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The epidemiology of birthweight and placental weight in New Zealand

Volume 1 (Text)

John Michael David Thompson

Department of Paediatrics

A thesis submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy,
University of Auckland, July 1997

THE UNIVERSITY OF AUCKLAND
FACULTY OF MEDICINE
DEPARTMENT OF PAEDIATRICS
1997

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Volume 2 (Figures and Tables)

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Abstract

The introduction to this thesis is a literature review. Kramer, in a study commissioned by WHO, reviewed the literature prior to 1985 on low birthweight. This is extended, mainly in respect to infants who are small for gestational age, with emphasis on important findings in relation to birthweight since that time. Work in New Zealand on birthweight is also summarised. The literature is also reviewed in respect to the mechanisms in the pathway between the placenta and the fetus, and in respect to recent work suggesting a link between birthweight and disease in adult life.

This thesis examines factors that influence birthweight and placental weight.

Birthweight for gestational age percentile curves for the New Zealand population were firstly defined. Small for gestational age (SGA) infants could then be categorised.

The thesis considers two sources of data, the first a cross-sectional sample of the New Zealand population from 1987 to 1990 (the control subjects of the New Zealand Cot Death Study, a national case-control study on sudden infant death syndrome), and the second a hospital population in Auckland (National Womens Hospital (1992)).

These two datasets are investigated to determine factors that influence birthweight in a univariate situation and then in the multivariate situation. Independent variables are considered using *a priori* categorisations and where appropriate Quantile-Quantile (Q-Q) derived categorisations determined by producing plots of the quantiles of cases versus controls.

A number of variables under the headings of socio-demographic, lifestyle, genetic, obstetric and nutrition are examined and found to be associated with the outcomes of interest at the univariate level. After controlling in multivariate analyses a number of variables are found to be no longer significant, however some show strong relationships.

The variable relating to smoking in both datasets shows the greatest detrimental effect on the outcomes considered in respect to birthweight. This confirms that in New Zealand, as in other places in the world, smoking has significant consequences on birthweight. The data is also investigated for the timing of insult to the fetus from smoking, and is found to be most important during pregnancy.

Comparison of the results comparing those obtained using a binary outcome for SGA, and those obtained using birthweight continuously, show relatively consistent results. The odds ratios and the decreases in birthweight obtained from both datasets show a relatively linear relationship between the two.

An examination into whether a distinct group of individuals exists in respect to having large placentae for birthweight, identified an artefact in the dataset relating to recording of placental weight for twins. After removal of twins from the dataset, examination of factors that influence placental weight showed that the factors that influence placental weight are not the same as those that influence birthweight. In particular smoking is found not to influence placental weight, and haemoglobin, which has no influence on birthweight, is found to be inversely associated with placental weight. Other factors such as parity are found to influence placental weight in the same proportion in which birthweight is affected.

In conclusion this thesis shows that factors investigated in New Zealand are consistent with findings in the international literature in relation to birthweight. The results on factors that influence placental weight add to the international literature on a topic on which little work has been carried out.

The results of this thesis point to areas where future research needs to be carried out, in particular in relation to maternal nutrition during pregnancy and maternal energy expenditure during pregnancy. There is also a need for further research into the relationships of factors on placental weight and the ratio of birthweight to placental weight, and how these relationships affect health outcomes in childhood and adult life.

Acknowledgements

I would like to thank Associate Professor Ed Mitchell and Dr Robert Scragg for their supervision and continued support and comments throughout the duration of this thesis. My thanks to colleagues in the Statistics Department for advice, especially Professor Alastair Scott, Associate Professor Chris Wild and Dr Chris Triggs.

My thanks to Mark Clements and Kimberly Rees for their respective proof reading efforts, and comments, especially when I needed them in a rush, and to Carol Everard for her support throughout.

My thanks to my family for their continued support throughout my university studies. My appreciation to friends at the Manurewa Harrier Club, and in the Auckland Domain, whose running company has kept me sane over the years. And special appreciation to Dawn and Neal Cleary for being there when I needed support.

This thesis is dedicated to the memory of my grandparents, and their fore-bears, without who's individual struggles through the passage of time the existence of this thesis in this form would not have been possible. It now seems they may have played a greater part in further generations of their families than one would ever have imagined.

This thesis was carried out with support from the Cot Death Association and a postgraduate scholarship from the Health Research Council of New Zealand (HRC).

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Abbreviations used in this thesis

| | |
|-------|--|
| e.g. | example |
| g | grams |
| i.e. | that is |
| kcal | kilo calories |
| lb | pounds |
| mm | millimetres |
| s.d. | standard deviation |
| s.e. | standard error |
| AGA | Appropriate for Gestational Age |
| BMI | Body Mass Index |
| Hb | Haemoglobin |
| Hg | mercury |
| Ht | Haematocrit |
| ICD | International Classification of Diseases |
| IQR | Inter Quartile Range |
| IUGR | Intra Uterine Growth Retardation |
| LBW | Low Birth Weight |
| LQ | Lower Quartile |
| MCV | Mean Cell Value |
| MN | Mononuclear |
| MSSI | Maternal Social Support System |
| NWH | National Womens Hospital |
| NHSS | National Health Statistical Services |
| NZCDS | New Zealand Cot Death Study |
| OR | Odds Ratio |
| PAR | Population Attributable Risk |
| PMN | Polymorphonuclear |
| RDS | Respiratory Distress Syndrome |
| RR | Relative Risk |
| SAS | Statistical Analysis System |
| SES | Socio Economic Status |
| SIDS | Sudden Infant Death Syndrome (cot death) |
| SGA | Small for Gestational Age |

| | |
|-----|---------------------------|
| UK | United Kingdom |
| UQ | Upper Quartile |
| US | United States of America |
| WHO | World Health Organisation |