TIGAR
Tracking the Impact of Gestational Age on health, educational and economic outcomes: a longitudinal Record linkage study

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Gestational age at birth and child's special educational needs

Evidence from the UK Millennium Cohort Study

Background

- Preterm birth (<37 weeks) leads to neurodevelopmental sequalae manifested by lower attainment in school and more special educational needs (SEN)
- Most studies examined extremely preterm births (<28 weeks) or all preterm births grouped together
- There appears to be a ‘dose-response’ effect between gestational age and SEN for any gestation earlier than full term (39-40 weeks’ gestation), even among early-term births (37-38 weeks)
- The gestational age at onset of birth is often not spontaneous but planned through pre-labour caesarean section or induction of labour
  - Most births at early term in England are currently planned

Objectives

- To investigate the association between gestational age at birth and SEN at age 11 (final year of primary school) across the full spectrum of gestation
- To investigate the association among births at term that began spontaneously
- To explore the reasons for SEN in children born preterm compared to those born at term

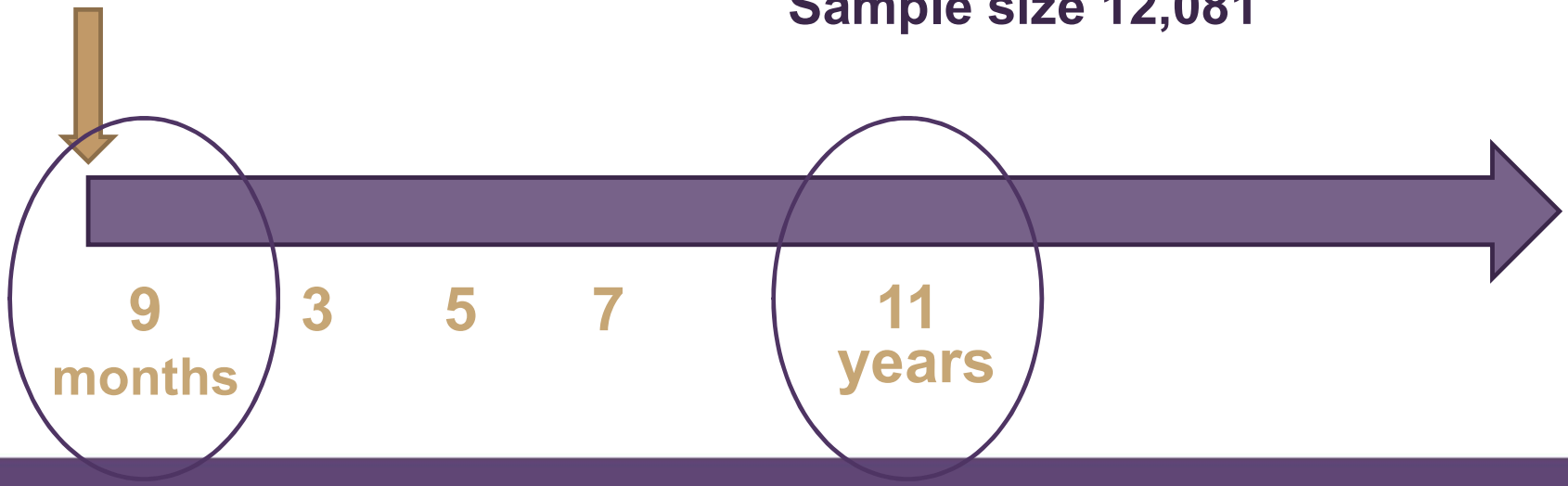
Methods: UK Millennium Cohort Study

18,818 children

- ✓ Respondent in first survey was birth mother
- ✓ Gestational week 23-41
- ✓ Gestational age not missing or implausible
- ✓ Participated in the age 11 survey

Born 2000-2002

Sample size 12,081



Methods: gestational age at birth

- Derived from maternal report of date the child was due to be born along with actual date of birth
- Previously validated using linked hospital birth records

Very preterm <32 n (%)	Moderately preterm 32-33 n (%)	Late preterm 34-36 n (%)	Early term 37-38 n (%)	Full term 39 n (%)	Full term 40 n (%)	Late term 41 n (%)
143 (1.2)	135 (1.1)	732 (6.6)	2,460 (20.6)	2,613 (21.3)	3,438 (28.6)	2,560 (20.6)

Methods: SEN and data analysis

"Has the school or local health board ever told you your child has special educational needs?"

