

University of Warwick institutional repository: <http://go.warwick.ac.uk/wrap>

This paper is made available online in accordance with publisher policies. Please scroll down to view the document itself. Please refer to the repository record for this item and our policy information available from the repository home page for further information.

To see the final version of this paper please visit the publisher's website. Access to the published version may require a subscription.

Author(s): Nick Spencer, Ann Wallace, Ratna Sundrum, Claire Bacchus and Stuart Logan

Article Title: Child abuse registration, fetal growth, and preterm birth: a population based study

Year of publication: 2006

Link to published version: <http://dx.doi.org/10.1136/jech.2005.042085>

Publisher statement: None

RESEARCH REPORT

Child abuse registration, fetal growth, and preterm birth: a population based study

Nick Spencer, Ann Wallace, Ratna Sundrum, Claire Bacchus, Stuart Logan

J Epidemiol Community Health 2006;60:337–340. doi: 10.1136/jech.2005.042085

See end of article for authors' affiliations

Correspondence to: Professor N Spencer, School of Health and Social Studies and Warwick Medical School, University of Warwick, Coventry, UK; n.j.spencer@warwick.ac.uk

Accepted for publication 21 November 2005

Objectives: To study the relation of intra-uterine growth and gestational age with child protection registration in a 20 year whole population birth cohort.

Setting: West Sussex area of England.

Study design: Retrospective whole population birth cohort.

Outcomes: Child protection registration; individual categories of registration—sexual abuse, physical abuse, emotional abuse, and neglect.

Population and participants: 119 771 infants born in West Sussex between January 1983 and December 2001 with complete data including birth weight, gestational age, maternal age, and postcode.

Results: In all categories of registration a linear trend was noted such that the lower the birth weight z score the higher the likelihood of child protection registration. Similar trends were noted for gestational age. All these trends were robust to adjustment for maternal age and socioeconomic status.

Conclusions: The results of this study suggest that lower levels of fetal growth and shorter gestational duration are associated with increased likelihood of child protection registration in all categories including sexual abuse independent of maternal age or socioeconomic status. This study does not permit comment on whether poor fetal growth or preterm birth predispose to child abuse and neglect or the association arises because they share a common pathway.

The association of low birth weight and preterm birth with child abuse and neglect has been the subject of debate for at least 30 years. Studies from the USA¹ and the UK² published in the 1970s and early 1980s reported an association. However, Leventhal,³ reviewing case-control studies investigating the association, argued that many were subject to potential bias because of methodological weaknesses particularly in the choice of control group and adjustment for confounding factors and those studies with better methodologies showed no association of low birth weight or preterm birth with child abuse.

Subsequent studies have reported conflicting results.^{4–10} The conflicting findings are likely to relate to the different research methodologies used and the different populations studied. Most studies have a case-control design^{4–8} with variation in the population from which the cases and controls are derived and the degree to which potential confounding variables are accounted for in the analyses. For example, among the case-control studies, four^{4–6–8} were based on hospital populations and matching was used in two^{6–7} to account for confounding but others did not adjust for confounding. The more methodologically robust studies,^{9–10} based on whole populations, reported associations of child abuse with low birth weight after adjustment for potential confounding variables.

Published studies have examined the relation of pregnancy outcomes to child abuse registration for all types of abuse combined^{1–2–4–5–7–9–10} or specific forms of abuse such as fractures⁸ and physical abuse.⁶ Studies have tended to follow the usual convention of dichotomising birth weight into low (<2500 g) and normal birth weight^{2–5–9–10} and gestational duration into preterm (<37 weeks) and full term.^{1–4} This precludes exploration of a possible “dose-response” relation between the pregnancy outcomes and child abuse. The use of low birth weight as the main predictor variable is also likely to obscure the distinction between low birth weight as a result of impaired fetal growth or short gestation.

