emotional/behavioural outcomes 8 week postnatal depression remained significant after controlling for antenatal maternal mood. (OR = 1.56 [1.04–2.32] **(S)**		N/A	**Sample:** Substantial Attrition. **Measures**: All data based on maternal reports. Possible reporter bias. Does not distinguish between emotional and behavioural outcomes; total SDQ score was utilized.
(O'Donnell, Glover, Barker, & O'Connor, 2014) **Ref:48**	Maternal anxiety; Paternal anxiety and depression; Maternal educational household crowding; parenting behavior; antenatal risk factors (maternal age smoking; alcohol/substance use during pregnancy. Obstetric outcomes	Longitudinal growth model.	MD (and anxiety which was the focus) predicted emotional and behavioural outcomes in the child (estimate = 0.08, SE = 0.02, *p < .01*). The effects were observed after controlling for multiple confounders including postnatal depression. **(S)**	not reported	not reported		**Measures:** All data based on mother reports. Relationships could have occurred due to common method bias. **Mechanisms:** Did not have direct measures of biological mechanisms that might mediate the effect.

(Raskin, 2016) **Ref:34**	Perinatal and birth outcomes (gestational age, birth weight, Apgar, pregnancy risk factors, complications of birth/delivery; conditions indicating pregnancy risk)	Latent growth curve modelling	Antenatal depression and postnatal depression predicted elevated child behaviour problems at 2 yrs. Antenatal depression had a significant direct effect on child behaviour, even after controlling for the effect of later symptoms. **(S)**	Antenatal depression and postnatal depression predicted elevated child behaviour problems at 2 yrs **(S)**			**Sample**: High risk sample , limits generalizability. Unsure location recruited from. Sample specifically sought to receive home visit services, again not generalizable. **Measures:** Self report maternal report on depression and child behaviour. Behaviour measure not clearly specified/unsure what it is measuring
(Soe et al., 2016) **Ref:39**	EEG analysis: gender: birth weight: ethnicity; prenatal smoking exposure; child sleep condition		Both prenatal (26 weeks) and early postnatal maternal depressive symptoms independently predicted children's externalizing and internalizing behaviours at 24 months of age. **(S)**	Both prenatal and early postnatal maternal depressive symptoms (3months) independently predicted children's externalizing and internalizing behaviours at 24 months of age. **(S)**			**Measures:** Self-report measure of maternal depression.
(van der Waerden et al., 2015) **Ref:44**	Maternal age at child's birth; years of formal education, maternal anxiety in pregnancy, history of mental health problems, maternal antidepressant use from pregnancy to the 5th year, maternal prenatal substance use. Family situation, low family income, number of siblings living in home, child care arrangements, domestic violence;	Growth trajectory models. Linear regression models.	High MD symptoms in pregnancy only group did not relate to increased levels of emotional or behaviour problems. **(NS)**		High MD in preschool years trajectory had increased overall problems at age 5 years including CD β =2.25 (0.69-3.79) **(S)**	Compared to never depressed-persistent depressive symptoms (either intermediate β =2.10 (1.33-2.88) or high β =5.60 (3.92-7.27) trajectories had greatest level of overall behaviour difficulties at age 5 yrs; including CD symptoms and hyperactivity/inattention.	**Sample:** Attrition nor random (women depressed during pregnancy more likely to drop out). **Measures:** All data based on mother reports. Relationships could have occurred due to common method bias. Self- reports. **Analyses:** concurrent MD included as a covariate did not explore independent effect.

(Woolhouse, Gartland, Mensah, Giallo, & Brown, 2016) **Ref:9**	Maternal age at time of first birth; country of birth; highest level of education; relationship status, employment status. Variables at the 4 yr period; total family income, number of children and relationship transitions since pregnancy	Univariate logistic regression. Series of multivariable models. Adjusted ORs	Perinatal depression (both pregnancy and postnatal period) associated with increased child difficulties after adjusting for later depression. (OR=2.38, 95% CI = 1.04-5.46) but not pregnancy alone or postnatal alone **(NS)**	Perinatal depression (both pregnancy and postnatal period) associated with increased child difficulties after adjusting for later depression. (OR=2.38, 95% CI = 1.04-5.46) **(NS)**	MD at 4 years postpartum had an independent effect on child emotional/behavioural outcomes after adjusting for perinatal depression. (OR=2.07, 95% CI= 1.18-3.63) **(S)**		**Sample:** Sample underrepresented young women; single women; non English speaking background. Selective attrition **Measures:** Maternal self-report of depression and child outcomes, potential shared method variance. Child outcome, did not distinguish between behavioural and emotional symptoms in child.

Notes: CBCL = Child Behaviour Checklist; SDQ – strengths and difficulties questionnaire; S = significant results; NS = non-significant result; MD = maternal depression; SES = Socioeconomic status; OR = Odds Ratio.

Maternal depression from pregnancy to age 7 years postpartum and associations with children's callous-unemotional behaviour.

Manuscript prepared in accordance with the guidance for

'European Child and Adolescent Psychiatry'.

The guidelines for authors can be found in Appendix A[3]

[3] Appendices and associated footnotes included for the purpose of thesis and removed for journal submission.

Abstract

Research on the timing of maternal depression and child antisocial behaviour (ASB) is emerging, although remains limited in several respects including a limited exploration of the ASB construct. The present study examined maternal depression from pregnancy to age 7 years postpartum and the association with a specific facet of ASB; Callous-Unemotional (CU) behaviour. The present study was embedded within a longitudinal study of a British birth cohort (the Cardiff Child Development Study); mothers (n = 249) were assessed for depression during pregnancy, at 6 months postpartum and at 7 years postpartum using a diagnostic interview, the Schedule of Clinical Assessment in Neuropsychiatry [1]. CU behaviour was measured in children at 7 years old using primary caregiver and teacher reports on the Inventory for Callous-Unemotional Traits [2]. Contrary to hypotheses, maternal depression during pregnancy and at 6 months postpartum was not associated with any aspect of the offspring's CU behaviour. However, regression analyses controlling for social adversity found that cumulative exposure to maternal depression from pregnancy to 7 years significantly predicted increased CU behaviour, according to the primary-caregiver but not teacher report. The preliminary evidence points to the importance of intervening early to manage mother's often recurring depressive illness and extending the monitoring of depression beyond the perinatal period. Further research is required to extend and replicate these findings.

Key Words: Maternal depression; antenatal; postnatal; callous-unemotional behaviour; longitudinal;

Introduction

Maternal depression is a significant public health issue and the impact on mothers and their children has understandably received considerable research attention; comprehensive reviews and empirical studies have accumulated on the association between maternal depression and offspring adverse outcomes in general and antisocial behaviour (ASB) in particular [3-5]. Child antisocial behaviour in terms of externalising, conduct problems and violence have been implicated [4]. Yet, there remains several limitations in the evidence base; for instance a lack of longitudinal studies limits our understanding of how depression over time differentially impacts on child outcomes. The exploration of timing of maternal depression can provide important information on the potential mechanisms underlying the association [6]. For instance, maternal antenatal depression is speculated to exert direct influence on the foetus (e.g., via programming and the disruption of the Hypothalamic-Pituitary-Axis) [e.g. 6, 7]; whilst postnatal depression is proposed to influence the mother-child relationship in a myriad of ways

(e.g. disrupting the formation of a secure attachment relationship; impacting the mother's resources to parent [e.g., 8, 9]).

Furthermore, longitudinal examinations of maternal depression in relation to behavioural outcomes have been limited by broad conceptualisations of ASB (e.g., externalising behaviour; conduct problems) rarely exploring the effect on more specific outcomes. ASB is heterogeneous and attempts to explore important dimensions and subgroups have developed as a way to potentially delineate distinct, causal pathways. Callous-Unemotional (CU) behaviour is a term used to refer to callous behaviour towards others, lower empathy and interpersonal emotion [10, 11]. Despite having obvious controversial implications, CU behaviour has grown in importance in the literature having been identified as an early predictor of more severe and persistent antisocial behaviour [12]. Including data that shows CU behaviour in children as young as 3 years old predicted stable trajectories of behavioural problems from aged 2 to 4 years [13] and aggression from 6-12 years old [14]. To the authors' knowledge, no studies have examined maternal depression over time and CU behaviour in particular.

Maternal depression is common with a prevalence estimated of up to approximately 18% in pregnancy [15, 16] and 13% during the postnatal period [17]. Studies also show a high or even higher prevalence rate outside this postnatal period and many years after birth (14.5% at 4 years postpartum) [18]. Maternal depression in both the antenatal [19, 20] and postnatal [21, 22] period is associated with behavioural problems in children. Although debate exists as to whether effects are unique to these time periods or represent exposure to mother's lifelong episodic illness [e.g., 23]. Longitudinal studies that examine maternal depression at multiple time points from pregnancy onwards have the capacity to explore the independent and cumulative effects of depression. Such studies are emerging but the findings are varied and complex.

Some studies have found that antenatal and postnatal depression are associated with different child outcomes [24]; certain studies find independent effects of antenatal depression only [e.g., 25]; and others postnatal only [26, 27]. Others have shown that recurrent/cumulative exposure to depression (i.e., child's exposure to multiple episodes) is as important as the effects of depression at specific periods [25, 28, 29]. Nevertheless, this research is still limited in number and subject to several methodological limitations including; a reliance on self-report measures of mother's depression; single informants on child behaviour; a focus mainly on early infancy and to the author's knowledge none have explored the associations with CU behaviour in particular.

CU behaviour is thought to have a high heritable component [31] although relatively few researchers have looked at the parental source of this heritability [19]. It has been argued that given the increased severity of ASB

associated with CU behaviour that parents of those displaying CU behaviours might be expected to have higher levels of psychopathology, criminogenic traits and provide more compromised parenting environments [19]. Examining these factors in a large longitudinal UK study, Barker et al. [19] found that maternal prenatal risks was associated with increased fearless temperament, conduct problems and CU traits. However, the prenatal risks included both depression, anxiety and other factors including maternal criminal behaviour, so that the independent effect of maternal depression was unclear. CU behaviour has also been associated with unique neural correlates of amygdala functioning and arguments have been made that a genetic predisposition could underlie differences in amygdala functioning and autonomic reactivity [32]. An association with depression during pregnancy (given theories of HPA functioning) and CU behaviour (as well as other prenatal risks) would fit with this biological theory and evidence.

Nevertheless, genetic vulnerability and neurobiological functioning does not diminish a role for social factors [33]. Indeed, research has also began to adopt a more ecological approach to the understanding of CU behaviour [34]. The examining of contextual risk factors have mainly focused on aspects of parenting. Studies have shown that CU behaviour is malleable and affected by aspects of parenting such as parental warmth [35]. Furthermore, Child et al. [36] found in a longitudinal study that parental depression moderated the association between parental corporal punishment and CU behaviour. More specifically, that at higher levels of depression (but not low levels), corporal punishment was predictive of increased CU behaviour. In developmental terms, one could predict that both early and cumulative exposure to maternal depression would increase the risk of more severe difficulties such as that associated with CU behaviour.

The present study aimed to examine the association between maternal depression and CU behaviour, by making use of data from a longitudinal study that has measured depression in mothers on several occasions from pregnancy to age 7 years postpartum. Limited research has examined maternal depression and CU behaviour specifically and therefore the present study provides an exploratory approach; the associations between maternal depression in pregnancy, and postnatally were independently assessed as well as the effect of cumulative exposure to maternal depression over the child's life time.

The well-established Inventory of Callous-Unemotional Traits (ICU) [2] was used to assess for CU behaviour and this has consistently demonstrated a three dimensional approach including Callousness, Unemotional and Uncaring factors. The Callousness factor in particular is associated with antisocial behaviour [37, 38]. Given the research indicating distinct associations with the factor scores and antisocial behaviour, the factors of the ICU

were explored independently. CU behaviours were measured by examining both primary caregiver report and teacher report to explore contextual differences.

Based on extant research on maternal depression and the more general child behaviour literature, we tested the following hypotheses;

(i) Depression during the (a) antenatal period and (b) the first 6 months postpartum will be independently associated with increased levels of CU behaviour in offspring at 7 years old.

(ii) Given the evidence that CU behaviour is associated with a more severe form of ASB, cumulative exposure to mother's depression may be associated with increased CU behaviour.

These hypotheses will be explored while controlling for the following factors; social adversity; mother's own antisocial history; and child gender; all factors that have been found to be important in understanding the associations between exposure to maternal depression and offspring antisocial behaviour [24, 39, 40].

Method

Design

The present study was embedded within the Cardiff Child Development Study (CCDS) which is a 6 wave prospective, longitudinal study of a nationally representative sample of first-born children and their parents. The study investigates the early prediction of antisocial and prosocial behaviour in early childhood, and explores biological, cognitive, social risk and protective factors for children's emotional and behavioural difficulties. The CCDS followed-up first time mothers and their partners from pregnancy and over the course of the child's first seven years of life, with six assessment points altogether (six study waves). Mothers and partners were recruited during pregnancy for the first assessment (wave 1). The families were followed up when the children were the mean ages of 6, 12, 21, 33 and 84 months postpartum (waves 2-6 respectively), in an alternating sequence of home and laboratory visits[4] . The current study focuses on data collected at waves 1, 2 and 6. The CCDS is funded by the Medical Research Council (MRC), and ethical approval was obtained for the procedures from the National Health Service Multi-centre Research Ethics Committee and the Cardiff University School of Psychology Research Ethics Committee. [5]

[4] See Appendix C for the graphical depiction of the CCDS waves
[5] See Appendix D for a copy of the ethical approval

Participants

Based on initial power calculations, 332 primiparous women were recruited between November 2005 and July 2007 from NHS antenatal clinics in hospitals and general practitioner surgeries, in two health trusts in Wales, United Kingdom. The catchment areas and clinics approached were selected in an attempt to provide a diverse sample, including clinics for individuals at increased social risk [see 41].

