Growing Up in Ireland
National Longitudinal Study of Children

Longitudinal effects of birth weight on the mental health of Irish children

Niamh Dooley

Royal College of Surgeons in Ireland (RCSI)

Trinity College Institute of Neuroscience (TCIN)

Colm Healy, David Cotter, Mary Clarke & Mary Cannon

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ESRI ECONOMIC & SOCIAL RESEARCH INSTITUTE

Trinity College Dublin
The University of Dublin

An Roinn Leanaí, Comhionannais, Míchumais, Lánpháirtíochta agus Óige
Department of Children, Equality, Disability, Integration and Youth

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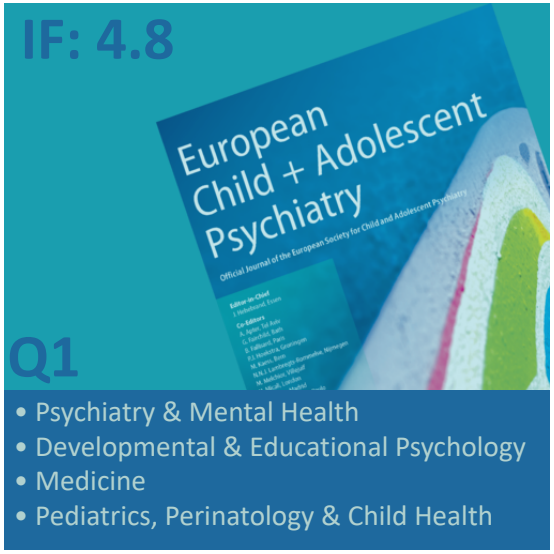
Research Article

The persistent effects of foetal growth on child and adolescent mental health: longitudinal evidence from a large population-based cohort

Under Review | European Child & Adolescent Psychiatry | Springer

Niamh Dooley, Colm Healy, David Cotter, Mary Clarke, & Mary Cannon



Childhood Mental Health

- Most **adult** mental health problems are preceded by **childhood** mental health problems Kim-Cohen et al. 2003 // Kessler et al. 2005
- The **earlier** the **onset** of problems in childhood, the **more likely** & **numerous** problems are in adulthood Caspi et al., 2020, JAMA
- The **type of issue** often **varies** throughout development Caspi et al., 2020

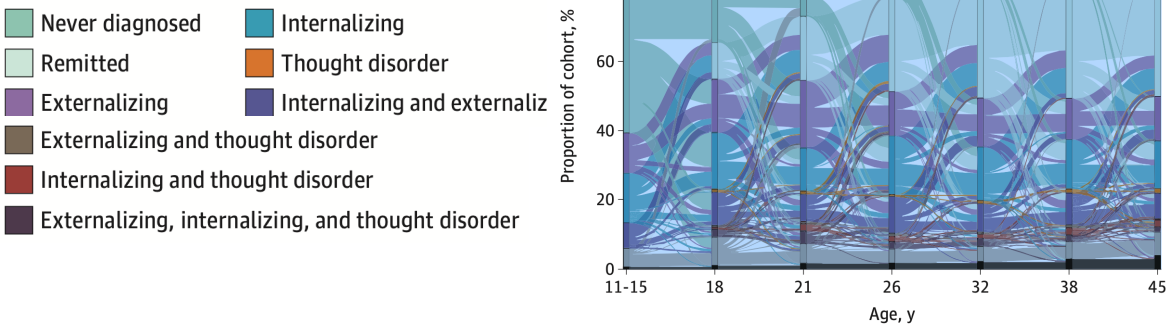


Figure from Caspi et al. (2020, JAMA)

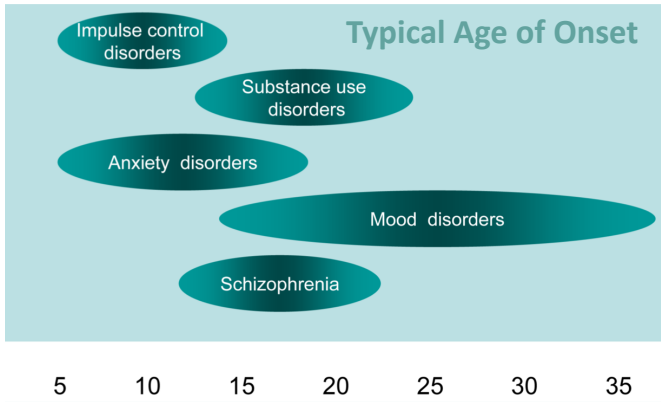


Figure from Giedd et al. (2008, Nat Rev Neurosci)

Predicting childhood mental health

BIRTH WEIGHT

Birth Weight & Childhood Mental Health

What we know so far

- Low birth weight has been associated with **mental health difficulties** in the child
- Most commonly linked mental health problem in childhood: **attention-deficits & hyperactivity** problems
- Linear association

Psychological Bulletin
2017, Vol. 143, No. 4, 347–383

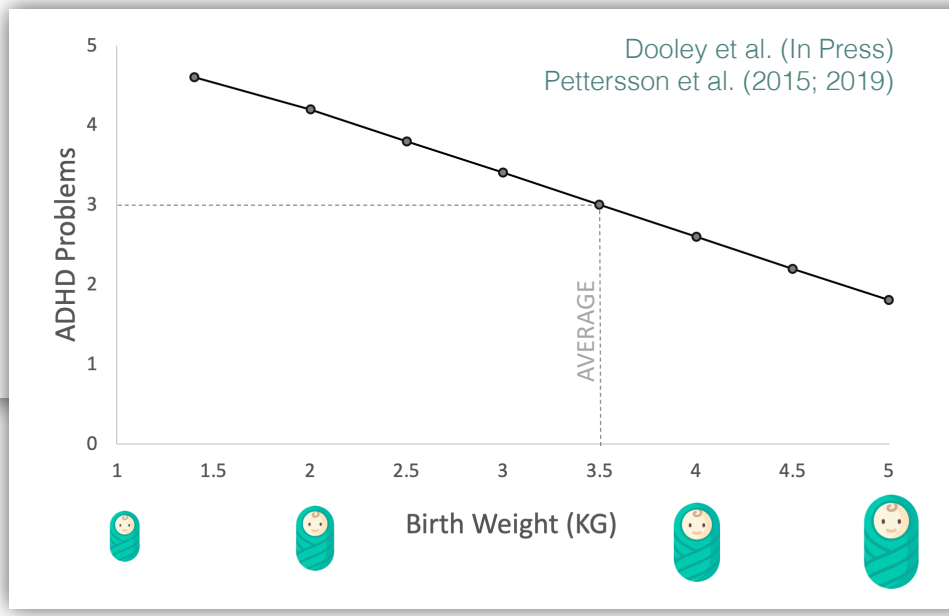
2017

0033-2909/17/$12.00 http://dx.doi.org/10.1037/bul0000091

Mental Health of Extremely Low Birth Weight Survivors: A Systematic Review and Meta-Analysis