- Modified Poisson regression was used to calculate relative risks with gestational week 40 as the referent
- Some confounders were included a-priori and additional ones were selected if independently associated with the outcome in multivariable models ($P<0.5$)
- Loss to follow-up (31% of original cohort) was accounted for using survey weights

Characteristics of study participants

N=12,081

White ethnicity	85%
Single mother	17%
Diploma or higher maternal education level	29%
Managerial/professional	40%
Mother’s age at birth (mean)	28 years
Firstborn child	42%
Male	51%
Multiple birth	3%
Smoking during pregnancy	24%
Breastfed	66%

Results: the association between gestational age & any SEN

"Has the school or local health board ever told you your child has special educational needs?"

11.2% of children at age 11 in the UK had SEN

	Very preterm <32 weeks	Moderately preterm 32-33 weeks	Late preterm 34-36 weeks	Early term 37-38 weeks	Full term 39 weeks	Full term 40 weeks	Late term 41 weeks
N	143	135	732	2,460	2,613	3,438	2,560
Any SEN n (%)	33 (27.4)	15 (10.6)	108 (17.1)	283 (12.7)	250 (10.3)	315 (9.5)	239 (10.0)
RR (95% CI)	2.88 (2.02, 4.11)	1.11 (0.62, 2.01)	1.80 (1.40, 2.31)	1.34 (1.11, 1.61)	1.08 (0.90, 1.30)	1.00	1.05 (0.88, 1.26)
Adjusted RR (95% CI)	2.89 (2.02, 4.13)	1.09 (0.58, 2.04)	1.78 (1.41, 2.25)	1.33 (1.11, 1.59)	1.07 (0.90, 1.28)	1.00	1.05 (0.88, 1.25)

Adjusted for ethnicity, maternal education, household socioeconomic class, child sex, month of birth, multiple birth

Results: the association between gestational age & any SEN

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Results: statement of SEN

"Does your child have a statement of special educational needs?"

4.9% of children had a statement of SEN

	Very preterm <32 weeks	Moderately preterm 32-33 weeks	Late preterm 34-36 weeks	Early term 37-38 weeks	Full term 39 weeks	Full term 40 weeks	Late term 41 weeks
Statement of SEN n (%)	18 (15.3)	8 (6.7)	53 (7.3)	127 (5.4)	106 (4.6)	134 (3.8)	115 (4.5)
RR (95% CI)	4.02 (2.29, 7.07)	1.76 (0.77, 4.04)	1.91 (1.33, 2.75)	1.41 (1.03, 1.94)	1.21 (0.90, 1.63)	1.00	1.18 (0.88, 1.58)
Adjusted* RR (95% CI)	3.96 (2.24, 7.06)	1.84 (0.78, 4.38)	1.88 (1.30, 2.72)	1.38 (1.01, 1.88)	1.20 (0.89, 1.62)	1.00	1.22 (0.91, 1.63)

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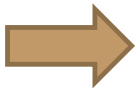
Results: multiple SEN

"What are the reasons for your child's additional support?"