This study is based on a 19 year whole population birth cohort (1983–2001), in which data on birth weight and gestation were recorded, linked with data from the child abuse register covering the same population from 1986 onwards. This is the first study to examine the association between risk of registration for child abuse in all major categories and intra-uterine growth, assessed by birth weight z score, and gestational age in a whole population birth cohort.

METHOD

This study is a retrospective whole population birth cohort based on linkage of data from the West Sussex Child Health Computer including a Special Conditions File¹¹ with the West Sussex Social Services Child Protection Register on children born between January, 1983 and end of December, 2001. The study was approved by the local research and ethics committee.

Data collection

West Sussex Child Health Computer collects data on all children born with addresses in the West Sussex area including those born outside the area, for example, in tertiary units. Children's files are initiated on the computer system by the birth notification that includes data on maternal age, birth weight, gestational age, and postcode of the address at the time of birth. Records on all children are regularly updated throughout childhood.

Children are entered onto the West Sussex Child Protection Register after a child protection investigation including a child protection conference. The criteria for registration are laid out in the West Sussex Area Child Protection Committee, Child Protection Procedures and state:

“The child can be shown to have suffered ill treatment or impairment of health or development as a result of

Table 1 Rates of child abuse registration

	Number	Rate/1000
Child abuse registration		
All categories	1853	15.5
Physical abuse	616	5.1
Sexual abuse	246	2.1
Emotional abuse	635	5.3
Neglect	509	4.3

physical, emotional or sexual abuse or neglect, and the professional judgement is that further ill treatment or impairment are likely”

Children are only registered under physical and emotional abuse and neglect if abuse has actually occurred. A child who has not yet suffered sexual abuse may be registered for sexual abuse if there is a known offender in the household. The entries on the electronic register are coded by category of registration with the main category first: physical abuse; sexual abuse; emotional abuse; neglect and non-organic failure to thrive. For the purposes of this study, only data on the main category of abuse are available and the numerator used is individual children not abuse incidents.

Data linkage

The following data files were linked to form a single anonymised data file:

- (1) West Sussex Child Health Computer data file with Special Conditions Files from 1983–2001
- (2) West Sussex Social Services Child Protection Register—data on all children born between 1983 and 2001 with entries on the register during the period 1986–2003

Linkage was undertaken in accordance with the Data Protection Act and with permission of the local research and ethics committee.

Data extraction

For the purposes of this study, a single anonymised data file was created containing the following variables:

Outcomes of interest

Registration on the child protection register in any of the four categories listed above and extracted from the West Sussex Social Services Child Protection Register

Main independent variables of interest

(1) Birth weight standard deviation scores (z scores) were calculated from the birth weight in kilograms, gestational age in weeks and infant sex by use of software provided by the Child Growth Foundation derived from a representative sample of British births in 1990 (LMS software using 1990 British height and weight reference data, London, Child Growth Foundation) and categorised into five groups: <−2.00; −2.00 to −1.01; −1.00 to +1.00; +1.01 to +2.00; >+2.00

(2) Gestational age categorised into three groups: <34 weeks; 34–36 weeks; 37 weeks+

Confounding variables

(1) Socioeconomic status based on area of residence at birth created by conversion of postcode into enumeration district (the lowest census unit) and ranking enumeration districts into quintiles by their score on the Townsend deprivation index¹² calculated from the 1991 census.

Table 2 Pregnancy outcome and demographic characteristics

	Number	Percentage
Birthweight z score group	2347	
<−2.00	14847	2.0
−2.00 to −1.00	84250	12.4
−0.99 to +1.00	15068	70.4
+1.01 to 2.00	3217	12.6
>+2.00		2.6
Gestational age group	1947	
<34 weeks	5319	1.6
34–36 weeks	112463	4.5
37+ weeks	4618	93.9
Maternal age group	60817	3.9
<20	51419	50.8
20–29	2875	42.9
30–39	23949	2.4
40+	23906	20.0
Deprivation quintiles	23996	20.0
Quintile 1 (least deprived)	23904	20.0
Quintile 2	23974	20.0
Quintile 3		20.0
Quintile 4		
Quintile 5 (most deprived)		