2007

Evidence for a Causal Association of Low Birth Weight and Attention Problems



Extremely Low Birth Weight = <1KG Low Birth Weight = <2.5KG

Birth Weight & Mental Health

ADHD symptoms in ***childhood***

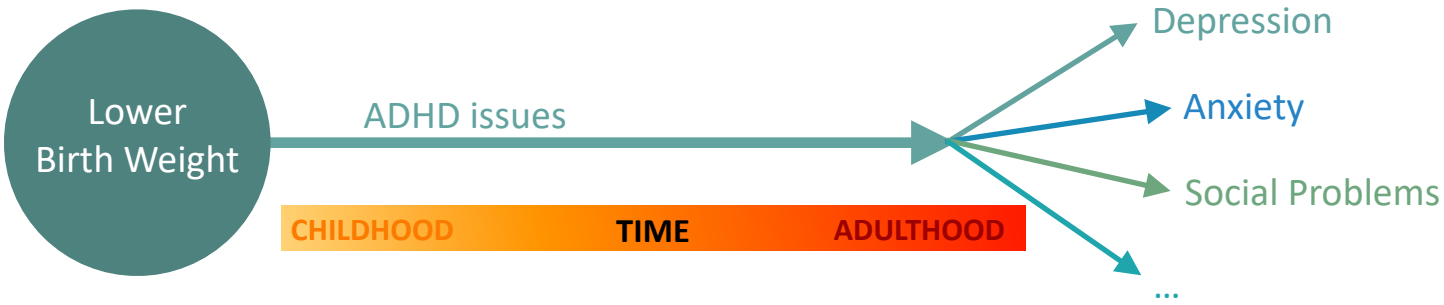
What about adolescence & early adulthood?

Abel et al. (2010)
-Affective disorders
-Alcohol/drug disorders
-Schizophrenia
-Neurotic, stress or somatoform disorders

Pettersson et al. (2019)
- Depression
- OCD

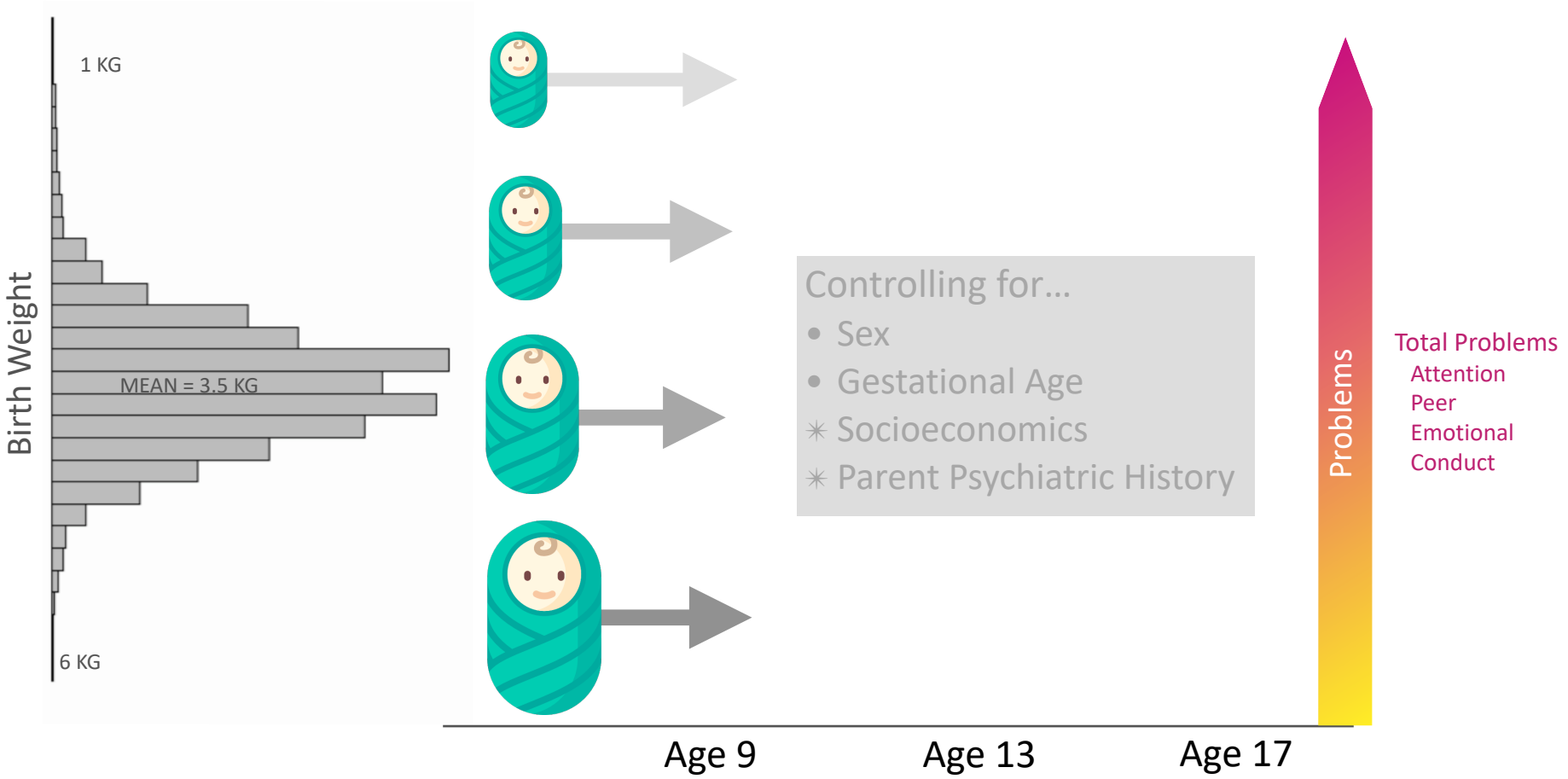
Class et al. (2014)
- Psychotic or Bipolar Disorders