Families who expressed an interest in participation provided contact details and were given an information leaflet to consider. Following the initial contact, families who had provided their contact details were telephoned to arrange a date for the initial interview scheduled for the third trimester of pregnancy. Both those who chose to participate and those who chose not to participate in the study represented the entire range of socioeconomic categories associated with UK postal codes. The recruitment strategy yielded a nationally representative sample in terms of sociodemographic factors (not differing significantly from the families of firstborn children in the Millennium Cohort Study, the most recent survey of a nationally representative birth cohort in the UK [42].

All 332 participants completed a measure of depression during pregnancy (wave 1). 310 participants (93.4% of original sample) were retained at the assessment when children were on average 6.6 months with 306 mothers providing information on depression (wave 2). 287 families (86.5% retained) provided data when the children were on average 7 years with depression data available for 251 mothers (wave 6). See Figure 1 for a detailed account of reasons of non-completion and attrition at each wave. Two participants did not provide primary caregiver report data on the ICU, while 20 teachers did not complete the teacher report ICU. The decision was made to use the complete data available for measures at all three time points including the caregiver ICU, but use imputed data for the teacher report (rather than reduce the sample size further). Therefore the current sample was $n = 249$. This represents 75% retained of the original sample. Power calculations used to establish the CCDS (and supported by previous CCDS findings [43]) show that the minimum sample size required to attain an R^2 value of .30 at $p < .05$, with ß = .90 and 12 proposed risk factors considered together was N = 74 and therefore the sample size is sufficient to detect the proposed effect.

……. …….. Insert Figure 1 here……..

Procedure

Wave 1- Home visit during pregnancy

During the third trimester (M = 30.7 weeks gestation; SD = 4.5 weeks), two trained research assistants conducted interviews at the family home. Information on sociodemographic factors (including educational history, occupation, relationship status and living circumstances) was obtained as well as semi-structured interviews that incorporated the mood disorder and anxiety disorder sections of the Schedules for Clinical Assessment in Neuropsychiatry (SCAN; 1] , with an additional screen for psychotic symptomatology.

Wave 2- Early infancy home visit

This visit (M = 6.55 months; SD = 0.82) included a re-administration of the SCAN by trained research assistants to examine for any mood disorder since the birth of the child to the current time.

Wave 6 - Early childhood home visit

This visit (M = 84 months; SD = 4.70) included a re-administration of the SCAN by research assistants to examine mood disorders currently and since the wave 2 assessment. As well as the administration of the Inventory of Callous-Unemotional Traits as part of a larger battery of questionnaire measures.

Measures

Maternal Depression

Depression was assessed using The Schedule of Clinical Assessment in Neuropsychiatry [SCAN; 1]. The SCAN is a clinical and research tool that assesses psychopathology associated with psychiatric diagnostic categories; including mood disorders (e.g., major depressive disorder), anxiety disorders (e.g. generalised anxiety disorder, obsessive compulsive disorder) and psychotic disorders. The interview covers a range of questions on depression that map onto the DSM-IV diagnostic criteria for depressive disorders including Major Depressive Disorder (e.g., depressed mood; decreased interest/pleasure; change in appetite; sleep; guilt/worthlessness; concentration; suicidality). The SCAN takes the form of a semi-structured interview that asks screening questions about symptoms (e.g., has there been a time when you have been feeling low in spirits?) which are then followed up

with further clarifying questions of both an open and closed form (e.g., would you describe your mood as sad, downcast etc; for how long did this period last for?).

Trained research assistants with psychology degrees and higher conducted the SCAN interviews at each wave and then rated mother's responses by matching the descriptions given to the SCAN glossary of symptoms and coding the interviews using the DSM –IV diagnostic criteria [44]. All potential cases (those meeting the DSM-IV criteria) were taken to case conferences and diagnostic decisions finalised with 1 to 2 consultant psychiatrists. The consultant psychiatrist at the latest wave (six) was the same psychiatrist that had been employed at the earlier waves and had previously reached reliability with another consultant psychiatrist at those earlier waves; (reliability ranged from .79 to .81). All of the coded transcripts that met DSM-IV criteria for disorder, as well as those in the borderline range (e.g. symptoms present but not enough to reach caseness) were reviewed by the consultant psychiatrist and diagnostic decisions were made. In addition, at the most recent assessment (wave 6) a random sample (20%) of participants that the researcher deemed to be non-cases were also reviewed by the consultant psychiatrist with 100% agreement achieved.[6]

The SCAN was administered during the third trimester of pregnancy (wave 1), where mothers were asked about depression during pregnancy; at the 6 months early infancy assessment (wave 2) to measure any depression from the birth to current time; and at the latest 7 years postpartum assessment (wave 6) to assess for current depression and to gather a retrospective measure of symptoms reaching diagnosis since the earlier postnatal assessment. The data was used to create four dichotomous variables for the current study purposes; (1) presence/absence of depression during pregnancy (2) presence/absence of depression postnatally (3) presence/absence of depression between 6 months and 37 months (4) presence/absence of depression from 37 months to 7 years. Furthermore, cumulative exposure to depression was examined using accepted conventions in the literature [e.g., 28, 24] by summing the number of periods the mother was diagnosed as depressed during the child's lifetime including pregnancy (a range of 1- 4 time periods).

Callous-Unemotional Behaviour

The Inventory of Callous-Unemotional Traits (ICU), [2] was used to assess CU behaviours when the children were 7 years old. The ICU was derived from the well-validated and established Antisocial Process Screening

[6] The first author's contribution to the data included the coding of the wave 6 SCAN data, co-ordinating case conferences, data processing, checking, and data entry. See Appendix E for more details.

Device [45]. It is a 24 item questionnaire with all items scored on a four point scale (0= not at all true; 1 = somewhat true; 2 = very true and 3 = definitely true) covering the assessment of three dimensions; (1) Callousness (capturing a lack of empathy and remorse) an exemplar item is "he/she does not care who he hurts to get what he wants" (2) Uncaring (capturing an uncaring attitude about performance on tasks and other's feelings) for example "he/she tries not to hurt others' feelings" (reverse scored) and (3) Unemotional (capturing deficient emotional affect) for example " he/she hides feelings from others". Several versions of the scale are available for different informants with slightly different wordings of questions; the present study used the primary caregiver informant version and the teacher informant version. The primary-caregiver informant was the mother in the majority of cases (98% of cases). Teacher questionnaires were posted/emailed and returned to the team accordingly.

Several studies have now confirmed the ICU three factor structure in a range of samples; Essau et al. [37] identified the three factors in exploratory factor analysis in 13-28 years olds (n = 1443). Ezpeleta et al. [38] confirmed the three factors in a community sample of preschool children. A common general factor comprising all of the items has also been established [e.g., 37]. The Callousness and Uncaring dimensions have been correlated with aggressive, antisocial and delinquent behaviour [37, 46, 47, 48]. Longitudinally, Callousness has predicted later ODD and CD diagnoses [38]. The Unemotional dimension has less consistently been associated with antisocial correlates.

A Principal Component Analysis using varimax rotation (appropriate items reversed for entry into the analysis) was conducted, that generally replicated the overall three factors established in the literature for both the primary caregiver measure and the teacher informant measure. In the primary caregiver report the variance explained by the factors were as follows; unemotional, 17.57%; uncaring; 14.52%; and callousness; 12.97%. For the teacher informant; unemotional, 23.09%; uncaring, 11.26%; and callousness, 14.41%. The resultant factor scores on the Unemotional, Uncaring and Callousness factors were utilised in further analyses. Both the primary caregiver and teacher report factor scores were utilised and examined separately to explore CU behaviour in different contexts.

Covariates

Mother's antisocial behaviour

This variable has been constructed in previous CCDS studies and described fully in Hay et al. [e.g., 41]. The questionnaire battery at Wave 1 included a section labelled 'what am I like' which included items from the screening questionnaire for the International Personality Disorder Examination (IPDE) [49]. The screening questionnaire associated with the IPDE interview has been used in community samples in the UK and other

developed countries, including a large national sample in Australia [50]. The mother's antisocial behaviour variable includes a subset of IPDE screening items that corresponded to the DSM-IV criteria for Antisocial Personality Disorder (ASPD) along with an additional set of items measuring DSM-IV symptoms of conduct disorder. The conduct symptom items were incorporated into a section of the Wave 1 questionnaire entitled 'what I was like as a child.' The mother's antisocial behaviour variable was created by summing the two individual scales and it showed and acceptable level of internal consistency, $\alpha = .79$. This composite variable was validated by mothers' reports of their history of arrest, point biserial $r\ (323) = .56$, $p < .001$.

Sociodemographic Adversity Index

An index of the child's exposure to maternal factors known to be associated with risk for social adversity was created using polychoric principal component analysis. The maternal experiences that contributed to this index were: (1) the mother not having achieved basic educational attainments (i.e., the mother having no qualifications or fewer than five GCSEs or equivalent attainments); (2) the mother being 19 years of age or under at the time of child's birth; (3) the mother not being legally married during the pregnancy; (4) the mother not being in a stable couple relationship during the pregnancy; and (5) the mother's current occupation being classified as lower status according to the Standard Occupational Classification 2000 [51]. All the items contributed to a single component (eigenvalue 3.84) which explained approximately 77% of the shared variance. Summary factor scores derived from the analysis were used as a proxy for social adversity (see Hay et al. [52]; for full description and previous use of this variable).

Data analysis

All statistical analyses were conducted in IBM SPSS Statistics Version 23 (IBM Ltd., Portsmouth, UK). Prior to analysis all variables were examined for accuracy of data entry and fit between their distributions and the assumptions of univariate and multivariate analysis. Data screening, verification and entry was conducted by two trained postdoctoral researchers. As is current practice bootstrapping was used to estimate standard errors which are robust to deviations from normality [53-55]. In all analyses the number of bootstrap samples was set to 2000 and 95% bias-corrected bootstrap confidence intervals (CIs) generated. Pearson/Pearson biserial point correlations were used to examine the relationship between maternal depression, offspring CU behaviour and additional risk factors. Hierarchical linear regressions were performed to examine the associations between depression and child CU behaviour, controlling for covariates in analyses where appropriate. The ICU data for the teachers were missing due to failure to complete/return within time the frame for 20 participants. Missing data imputation using

the regression method was used to impute missing values based on the associations between the primary caregiver report and available teacher reports (following accepted guidance; see [56]). [7]

Results

Participants

Participants are the 249 mothers retained and with full data on the assessments of interest. The sociodemographic details of the mothers in the total study and the present study sample are provided in Table 1 below. The study sub-sample did not differ significantly from the total sample on the sociodemographic adversity index (one sample t = -.713, p = .476).

83 families were lost to attrition/excluded from the study at wave 6; this was as a result of attrition at the wave 2 or 6 follow up*; n* = 69; the SCAN depression assessment conducted on a caregiver other than the mother; n = 12; The ICU measure missing for the primary-caregiver for two participants; *n* = 2 (further details in Figure 1). The 83 mothers did not differ from those in the present study subsample on the demographic measures (noted in Table 1) or on the earlier SCAN depression variables (antenatal and postnatal measures) of interest (t-tests and chi-square all $p > .05$).

----------Insert Table 1 about here----------

At the wave 6 assessment, the majority of mothers were in a relationship with the biological father (55% married to child's biological father; 9.6% cohabiting with child's biological father; 1.2% in a relationship with biological father but not living together); 13.8% were in relationships with new partners; 15% living alone. The remaining 5.4% information was not provided by mothers. The mean age for the children included at wave 6 was 84.00 months (SD= 4.68) and 109 children were female and 140 were male.

Maternal depression over time

Of the 249 women who were assessed with the SCAN interview at all time points, 112 women (45%) met DSM-IV criteria for depression on at least one occasion over the study period (from pregnancy to 7 years). The mothers in our sample who had experienced at least one episode of depression scored significantly higher on the socioeconomic adversity index than those who had never been depressed (t = -5.42, $p < .001$).

[7] The analyses were run both with and without imputed values for 20 participants and resulted in only marginal differences and did not change findings.

The prevalence of depression at each time period was as follows; during pregnancy, 40 women (16.1%) were depressed; at the 6 months postnatal assessment, 30 women (12 %) were depressed. 68 women (27.3%) met criteria for depression between 6 months and 37 months. Whilst 65 women (26.1%) met depression criteria between 37 months and 7 years.

In examining the cumulative exposure to depression; 4 (1.6%) women were diagnosed in all 4 time periods; 16 (6.4%) during three time periods; 48 (19.3%) during two time periods; and 44 (17.7%) during one time period.

Gender differences were found in that mothers of boys were more likely to have been depressed at least once over their lifetime than girls (63 of 141 boys of sample (44.68%) versus girls 39 of 108 (36.11%); $\chi^2 = 6.06$, $p = .014$). Gender by time categories revealed no significant differences for the antenatal ($\chi^2 = .02$, p = .903) postnatal ($\chi^2 = 1.40$, $p = .237$) or cumulative depression variables ($\chi^2 = 7.37$, $p = .118$).

Callous-Unemotional behaviour

The descriptive data for the three factor scores for both the primary-caregiver and teacher informant are shown in Table 2. Associations between the factor scores for the two different informant types were also explored. There were significant positive correlations between the teacher reported Uncaring factor and the primary caregiver reported Uncaring factor *(*$r = .245$, p < .001) and the primary caregiver report Unemotional factor ($r = .185$, = p .005). Also significant positive correlations between the teacher reported Unemotional factor and the primary caregiver report Unemotional factor ($r = .192$, $p = .004$). Parents and teachers ratings for the Callousness factor scores were not significantly associated.

