

Costs of perinatal mental health problems

Appendices

Appendix 1 - Literature review

We searched for evidence on different maternal mental health problems during the perinatal period and their consequences for mothers, partners and children, drawing on the published and unpublished literature, with a focus on the UK but also drawing on evidence from other developed countries with similar prevalence of mental health conditions.

In particular, we looked for the following:

- Studies which measured resource use or costs linked to perinatal maternal mental health problems. We extracted information such as study design, year, country, population, time horizon, types of resources used, source of unit costs (if applicable), conflict of interest, and findings. We considered the appropriateness of studies for inclusion in our analysis based on this information.
- Studies which measured the relationship between perinatal maternal mental health problems and family health and wellbeing outcomes. We extracted information about studies such as their design, information about maternal and paternal or child variables (including assessment tools and time points of assessment), methods, conflict of interest, and findings of statistical analysis, including effect sizes and control variables. We assessed their appropriateness for inclusion in the analysis based on this information.
- Studies, particularly systematic reviews and meta-analyses, on prevalence and the natural course of mental health conditions.

In addition, we searched for studies which quantified resource use or costs linked to adverse child outcomes. Priority was given to recent, peer-reviewed studies from the UK. We specifically looked for studies on the natural course of mental health conditions and on the impact of mental health conditions on employment and health-related quality of life.

Our search strategies were comprehensive and pragmatic, including snowballing. We looked at the following databases: PsycINFO, CINAHL, Global Health, SocINDEX, Social Care Online. We searched Google and Google Scholar, and the following websites:

- National Collaboration for Women's and Children's Health (<http://www.ncc-wch.org.uk/guidelines/>),
- National Collaborating Centre for Mental Health (<http://www.nccmh.org.uk/>),
- Office for National Statistics (ONS, <http://www.ons.gov.uk/ons/index.html/>),
- Avon Longitudinal Study of Parents and Children (ALSPAC, <http://www.bristol.ac.uk/alspac/>),
- EQ-5D (<http://www.euroqol.org/>)
- NHS reference costs (<https://www.gov.uk/government/collections/nhs-reference-costs>) and

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- PSSRU compendium on the unit costs of health and social care (<http://www.pssru.ac.uk/project-pages/unit-costs/2013/>).

The framework we applied in our search strategy is shown below.

Figure 1: Framework for search strategy

Population	Period	Study type	Condition	Outcome
Maternal/ mother	Perinatal	Cost	Depression	Pregnancy or birth outcomes
Paternal/ father	Pre-/Ante- natal	Burden of disease	Anxiety	Infant attachment
Infant/child	Pregnancy	Effectiveness	Stress	Child development
	Postnatal	Economic evaluation	Psychosis	Mental health
	Postpartum	Epidemiological	Schizophrenia	Physical health
	Infancy	Projection	Bipolar	Nutrition
	Childhood	Longitudinal	Eating Disorder	Wellbeing
	Adolescence	Quality of life	Personality	Health utility
	Adulthood	Reviews	disorder	Service use
		Meta-analysis Report Guidelines Research briefing		Employment

We utilised the experience and knowledge of experts in this area, including members of the Maternal Mental Health Alliance and of our Expert Reference Group.

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Appendix 2 - Tables with parameters used for calculating costs

Table A2.1: Parameters, sources and descriptions used to estimate the costs incurred to mothers attributable to perinatal depression

Parameter	Value (in 2012/13 prices for costs)	Source and comments
<i>Course and recovery of perinatal depression and risk of suicide</i>		
Probability of depression during pregnancy	10.7%	Heron <i>et al.</i> 2004; Bennett <i>et al.</i> 2004
Probability of depression during 0-9 months postpartum	7.4%	As above
Probability of perinatal depression (combined)	9.4%	As above
Cumulative probability estimates for recovery from depression episode	1 st year 67%; 2 nd year 81%; 5 th year 88% 10 th year 93%	Mueller <i>et al.</i> 1996
Probability of suicide from depression	0.049%	Calculated from rates of suicide due to depression and prevalence of depression (Kunzman 2011); suicide numbers (ONS 2012), population estimates (ONS 2014); weighted average for women, 20-44 years.
<i>Incremental annual public sector costs attributable to perinatal depression</i>		
Mean difference in annual public sector costs (health and social care)	£354	Petrou <i>et al.</i> 2002
Mean difference in annual public sector costs (health and social care)	£1,977	McMahon <i>et al.</i> 2012
<i>Probabilities of part-and full-time employment for women after birth</i>		
Probability of employment of women before birth	67%	ONS 2013a
Probability of return to employment after birth	77%	DWP 2010; measured between 1 st and 2 nd year after birth
Probability of full (part)-time employment of women returning to work	Full-time: 13% (13%-21%); part-time: 87% (79%-87%)	ONS (2005)
<i>Incremental work weeks lost per year attributable to depression</i>		
Reduced work weeks per year for current (remitted) depression	12(2) wks.	Plaisier <i>et al.</i> 2010
<i>Incremental health utility attributable to perinatal depression and depression</i>		
Health disutility for depressed women during pregnancy and	0.26	Morrell <i>et al.</i> 2009, Ara and Brazier 2011, Burns <i>et al.</i> 2013; health utility (0.6) for