Theory & Research Aim



Explore the age-related changes in the association between birth weight and various aspects of mental health in the child cohort (ages 9, 13 & 17)

Study Design



Study Design

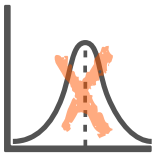
GUI Variables

	Age 9		Age 13		Age 17	
Categorical Variables	**N**	**%**	**N**	**%**	**N**	**%**
Males	4030	48.6%	3571	48.9%	2940	48.8%
Females	4263	51.4%	3727	51.1%	3086	51.2%
Premature born (<37w)	964	11.7%	829	11.5%	685	11.5%
Born late (>41w)	2038	24.8%	1813	25.0%	1474	24.7%
Single Parenthood	964	12%	965	13%	896	15%
1 Parent with Mental Illness	1178	14%	874	12%	795	13%
2 Parents with Mental Illness	179	2%	190	3%	158	3%
Continuous Variables	**Range**	**M (SD)**	**Range**	**M (SD)**	**Range**	**M (SD)**
BW (kg)	0.45-6.10	3.53 (0.57)	0.62-6.10	3.54 (0.56)	0.62-6.10	3.54 (0.56)
Equivalised Household Income (€)[a]	504 - 223K	21K (14K)	549 - 134K	18K (10K)	504 - 1.2M	17K (22K)
Parental Education level (1-6)	1-6	4.0 (1.3)	1-6	4.2 (1.3)	1-6	4.1 (1.3)
OUTCOMES						
SDQ Total Problems	0-37	7.38 (5.02)	0-35	6.49 (5.05)	0-33	6.48 (4.93)
SDQ Attention/Hyperactivity	0-10	2.98 (2.42)	0-10	2.54 (2.34)	0-10	2.23 (2.16)
SDQ Emotional	0-10	2.01 (1.97)	0-10	1.78 (1.93)	0-10	1.94 (2.09)
SDQ Peer	0-10	1.14 (1.43)	0-10	1.08 (1.44)	0-10	1.36 (1.46)
SDQ Conduct	0-10	1.25 (1.42)	0-10	1.10 (1.38)	0-10	0.95 (1.27)

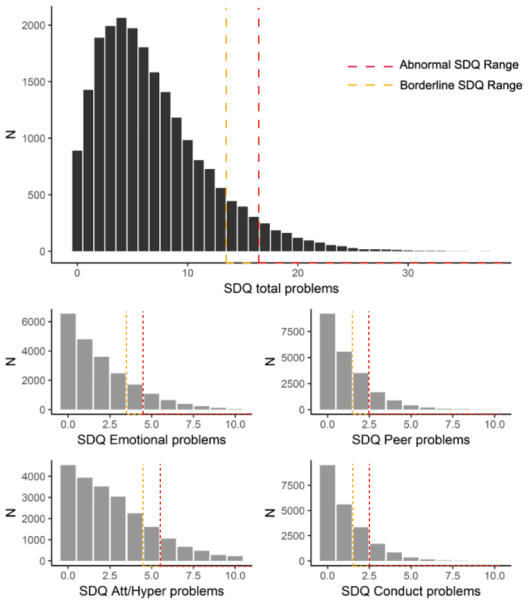
Analysis

Age 9
Age 13
Age 17

Longitudinal data



Non-normally distributed outcome data



Generalised Linear Mixed Model

Link: identity
Distribution: Gamma

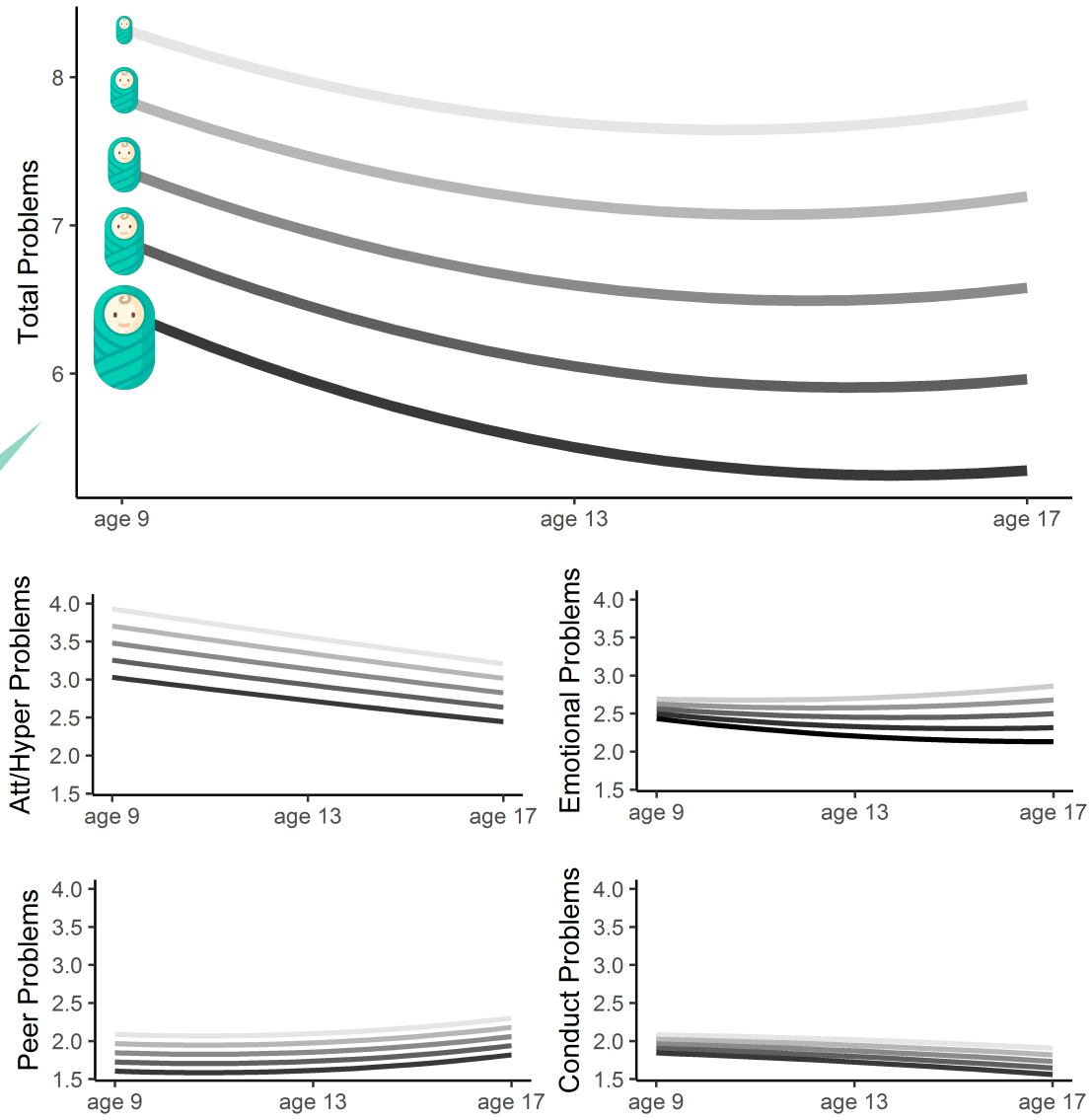
SDQ score ~ birth weight + time*birth weight + sex + time + time^2 + gestational age + income + education + single-parenthood + parental psychiatric history