- Learning difficulty
- Autism spectrum disorder (ASD)
- Speech/language/communication difficulties
- Attention-deficit/hyperactivity disorder (ADHD)
- Health/physical problem
- Behavioural/emotional/social difficulties



a child with more than a single reason for SEN =

"Multiple SEN"

2.8% of children had multiple SENs

	Very preterm <32 weeks	Moderately preterm 32-33 weeks	Late preterm 34-36 weeks	Early term 37-38 weeks	Full term 39 weeks	Full term 40 weeks	Late term 41 weeks
Multiple SEN n (%)	11 (8.5)	3 (2.5)	28 (6.0)	68 (3.1)	68 (2.9)	70 (2.1)	39 (2.0)
RR (95% CI)	4.01 (2.08, 7.72)	1.20 (0.35, 4.12)	2.85 (1.55, 5.23)	1.46 (0.99, 2.15)	1.36 (0.92, 2.01)	1.00	0.94 (0.59, 1.49)
Adjusted* RR (95% CI)	3.32 (1.61, 6.84)	1.09 (0.30, 3.94)	2.55 (1.41, 4.60)	1.40 (0.95, 2.05)	1.32 (0.90, 1.94)	1.00	0.97 (0.62, 1.53)

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Adjusted for ethnicity, maternal education, household socioeconomic class, child sex, month of birth, multiple birth

Results: sub-group of term births with spontaneous onset

Adjusted RR (95% CI)	Early term 37-38 weeks	Full term 39 weeks	Full term 40 weeks	Late term 41 weeks
Any SEN				
all births	1.33 (1.11, 1.59)	1.07 (0.90, 1.28)	1.00	1.05 (0.88, 1.25)
spontaneous-onset births	1.38 (1.08, 1.76)	1.04 (0.83, 1.30)	1.00	1.07 (0.84, 1.37)
Statement of SEN				
all births	1.38 (1.01, 1.88)	1.20 (0.89, 1.62)	1.00	1.22 (0.91, 1.63)
spontaneous-onset births	1.33 (0.89, 1.97)	1.00 (0.68, 1.49)	1.00	1.31 (0.90, 1.90)
Multiple SEN				
All births	1.40 (0.95, 2.05)	1.32 (0.90, 1.94)	1.00	0.97 (0.62, 1.53)
spontaneous-onset births	1.81 (1.08, 3.06)	1.40 (0.87, 2.28)	1.00	0.99 (0.57, 1.71)

Adjusted for ethnicity, maternal education, household socioeconomic class, child sex, month of birth, multiple birth