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postpartum period compared to women in general population		women 8-18 weeks pregnant with ICD-10 diagnosis of depression and, at 6 weeks postpartum, score on the Edinburgh Postnatal Depression Scale (EPDS) > 11, and health utility (0.856) for women in general population
Health disutility for depressed women compared to women in general population	0.29	Mann <i>et al.</i> 2009, Ara and Brazier 2011; health utility (0.568) for female adults with depression and health utility (0.856) for women in general population

Table A2.2: Parameters, sources and descriptions used to estimate the costs incurred to children attributable to maternal perinatal depression

Parameter	Value (in 2012/13 prices for costs)	Source and comments
<i>Parameters to calculate incremental costs of pre-term birth</i>		
Relative risk (RR) of pre-term birth	1.34	Grote <i>et al.</i> 2010; RR divided by middle/upper vs. lower socio-economic groups 1.13 vs 1.69 multiplied by their proportions of 62% vs. 38% according to ONS 2011
Probability of (extremely) pre-term birth (p PTB, p PTBe)	7.7% (of those 3.9% extremely pre-term)	Mangham <i>et al.</i> 2007, Table 2; extremely PTB refers to infant of <28 weeks gestational age
Risk difference pre-term	2.64 percentage points (pp)	Derived from p PTB and RR PTB: $1.34 * 0.077$
Risk difference extremely pre-term	0.1pp	Derived from RD PTB and p PTBe: $0.039 * 2.64pp$
Risk difference pre-term but not extremely	2.54pp	Derived from RD PTB and 1-p PTBe: $0.961 * 2.64pp$
Incremental life-time costs of extremely pre-term birth (<28wks)	HSC £105,022; ED £4,874; OOP £2,363; PL £3,845	Petrou and Khan 2012; 95% of the costs for health and social care (HSC) related to hospital inpatient stays during the neonatal phase; ED=education; the costs of out-of-pocket expenditure (OOP) and productivity losses (PL) related to parents
Incremental life-time costs of (non-extreme) pre-term birth (>28wks)	HSC £34,131; ED £584; OOP £439; PL £693	As above
Health disutility for extremely pre-term	0.167	Petrou <i>et al.</i> 2009; measured at 11 years; we applied this in our analysis for children 5 to 18 years

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children		
Health disutility for (non-extreme) pre-term children (>28wks)	0.073	Petrou <i>et al.</i> 2010; we did not have a value for this so we conservatively took the health decrement for child moderate cognitive impairment (term population)
<i>Parameters used to calculate incremental costs of infant death</i>		
Risk difference of infant death	1.3pp	Sanderson <i>et al.</i> 2002 and Howard <i>et al.</i> 2007; relative risk (RR) 4.1 (3.2-4.93); probability of infant mortality in general population 0.42% (ONS 2011)
<i>Parameters used to calculate incremental costs of child emotional problems</i>		
Risk difference (RD) child emotional problems	2.4pp (5-10 years); 5pp (11-16 years)	Bauer <i>et al.</i> 2014; RD at 11 years applied for 11 to 16 years and adjustment of 0.48 applied for RD 5-11 years based on progression of child emotional problems from 5-10 years to 11-16 years (Green <i>et al.</i> 2005)
Probability of postnatal depression and at least one subsequent depression episode	6.2%	Halligan <i>et al.</i> 2007; 83.6% who have a subsequent episode of depression after postnatal period and mean of postnatal depression of 7.4% (Table A3.1)
Risk difference child emotional problems (linked to subsequent episodes of depression)	7.7pp (5-10 years); 16pp (11-16 years)	Halligan <i>et al.</i> 2007;- OR = 3.86 (measured at 13 years and which we applied for 11 to 16 years); adjustment of 0.48 to derive RD (5-11 years) based on progression of child emotional problems from 5-10 years to 11-16 years (Green <i>et al.</i> .2005)
Incremental cost of child emotional disorder p.a.	HSC £132; ED £1,305	Snell <i>et al.</i> 2013; HSC=health and social care; ED=education; we assumed that all costs related to the psychiatric disorder
Incremental cost of adult depression p.a.	HSC £1,977	McMahon <i>et al.</i> 2012; we assumed that all health and social care (HSC) costs related to the psychiatric disorder
<i>Parameters used to calculate incremental costs of child conduct problems</i>		
Risk difference child conduct problems	12pp	Bauer <i>et al.</i> 2014; based on data from South London Development Study; conduct problems were measured when child was 11 years
Incremental life-time costs of conduct problems	HSC: £5,100; CJ: £10,000; PL: £10,500; VC: £37,900; QL: £21,500	Parsonage <i>et al.</i> 2014; refers to conduct problems without severity of a disorder; costs to health and social care (HSC) were those to the NHS; CJ=criminal justice; PL=productivity loss; VC=cost to victims of crime; QL = losses of quality-adjusted life-years
Incremental life-time costs of conduct disorder	HSC: £12,600; CJ: £35,800; PL £28,400; VC: £134,500; QL: £48,700	Parsonage <i>et al.</i> 2014; refers to conduct disorder