(2) Maternal age at infant’s birth: two dummy variables were created to represent maternal age: <20 v the rest and 40+ v the rest—to account for a possible J shaped relation of the outcome variables with maternal age

Data analysis

Only children with complete data for all variables of interest were included in the analysis. Rates/1000 for registration in any child abuse category and for each category separately by birth weight z score and gestational age categories and χ^2 for linear trend with p values were calculated. Binary logistic regression models fitted on the outcomes were used to adjust for maternal age and socioeconomic status. All analyses were carried out in SPSS v10 (SPSS, Chicago, 1999).

RESULTS

Of 158 229 children entered onto the West Sussex Child Health Computer in the 19 year period, 1983–2001, 119 729 (76%) had complete data and were included in this study. Missing postcode data accounted for 33 128 children with missing data and of the remainder (5406), maternal age data were missing in 5187, gestational age in 168 and birth weight in 51. Rates of child abuse registration among the children without complete data did not differ from those included in the study (tables 1 and 2).

Statistically significant linear trends across birth weight z score group such that rates decreased as fetal growth increased were noted for each child abuse registration category (table 3). The relation of the combined categories of child abuse registration with birth weight z score showed a slight reverse J shape with a slight rate increase among the largest babies. A similar pattern was noted for physical and for emotional abuse. Registration for both sexual abuse and neglect showed a linear relation with decreasing birth weight z score. These relations persisted after adjustment for maternal age and socioeconomic status in logistic regression models.

Linear trends by gestational age group in risk of child abuse registration by all categories combined and each separate category were statistically significant (table 4) such that the shorter the gestation the higher the risk of child abuse registration. Physical abuse, emotional abuse, and neglect all showed consistent trends across the gestational age groups. Registration for sexual abuse was more likely in

Table 3 Number and rate/1000 in different categories of abuse registration by birth weight z score group

Abuse category	Birth weight z score group					χ^2 for linear trend (p value)
	<-2 (n=2347)	-2 to -1.00 (n=14846)	-0.99 to +1.00 (n=84249)	+1.01 to +2 (n=15067)	>+2 (n=3217)	
All categories combined	75 32.0/1000	314 21.2/1000	1255 14.9/1000	166 11.0/1000	43 13.4/1000	89.9 (p<0.0001)
Physical abuse	23 9.8/1000	110 7.4/1000	403 4.8/1000	61 4.0/1000	19 5.9/1000	19.5 (p<0.0001)
Emotional abuse	20 8.5/1000	108 7.3/1000	435 5.2/1000	57 3.8/1000	15 4.7/1000	22.6 (p<0.0001)
Sexual abuse	10 4.3/1000	40 2.7/1000	171 2.0/1000	21 1.4/1000	4 1.2/1000	14.9 (p<0.0001)
Neglect	24 10.2/1000	94 6.3/1000	342 4.1/1000	41 2.7/1000	8 2.5/1000	43.1 (p<0.0001)

children born at less than 34 weeks gestation but there was no difference in risks between those born at 34–36 weeks and those born at 37 weeks or more. All the trends noted in table 4 remained significant in logistic regression models including maternal age and socioeconomic status.

DISCUSSION

The findings of this population based study show that infants experiencing poorer fetal growth or preterm birth are at increased risk of registration for physical, emotional, or sexual abuse, or neglect independent of maternal age and socioeconomic status.