In exploring gender differences on the ICU factor scores; boys scored higher in comparison to girls on all factors but this reached significance for the Uncaring factor only for both teacher report (females; $\bar{x} = -.04$; SD = 1.03; males; $\bar{x} = .01$; SD = 1.06; $t = -3.84$, $p < .001$) and primary caregiver report (females; $\bar{x} = -.28$; SD = .90; males $\bar{x}$ = .24; SD = 1.01; $t = -4.23$, $p < .001$). There were no significant differences between boys and girls on the Callousness factor.

----------Insert Table 2 about here----------

Maternal depression and callous-unemotional behaviour

Hypothesis 1 – Antenatal depression will be associated with increased levels of CU traits at age 7 years old

All univariate associations are shown in Table 3. Pearson Point-Biserial correlations showed that there were no significant associations between antenatal depression and any of the teacher informant factor scores ($p > .05$). In addition, there were no significant associations between antenatal depression and primary caregiver factor scores ($p > .05$). Therefore no further analyses were conducted in relation to antenatal depression and this hypothesis was rejected.

----------Insert Table 3 about here ----------

Hypothesis 2 – Depression at 6 months postpartum will be associated with increased levels of CU traits at age 7 years old.

As shown in Table 3, univariate analyses (Pearson Point-Biserial) showed that there were no significant associations between maternal depression at 6 months postpartum and the teacher informant factor scores ($p > .05$). In addition, there were no significant associations between depression at 6 months postpartum and the primary-caregiver factor scores. Therefore no further analyses were conducted in relation to postnatal depression and this hypothesis was rejected.

Hypothesis 3 – Cumulative exposure to maternal depression predicts children's CU behaviour

As shown in Table 3, Pearson Correlations showed that there were no significant associations between cumulative depression and the teacher informant factor scores. In addition, cumulative depression was not associated with primary-caregiver Uncaring factor (r (248) =. 073, p = .268) or Unemotional factor (r (248) = .002, p = .980). However, cumulative depression was positively associated with the primary-caregiver Callousness factor (r (248) = .176, p = .008).

Contrary to predictions, mother's antisocial history was not associated with any of the depression variables or CU variables (p >.05) so was not included in further analyses. Sociodemographic adversity was associated with all measures of depression (antenatal (r (248) = .443, p <.001): postnatal (r (248) = .205, p = .002); cumulative (r (248) = . 403, p < .001;) and the ICU primary caregiver Unemotional factor (r (248) = . 185, p = .003) and teacher report Uncaring factor (r (248) = .283, p < .001) and so was entered as a control variable in further analyses.

A hierarchical linear regression was then conducted in order to explore the relationship between cumulative exposure to depression and the PQ callousness factor. This association remained significant while controlling for both social adversity and gender (β = .169, p = .045). See Table 4 for the full regression model.

----------Insert Table 4 about here ----------

Discussion

This study examined the associations between maternal depression during pregnancy, during the first 6 months postpartum and cumulative exposure to depression over the child's lifetime and CU behaviour at age 7 years postpartum. The findings indicated that maternal depression during pregnancy and at 6 months postpartum was not associated with any aspect of the offspring's CU behaviour. However, regression analyses controlling for social adversity and gender found that cumulative exposure to maternal depression from pregnancy to 7 years significantly predicted increased Callousness in offspring, according to the primary-caregiver but not teacher report.

The finding that perinatal depression was not associated with CU behaviour was contrary to hypotheses and does not fit with the evidence on the association between perinatal depression and antisocial behaviour more generally [e.g., 57, 58]. However, few studies have explored maternal depression in relation to CU behaviour in particular as there is a tendency to use broader measures of antisocial behaviour (ASB) in the literature. It may be that this particular facet associated with ASB is not related to the perinatal period; although clearly this study presents an initial exploration of the associations and further research is required to replicate the finding. Cumulative exposure to mother's depression which included exposure during the perinatal period was associated with increased callous behaviour in offspring. However, it must be acknowledged that this was a small effect representing just 2% of the variance and the findings were largely non- significant. It could be implied that this provides further support for the importance of a genetic contribution to the development of CU traits.

The evidence does not support a foetal programming effect [e.g. 59] with direct effects on the foetus being associated with CU in particular; rather from our results the evidence is more suggestive of the ongoing impact of depression through the child's life (perhaps via parenting factors). This suggests that despite the heritable component to CU behaviour that environmental factors are influential to some extent. It is interesting to note that Hay et al. [24] showed no effect of antenatal and postnatal depression on disruptive behaviour disorders (DBD)

in adolescence. In a similar vein they found that the extent of cumulative exposure (after 3 months) was predictive of DBD. They proposed that any effects of perinatal depression are likely bound up with exposure to mother's lifelong depressive illness. Further, that the mother's depressive illness creates an environment of increased risk both before and after the child's birth. Children of mothers who are depressed in pregnancy are likely to be at increased genetic risk for difficulties; exposure to recurrent depressive episodes creates a gene-environment correlation which increases the risk for antisocial behaviour [24]. The evidence from the present study while unable to disentangle gene and environment contributions leans towards such a hypothesis.

Of interest also is that significant findings were only discovered in relation to the Callousness Factor in particular. The Callousness factor which is thought to capture a lack of empathy and remorse for wrongdoing is generally the factor in the literature found to be most associated with ASB. Our results provide further validation of the use of the ICU measure in assessing CU behaviour in a community sample by both replicating the three factor structure found in the literature and particularly by demonstrating the utility of the Callousness Factor specifically.

The discrepancy between findings for teacher and primary-caregiver report is perhaps not surprising, as consistency between informants on child behaviour is often low [60, 61]. The reasons for such discrepancies may include that the behaviour is context dependent or that the behaviour manifests differently in those settings. Alternatively, individuals in different contexts may have different tolerances of the behaviour or the interactional style of certain individuals in certain contexts are more likely to elicit the behaviours [60, 61]. Other hypotheses can also not be ruled out including the notion that there is a bias in maternal reporting which has sometimes been reported in the literature, where mothers who are depressed are more likely to rate their children as having problems compared to mothers who are not depressed [60]. Although differing hypotheses cannot be distinguished in this study it certainly points to the importance of including multiple informants on behaviour and exploring in different contexts so that any differences can be observed.

The study has several limitations that need to be considered before drawing conclusions. Firstly, depression is heterogeneous and as well as the timing and the recurrence of depression being of importance, it is likely that the severity and duration of the episodes has an impact on children and we were unable to disentangle these influences in the present study. In addition, although factors such as adversity and mother's antisocial history was included, it is unclear how comorbid conditions such as anxiety would have influenced the relationships. Of course, this study only examined the relationships between key variables and does not tell us about potential mechanisms of the effect. Aspects such as parental warmth and hostility [33] have been implicated in the development of CU and

further research is required to explore how maternal depression over time may influence these associations. In addition, it must also be considered that CU behaviour may elicit/exacerbate difficulties in the mother; the measurement of CU behaviour earlier in the developmental process would have allowed for the exploration of the longitudinal development of CU and examination of bidirectional relationships with mother's mood [e.g., 33].

The study presents an exploratory approach to the association between maternal depression and CU behaviour and further research is required to delineate the complex associations between depression over time and offspring ASB. For instance, research that explores multiple approaches to the measurement of ASB would be a useful addition to the literature; the use of more observational approaches would increase the objectivity in the assessments. In relation to CU behaviour in particular, measures of CU, like many other psychological constructs, do not show strong associations across methods [11]. There is much utility in combining across methods such as scores from questionnaires, laboratory measures and arrest records to derive composite measures of CU behaviour [11]. Furthermore, although the ICU has been validated in community and clinical samples there are yet no normative data available to provide some sense of clinically significant levels of the behaviour. Of course the community sample has great utility in prospectively exploring the association between early factors and CU behaviour; however CU behaviour, as well as being important in predicting later difficulties has been particularly useful in delineating subgroups of antisocial individuals that go on to demonstrate more persistent and severe ASB [11]. Our study did not have sufficient numbers to subgroup individuals based on conduct behaviour and CU behaviour, but would be an important focus for the future.

As well as providing an initial investigation of the relationship between maternal depression and CU there are several other strengths of the study that should be considered. The longitudinal nature of the study beginning in pregnancy and incorporating a follow up of children to age 7 years is a particular strength ; the assessment of depression at multiple time points allowed the comparison between antenatal, postnatal as well as the effects of cumulative exposure. The representativeness of the sample in terms of sociodemographic factors further increases generalisability; the sample was of a moderate size and attrition low and seemingly random in relation to the present study sample. Moreover, the use of a diagnostic interview with a consultant psychiatrist confirming the diagnoses of maternal depression adds to the confidence and objectivity in the diagnosis. Finally, the present study provides an extension of the literature on maternal depression and ASB by examining the associations with CU behaviour in particular.

Clinical Implications

Firstly, the findings indicate that depression in mothers is common; both during the perinatal period and during their offspring's early to middle childhood years. Nearly half the mothers in the sample had been depressed at some point over the course of the study. This common disorder is also one that recurs with a substantial number of women going on to experience further episodes of depression. Mothers need support in managing what may be for some a chronic illness. Although perinatal depression specifically may not be associated with CU behaviour, cumulative exposure which included the perinatal period was associated. Intervening early to prevent and manage a mother's illness is important also for the developing child. This is consistent with current clinical guidance; (e.g., NICE [62] clinical management service guidance for antenatal and postnatal mental health) which promotes early detection and good management during the perinatal period. The evidence would also advocate for the importance of monitoring and intervening beyond the perinatal period for those where depression reoccurs or there is a new onset of the disorder.

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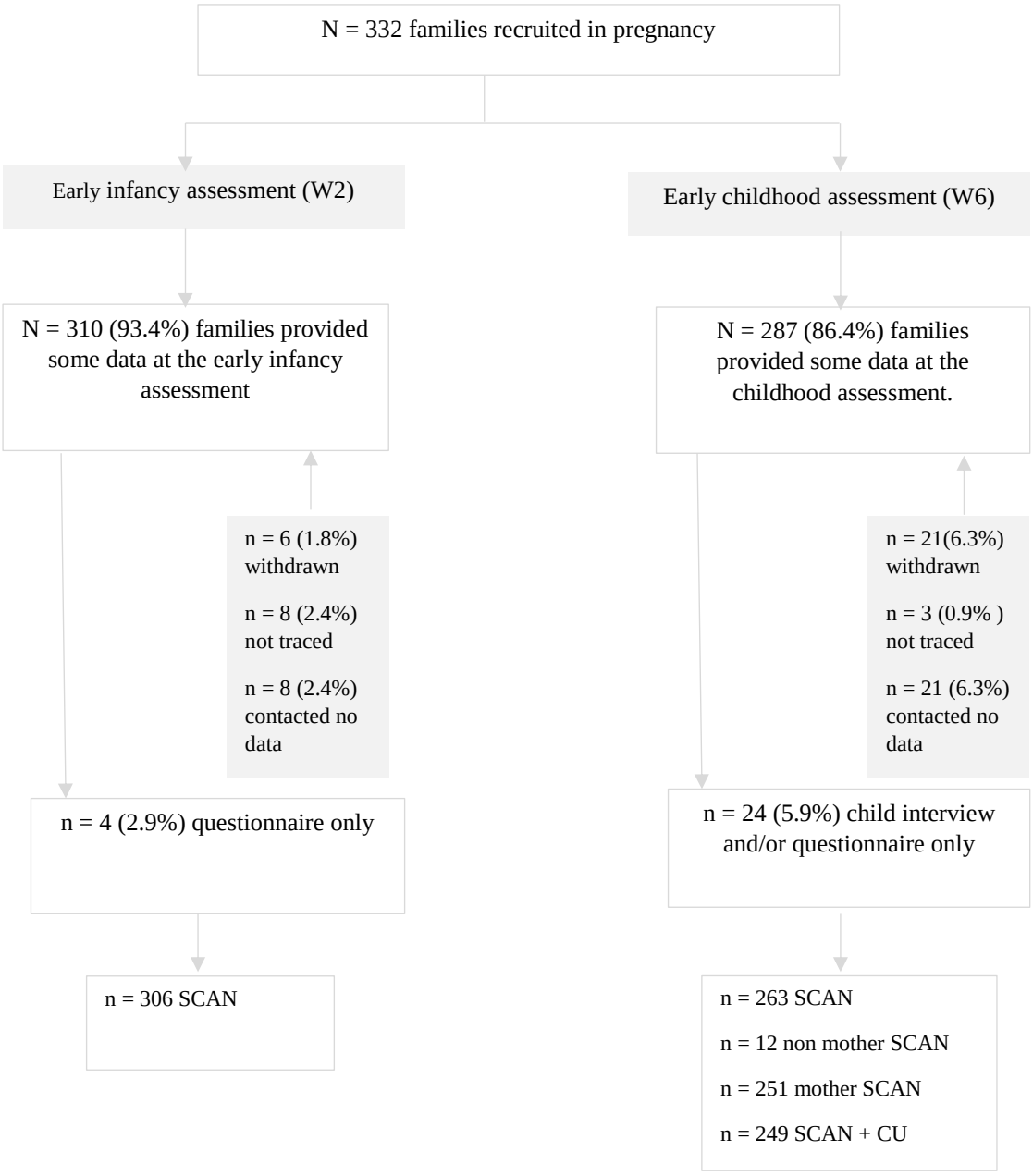

Figure 1. Flow Chart of Child Development Study Participation.