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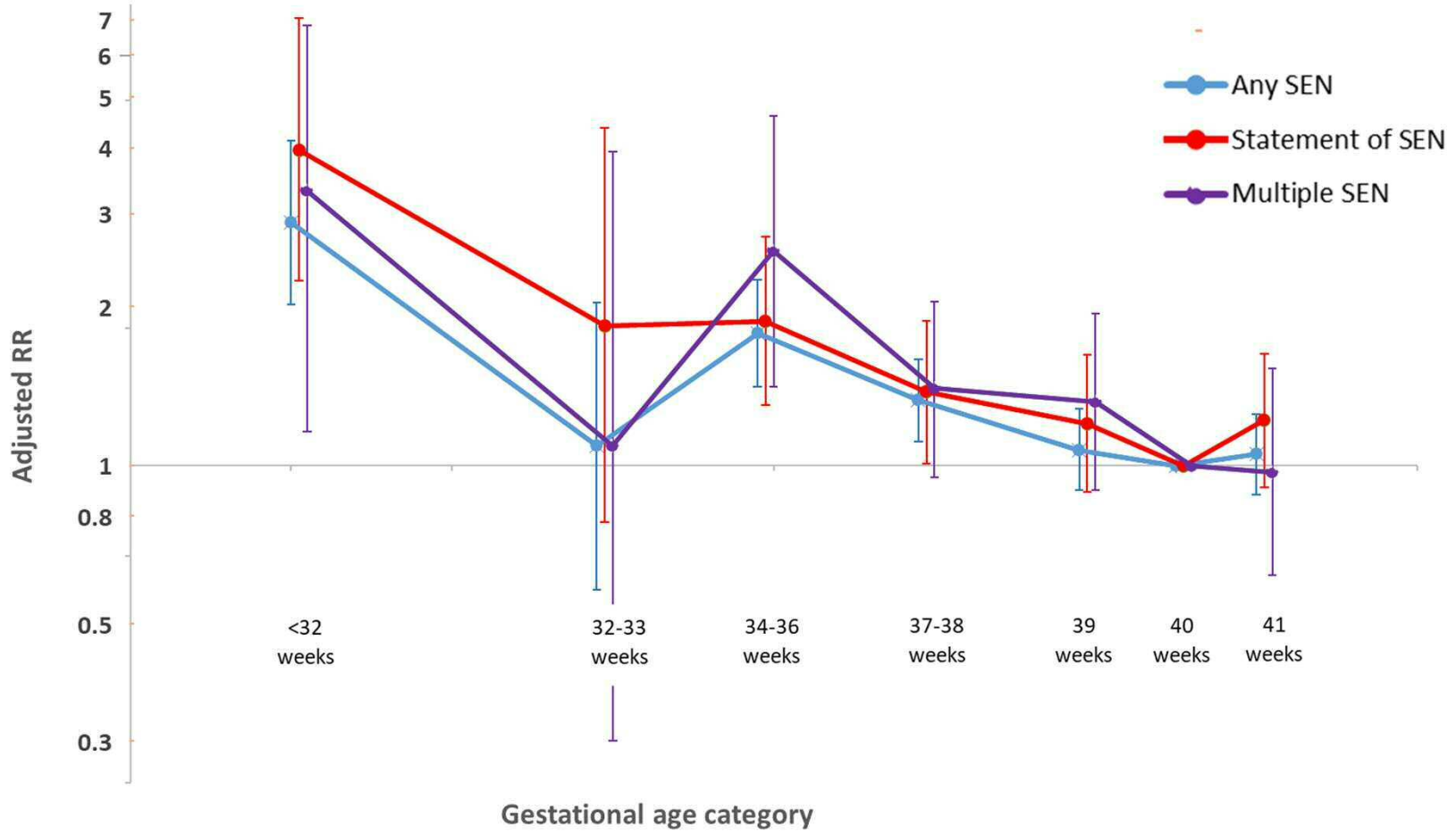
Adjusted for ethnicity, maternal education, household socioeconomic class, child sex, month of birth, multiple birth

Results: relative risks of SEN



Results: reasons for SEN in children born preterm vs. term

	Learning difficulty		Autism Spectrum Disorder (ASD)		Speech/ communication difficulties		Attention Deficit Hyperactivity Disorder (ADHD)		Health/physical		Behavioural /emotional /social difficulties	
	n (%)	Adjusted RR (95% CI)	n (%)	Adjusted RR (95% CI)	n (%)	Adjusted RR (95% CI)	n (%)	Adjusted RR (95% CI)	n (%)	Adjusted RR (95% CI)	n (%)	Adjusted RR (95% CI)
Total	772 (6.8)		235 (2.1)		175 (1.7)		149 (1.6)		162 (1.4)		114 (1.2)	
37-41 weeks	678 (6.5)	1.00	209 (2.0)	1.00	155 (1.6)	1.00	128 (1.4)	1.00	129 (1.2)	1.00	99 (1.1)	1.00
<37 weeks	94 (9.6)	1.40 (1.08, 1.83)	26 (3.4)	1.68 (1.02, 2.77)	20 (2.3)	1.46 (0.83, 2.55)	21 (3.5)	2.22 (1.11. 4.47)	33 (3.5)	2.86 (1.80, 4.54)	15 (2.8)	2.16 (0.88, 5.29)

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Discussion

- Strengths
  - a large, nationally representative sample that enables examination of the entire gestational age spectrum
  - various complexity levels of SEN investigated
  - reasons of SEN explored
- Limitations
  - parental report of SEN and reasons for SEN

Conclusion

- UK children born at earlier gestational ages are more likely to have SEN at age 11 compared with those born in week 40
- An increased risk of SEN was found even for children born at early term gestation, and even when the birth was of spontaneous-onset.
- SEN in children born preterm in not only more common, but also more complex
- Preterm birth is most strongly associated with SEN for reasons of ADHD and health/physical difficulties

Acknowledgements

- Thank you to participants of the Millennium Cohort Study
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