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<i>Parameters used to calculate special educational needs and leaving school without qualification</i>		
Incremental cost for special education	£3,166	Bauer <i>et al.</i> 2014; refers to children with special educational needs (during primary and secondary school) per woman with perinatal depression
Incremental life-time costs for lost productivity	£1,463	Bauer <i>et al.</i> 2014; refers to life-time productivity loss due to increased risk of leaving school without qualifications per woman with perinatal depression

Table A2.3: Parameters, sources and descriptions used to estimate the costs incurred to mothers attributable to perinatal anxiety

Parameter	Value (in 2012/13 prices for costs)	Source and comments
<i>Course and recovery of perinatal anxiety</i>		
Probability of anxiety during pregnancy	6.9%	Heron <i>et al.</i> 2004; refers to anxiety without comorbid depression measured in second and third trimester
Probability of anxiety after birth	3.0%	As above; refers to anxiety without comorbid depression, measured 0 to 9 months postpartum
Probability of non-remitted anxiety	1 st year 85.2%; 2 nd year 74.7%; 3 rd year 69.9%; 4 th year 65.6%; 5 th year 64.2%; 6 th year 62.1%; 7 th year 59.5%; 8-10 th year 57.7%	Yonkers <i>et al.</i> 2003; weighted across different anxiety disorders based on prevalence in women (taken from the same source, number with diagnoses of anxiety=496): panic disorder (8.5%), panic disorder with agoraphobia (48%), social phobia (19.4%), generalised anxiety disorder (24%)
<i>Incremental health utility attributable to anxiety</i>		
Health disutility anxiety	0.088	Saarni <i>et al.</i> 2007; refers to anxiety disorders across different types compared to population without disorder
<i>Incremental work weeks lost per year attributable to anxiety</i>		
Reduced work weeks due to (remitted) anxiety	9.4(2.8) weeks	Plaisier <i>et al.</i> 2010
<i>Incremental annual public sector costs attributable to perinatal anxiety</i>		
Incremental costs of health and social care	£866	McManus <i>t.</i> 2009, NICE 2011, p128; refers to costs for generalised anxiety disorder; derived from data in McManus <i>et al.</i> 2009.

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Table A2.4: Parameters, sources and descriptions used to estimate the costs incurred to children attributable to maternal perinatal anxiety

Parameter	Value (in 2012/13 prices for costs)	Source and description
<i>Parameters to calculate incremental costs of pre-term birth</i>		
Probability of anxiety during pregnancy	10% (anxiety score 5); 1.8% (anxiety score 6)	Orr <i>et al.</i> 2004; measured anxiety on a scale from 0 to 6; significant associations were only found for scores 5 and 6
Risk difference pre-term birth (PTB)	5.4pp (anxiety score 5); 13.3pp (anxiety score 6)	As above; derived from OR=1.7 (anxiety score 5) and OR=2.73 (anxiety score 6); and probability of PTB 7.7% (see Table A4.2)
Incremental life-time costs PTB	HSC £36,896; ED £190; PL £816; OOP £514	Derived from Petrou and Khan 2012 (Table A3. 2); weighting of p PTBe and 1-p PTBe applied to costs
<i>Parameters to calculate incremental costs of child emotional and conduct problems</i>		
Probability of anxiety during pregnancy	15.3%	O'Donnell 2014
Probability of child emotional or conduct problems	7.3%	O'Connor <i>et al.</i> 2002; probability emotional problems: 2.4%; probability conduct problems: 4.9%
Risk difference (RD) child emotional or conduct problems	5.1pp	O'Connor <i>et al.</i> 2002, O'Donnell 2014 ; RD (4 years) 4.6pp; RD (13 years) 5.5pp; measured 4 to 13 years
RD child emotional problems	1.7pp	As above; RD conduct or emotional problems weighted with 2.4%/7.3%
RD child conduct problems	3.4pp	As above; RD conduct or emotional problems weighted with 4.9%/7.3%
<i>Parameters to calculate incremental costs of child abdominal pain</i>		
Probability of postnatal anxiety	14.7%	Ramchandani <i>et al.</i> 2006
Risk difference chronic abdominal pain	3.97pp	As above; OR=1.4; probability of abdominal pain 11.8%
Costs of child chronic pain p.a.	HSC £9,028; ED £433; OOP £1,071; UC: £5,850; PL £1,827	Sleed <i>et al.</i> 2005; education costs (ED) referred to those of home tutoring; all other service use related to health and social care (HSC); UC=unpaid care