Table 1. Demographic information for total sample and subsample

Variable	Total Sample (N = 332)	Subsample (n = 249)
Mother's age at first birth (mean years)	28.15	28.32
Social class (% middle class)	50.9	53.4
Mother's education (& > basic qualifications)	78.3	81.1
Stable partnerships (% stable partnerships)	90.4	90.4
Legally married (% married)	50.3	51.4
Ethnicity (% British or Irish)	93.0	93.3
Sociodemographic adversity risk index (mean)	.00	-.04
Firstborn child gender (% female)	43.3	43.7
Mean number of cigarettes smoked during pregnancy	1.68	1.83

Note: Basic educational qualifications defined as 5 or more pass marks on national GCSE examinations in the UK or their equivalents.

Table 2. Descriptive data for ICU factor scores for primary caregiver and teacher informant

	Mean	SD	Min	Max
PQ_Uncaring	.01	.99	-1.81	2.68
PQ_Unemotional	.01	.97	-3.49	3.60
PQ_Callous	-.02	.99	-1.55	5.28
TQ_Uncaring	.01	1.00	-1.79	2.26
TQ_Unemotional	-.00	1.00	-2.88	2.66
TQ_Callous	-.01	1.05	-7.06	1.77

Note: PQ = primary caregiver report questionnaire; TQ = teacher report questionnaire.

Table 3. Pearson Product moment/Pearson Point-Biserial associations for key variables

	PQ_Uncar	PQ_Unem	PQ_Call	TQ_Uncar	TQ_Unem	TQ_Call
Antenatal	.076	.098	.084	.095	.025	.074
Postnatal	.080	-.023	.048	-.013	.043	.043
Cumulative	.073	.002	.176**	.098	.066	.077
Lifetime	.034	-.031	.155*	.058	.064	.094
Gender	.240**	.103	.051	.247**	.070	.027
SES	.079	.217**	.099	.283**	.011	.002
MQAsb	-.031	-.108	-.020	.083	-.047	.018

Note: Antenatal = antenatal depression; Postnatal = depression at 6 months postnatal; Cumulative = cumulative exposure to depression (0-4 periods); TQ = teacher report questionnaire: PQ = Parent report questionnaire;; MQasb = mother's antisocial history; SES adversity = socioeconomic adversity risk. Bootstrapped results are based on 2000 samples: 95% bias corrected.

** correlation significant at 0.01 level (2 tailed)

* correlation significant at 0.05 level (2 tailed)

Table 4. Hierarchical Regression; Cumulative Depression and PQ Callousness Factor

	F	ΔR^2	*B*	*SEB*	β	CI lower	CI upper
Step 1	1.02	.000					
Adversity			.073	.069	.073	-.055	.221
Gender			.086	.115	.043		
Step 2	2.68*	.020					
Cumulative			.158	.082	.169*	.008	.322

Bootstrapped based on 2000 samples: 95% bias corrected.

* correlation significant at 0.05 level (2 tailed)

The critical evaluation of the systematic review, empirical paper and overall research endeavour.

Critical Evaluation

The current research project aimed to elucidate elements of the complex relationship between maternal depression and child behaviour. More specifically, both the timing of depression and cumulative exposure to depression was explored in relation to offspring antisocial behaviour (ASB) in general and Callous-Unemotional (CU) behaviour in particular. The following paper presents a critical evaluation of the research process undertaken in both the systematic review and empirical study as well as a critical consideration of the research enquiry as a whole. This will include an evaluation of the strengths and limitations of the research project and overall enquiry with reference to the methodology and conclusions drawn. Future research directions and implications for theory, policy and importantly clinical practice and service development will also be discussed.

The Systematic Review

Summary of study and findings

The systematic review synthesised and evaluated findings from longitudinal studies that examined both antenatal and subsequent episodes of maternal depression and offspring ASB. Three databases were searched (Psychinfo, Web of Science, Medline) from the period of January 1900 to December 2017. Twenty of 5936 studies met the inclusion criteria. Study quality was assessed by two reviewers and disagreements resolved by consensus. Overall, the findings indicated significant, independent effects of exposure to maternal depression during pregnancy, postnatal depression and exposure to maternal depression after the perinatal period on child antisocial outcomes. The studies that examined the effect of cumulative exposure to depression also found significant effects with some demonstrating that cumulative exposure to depression was particularly important in predicting adverse outcomes.

Question Development and Rationale

Maternal depression is recurrent, common and has been consistently associated with emotional and behavioural problems in children including increased antisocial behaviour (Connell & Goodman, 2002; Fergusson et al., 1993; Goodman & Gotlib, 1999; Goodman et al., 2011; Kim-Cohen et al., 2005: Waters, Hay, Simmonds, & van Goozen, 2014). ASB in children is one of the main reasons children and families present to mental health services (Bailey, 2002). A better understanding of the associations between maternal depression and child ASB hopes to facilitate the development of clinical interventions for families affected by both depression and ASB. It is not surprising then that research on the impact of maternal depression on child outcomes has burgeoned in recent years.

Given the large and often quite complex evidence base in the area, it was important and necessary that substantial time was given to ensuring the identification of a suitable research question and scoping exercises undertaken in an attempt to prevent duplication of existing projects. The PROSPERO (Prospectively Registered Systematic Reviews in health and social care) database was particularly helpful in accessing reviews that were currently being undertaken. The contacting of authors was helpful both in formulating and refining the research question as well as ensuring the research review was suitably distinct.

The timing of maternal depression and specificity of the effect on particular child outcomes was identified in the literature as important for further investigation. The timing of maternal depression provides information on potential developmental mechanisms and can inform the appropriate intervention for mothers and children. Longitudinal studies that examine maternal depression at multiple time points and begin during the pregnancy period are essential for examining the independent and cumulative effects of particular episodes and indeed the relative importance of specific periods. Although previous reviews had been undertaken in the area of maternal depression and child psychopathology (e.g., Goodman et al., 2011) including those that have examined antenatal depression (e.g., Waters et al., 2014) and pre and postnatal distress (e.g., Kingston, McDonald, Austin & Tough, 2015; Kingston & Tough, 2013; Kingston, Tough, & Whitfield, 2012); there had not been a review synthesising the emerging evidence from longitudinal studies of depression that include a focus on both the perinatal period and later and with a particular examination of offspring antisocial outcomes.

Choosing the systematic review methodology

A systematic review methodology was adopted for the exploration of longitudinal studies on maternal depression as opposed to a generic literature review. Systematic reviews (and meta-analyses) provide a method for summarising a large amount of evidence, helping researchers and clinicians keep abreast of recent research and potentially informing clinical and policy decision making (Liberati et al., 2009; Moher et al., 2009). The skills required to conduct a systematic review include identifying, evaluating and synthesising research as well as gaining an understanding of a range of research methods (Boland, Cherry, & Dickson, 2017). Conducting a systematic review often requires fewer resources (given that ethical approval and participant recruitment is not required) and as such the skills gained are particularly advantageous in an often resource poor clinical setting.

Conducting a systematic review on maternal depression and ASB provided the opportunity to further develop these important research skills; gain an understanding of the current state of evidence in the field; identify gaps in the evidence base and facilitate the development of the empirical study.

Nevertheless, it is also important to acknowledge that information in systematic reviews are often reported inaccurately and the processes researchers follow are sometimes unclear (Moher et al., 2009). It is essential that when conducting systematic reviews, (as when conducting any research), that the methodology is transparent and replicable. The PRISMA (preferred reporting items for systematic reviews and meta-analyses) statement was developed for this purpose along with the four-phase flow chart and 27 item checklist (e.g., Moher et al., 2009; see Appendix F for a copy of the checklist). This approach was adopted in the present systematic review and was followed throughout the conducting and reporting of information in an attempt to increase the transparency in the process. A number of departures from the PRISMA criteria was apparent and this resulted in the main from the difficulties with resources within the requirements of a student thesis. For instance, within the scope and timing of a thesis it was not possible to register the systematic review formally. PRISMA recommends that systematic reviews should be registered with a protocol and registration number; this reduces the likelihood of bias in terms of post hoc changes to methods or selective reporting of results (Liberati et al., 2009). Nevertheless, it is acknowledged that registration is still not common practice but something that should be considered as best practice for the future (Moher et al., 2009). To minimise the possibility of bias in the present project, the protocol was submitted for university purposes prior to commencing.

Systematic Review Search strategy

The search strategy was devised in collaboration with an experienced university librarian and the research team in an attempt to ensure appropriate and thorough procedures were adopted. Following best practice procedures a copy of the exact search strategy can be found in the Appendix B. The large scope of the literature made the development of a systematic review question with the appropriate balance of specificity and sensitivity a difficult undertaking. Although examining a relatively smaller component of the wider literature (i.e., longitudinal studies of depression beginning in pregnancy) the wider literature needed to be systematically searched also as there was no valid way of narrowing the focus of the search. For instance, using design terms such as 'longitudinal' in my search strategy is not considered best practice and would likely impact on the specificity of the search. Similarly, focusing on terms such as 'antenatal depression' ran the risk of missing studies that had focussed on later episodes of depression but incorporated antenatal depression as a control measure.

Therefore, broad constructs/terms such as "maternal depression" and "antisocial behaviour" necessarily achieve high levels of return when searching. The scoping exercises and examination of comprehensive reviews on maternal depression (e.g., Kingston et al., 2012; Kingston et al. 2015; Kingston & Tough, 2013; Waters et al.,

2014) provided examples of appropriate terms, synonyms and databases to utilise. The university librarian also encouraged the use of subject heading terms and advised on the number and types of databases for searching. The search process was necessarily an iterative process; searches would be performed and then further investigation would reveal the need for the inclusion of further terminology, for instance additional child specific terms (babies, toddlers etc.) were needed or American terminology required and so on.

My prior research interests in the area of antisocial behaviour and my supervisor's interests in perinatal depression combined in the development of both the systematic review and empirical study questions; initial scoping exercises had revealed a limited exploration of the diversity of the antisocial behaviour construct in longitudinal studies of maternal depression and this guided the large scope of antisocial behaviour terms utilised in the search process. The studies obtained in this review were a result of a thorough, comprehensive and corroborated search strategy which is a strength of the systematic review undertaken.

The final search strategy resulted in a substantial number of papers for sifting (9571 before duplicates and 5936 following removal of duplicates). A more focussed search strategy would have resulted in fewer studies but ran the risk of excluding potentially relevant articles. In hindsight given that most studies were found to be published in the last 10 years a narrower time frame could have been selected and this would have reduced the number of studies identified. However, there were no a priory factors that would inform a decision for a date cut off and also reviews in a similar vein (e.g., Rees, Waters & Channon, 2018; Waters et al., 2014) used a similarly wide scope.

Nonetheless, the sifting component in the early stages was a straight forward process with the assistance of a reference management system (The Mendeley System). The more challenging aspect of the process was making decisions at the later stages of the sifting process. A substantial number of texts were necessary for downloading as important inclusion/exclusion criteria could not be ascertained from the abstract alone. For instance, abstracts would refer to maternal depression but not specify whether an antenatal measure had been used or whether independent or cumulative exposure had been explored.

For other studies, the statistical analyses and design needed close inspection as the analytical focus did not allow for the comparison of different time periods, perhaps because the study combined measures of depression at different time points, included depressive episodes as covariates or mediators and moderators and independent associations were not explored. An exemplar study of this point was Abulizi et al. (2017); in a longitudinal study Abulizi et al. explored the contribution of temperament in infancy and behavioural and emotional problems at 5 years and also how environmental context shapes this. The environmental context, which included aspects of

maternal depression both during the antenatal and postnatal period combined (as well as socioeconomic status), were examined as moderators of the associations. The association was not moderated by these factors although contributed some to the later behavioural outcome. Independent effects of depressive episodes were not explored in relation to the outcome. The opportunity to discuss these more complex designs and analyses with the research team was useful for informing decision-making.

Inclusion/Exclusion Criteria

There were several decisions that required considerable thought and discussion and operational definitions of terms needed to be clearly specified. Antisocial behaviour is a heterogeneous construct and operationalised in diverse ways. The systematic review deliberately attempted to capture any measure related to this (externalising behaviours, conduct disorders, aggression, criminality, Callous-Unemotional behaviour, offending etc.). Terms such as child development, maladjustment and psychopathology were also included which broadened the search further. This was considered necessary as often behavioural measures were embedded within wider measures and would potentially have been missed without this broader conceptualisation. Furthermore, child problems are often comorbid and making a distinction between internalising disorders and externalising disorders for instance can arguably appear artificial. It was within this context that the decision was made to include studies that incorporated behavioural and emotional problems into one total problem score. However, a potential limitation of the review is that for four of the included studies that clear associations with behaviour cannot be established because behaviour was bound up with emotional problems also.

Furthermore, some studies have included both externalising and internalising measures in a single review and compared differences in associations with maternal depression (Goodman et al., 2011; Waters et al., 2014) while others have used more focussed analyses of specific outcomes such as cognitive outcomes specifically (Kingston et al., 2015). There are advantages and disadvantages to both approaches; in this particular review it meant that a more thorough investigation of antisocial behaviour could be accomplished , whereas broader reviews may gain in the ability to compare diverse outcomes , they potentially lose depth in exploring the heterogeneity of antisocial behaviour. In addition, the decision was made to focus on maternal depression specifically as opposed to including global distress and anxiety for instance. It is acknowledged that depression and anxiety and stress are comorbid and focussing on only maternal depression presents just one aspect of the picture; the decision was made again in order to have a streamlined and focused review that allows conclusions to be drawn in relation to maternal depression in particular.

