The effects of antenatal stress, anxiety and depression on the fetus and the child

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The mother’s emotional state in pregnancy can have a long lasting effect on her child
How the first nine months shape the rest of your life

The new science of fetal origins

BY ANNIE MURPHY PAUL
"Yes! The history of man for the nine months preceding his birth would probably be far more interesting and contain events of greater moment, than all the three score and ten years that follow it"

Samuel Taylor Coleridge (1772 –1834)
The things desired by the mother are often found impressed on the child that the mother carries.

Leonardo Da Vinci
Educational Poster for Expectant Mothers

DON'T LISTEN TO "OLD WIVES' TALES"
No shock can mark an unborn baby.
No horrible sight can deform him.

BUT
WORRY, FEAR and ANGER may affect his mother's blood, which supplies his food.

THEREFORE
she should be CALM, HAPPY and SWEET-TEMPERED.

National Child Welfare Association 1919
Anxiety and depression
the scale of the problem

- The single biggest cause of misery in our community is mental illness
- 40% of all disability is due to mental illness

% of population
- Anxiety and depression 8.8
- Generalised anxiety 4.4
- Depression 2.6

LSE report 2006 (Lord Layard)
• Women have more symptoms of depression and anxiety during pregnancy than postnatally

• Pregnancy can also be a time of increased domestic abuse and relationship strain
One paragraph on postnatal depression, psychosis and baby blues.

Nothing on antenatal maternal anxiety or depression.

Year 2000
What causes stress?

• Anxiety and depression/mental illness
• Bad relationship with partner (emotional or physical abuse)
• Lack of social support—not much supportive contact with family or friends
• Recent immigrant/ethnic minority
• Poverty/bad housing
More than one million children in UK suffer from neurodevelopmental disorders

- Emotional disorder (anxiety and depression) (4%)
- Conduct disorder (6%)
- Hyperkinetic and/or attention disorder (ADHD) (2%)
- Other e.g autism (1%)

- Boys 11% girls 8%

Social Trends 2007
From fetus

To child
Fetal programming

Environment in the womb, during different sensitive periods for specific outcomes, can alter the development of the fetus, with a permanent effect on the child.
Relative increase in brain size

20 week fetus

birth

5 years
The Fetal Brain is “Under Construction”

- 3 mm long neural tube – whole brain with 100 billion neurons and 100 trillion connections
- 250,000 neurons/minute – all through gestation
- **Proliferation**: 5 wks gestation through 18 months after birth
- **Migration**
- **Differentiation**
- **Synaptogenesis**
- **Neural pruning**: continues till puberty...
Long term effects of prenatal stress on neurodevelopment
Animal studies.
Wide range of effects on offspring with prenatal stress

- More anxiety
- Reduced attention
- Learning deficits
- Reduced laterality
- Altered sexual behaviour
- Effects different on male and female offspring

- Mediated by HPA axis and cortisol/corticosterone in both mother and offspring
Epigenetic modifications—basis for fetal programming

Epigenetic changes are functionally relevant modifications to the genome that do not involve a change in nucleotide sequence. Can persist to grandchild generation.
Human studies
Human Fetal Development

- Responds to touch at 10 weeks (just a reflex response)
- Probably can feel pain from 20-26 weeks
- Can respond to sound from 26 weeks
Links between maternal anxiety and fetal behaviour and heart rate

e.g. Study shown that if pregnant mothers are asked to do a mental arithmetic and Stroop test, fetal heart rate goes up in the anxious group

Monk et al. 2000
Stress/anxiety during pregnancy and long term effects on the child
Prenatal stress in humans associated with increased incidence of:

- Anxiety and Depression
- Behavioural problems-ADHD, conduct disorder
- Impaired cognitive development, especially of language
- Mixed handedness
- Sleep problems in infants
- Autism?
- Schizophrenia?
Examples of prenatal stress reported to cause changes in development and behavior

- Maternal anxiety and depression
- Maternal daily hassles
- Pregnancy specific anxiety
- Partner or family discord
- Distress caused by 6 day war in Israel, 1967
- Experience of acute disasters, e.g. freezing ice storm, hurricane or 9/11

- It’s not just extreme stress
ALSPAC Study. Does antenatal stress affect child behaviour in humans?