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Table A2.5: Parameters, sources and descriptions used to estimate the costs incurred to mothers and children attributable to maternal perinatal psychosis

Parameter	Value (in 2012/13 prices for costs)	Source and comments
<i>Parameters for calculating costs incurred to mothers (incl. those linked to subsequent psychosis)</i>		
Probability of perinatal psychosis	0.2%	Kendell <i>et al.</i> 1987, Oates 2003
Mean duration of episode (in years)	0.71	Blackmore <i>et al.</i> 2013 Table 2; time from onset of symptoms to resolution: 18.1%*3 months+ 29.3*6 months+26.7*12 months+25.9*12 months
Probability of subsequent episodes	60%	Robertson <i>et al.</i> 2005
Mean duration of subsequent episodes (in years)	0.997	Average duration between onset of episode and treatment start: 52 weeks (e.g. Loebel <i>et al.</i> 1992)
Annual probability of subsequent episode	9.7%	Calculated from probability of subsequent episodes and mean duration
Proportion of individuals with psychosis who have schizophrenia	37%	Mangalore and Knapp 2007
<i>Parameters used to calculate costs of maternal suicide</i>		
Probability of puerperal psychosis	0.2%	Kendell <i>et al.</i> 1987, Oates 2003
Probability of suicide for women with puerperal psychosis	0.1%	Oates 2003
Annual probability of suicide among individuals with psychosis	1.5%	Sharma and Marker 1994
<i>Parameters used to calculate costs of health and social care linked to perinatal psychosis and subsequent episodes (incl. cost for institutionalisation)</i>		
Unit costs of mother and baby units in England	AD £678; CC £195; OA £201	DH (2013), NHS reference costs 2012-13; includes costs for admissions (AD), community contacts (CC), outpatient attendances (OA)
Activities of mother and baby units in England per annum	AD 30,671; CC 32,868; OA 6,109	As above
Maternities per year (England)	671,255	HSCIC (2013)
Incremental costs	£9,140	Mangalore and Knapp 2007, Andrew <i>et al.</i> 2012;

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health and social care p.a.		presents the costs for individuals with schizophrenia
Incremental costs institutionalisation p.a.	£11,626	As above
<i>Parameters used to calculate incremental costs of QALY losses (mothers)</i>		
Health disutility psychosis	0.177	Roberts <i>et al.</i> 2014; measured on EQ-5D; health utility with psychosis 0.665, without mental health condition 0.842
<i>Parameters used to calculate costs of productivity loss (mothers)</i>		
Costs of productivity loss p.a.	£25,405	Mangalore and Knapp 2007, Andrew <i>et al.</i> 2012; presents the costs for individuals with schizophrenia
<i>Parameters used to calculate incremental costs of unpaid care</i>		
Cost of unpaid care p.a.	£6,556	As above
<i>Parameters used to calculate incremental costs of infant death</i>		
Risk difference infant death	0.72pp	Bennedson <i>et al</i> 2001; RR=2.76 and probability (0.26%) of post-neonatal infant death
<i>Parameters used to calculate incremental costs of pre-term birth</i>		
Risk difference pre-term birth	0.94pp	Nilsson <i>et al.</i> 2008, Table 4; adjusted OR 1.2; probability of pre-term birth 4.7%

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Appendix 3 - Study details

Murray 1992 Cohort (MC)