In terms of other types of exclusion criteria; grey literature was excluded from the review given that it is not peer reviewed and introduces bias to the findings (Boland et al., 2017). However, it must be acknowledged that with the exclusion of grey literature, the review may be excluding relevant recent research for instance in conference abstracts that have not yet been published. The use of abstracts in particular would not have been sufficient as it is unlikely that detailed information could be obtained for the purposes of the review. However, grey literature including abstracts, conference proceedings and governmental reports, were examined if relevant and provided useful supplementary information for overall arguments. There did not appear to be any indication of a bias where unpublished, grey literature was yielding a different pattern of findings.

Furthermore, the author lacked the resources to include non-English papers in the review. This is likely to have introduced an element of bias. For instance, it is acknowledged that there is a language bias in that positive findings are published in English while negative findings are likely to be published in local-language journals (Dundar & Fleeman, 2017).

Data Extraction

This element of the process involved several revisions to data extraction forms in an attempt to gather the information required. Initially, postnatal depression was defined as later than one year to follow the terminology used in studies such as Barker et al. (2011) who referred to 1.5 years after birth as postnatal depression. But in further reviewing the literature and consulting with the team it was considered important to adhere to established time frames. Extracting data in relation to whether studies found significant findings controlling for other episodes was challenging given the vastly different statistical analyses and focus of the papers. Unfortunately, an independent reviewer was not able to screen the studies that were not selected or independently conduct the data extraction component of the process that is often recommended to increase reliability (Boland et al., 2017). This was not possible within the many limitations of a student project (e.g., time, resources) and therefore must be acknowledged as a potential limitation. In an attempt to reduce potential bias, the rechecking of extraction was done at different times for comparison. However, an independent reviewer was able to examine all 20 full texts that were included in the review to ensure they met the inclusion criteria and assessed the quality of a proportion of the studies (see quality appraisal section below).

Another issue that arose was to consider how to deal with multiple publications for the same study cohort. It is sometimes considered best practice to combine these in a data extraction process (Boland et al., 2017). However, the studies had very different focus, usually different numbers of participants and different time points focussed

upon. Therefore, it felt more appropriate to examine separately whilst making it clear that they were based on the same study.

Quality Appraisal

The Critical Appraisal Skills Programme (CASP, 2013) for cohort studies was used to aid the quality appraisal of the studies identified. CASP gathered experts in their field to develop and pilot the checklist. In addition, the framework is recommended by Cardiff University's Specialist Unit for Review Evidence (SURE) for reviewing observational research. A number of quality tools were reviewed including CASP and the Scottish Intercollegiate Guidelines Network framework (SIGN). The CASP appeared a more user friendly (easy to access, clear prompts to consider the question in more depth) approach and was decided upon for use. Nevertheless, the CASP was originally developed for educational purposes and does not include a scoring system which makes it more difficult to compare studies readily.

As such, I adapted the tool in line with previous reviews in the area (Rees et al., 2018) to include a score of 0,1, 2 for each item along with a qualitative descriptor which is consistent with the SIGN protocol in an attempt to increase objectivity and capacity for comparison. This also facilitated the discussions between myself and the independent reviewer as we had a number and descriptor to compare and achieve a consensus if necessary. It must be noted however that although adapting a tool may make it more appropriate for the task at hand there is a risk as it alters a standardised tool. It was deemed an appropriate trade off to achieve the necessary outcome of assisting in the rating of quality and being able to compare between raters. It must be noted also that the CASP tool has no research evidence of validity or reliability to draw upon and this is something that should be considered in future research in the area.

Overall, the quality rating procedure facilitated the process of reviewing the papers in a more objective and transparent way. It has been noted that quality assessment tools can be prone to biased ratings and poor inter-rater reliability (Higgins, Altman & Sterne, 2011). The use of another independent rater permitted a less biased approach and although scores were slightly different the qualitative descriptors were consistent and showed adequate reliability. The use of an independent rater is a strength of the review and a necessary requirement for publication (Boland et al. 2017).

Synthesis

A qualitative review was undertaken and this was deemed appropriate to answer the research question of whether the timing and recurrence of depression was associated with antisocial behaviour; identify gaps in the evidence base and direct the next stage of the research. A meta-analysis for this review was a possibility and may have perhaps facilitated the understanding of whether antenatal, postnatal or later episodes were more strongly associated with child outcomes. Nevertheless, the statistical analyses, varying antisocial outcomes used and lack of information reported on occasion made the possibility of conducting a meta-analysis a challenging undertaking that was beyond the scope of this review (Garg, Hackam & Tonello, 2008). It was deemed sufficient that the qualitative synthesis allowed us to ascertain that depression at all time points were related to child outcomes and it is likely that there are both relevant independent and cumulative effects.

The differing focus of the studies, the analyses undertaken and the substantial number of assessment points made synthesis challenging. Furthermore, there did not appear to be patterns that would distinguish between studies that found significant associations versus those that did not. The use of developmental periods, and combining by measure and so on did not elucidate patterns or trends that could be drawn upon. It must be noted also that obtaining a definitive reference for developmental stages of childhood was difficult. Although the age periods made intuitive sense, caution must be applied as the categories are used for this thesis rather than representing established stages of childhood.

Theoretical Considerations

The seminal paper by Goodman and Gotlib (1999) described an influential model that integrates information on mechanisms of the transmission of risk to children. In particular the model describes four mechanisms of transmission (i) heritability of depression; (ii) "innate dysfunctional neuroregulatory mechanisms" (Goodman & Gotlib, p 458) (that may result from genetic factors or adverse prenatal experiences (iii) exposure to negative maternal cognitions, behaviours and emotions and (iv) the stressful context of the offspring's lives. See Figure 1 adapted from Goodman and Gotlib's (1999) article.

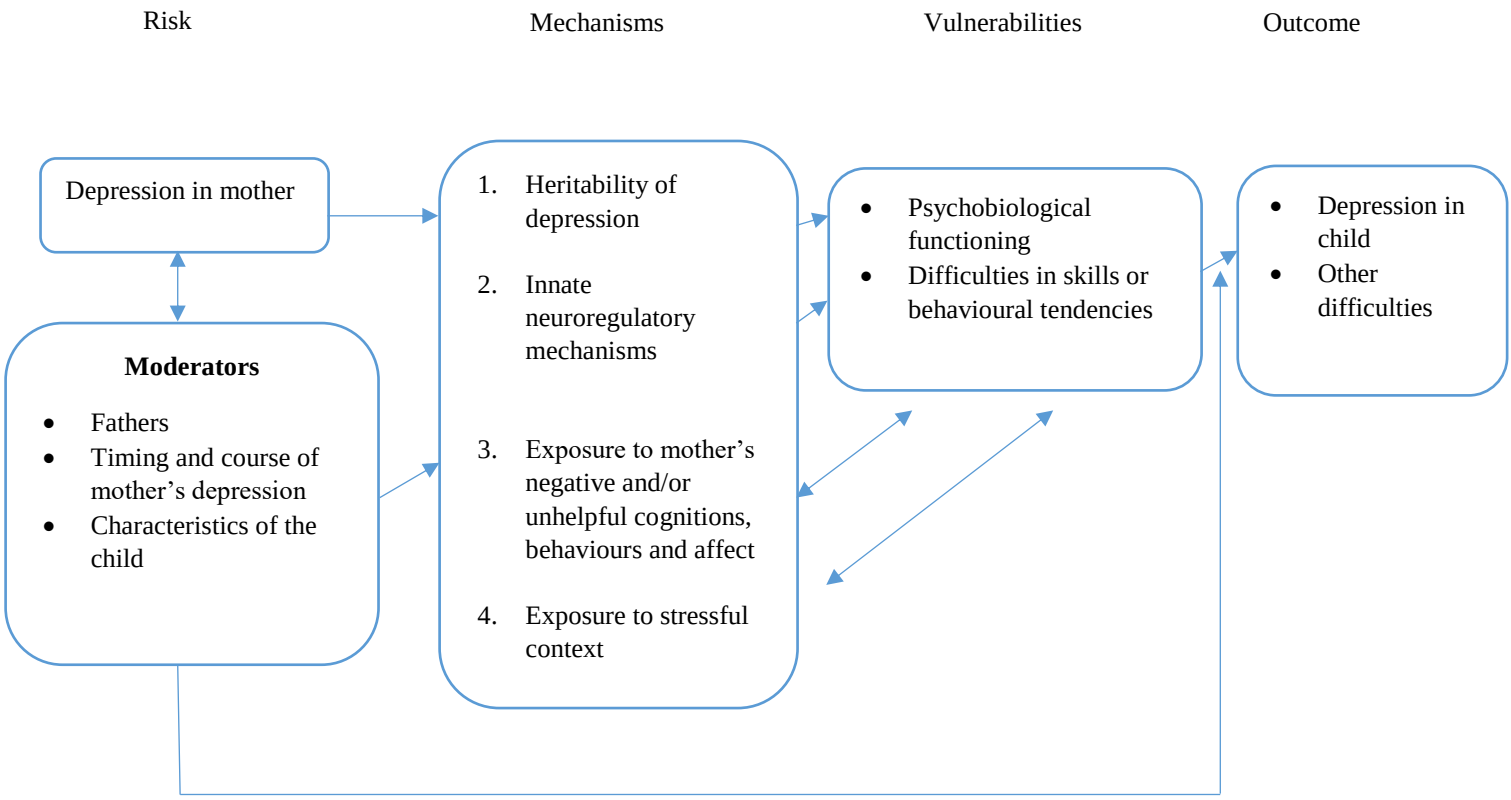

Figure 1. Goodman & Gotlib (1999) model of the transmission of risk.

In brief, the model proposes that depression in mothers increases the possibility of the four mechanisms of risk and they propose that any depressed mother-child dyad is likely to be characterised by one, more than one (or in some cases none of these) mechanisms. They postulate that these mechanism interact, for instance that genetic factors are likely to interact with all of the mechanisms and proposed moderators. The proposed mechanisms then result in vulnerabilities for the child in domains of functioning including biological (particularly the hypothalamic-pituitary adrenal [HPA] axis) cognitive factors (e.g., beliefs, self-esteem, helplessness), emotional (e.g., low stress resilience, difficulties in emotional regulation) and behavioural and interpersonal factors (e.g., difficulties in social skills, impulsivity, concentration etc.). The model also proposes that vulnerabilities interact with moderators including the timing of the mother's depression (Goodman & Gotlib, 1999).

The model provides a useful framework for considering the results of the systematic review. The consistent findings for the association between antenatal depression and child outcomes lends some support to the biological risk mechanism and the associated contention that depression in mothers during pregnancy potentially affects the developing foetus. There is evidence from animal research that stress during the antenatal period can have persistent effects on the offspring; although mechanisms have not been elucidated the HPA axis has been implicated (Talge et al., 2007; Weinstock, 2005). The HPA axis is activated by stress and threat and produces cortisol, which has been viewed as an "endocrinological marker of depression" (Waters et al., 2014; p 958). It has

been postulated that one mechanism of transmission could involve the mother's cortisol passing through the placenta during pregnancy, resulting in an alteration of the foetal level of cortisol and disrupting HPA development (see Waters et al., 2014 for a comprehensive review of the theoretical and biological underpinnings of transmission).

The evidence for additional independent effects for later depression are consistent with mechanism 3 and 4 of the model. The review demonstrated that for many women depression is recurrent, those depressed in pregnancy are likely to become depressed again and therefore any antenatal effects may also be explained by other processes such as genetic ones but also the impact on the parent-child relationship and the wider stressful context (Waters et al., 2014; Goodman & Gotlib, 1999). These factors are all likely to interact in complex ways and the longitudinal studies in the review provide only evidence of associations. Future research is required to disentangle pathways and potentially promising areas include those studies that incorporate fostered and adopted children and their biological and non-biological parents, cross-fostering paradigms of those undergoing IVF treatment and twin studies which may all help to delineate genetic and environmental influences (e.g., Rice et al., 2010; Waters et al., 2014).

Clinical Implications

Overall, the results were consistent and convincing on the association between maternal depression and child antisocial behaviour. There were independent effects during the antenatal, postnatal and later periods and also associations with cumulative exposure. The findings from the review provide further support for early detection and intervention for both mothers and their children. This is consistent with NICE guidance (2011) for antenatal and postnatal mental health that argues for early detection and management of mental health during pregnancy and in the first year postnatally. As noted, many women still do not have access to perinatal mental health services with a cost of an estimated £8.1 billion for each one-year cohort of births in the UK to the public sector (Bauer et al., 2014). This review provides additional support for the importance of providing services during this time.

However, interestingly the findings also advocate for the importance of continued monitoring and support for mothers and their children beyond the perinatal period. There were independent associations between maternal depression and child antisocial behaviour beyond the first year of life and some studies find higher rates of depression outside of the perinatal period. Woolhouse et al. (2016) argue for the rethinking of current policy frameworks as many women may fall through the gaps as they do not reconnect with mental health services beyond the perinatal period. Finally, the evidence also suggests that for many women depression is recurrent and

this cumulative exposure is problematic for children; unfortunately it is not clear to what extent mothers in these studies had received treatment for depression during the perinatal period, nevertheless the evidence suggests that mothers need intervention early on how to manage chronic illness rather than advice on short term reduction of their current difficulties (e.g., Hay et al., 2008).