lme4
glm (cross-sectional)
glmer (longitudinal)

Results

Figure 1.

Relationship between **age** (x-axis) and **SDQ** mental health problems (y-axis) for various birth weights.



Every KG drop in birth weight is linked with significantly higher problems

Results

Statistical Results

Main effects* of Birth Weight on…

	B (SE)	*t*
Total Problems	-0.55 (0.08)	-7.14**
Attention/Hyp. Problems	-0.21 (0.04)	-5.80**
Peer Problems	-0.12 (0.02)	-5.79**
Emotional Problems	-0.12 (0.03)	-4.26**
Conduct Problems	-0.07 (0.02)	-3.70**

*corrected for sex, time, time^2, sex*time, gestational age, income, education, single-parenthood, parental psychiatric history

**p < .001

1.3%↑in total problems

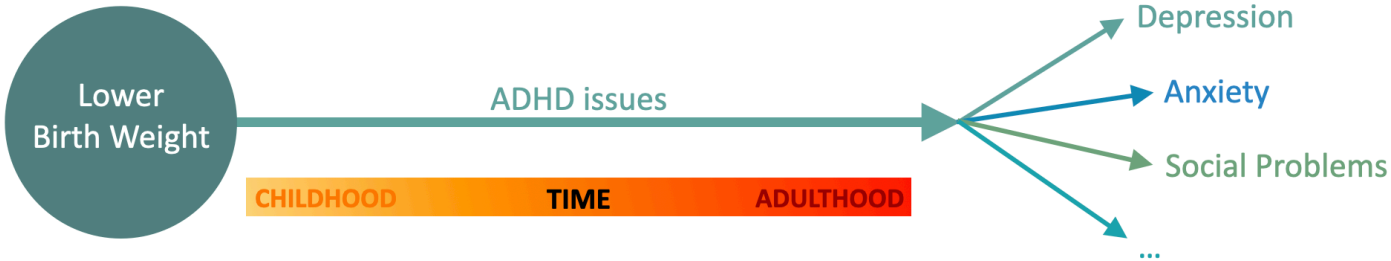
2.1%↑in ADHD problems

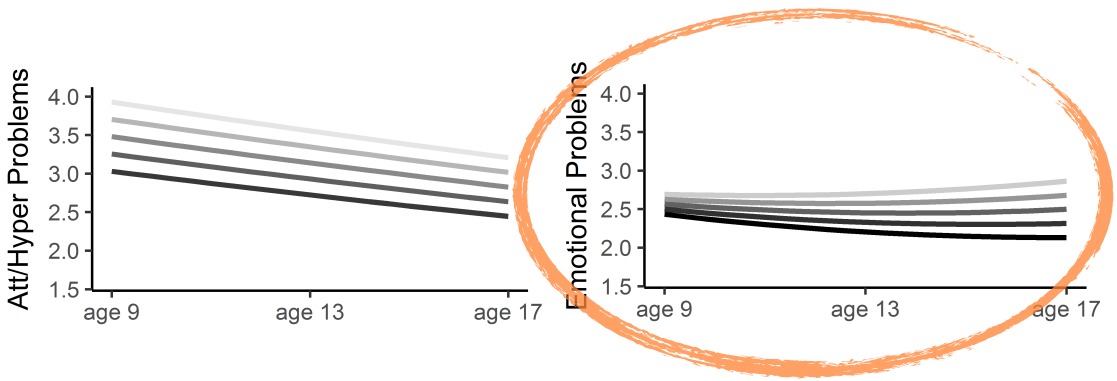
1.2%↑in peer problems

1.2%↑in emotional problems

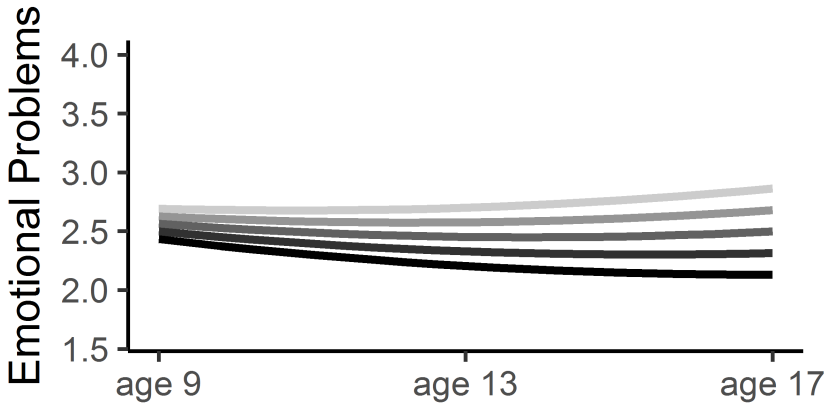
0.7%↑in conduct problems

Results


Lower Birth Weight
ADHD issues
CHILDHOOD
TIME
ADULTHOOD
Depression
Anxiety
Social Problems
...