To the best of our knowledge, ours is the first study to examine the relation between the main categories of child abuse registration and fetal growth and to examine the relation across the range of fetal growth. A number of studies have examined the association between low birth weight (defined as <2500 g) and child abuse and neglect,^{1, 5, 6, 9, 10} but unlike this study have been unable to distinguish the effects of fetal growth from those of preterm birth. This distinction is important when considering possible explanations for the association of child abuse registration with poor fetal growth and preterm birth as the determinants of fetal growth and gestation differ.¹³

It is worthy of note that, in contrast with the conflicting findings of case-control studies,⁷ the findings of this study are broadly consistent with previous population based studies.^{9, 10} Needell and Barth⁹ linked administrative birth data with foster care placement data for California between 1989 and 1994. They reported that infants admitted into foster care as a result of maltreatment were more than twice as likely as those not in care to have been born low birth weight after adjustment for single parenthood, family size, and ethnicity. Sidebotham *et al*,¹⁰ based on the Avon longitudinal study of parents and children with linked data

from local child protection registers, showed a similar twofold increase in the likelihood of child abuse registration before the age of 6 years among children born low birth weight after adjustment for unintended pregnancy, hospital admissions, feeding difficulties, and other behavioural attributes of the child. Neither of these studies was able to adjust the findings for socioeconomic status or maternal age.

There are a number of possible explanations for the associations reported here. Preterm infants or those with poor fetal growth may have characteristics that make them more vulnerable to all forms of abuse. It is possible that such infants may be more likely to provoke hostile parental feelings leading to increased risk of abuse. Early separation, more commonly experienced by preterm and small for gestational age infants, may interfere with parent-infant bonding, although this is unlikely to be an important factor except at the extremes. Alternatively, preterm birth and poor fetal growth may share a common pathway with abuse, for example, through maternal characteristics that predict increased risk of both poor pregnancy outcomes and child abuse. It is also possible that an unidentified confounding variable explains the apparent association. The design of this study does not permit definitive comment on these explanations. However, this study does suggest that any explanation must be consistent with the findings that all main categories of abuse broadly show the same association with both fetal growth and preterm birth and the association is not confined to infants born very early or very small but shows a trend across the range of fetal growth and gestational duration.

Strengths and limitations

The main strengths of this study are that it is population based, allowing us to examine the relation between fetal growth, gestational age and abuse in a whole population rather than in highly selected subgroups, and the large

Table 4 Rate/1000 different categories of abuse registration by gestational age group

Abuse category	Gestational age <34 weeks (n=1947)	Gestational age 34–36 weeks (n=5319)	Gestational age 37+ weeks (n=112463)	χ^2 for linear trend (p value)
All categories combined	69 35.4/1000	124 23.3/1000	1660 14.8/1000	74.6 (p<0.0001)
Physical abuse	21 10.8/1000	47 8.8/1000	548 4.9/1000	26.9 (p<0.0001)
Emotional abuse	18 9.2/1000	45 8.5/1000	572 5.1/1000	15.5 (p<0.0001)
Sexual abuse	9 4.6/1000	12 2.3/1000	225 2.0/1000	4.8 (p=0.029)
Neglect	21 10.8/1000	38 7.1/1000	450 4.0/1000	31.5 (p<0.0001)

Key points

- This is the first study to examine the association between risk of registration for child abuse in all major categories and intra-uterine growth, assessed by birth weight z score, and gestational age in a whole population birth cohort
- Lower levels of fetal growth and shorter gestational duration are associated with an increased likelihood of child protection registration in all categories including child sexual abuse
- These associations are independent of maternal age and socioeconomic status

sample size. In addition, the availability of population based data on potential confounding variables including maternal age and socioeconomic status has allowed us to examine the effects of these factors on the reported associations. Finally, linkage with the West Sussex Social Services Child Protection Register allowed us to study these associations with registration for each of the major categories of abuse separately.

Child abuse registration categories and thresholds for registration are likely to have changed over the 19 year study period. These changes are likely to have led to misclassification bias affecting the classification of abuse. However, unless they can be shown to differentially increase or decrease the estimate of abuse rates among children experiencing different levels of fetal growth and gestational duration, they are unlikely to systematically bias the relations studied. The length of the study period means that the period of risk exposure varies from 18 years to one year but, as this is true for all children, independent of pregnancy outcome, it is again unlikely to bias the relation of fetal growth or preterm birth with abuse.