The sample was originally recruited at two months after birth, with follow-ups when the child was 18 months, 5, 8, 13, 16 and 22 years old with a 93% (80%) retention at 16 (22) years. Initial recruitment was through screening a community sample (N=702) of mothers of healthy, full-term infants at 6 weeks postpartum using the Edinburgh Postnatal Depression Scale (EPDS, Cox et al. 1987). Women scoring > 12 on the EPDS were interviewed and further assessed using Research Diagnostic Criteria (RDC; Spitzer et al. 1978) for depressive disorder and recruited for the study (n=58); a comparison group of n=42 mothers without postnatal depression was randomly selected from the same population. Maternal depression was assessed with the EPDS and the Structured Clinical Interview for DSM-IV (SCID; First et al, 1995) applied for all assessments from 5 years. A range of tools for different child development outcomes were used at different ages including: the General Health Questionnaire (GHQ) and the cognitive/language score via Bayley Scales at 18 months; the General Cognitive Index administered when the child was 5 years old ; IQ from the Wechsler Intelligence Scale for Children (WISC-III) at 8 years and 13 years; and GCSE grades at 16 years. In the analysis, a range of covariates were controlled for, including chronicity, recency and subsequent episodes of maternal depression.

UK Millennium Cohort (UKMC)

The UK Millennium cohort is a large-scale survey of children born in the four constituent countries of the UK. Data were first collected during 2001–2 from the parents when the babies (N=18,819) were 9–11 months old. The sample design allowed for overrepresentation of families living in areas with high rates of child poverty and high proportions of ethnic minorities in England, and the three smaller countries of the UK. The families were followed up when the child was age 3 years; response rate was 78%. Mother's depression was measured as 'Low or sad for 2 weeks since birth of child', diagnosed depression by a doctor, malaise score; child outcomes were measured at the three-year-old interview including cognitive development via six tests of the BBCS (Bracken Basic Concept Scale); behavioural problems were assessed via the SDQ (Strengths and Difficulties Questionnaire, Goodman 1997).

South London Child Development (SLCD) study

A random sample of 178 women was drawn from records of consecutive antenatal patients who attended two GP practices in South London in 1986 (Sharp, 1995); the follow-up study of the children was based on 151 cases (89% of the random sample). At child age 16 years, 137 (91%) participated in the study. Complete information was available for 120 families (80%). Compared to national norms, the sample had a higher proportion of working-class families and families from ethnic minorities. A wide range of child development outcomes were measured including literacy skills measured through "sustained attention over a 6-minute period on a task requiring vigilance."; "behaviours observed during the child's testing session"; "psychiatric symptoms, ... distress, social impairment, and burden"; children and parents were interviewed using the Child and Adolescent Psychiatric Assessment CAPA at child ages 11 and 16 years, and child-rated scores on the SDQ (Strengths and Difficulties Questionnaire, Goodman 1997) were collected at the same ages; violent

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antisocial behaviour was defined in terms of the DSM–IV categorization of aggressive conduct symptoms and/or arrest for violent crimes.

Avon Longitudinal Study of Parents and Children (ALSPAC)

This study collects data on genetic and environmental characteristics that are thought to influence health and development in parents and children. N=13,761 women were recruited into the sample from a defined area in the south west of England, with an expected date of delivery between April 1991 and December 1992. These women have been followed over the past 19–22 years. When compared with 1991 national census data, the ALSPAC sample was found to be similar to the UK population as a whole. Outcomes for 6,979 women were collected via self-report measures of maternal depression and anxiety using the Edinburgh Postnatal Depression Scale (EPDS) and Crown–Crisp Experiential Index (Birtchnell *et al.* 1988), completed on 6 occasions up to child age of 3 years. Child outcomes include: maternal reports of the nutritional environment at 32 weeks gestation and 47 months; emotional and behavioural problems based on the SDQ (Strengths and Difficulties Questionnaire, Goodman 1997) completed by mothers when children were aged 4, 7, 9, 11.5, and 13 years; child cognitive function (IQ) assessed via the WISC-III at 8 years; and the Clinical Interview Schedule for ICD-10 diagnosis applied at 18 years.

Baltimore (Maryland) Study

From 1991 to 1993 a total of 1,820 women completed a questionnaire during their first prenatal visit to clinics in Baltimore, Maryland. Pregnancy-related anxiety was assessed using six questions from the Prenatal Social Environment Inventory; data on pregnancy outcome and clinical and behavioural covariates were obtained from the women's clinical records; factor analysis was used to ascertain if pregnancy-related anxiety was an independent construct from depressive symptoms; covariates in statistical analysis include first or second trimester bleeding, drug use, employment, prior poor pregnancy outcome, smoking, low body mass index, maternal education, age and race.

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