Att/Hyper Problems
4.0
3.5
3.0
2.5
2.0
1.5
age 9
age 13
age 17
Emotional Problems
4.0
3.5
3.0
2.5
2.0
1.5
age 9
age 13
age 17

Results



Low birth weight is linked with an age-dependant increase in emotional problems

Statistical Results

Longitudinal effect of Birth Weight* on…

	B (SE)	*t*
Total Problems	-0.07 (0.06)	-1.11
Attention/Hyp. Problems	0.02 (0.03)	0.58
Peer Problems	<0.01 (0.02)	0.001
Emotional Problems	-0.06 (0.03)	-2.32†
Conduct Problems	-0.01 (0.02)	-0.83

*time X birth weight interaction. Corrected for birth weight, sex, time, time^2, gestational age, income, education, single-parenthood, parental psychiatric history

† p = .03

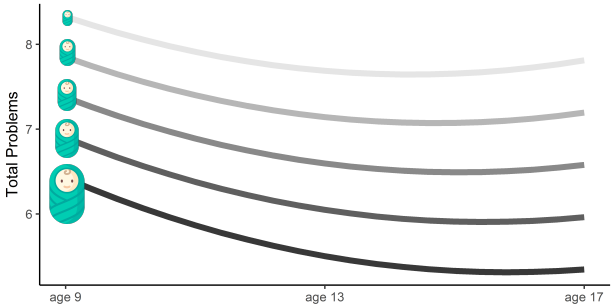
Cross-sectional effects of birth weight

Age 9	Age 13	Age 17
-0.05 (0.04) -1.33	-0.14 (0.04) -3.40**	-0.17 (0.05) -3.35**

** p < .001

Summary

- Lower birth weight is linked with **persistently** poorer mental health from 9-17 years



- The largest effect of birth weight was on **attention/ hyperactivity problems**

Sees tasks through to the end, good attention span

Constantly fidgeting or squirming

Thinks things out before acting

Easily distracted, concentration wanders

Restless, overactive, cannot stay still for long

1.3%↑in total problems

2.1%↑in ADHD problems

1.2%↑in peer problems

1.2%↑in emotional problems

0.7%↑in conduct problems

- The effect of birth weight on **emotional problems** *grew* over time

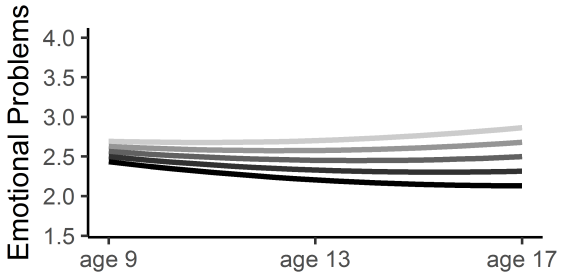
Nervous or clingy in new situations, easily loses confidence

Often unhappy, down-hearted or tearful

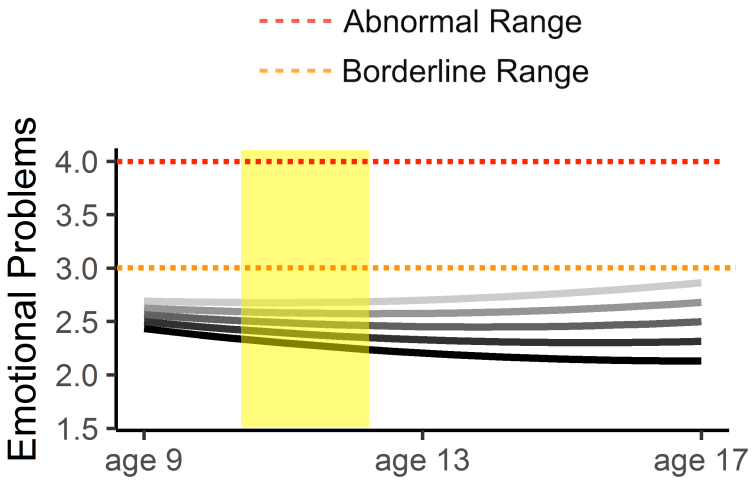
Many fears, easily scared

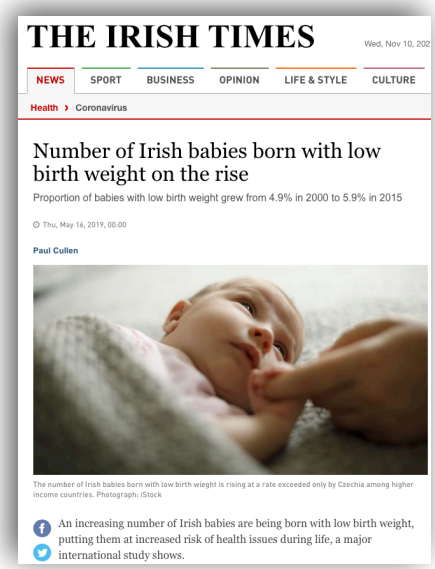
Often complains of headaches, stomach-aches or sickness

Many worries, often seems worried



Policy Relevance





THE IRISH TIMES

Wed, Nov 10, 202

NEWS | SPORT | BUSINESS | OPINION | LIFE & STYLE | CULTURE

Health › Coronavirus

Number of Irish babies born with low birth weight on the rise

Proportion of babies with low birth weight grew from 4.9% in 2000 to 5.9% in 2015

Thu, May 16, 2019, 00:00

Paul Cullen

The number of Irish babies born with low birth weight is rising at a rate exceeded only by Czechia among higher income countries. Photograph: iStock

An increasing number of Irish babies are being born with low birth weight, putting them at increased risk of health issues during life, a major international study shows.

Survival rate of premature babies set to rise

4,500 babies born prematurely in Ireland every year

Fri, Nov 17, 2017, 18:47

Sorcha Pollak, Vivienne Clarke

A premature baby lies in an incubator in the child care unit of a hospital in Sanaa, Yemen. Photograph: Khaled Abdullah/Reuters

The survival rate of premature babies born at 23 weeks is expected to continue rising in the coming years thanks to new medical practices and research, the Master of the Rotunda Hospital has said.