Summary

In summary, there were a number of strengths to the systematic review undertaken; in particular the use of transparent, comprehensive, systematic approaches to the search strategy and data extraction; the assessment of quality of the studies using an appropriate tool and an independent reviewer for the assessment of quality. However, limitations include the lack of an independent reviewer at the screening and inclusion stage and the exclusion of potentially relevant information in the form of grey literature and non-English publications. Although the research has clinical implications, there was a need for further research that attempted to improve on methodological limitations and also to extend the research into the wider examination of the ASB construct.

The Empirical Study

Rationale, question development and main findings

The systematic review identified a number of methodological limitations to longitudinal research in the area including a focus on self-report measures of maternal depression and single informants on the child outcome measure. In addition, the review emphasised the limited conceptualisation of the ASB construct identified in these studies. The studies derived from the South London Child Development Study (SLCDS) cohort stood out in terms of their more varied approach to the examination of antisocial behaviour. Hay et al. (2003) for instance, explored child violence in particular at 11 years and found that it was predicted by postnatal depression at three months. The wider literature on antisocial behaviour and children has attempted to explore the heterogeneity within the construct, in an attempt to explore more homogenous subgroups with similar causal pathways; Callous-Unemotional traits grew out of this endeavour. It was interesting to find that there was limited longitudinal evidence exploring maternal depression and Callous-Unemotional behaviour. It was within this context that the empirical study question developed.

The empirical study examined maternal depression from pregnancy to age 7 years postpartum and the association with Callous-Unemotional (CU) behaviour. The study was embedded within a longitudinal study of a British birth cohort (the Cardiff Child Development Study); mothers (n = 249) were assessed for depression at pregnancy, 6

months postpartum and at 7 years postpartum using a diagnostic interview. CU behaviour was measured in children at 7 years old using primary caregiver and teacher reports on the Inventory for Callous-Unemotional Traits (ICU; Frick, 2004). Contrary to hypotheses, maternal depression during pregnancy and at 6 months postpartum was not associated with any aspect of the offspring's CU behaviour. However, regression analyses controlling for social adversity found that cumulative exposure to maternal depression from pregnancy to 7 years significantly predicted increased CU behaviour, according to the primary-caregiver but not teacher report.

The Cardiff Child Development Study

It was an exciting opportunity to be able to examine the research question within the context of the Cardiff Child Development Study (CCDS). The CCDS is a 6 wave, prospective, longitudinal study of a nationally representative sample of first born children and their parents. The CCDS is based at Cardiff University, funded by the Medical Research Council, and investigates the early prediction of aggression and prosocial behaviour in infancy and early childhood. The CCDS has followed families from pregnancy through to approximately 7 years old. Participants were recruited into the study during pregnancy for the first assessment (wave 1). These families were followed up six (wave 2), 12 (wave 3) and 20 (wave 4) months postpartum and at age three (wave 5) and seven (wave 6) years old. These assessment and follow ups consisted of an alternating sequence of home visits and laboratory visits. A diverse range of data was collected including DNA, physiological data, data on social interaction, parent's mental health and social, economic and psychological risk factors, data from education providers and data on parent and child interaction (e.g., Hay et al., 2011). Working on a study of this magnitude with access to a wealth of longitudinal data was a strength of the LSRP project.

Sample

The CCDS included a community sample of first born children and their parents. A considerable strength is the sample size under study with 249 mothers and children examined in the subsample. The CCDS includes a sample large enough to provide sufficient power for longitudinal analyses, while also being small enough to make observational and experimental methods feasible. Research on this scope would not have been possible for the thesis without access to the wealth of data from the Cardiff Child Development Study. Despite some attrition the levels of participation in the CCDS is good with 75% being retained for the current study purposes; the study variables measured showed that the sample did not differ from the full sample on sociodemographic factors. The recruitment strategy for the original 332 in the CCDS sample yielded a nationally representative sample in terms of sociodemographic factors (not differing significantly from the families of firstborn children in the Millennium

Cohort Study, the most recent survey of a nationally representative birth cohort in the UK (Hay et al., 2011). Therefore, the present study sample is likely to be representative and this increases generalisability of the findings. Nevertheless, attrition is an issue in any longitudinal study and one must consider that those who remained in the study may have differed from the wider sample on issues not measured in this study.

The community sample followed longitudinally allowed for the exploration of the course of depression and other factors over time. However, the normative community sample means that levels of antisocial problems in the children were likely to be relatively low which makes exploration of severe levels of antisocial behaviour more difficult. CU behaviour, as well as being important in predicting later difficulties has been useful in delineating subgroups of antisocial individuals that go on to demonstrate more persistent and severe antisocial behaviour (Frick & White, 2008). Our study did not have sufficient numbers to subgroup individuals based on conduct disorder and CU behaviour, and this would be an important focus for the future.

Design

The longitudinal design is essential for studying the effects of depression over time and indeed a limitation in the wider literature is the focus on cross-sectional studies that do not allow for the controlling for earlier and later depressive episodes. The prospective nature is a strength but it must be taken into consideration that there was a substantial gap in assessment from age 3 years to 7 years and the data for depression was captured retrospectively for that time period; the limits of memory and recall may impact on the accuracy of the findings. Nevertheless, this is a limitation of many studies in the area (e.g., Pawlby et al., 2009).

Again, the studying of depression over time could never have been achieved in a clinical psychology thesis without access to the longitudinal data provided by the CCDS. However, the nature of a longitudinal dataset means that the data is collected with different aims and may not be examined in the way that one would choose at this point in time or if the focus was solely on the study at hand. For instance, the severity and duration of depressive symptoms was not collected at earlier waves and would have been particularly interesting to explore in this study. Duration of episodes was ascertained by myself at wave 6 but without the measures at earlier waves for comparison, this variable was not suitable for use. In addition, other conditions such as generalised anxiety disorder was coded and diagnosed at wave 6 but without access to these variables at earlier waves the decision was made not to utilise. From a pragmatic point of view, the CCDS dataset is vast and at times overwhelming and the checking of variables, data screening and even data entry can be a time consuming and challenging process. It was important that another researcher also double entered data for accuracy. Given the wealth of information

that is potentially available, it makes it even more important to remain hypothesis driven; testing hypotheses that evolve from the literature and avoiding post hoc analyses.

Measures

Maternal Depression

The Schedules in Clinical Assessment in Neuropsychiatry (SCAN; Wing et al., 1990) was developed by the World Health Organisation and is a derivation of the Primary State Examination. Studies have demonstrated the utility of the SCAN in providing valid and reliable diagnoses when trained researchers administer the measure (e.g. Rijinders et al., 2000). The use of semi-structured diagnostic interviews, coded according to DSM-IV criteria, with consultant psychiatrists confirming the diagnosis is a substantial strength of the study. The reported reliability estimates also adds to the credibility of the maternal depression diagnoses.

The SCAN provided data on the presence of symptoms of depression as well as other conditions. The interview takes between approximately 1-2 hours to complete and therefore a considerable amount of audiotaped qualitative information is gathered. The longitudinal study design, the research questions and perhaps my own research background dictated a preference for a quantitative approach. However, when listening to the audios and then creating the maternal depression variables, I felt that a lot of powerful qualitative information in relation to mother's experiences were perhaps not being conveyed in reducing down to a few quantitative, categorical variables. It would be interesting for future projects involving the CCDS to explore the data using a qualitative approach, which to my knowledge would be a novel endeavour in relation to the CCDS.

The information collected was used to create dichotomous variables stipulating the presence or absence of a depression diagnosis at different time periods. As noted key variables were based on a retrospective account of symptoms from 6 months to 7 years; the decision to divide the period from 6 months to 7 years into 6 months to 36 months and 37 months to 7 years seemed to fit well with the CCDS waves of data collection and therefore could be utilised in future research based on the study. Furthermore, it reflected similar age periods for cumulative exposure variables in other longitudinal studies (e.g. Pawlby et al., 2009; who used 4 years old as a cut off). The information was used to create a cumulative exposure variable so the timing within that time frame was not that important, but rather what was important was whether depression was present in those time periods and any cut off would have sufficed for this. The decision to refer to this variable as cumulative exposure rather than recurrent exposure to episodes relates to the fact that we cannot be sure that all episodes were new episodes with a clearly

defined onset and offset and the depression variables may be confounded with the duration of episodes (which again is a common limitation in the literature).

Callous-Unemotional Behaviour

The Inventory of Callous-Unemotional Traits (ICU: Frick, 2004) is a well-validated measure of CU behaviour and having both parent and teacher report is a strength of the study as many of the studies in the area focus on maternal report of behaviour only. The discrepancy between findings for teacher and primary-caregiver report is perhaps not surprising, as consistency between informants on child behaviour is often low (Leis et al., 2014). One hypothesis that could not be ruled out is that there is a bias in maternal reporting, where mothers who are depressed are more likely to rate their children as having problems compared to mothers who are not depressed. It would have been helpful to include measures of offspring antisocial behaviour from other sources (e.g., father report) as well as more observational measures of behaviour to further explore the associations.

The study replicated the three factor structure for the ICU found in the literature (e.g., Frick & White, 2008) in the main which provides support for the validity of the instrument in our sample (although there were some minor differences at the item level (please see Appendix G for the results of the factor analysis for this study). The use of this instrument in a community sample of children during the middle childhood period provides an extension to the evidence base in the area. The findings for the association between the Callousness factor in particular also supports previous findings (e.g., Ezpeleta et al., 2013).

The systematic review demonstrated that research examining CU was lacking and hence the focus in the empirical study. Nevertheless, a wider focus on the ASB construct (e.g., conduct disorder, oppositional defiant disorder diagnoses) would have allowed for comparison with the wider literature and also been useful for exploring the heterogeneity of ASB. As noted, using alternatives to self-report antisocial behaviour such as observable and more objective forms of assessment would supplement findings also. The CCDS also has measures of observed behaviour in children and novel ways of exploring antisocial behaviour (virtual reality games, peer interaction toys, as well as diagnostic interviews on child problems) which would have been interesting to examine. It was considered beyond the scope of the thesis, but was originally considered as a potential avenue of exploration.

Analyses

Assessment of the assumptions of parametric tests using the visual inspection of histograms, boxplots and appropriate statistics indicated that there were issues of skewness and kurtosis on many of the Callous-

Unemotional outcome variables. There were also some outliers on continuous variables. It was likely that the assumptions of parametric tests had been violated. The removal of outliers did not appear appropriate as they were not likely to be misrepresentations of the data. Transformation of variables have previously been the adopted approach (Field, 2013), however it is now not considered to be the most effective way of dealing with violations. The current practice advocates for the use of bootstrapping which was used in the present study (e.g., Bakker & Wicherts, 2014; Wright, London & Field 2011).

It is also worthy of note that other analytical procedures could potentially have been used. The systematic review process and general literature search resulted in a number of recent studies that were using statistical techniques such as trajectory modelling as a way to examine patterns in maternal depression over time (Cents et al., 2013; Glasheen et al., 2013; Giallo et al., 2015). Glasheen et al. (2013) argued that attempts to isolate the relative effects of distinct depressive periods in regression frameworks may potentially obscure individual level associations. In light of this they used trajectory analysis to explore the course of maternal depression. However, in contrast to this approach, the majority of studies have used the timing of episodes and found distinct relationships (such as the many studies included in the systematic review). Furthermore, a number of studies that have used trajectory modelling have also demonstrated that symptoms come together in distinct periods also (e.g., van de Waerden et al., 2015). Arguably, the trajectory modelling approach provides a complimentary rather than alternative approach to the analysis of maternal depression over time (e.g. Korhonen et al., 2014).

Future Directions

The study presents initial findings on the longitudinal association between maternal depression and CU behaviour. This remains an under researched area of the literature and further replication is required before firm conclusions can be drawn. The study while demonstrating the importance of maternal depression in relation to CU behaviour, opens up many more questions. For instance, it points to the need to further understand the mechanisms by which maternal depression would influence the development of CU behaviour. As noted previously, there is evidence that CU behaviour is modified by parenting factors and these mechanisms then provide targets for intervention. Waller, Gardner and Hyde (2013) demonstrated convincingly in a systematic review that dimensions of parenting (e.g., parenting warmth) are prospectively related to changes in CU behaviour and importantly that parent-focussed interventions are effective in reducing the level of antisocial behaviour and CU behaviour in youth. In one study, parental depression moderated the association between parenting behaviour and CU behaviour (at high levels of depression, corporal punishment predicted increased CU traits but not at low levels of depression; Childs

et al., 2014). How depression over time and cumulative exposure to maternal depression interacts with these factors has not been explored.

As noted there are a number of additional areas of research that would be useful to explore further; including an exploration of the heterogeneity of the ASB construct using multiple measures of assessment. In addition, to these suggestions it is a limitation of research in this area in general and of this study in particular that there a lack of research on the role of fathers. Although some information on fathers is captured in the CCDS it was not available for study for this thesis purposes. There is increasing evidence that depression in fathers also has negative effects on parent-child relationships and child outcomes (Connell & Goodman, 2002).

Theoretical considerations

Goodman and Gotlib's (1999) model is of course relevant to the findings of the empirical study also; as noted the evidence from the study does not necessarily support a foetal programming effect (e.g., O'Donnell, Glover, Barker, & O'Connor, 2014) with direct effects on the foetus being associated with CU in particular; rather from our results the evidence is more suggestive of the ongoing impact of depression through the child's life (perhaps via parenting factors). This suggests that despite the heritable component to CU behaviour that environmental factors are still influential. Any effects of perinatal depression are likely bound up with exposure to mother's lifelong depressive illness. Further, that the mother's depressive illness creates an environment of increased risk both before and after the child's birth. Children of mothers who are depressed in pregnancy are likely to be at increased genetic risk for difficulties; exposure to recurrent depressive episodes creates a gene-environment correlation which increases the risk for antisocial behaviour (e.g., Hay et al., 2008).