CONCLUSIONS

This study confirms the findings of previous population based studies that there is an association of low birth weight with child abuse registration and extends these findings by showing that the association holds for both fetal growth and preterm birth. This is the first study to report that this association exists for all categories of abuse and that the association is seen across the whole range of fetal growth and gestational age, not simply an association with the extremes. These findings do not permit an explanation of the associations noted and clarification must await further research. However, plausible explanations must take account of these findings.

ACKNOWLEDGEMENTS

We wish to acknowledge the work of the paediatricians, child health professionals, and social workers in West Sussex whose dedication

Policy implications

- Strategies and interventions aimed at preventing child abuse need to take account of the association with poor fetal growth and short gestational duration
- Further study is needed to explore whether poor fetal growth and preterm birth predispose to child protection registration or are markers of maternal characteristics that predict increased risk of both poor pregnancy outcomes and child abuse

and attention to detail has made possible the consistent and reliable collection of the data reported in this study.

Authors' affiliations

N Spencer, School of Health and Social Studies and Warwick Medical School, University of Warwick, Coventry, UK

A Wallace, Western Sussex Primary Care Trust, UK

R Sundrum, Adur, Arun and Worthing Primary Care Trust, Worthing, UK

C Bacchus, West Sussex County Council, UK

S Logan, Paediatric Epidemiology, Peninsula Medical School, Exeter, UK

Funding: the study was conceived and undertaken by the authors working as a team without financial assistance.

Conflicts of interest: none.

REFERENCES

- 1 **Goldson E**, Fitch MJ, Wendell TA, *et al*. Child abuse. Its relationship to birthweight, apgar score and developmental testing. *Am J Dis Child* 1978;**132**:790-3.
- 2 **Murphy JF**, Jenkins J, Newcombe RG, *et al*. Objective birth data and the prediction of child abuse. *Arch Dis Child* 1981;**56**:295-7.
- 3 **Leventhal JM**. Risk factors for child abuse: methodologic standards in case-control studies. *Pediatrics* 1981;**68**:684-90.
- 4 **Shearman JK**, Evans CE, Boyle MH, *et al*. Maternal and infant characteristics in abuse: a case control study. *J Fam Pract* 1983;**16**:289-93.
- 5 **Starbuck GW**, Krantzler N, Forbes K, *et al*. Child abuse and neglect on Oahu, Hawaii: description and analysis of four purported risk factors. *J Dev Behav Pediatr* 1984;**5**:55-9.
- 6 **Benedict MI**, White RB. Selected perinatal factors and child abuse. *Am J Public Health* 1985;**75**:780-1.
- 7 **Leventhal JM**, Berg A, Egarter SA. Is intrauterine growth retardation a risk factor for child abuse? *Pediatrics* 1987;**79**:515-19.
- 8 **Dahlenburg SL**, Bishop NJ, Lucas A. Are preterm infants at risk for subsequent fractures? *Arch Dis Child* 1989;**64**:1384-5.
- 9 **Needell B**, Barth RP. Infants entering foster care compared with other infants using birth status indicators. *Child Abuse Negl* 1998;**22**:1179-87.
- 10 **Sidebotham P**, Heron J and the ALSPAC Study Team. Child maltreatment in the "children of the nineties": the role of the child. *Child Abuse Negl* 2003;**27**:337-52.
- 11 **Abra A**, Woodroffe C. A special conditions register. *Arch Dis Child* 1991;**66**:927-30.
- 12 **Townsend P**, Phillimore P, Beattie A. *Health and deprivation: inequality and the North*. Beckenham: Croom Helm, 1988.
- 13 **Kramer MS**. Determinants of low birth weight: methodological assessment and meta-analysis. *Bull World Health Organ* 1987;**65**:663-737.