LIMIT LOW BIRTH WEIGHT & PREMATURITY

Maternal & Household Smoking during pregnancy

Maternal stress during pregnancy

Gestational Complications

TARGET VULNERABLE GROUPS

LOWER BIRTH WEIGHT

etc.

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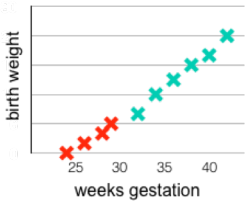
Photos by Alberta Casetta, Robert Collins, Brooke Cagle, and Omar Lopez on Unsplash

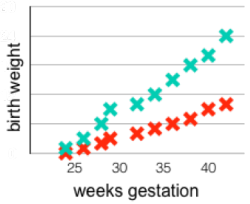
What determines low birth weight?

Maternal Age
Parity
Maternal BMI
Environ. Toxins
Maternal Stress
Malnutrition
Alcohol abuse
Maternal smoking / 2nd hand
Placental insufficiency
Hypoglycemia
Hypoxia
Infection
Preeclampsia

Premature Birth



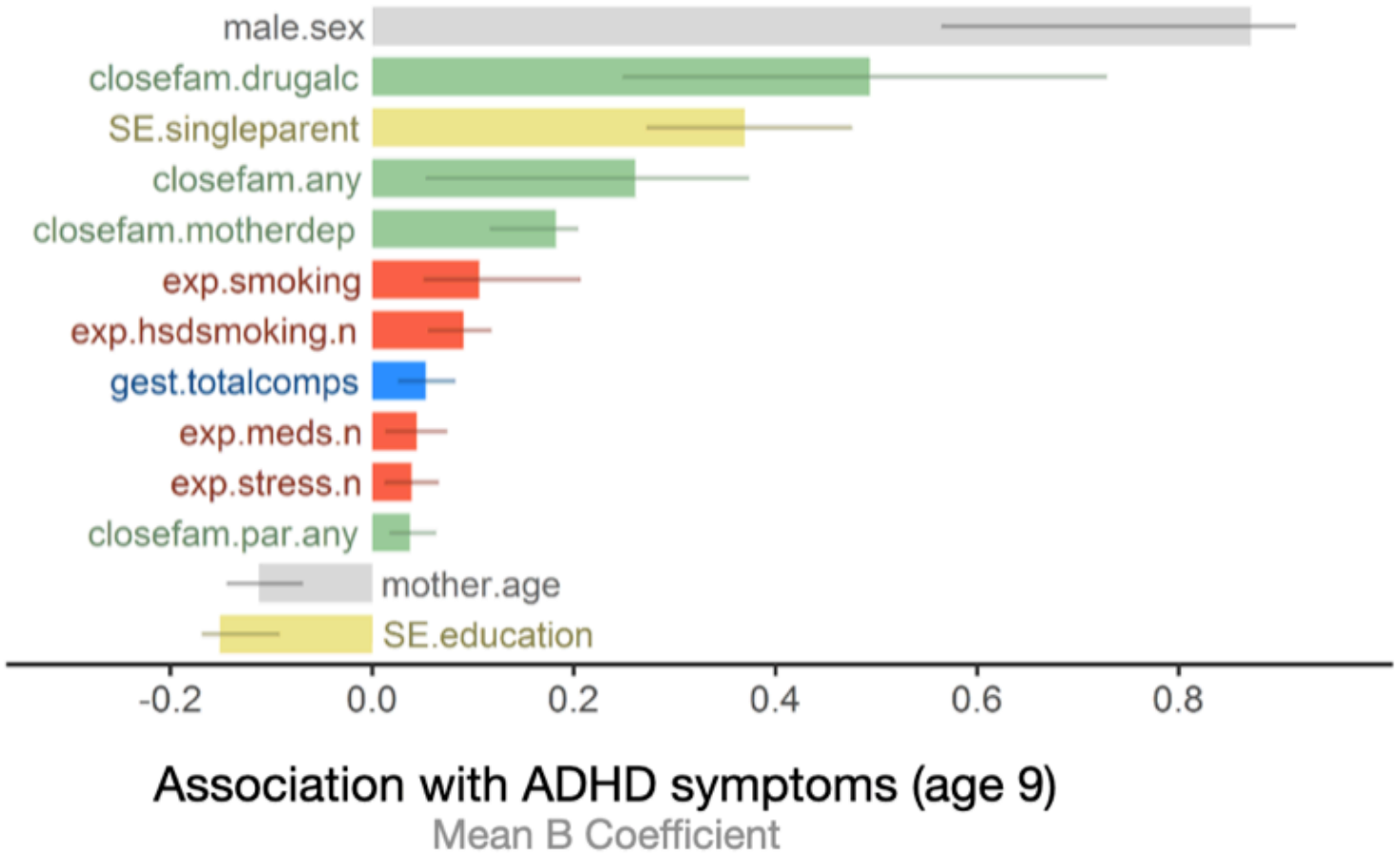
IUGR



Low Birthweight

Growing Up in Ireland
National Longitudinal Study of Children

GUI Infant Cohort (b.2008)