Theories on the development of antisocial behaviour and CU in particular are also relevant to mention here. Two theories have been proposed to understand the development of CU behaviour and antisocial behaviour. Kochanska (e.g., Kochanska, 1997) contend that parent socialisation, including effective discipline, lead to negative emotions in children in typical socialisation attempts. This process leads to the internalisation of norms and conscience development (Waller et al., 2017). A fearlessness temperament which is associated with CU behaviour is thought to lower the anxiety associated with wrongdoings (e.g. antisocial behaviour) and so those with CU are more likely to engage in transgressions. Blair (2013) postulates that that underactivity in the amygdala in response to cues of fear, sadness and distress contributes to the development of CU. Children do not associate behaviours that are hurtful to others with negative emotions and this can result in difficulties in the experience of empathy (Waller et al., 2017). Neither model specifies the cause of fearless temperament although genetic contributions have been

implicated (Viding & McCrory, 2012). As Waller et al. (2017) argue children who are vulnerable to the development of CU, perhaps because of genetic and neurobiological factors are likely to need the environmental conditions to be just right in order to prevent the development of the behaviour. It is conceivable that maternal depression (and the impact on parenting and the parent-child relationship) could interact with this vulnerability and contribute to the development of CU behaviour.

Clinical Implications

The findings of the study indicate that depression in mothers is common; both during the perinatal period and during their offspring's early to middle childhood years. Nearly half the mothers in the sample had been depressed at some point over the course of the study. This common disorder is also one that recurs with a substantial number of women going on to experience further episodes of depression. Mothers need support in managing what may be for some a chronic illness. Although perinatal depression specifically may not be associated with CU behaviour, cumulative exposure which included the perinatal period was associated. Intervening early to prevent and manage a mother's illness is important also for the developing child. This is consistent with current clinical guidance; (e.g. NICE [2014] clinical management service guidance for antenatal and postnatal mental health) which promotes early detection and good management during the perinatal period. The evidence would also advocate for the importance of monitoring and intervening beyond the perinatal period for those where depression reoccurs or there is a new onset of the disorder.

Considering the CU behaviour, we know that antisocial behaviour is costly to individuals, families and society. Disruptive behaviour disorders are one of the main reasons children present to mental health services. Of course we did not explore in our study whether the CU behaviour was impacting functionally on the child and family and whether there were clinically significant difficulties. However, early CU behaviour is predictive of severe antisocial behaviour and the hope is that by targeting this behaviour early that individuals can be diverted from the development of and persistence in antisocial behaviour (Waller et al., 2015). Our evidence demonstrated that increased exposure to maternal depression is associated with increased CU behaviour. The wider evidence shows that parenting factors impact on CU behaviour and that maternal depression moderates the association between parenting factors and CU (e.g., Childs et al., 2014). Taken together the evidence suggests that maternal mental health, parenting and the parent-child relationship appear important intervention targets. Indeed, the development of a warm, positive parent-child relationship is one of the factors thought to contribute to the development of

empathy and conscience, key areas thought to be impaired in those individuals with clinically significant CU behaviour and antisocial behaviour (Waller et al., 2014).

In relation to mother's maternal health and children's behaviour problems not surprisingly then a systemic approach is advocated. When children and young people present to services with difficulties, an assessment of the mental health of mothers (and potentially fathers), the provision of information on how mental health factors impact on parenting and parental mental health interventions would potentially support the wider intervention attempts for the child (Childs et al., 2017). This too is consistent with clinical guidance on the management of conduct disorder in children, which advocates for a full assessment of the child that incorporates the assessment of mental health in parents and caregivers and provision of parenting training (NICE, 2014). However, the extent to which this systemic approach is routinely followed in resource poor clinical settings is unknown. Research needs to continue to inform practice and researchers/clinicians need to continue to advocate for the importance of a systemic and holistic approach. Given that CU behaviour is predictive of poorer outcomes in terms of severe and persistent ASB, the provision of intervention to this higher risk group may also provide an economical use of resources.

Wider issues on the general line of enquiry

File Drawer Problem and Dissemination

The file drawer problem (i.e. the tendency for studies that contain positive results but not negative or non-confirmatory results to be published) is an issue for both the findings included in the systematic review which may be a biased representation of true research but also the empirical study. The findings did not support an association between perinatal depression specifically which was not consistent with some studies in the literature; the lack of a finding here also precluded the examination of further steps of the analyses proposed and it may be more difficult for this paper to be published as a result. It will be important to make every attempt to publish the findings but also disseminate in additional ways including conference presentations. The further advantage of working as part of the CCDS research term is the prolific record of publication in high-impact journals. The findings from the CCDS have been reported in print, conferences, and online media in the UK and internationally and I am encouraged to continue in this endeavour.

Language, diagnoses and responsibilities

The pressing need on my part is to consider the language used, the responsibilities held as both a researcher and a clinician and perhaps the dilemmas that being at the interface of clinical work and research can bring. From my perspective, there is something particularly uncomfortable with using terms such as Callous-Unemotional to describe any individual and particularly a child. The thought of using these terms clinically would not seem appropriate and I would not advocate as such. Yet there is a substantial body of literature referring to Callous-Unemotional traits and considerable evidence demonstrating the importance of these behaviours in predicting poor outcomes in children. From this perspective, research exploring CU behaviour and the risk factors for the development of the behaviours is imperative for early intervention. To not engage with the literature because of the terminology would clearly ignore good quality research with important clinical implications. In an attempt to reconcile some of the dilemma, I have deliberately used the term CU behaviour as opposed to traits in my empirical paper. Traits imply enduring aspects of the personality that are difficult to alter and perhaps not amenable to treatment (this follows an approach used by Waller et al., 2017). As argued previously, by exploring factors that contribute to the variation in CU behaviour, it is hoped that interventions will be developed and targeted appropriately.

The issue of labelling individuals applies to the diagnostic label of depression in mothers also. It is important to acknowledge both the limitations of and sometimes negative impact of diagnostic labels on individuals. As clinical psychologists conducting research, we have a responsibility that the research we conduct is conveyed in ways that are helpful to service users and particularly within the context of this type of research does not contribute to feelings of blame or shame in mothers for instance. It should be emphasised that this research presents one part of a complex picture and that there are many limitations and unanswered questions. There are many factors that contribute to both maternal depression and CU behaviour and while research can inform our understanding and importantly contribute to arguments on the need for services, on an individual clinical level the unique formulation of both risk and protective factors and the making sense of someone's problems in context is imperative.

Furthermore, in relation to diagnoses there are of course challenges in abandoning diagnostic approaches generally but also within a research context. It is unlikely at present that high impact journal will publish without reference to diagnoses and systems such as NICE are organised by diagnoses and research categories (Johnstone & Boyle, 2018). The recent development of alternatives to the diagnostic approaches are worthy of mention here. The Power Threat Meaning (PTM) framework (Johnstone & Boyle, 2018) has been developed as an alternative approach to

the traditional psychiatric diagnosis. It acknowledges the limitations in medical diagnoses as a way to understand emotional/psychological distress. "The framework for the origins and maintenance of distress replaces the questions at the heart of medicalisation, 'what is wrong with you' with four others; What has happened to you? (How has Power operated in your life?); How did it affect you? (What kind of Threats does this pose?); What sense did you make of it? (What is the meaning of these situations and experiences to you?); What did you have do to survive? (What kinds of threat response are you using?)" (Johnstone & Boyle, pp189-190).

Adopting a Power Threat Meaning framework in a research context may include considering dimensional approaches to problems rather than a categorical diagnostic approach (CU behaviour was measured dimensionally which was an example of this) but more broadly would involve considering the range of factors that has led to the development of antisocial behaviour and maternal distress and considering how troubling behaviours are a person's best attempts at surviving and responding to adversity and threat. Furthermore, considering how wider social disadvantage contributes to these difficulties. Our findings demonstrated consistent associations between social adversity and maternal depression as well as aspects of child behaviour; although often used as a control measure in research of this nature it seems clear that social disadvantage is completely bound up with these difficulties (e.g., perhaps contributes, causes, exacerbates etc). These wider social elements should be taken into consideration in formulation and intervention.

By exploring potential contributors to the development of Callous-Unemotional behaviour we are widening the approach from a simply genetic or biological explanation (which fits with an approach that attempts to understand what has happened to you rather than what is wrong with you) but nevertheless the approach continues to use psychiatric diagnoses, categories and labels. As researchers and clinical psychologists we have a role in contributing to the evidence base in ways that opens up new perspectives. It will be interesting to observe and hopefully contribute to a changing research landscape in the context of the development of the Power Threat Meaning framework.

Conclusions

The research project has investigated the relationship between maternal depression and child antisocial behaviour in general and CU behaviour in particular by way of a systematic review, empirical study and critical evaluation. The systematic review findings demonstrated independent associations between antenatal depression, postnatal depression and maternal depression beyond the perinatal period and offspring antisocial behaviour. As well as finding evidence of the positive association between cumulative exposure to maternal depression and increased

child problems. The empirical study aimed to improve on methodological limitations identified in the systematic review and extend the literature by focusing on a particular behaviour associated with antisocial behaviour; Callous-Unemotional Behaviour. Contrary to hypotheses perinatal depression was not associated with CU behaviour, while cumulative exposure to maternal depression was associated with increased CU behaviour. As identified in the final critique, there are both strengths and limitations of this research endeavour; there are potential clinical implications but also a need for further research to corroborate, improve upon and extend the findings presented here.

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Appendices

Appendix A - The journal requirements for ECAP

European child and adolescent psychiatry

Instructions for Authors

Close

Types of Papers

Accepted article types: Original Contribution, Review Article, Brief Report, Letter to the Editors

Declaration of Conflict of Interest is mandatory for all submissions. Please refer to the section "Integrity of research and reporting" in the Instructions for Authors.

Original Papers must not exceed 20 manuscript pages of max. 32 lines each plus 8 figures, taking up no more than 3 printed pages altogether. Exceptions can be made only with the agreement of an Editor.

Letters to the Editors and Brief Reports should not have more than 4 authors, and not contain more than 1000 words, 1 figure, 1 table (or 2 of either) and 10 references. Summary and key words are not required. Letters are subject to editorial review and may be peer-reviewed. When a submitted letter refers to an article published in a previous issue of the journal, the letter is sent to the authors of that article. Brief Reports are abbreviated research papers which should focus on a small number of principal findings. A Brief Report could be formatted as follows: Introduction, Methods, Results and Discussion.

Manuscript Submission

Manuscript Submission

Submission of a manuscript implies: that the work described has not been published before; that it is not under consideration for publication anywhere else; that its publication has been approved by all co-authors, if any, as well as by the responsible authorities – tacitly or explicitly – at the institute where the work has been carried out. The publisher will not be held legally responsible should there be any claims for compensation.

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Online Submission

Please follow the hyperlink “Submit online” on the right and upload all of your manuscript files following the instructions given on the screen.

Title page

Title Page

The title page should include:

The name(s) of the author(s)

A concise and informative title

The affiliation(s) and address(es) of the author(s)

The e-mail address, and telephone number(s) of the corresponding author

If available, the 16-digit ORCID of the author(s)

Abstract

Please provide an abstract of 150 to 250 words. The abstract should not contain any undefined abbreviations or unspecified references.

Keywords

Please provide 4 to 6 keywords which can be used for indexing purposes.

Text

Text Formatting

Manuscripts should be submitted in Word.

Use a normal, plain font (e.g., 10-point Times Roman) for text.

Use italics for emphasis.

Use the automatic page numbering function to number the pages.

Do not use field functions.

Use tab stops or other commands for indents, not the space bar.

Use the table function, not spreadsheets, to make tables.

Use the equation editor or MathType for equations.

Save your file in docx format (Word 2007 or higher) or doc format (older Word versions).

Manuscripts with mathematical content can also be submitted in LaTeX.

LaTeX macro package (zip, 182 kB)

Headings

Please use no more than three levels of displayed headings.

Abbreviations

Abbreviations should be defined at first mention and used consistently thereafter.

Footnotes

Footnotes can be used to give additional information, which may include the citation of a reference included in the reference list. They should not consist solely of a reference citation, and they should never include the bibliographic details of a reference. They should also not contain any figures or tables.

Footnotes to the text are numbered consecutively; those to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data). Footnotes to the title or the authors of the article are not given reference symbols.

Always use footnotes instead of endnotes.

Acknowledgments

Acknowledgments of people, grants, funds, etc. should be placed in a separate section on the title page. The names of funding organizations should be written in full.

Scientific style

Generic names of drugs and pesticides are preferred; if trade names are used, the generic name should be given at first mention.

References

Citation

Reference citations in the text should be identified by numbers in square brackets. Some examples:

1. Negotiation research spans many disciplines [3].

2. This result was later contradicted by Becker and Seligman [5].

3. This effect has been widely studied [1-3, 7].

Reference list

The list of references should only include works that are cited in the text and that have been published or accepted for publication. Personal communications and unpublished works should only be mentioned in the text. Do not use footnotes or endnotes as a substitute for a reference list.

The entries in the list should be numbered consecutively.