• Aim of our study:
• To determine the long term effects of antenatal stress or anxiety on the behavioural development of the child

Fetus age 20 weeks (18cm)
ALSPAC
Avon Longitudinal Study of Parents and Children

• Large prospective birth cohort
  ~14,000 pregnant women recruited around Bristol in 1990-1991

• Detailed information on children at 4, 7, 11 and 13 years
ALSPAC study

Maternal anxiety-at 18 and 32 weeks of pregnancy Compared 15% most anxious mothers both pre and 33 months postnatally with the rest

Child behaviour
–maternal report at from 4 to 13 years old. Strengths and Difficulties questionnaire. Attention deficit/hyperactivity; anxiety and depression; conduct disorder
Multivariate Analysis

Cohort with complete data

n = 7,363

- Maternal Postnatal anxiety and depression
- Paternal pre and postnatal anxiety
- Parenting
- Maternal age
- Birthweight
- Gestational age
- Smoking
- Alcohol
- Psychosocial factors: crowding (SES)
- Maternal education
Total SDQ scores and maternal anxiety at 32 weeks
Prenatal and 33 months Postnatal
-allowing for BW, GA, maternal age, maternal education, SES, maternal substance use, parenting, etc

O’Donnell et al., in prep
Links are similar with antenatal anxiety at 18 weeks gestation

Links are similar with depression

It is not just first trimester
• For top 15% of most anxious women in pregnancy, SDQ symptom rate
  (ADHD, anxiety, conduct disorder)

• doubled from about 5 to 10% (after multivariate analysis).

• Attributable load of behavioural/emotional problems in whole population due to antenatal anxiety/stress ~10-15%
How?
Maternal stress/anxiety/mental illness

Transplacental passage of cortisol
1/11β-HSD2 ΔCT

Maternal Trait anxiety

Males r = -0.39, p = 0.040, n = 28
Females r = -0.40, p = 0.034, n = 28

significant correlation with State anxiety trend with depression

O’Donnell et al 2011
11-βHSD2

Stress

Maternal Placenta Fetal

cortisol
cortisone
cortisol
Maternal stress/anxiety/mental illness

transplacental passage cortisol

cortisol
cortisol
cortisol
Blood sample
cortisol

Spielberger state and trait Anxiety questionnaire

Amniotic fluid
cortisol
Bayley Scales of Infant Development (BSID-II)

Study child’s cognitive (MDI) development at 17 months
Correlation between amniotic fluid cortisol and cognitive development

$r = -0.245$  $n=125$  $p=0.006$

Bergman et al 2010
Ainsworth's 'Strange Situation' Assessment

1. Parent and child are alone in a room.

2. Child explores the room without parental participation.

3. Stranger enters the room, talks to the parent, and approaches the child.

4. Parent quietly leaves the room.

5. Parent then returns and comforts the child.
Effect of Maternal Attachment on association between AF cortisol and Cognitive Development

Bergman et al 2010
• Higher in utero exposure to cortisol is associated with lower cognitive function

• Sensitive early mothering can reverse the effects of high in utero exposure to cortisol
But insensitive mothering can increase fearfulness in the child.

Early mothering is just as important as what happens in the womb for child outcome.
Role of Professionals

- Different for each mother
- Detect and treat anxiety and depression in pregnancy
- Help with relationship problems
- Help to create more social support
- Practical help with housing etc
- Help to teach sensitive mothering - video feedback?
How we can all help support pregnant women

• Fathers
• Employers
• Grandparents
• Friends

• It helps to talk
How women can help themselves

• Take time for themselves each day to relax

• yoga

• massage

• sitting down and listening to music

• It helps to talk
www.beginbeforebirth.org