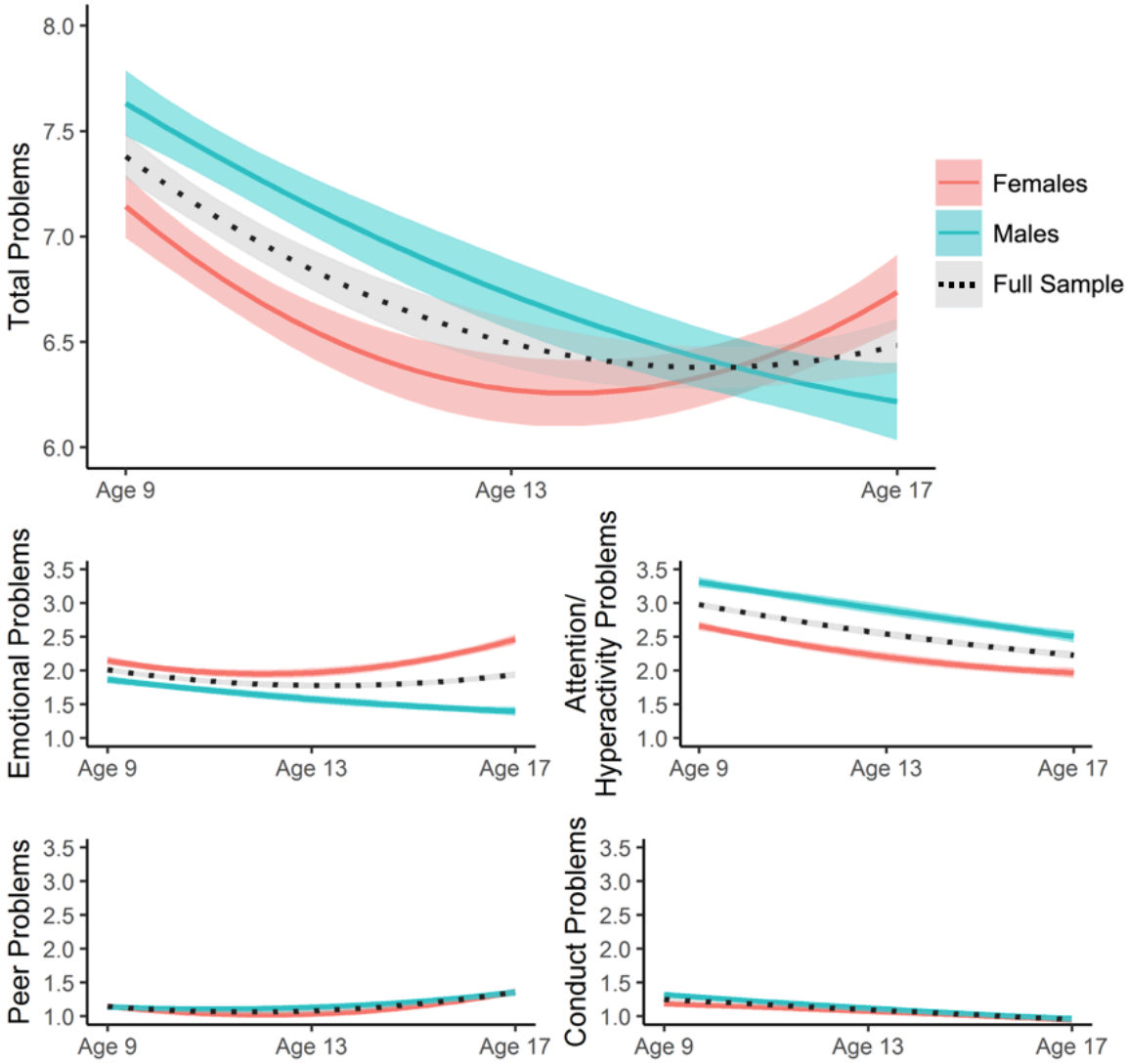


[Extra Slide]

Figure S1.

Basic descriptive statistics.

Relationship between **age** (x-axis) and **SDQ** mental health problems (y-axis) for males, females and the whole sample.



[Extra Slide]

Table S1.

Longitudinal prediction of ***Total*** Problems (generalized linear mixed model)

	M1		M2		M3	
	Birth weight, gestational age, sex & time		M1 + socioeconomic factors		M2 + parental mental disorder	
	B (SE)	***t***	***B (SE)***	***t***	***B (SE)***	***t***
Birth Weight (kgs)	-0.63 (0.07)	-8.38**	-0.57 (0.08)	-7.43**	-0.55 (0.08)	-7.14**
Time * Birth Weight	-0.07 (0.06)	-1.16	-0.09 (0.06)	-1.46	-0.07 (0.06)	-1.11
Time	-0.42 (0.03)	-12.97**	-0.41 (0.03)	-11.87**	-0.40 (0.03)	-11.60**
Sex (male)	0.21 (0.08)	2.64*	0.25 (0.08)	3.15*	0.25 (0.08)	3.10*
Time * Sex	-0.41 (0.06)	-6.32**	-0.40 (0.07)	-5.77**	-0.40 (0.07)	-5.75**
$Time^2$	0.42 (0.03)	15.05**	0.39 (0.03)	13.08**	0.38 (0.03)	12.64**
Premature birth (< 37 weeks)	0.56 (0.13)	4.24**	0.45 (0.13)	3.34**	0.45 (0.13)	3.38**
Late birth (42 weeks +)	0.59 (0.09)	6.34**	0.50 (0.10)	5.24**	0.48 (0.10)	5.08**
Household Income (1-10)			-0.08 (0.01)	-7.40**	-0.08 (0.01)	-6.81**
Parental Education Level (1-6)			-0.30 (0.03)	-10.19**	-0.30 (0.03)	-10.00**
Single-Parenthood			0.96 (0.11)	9.16**	0.97 (0.11)	9.14**
Parental Psychiatric History					0.76 (0.06)	11.94**
Intercept	6.34 (0.05)	123.19**	6.28 (0.05)	115.70**	6.16 (0.05)	112.12**
No. Subjects	8,180		8,033		8,007	
No. Observations	21,254		19,559		19,196	
AIC	108,115		99,224		98,294	
BIC	108,218		99,350		98,428	

** $p < 0.001$ * $p < 0.01$ † $p < 0.05$.
Gestational age reference group = on-time births (37-41 weeks inclusive).

[Extra Slide]