Journal article

Gamelin FX, Baquet G, Berthoin S, Thevenet D, Nourry C, Nottin S, Bosquet L (2009) Effect of high intensity intermittent training on heart rate variability in prepubescent children. Eur J Appl Physiol 105:731-738. https://doi.org/10.1007/s00421-008-0955-8

Ideally, the names of all authors should be provided, but the usage of "et al" in long author lists will also be accepted:

Smith J, Jones M Jr, Houghton L et al (1999) Future of health insurance. N Engl J Med 965:325–329

Article by DOI

Slifka MK, Whitton JL (2000) Clinical implications of dysregulated cytokine production. J Mol Med. https://doi.org/10.1007/s001090000086

Book

South J, Blass B (2001) The future of modern genomics. Blackwell, London

Book chapter

Brown B, Aaron M (2001) The politics of nature. In: Smith J (ed) The rise of modern genomics, 3rd edn. Wiley, New York, pp 230-257

Online document

Cartwright J (2007) Big stars have weather too. IOP Publishing PhysicsWeb. http://physicsweb.org/articles/news/11/6/16/1. Accessed 26 June 2007

Dissertation

Trent JW (1975) Experimental acute renal failure. Dissertation, University of California

Always use the standard abbreviation of a journal's name according to the ISSN List of Title Word Abbreviations, see

ISSN.org LTWA

If you are unsure, please use the full journal title.

For authors using EndNote, Springer provides an output style that supports the formatting of in-text citations and reference list.

EndNote style (zip, 2 kB)

Authors preparing their manuscript in LaTeX can use the bibtex file spbasic.bst which is included in Springer's LaTeX macro package.

Tables

All tables are to be numbered using Arabic numerals.

Tables should always be cited in text in consecutive numerical order.

For each table, please supply a table caption (title) explaining the components of the table.

Identify any previously published material by giving the original source in the form of a reference at the end of the table caption.

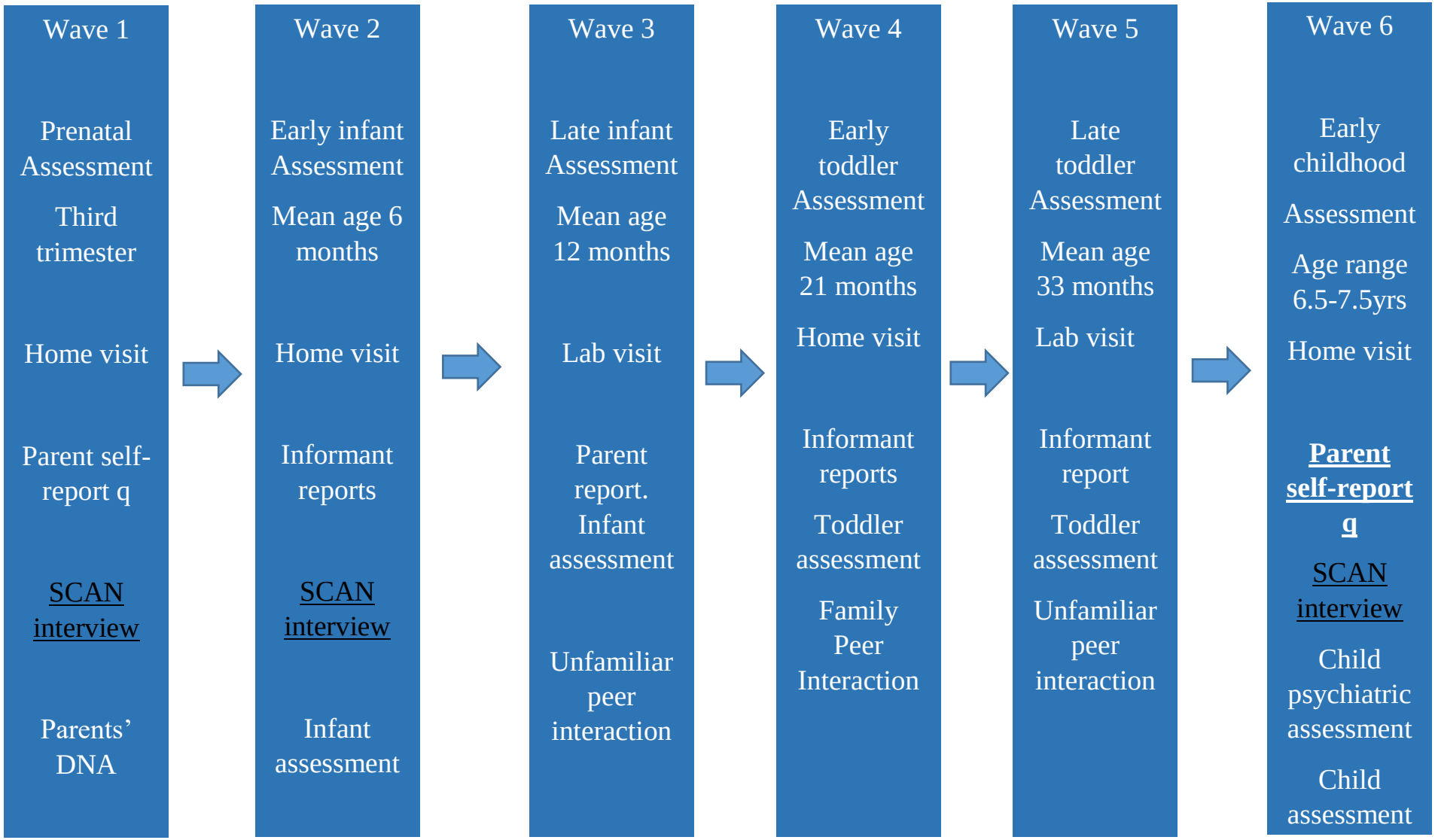
Footnotes to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data) and included beneath the table body.

Appendix B – The ovid psychinfo screen shot of the search strategy

☐	19	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 psychopathology).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	9285	Advanced	Display Results | More	🗨
☐	18	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 conduct disorder*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	1799	Advanced	Display Results | More	🗨
☐	17	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 conduct problem*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	1400	Advanced	Display Results | More	🗨
☐	16	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 externalising).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	103	Advanced	Display Results | More	🗨
☐	15	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 development).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	163646	Advanced	Display Results | More	🗨
☐	14	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 behavior*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	84270	Advanced	Display Results | More	🗨
☐	13	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 behaviour*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	8141	Advanced	Display Results | More	🗨
☐	12	Childhood Development/	62974	Advanced	Display Results | More	🗨
☐	11	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10	11332	Advanced	Display Results | More	🗨
☐	10	(postpartum adj3 depress*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	4944	Advanced	Display Results | More	🗨
☐	9	(postnatal adj3 depress*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	3592	Advanced	Display Results | More	🗨
☐	8	(perinatal adj3 depress*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	636	Advanced	Display Results | More	🗨
☐	7	(pregnan* adj3 depress*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	1552	Advanced	Display Results | More	🗨
☐	6	(antepartum adj3 depress*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	91	Advanced	Display Results | More	🗨
☐	5	(prenatal adj3 depress*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	452	Advanced	Display Results | More	🗨
☐	4	(antenatal adj3 depress*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	405	Advanced	Display Results | More	🗨
☐	3	(mother* adj3 depress*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	3456	Advanced	Display Results | More	🗨
☐	2	maternal depression.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	2663	Advanced	Display Results | More	🗨
☐	1	Postpartum Depression/	4128	Advanced	Display Results | More	🗨

37	11 and 36	3423	Advanced	Display Results	More	
36	12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35	282276	Advanced	Display Results	More	
35	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth) adj3 antisocial*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	2266	Advanced	Display Results	More	
34	juvenile delinquen*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	18834	Advanced	Display Results	More	
33	youth offend*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	417	Advanced	Display Results	More	
32	young offend*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	1331	Advanced	Display Results	More	
31	Juvenile Delinquency/	16493	Advanced	Display Results	More	
30	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 cognit*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	14056	Advanced	Display Results	More	
29	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 emotion*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	22500	Advanced	Display Results	More	
28	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 oppositional defiant disorder*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	289	Advanced	Display Results	More	
27	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 disruptive behavior disorder*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	408	Advanced	Display Results	More	
26	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 disruptive behaviour disorder*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	41	Advanced	Display Results	More	
25	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 anger*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	1189	Advanced	Display Results	More	
24	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 violen*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	9106	Advanced	Display Results	More	
23	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 aggress*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	7700	Advanced	Display Results	More	
22	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 maladjust*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	2022	Advanced	Display Results	More	
21	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 callous-unemotional).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	152	Advanced	Display Results	More	
20	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 callous unemotional).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	152	Advanced	Display Results	More	
19	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 psychopathology).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	9285	Advanced	Display Results	More	
18	((child* or infant* or adolescen* or teen* or toddler* or baby or babies or youth or offspring) adj3 conduct disorder*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	1799	Advanced	Display Results	More	

Appendix C – The Cardiff Child Development Study Waves



Appendix D – Ethical approval for empirical study

Ethics Feedback - EC.17.04.11.4884

P

psychethics

Reply all

Thu 04/05/2017, 10:22

Joanne Morgan;
Cerith Waters;
Sue Channon;
Dale Hay

Inbox

Flag for follow up.

Action Items

Dear Joanne,

The Ethics Committee has considered your PG project proposal: Maternal depression and child antisocial behaviour (EC.17.04.11.4884).

The project has been approved.

Please note that if any changes are made to the above project then you must notify the Ethics Committee.

Best wishes,
Mark Jones

Appendix E – The candidate's contribution to data collection.

The candidate's role was to work on the wave 6 SCAN data.

- To organise and sort SCAN files at wave 6; n = 262 SCAN interviews were completed; 60 immediately ruled out as no cases; 170 potential cases; 32 were not transcribed.
- To code SCAN transcripts (n = 170) according to the SCAN coding criteria in the areas of depression; anxiety disorders including GAD, specific phobia, social phobia, panic disorder and psychosis.
- To gather information from audio, hard copy and interviewer notes on missing information and duration of symptoms. More specifically, considering the onset and offset of episodes.
- To decide on diagnoses according to DSM criteria
- To anonymise and send data to a psychiatrist for case conferences confirmation of diagnoses
- To synthesise the information provided by the psychiatrist
- To transcribe transcripts (n= 5) of interviews that had not been transcribed.
- To train a research assistant in the transcribing of interviews (n = 25) that had not been transcribed
- To conduct reliability on the mother-child interaction tasks (n = 25).
- Double data entry

Appendix F – PRISMA checklist

TITLE
Title 1 Identify the report as a systematic review, meta-analysis, or both.
ABSTRACT
Structured summary 2 Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.
INTRODUCTION
Rationale 3 Describe the rationale for the review in the context of what is already known.
Objectives 4 Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).
METHODS
Protocol and registration 5 Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.
Eligibility criteria 6 Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.
Information sources 7 Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.
Search 8 Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.
Study selection 9 State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).
Data collection process 10 Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.
Data items 11 List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.
Risk of bias in individual studies 12 Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.
Summary measures 13 State the principal summary measures (e.g., risk ratio, difference in means).
Synthesis of results 14 Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I2) for each meta-analysis.
Risk of bias across studies 15 Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).
Additional analyses 16 Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.
RESULTS
Study selection 17 Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.
Study characteristics 18 For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.
Risk of bias within studies 19 Present data on risk of bias of each study and, if available, any outcome-level assessment (see Item 12).
Results of individual studies 20 For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group and (b) effect estimates and confidence intervals, ideally with a forest plot.
Synthesis of results 21 Present results of each meta-analysis done, including confidence intervals and measures of consistency.
Risk of bias across studies 22 Present results of any assessment of risk of bias across studies (see Item 15).
Additional analysis 23 Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).
DISCUSSION
Summary of evidence 24 Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., health care providers, users, and policy makers).
Limitations 25 Discuss limitations at study and outcome level (e.g., risk of bias), and at review level (e.g., incomplete retrieval of identified research, reporting bias).
Conclusions 26 Provide a general interpretation of the results in the context of other evidence, and implications for future research.
FUNDING: Funding 27 Describe sources of funding for the systematic review and other support (e.g., supply of data

Appendix G- ICU factor analyses	Primary Caregiver Report			Teacher Report		
	Factor 1 Uncaring	Factor 2 Unemotional	Factor 3 Callousness	Factor1 Uncaring	Factor 2 Unemotional	Factor 3 Callous
Items						
Works hard at everything (r)	.866			.855		
seems motivated to do best in structured activities (r)	.815			.817		
Always tries his/her best (r)	.738			.885		
Does things to make others feel good (r)	.598			.696		
Is concerned about the feelings of others (r)	.578			.659		
Tries not to hurt others' feelings (r)	.577			.648		
Apologises to persons he/she has hurt(r)	.521			.605		
Easy to tell how he/she is feeling (r)		.715			.697	
Is very expressive and emotional (r)		.703			.692	
Expresses his/her feelings openly (r)		.637			.707	
Hides his/her feelings from others		.542			.414	
Feels bad or guilty when he/she has done something wrong (a) (r)		.468			.417	
Easily admits to being wrong (a) (r)		.437			.314	
Does not show emotions		.426			.650	
Does not like to put the time into doing things well (d)			.483			
Shows no remorse when he/she has done something wrong			.686			.788
Does not care who he/she hurts to get what he/she wants			.653			.782
Does not care if he/she is in trouble			.630			.577
The feelings of others are unimportant to him/her			.536			.663
Does not seem to know right from wrong			.511			.389
Does not care about doing things well			.469	.411		
Seems very cold and uncaring			.432			.347
Does not care about being on time (b)						
Does not let feelings control him/her (c)						

a this loaded on uncaring in Frick & White (2008)
b this loaded on callousness factor in Frick & White (2008)
c not an item on the original Frick & White (2008) questionnaire
d this item loaded appropriately on the parent informant but not teacher informant.
r reversed items.PCA ; varimax rotation. Kaier Meyer- Olkin Measure of Sampling Adequacy = .89 (satisfactory Hutcheson & Sofroniou, 1999)
Bartlett's test of sphericity was significant – factor analysis adequate