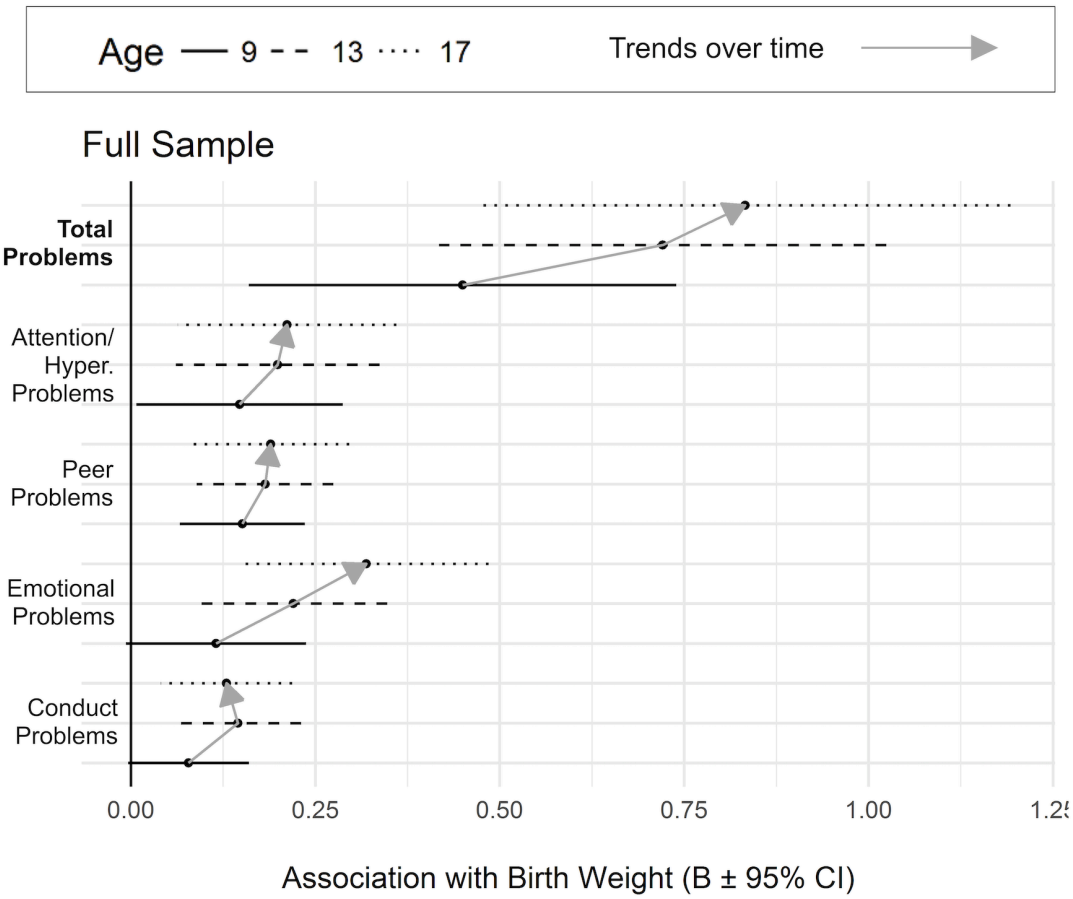
Table S2.

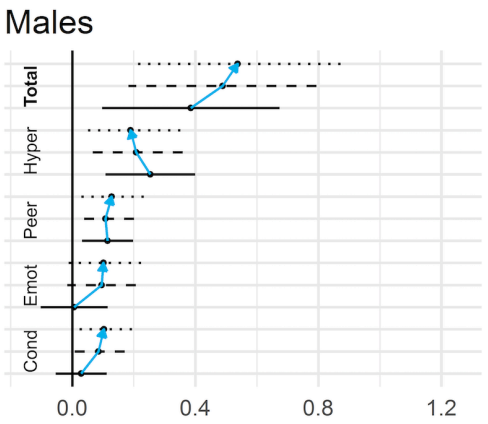
	M1		M2		M3	
	Birth weight, gestational age, sex & time		M1 + socioeconomic factors		M2 + parental mental disorder	
	B (SE)	***t***	***B (SE)***	***t***	***B (SE)***	***t***
Birth Weight (kgs)	-0.23 (0.03)	-6.61**	-0. 21 (0.04)	-5.98**	-0.21 (0.04)	-5.80**
Time * Birth Weight	0.03 (0.03)	0.99	0.01 (0.03)	0.36	0.02 (0.03)	0.58
Time)	-0.33 (0.02)	-22.18**	-0.33 (0.02)	-20.32**	-0.33 (0.02)	-20.08**
Sex (male)	0.55 (0.04)	14.96**	0.57 (0.04)	15.07**	0.57 (0.04)	14.98**
Time * Sex	-0.06 (0.03)	-2.10 §	-0.05 (0.03)	-1.43	-0.05 (0.03)	-1.48
$Time^2$	0.03 (0.01)	1.96	0.02 (0.01)	1.05	0.01 (0.01)	0.94
Premature birth (< 37 weeks)	0.21 (0.06)	3.39**	0.16 (0.06)	2.55§	0.16 (0.06)	2.57§
Late birth (42 weeks +)	0.17 (0.04)	4.00**	0.13 (0.04)	2.95*	0.12 (0.04)	2.74*
Household Income (1-10)			-0.02 (0.01)	-3.96**	-0.02 (0.01)	-3.40**
Parental Education Level (1-6)			-0.13 (0.01)	-9.46**	-0.13 (0.01)	-9.43**
Single-Parenthood			0.29 (0.05)	5.98**	0.30 (0.05)	6.14**
Parental Psychiatric History					0.18 (0.03)	6.25**
Intercept	3.06 (0.02)	126.22**	3.06 (0.03)	118.51**	3.02 (0.03)	115.55**
No. Subjects	8,180		8,033		8,007	
No. Observations	21,272		19,574		19,408	
AIC	75,568		69,529		68,876	
BIC	75,672		69,655		69,010	

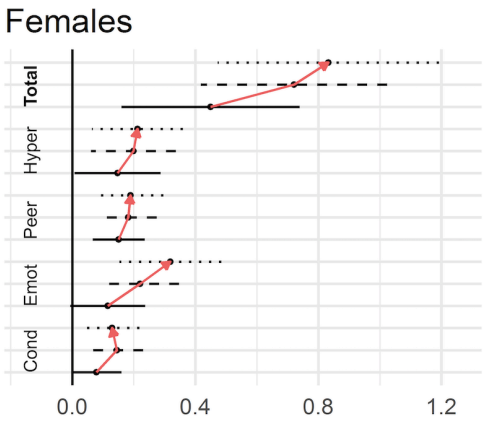
** $p < 0.001$ * $p < 0.01$ † $p < 0.05$.
Gestational age reference group = on-time births (37-41 weeks inclusive).

[Extra Slide]

Figure S2.







[Extra Slide]

Figure S3