Re-analysis of antecedent and outcome data from the National Collaborative Perinatal Project

S.M. Garn[1] & T.V.E. Sullivan[2]

The NCPP database

The data involved in our study were derived from a total of 59 000 pregnancies registered in the National Collaborative Perinatal Project (NCPP) of the National Institute of Neurological and Communicative Diseases and Stroke (NINCDS), resulting in 49 995 liveborn singletons, which were followed in serial fashion for a maximum of 7 years. Excluding medical abnormalities and neonates requiring special procedures after or during delivery, there were over 20 000 Black (Afro-American) and White neonates to consider. For some of the data analysis the study was further restricted to a narrow range of maternal ages at registration, i.e., 20–29 years. A description of the NCPP and the participating hospitals has been published (1).

In all, some 40 antecedent variables were considered, including maternal anthropometric measurements, computerized changes, cigarette usage during pregnancy, and socioeconomic status. Placental weight was included as an outcome variable. Except for pre-pregnancy weight, which was self-reported but validated against successive weighings during pregnancy, previous pregnancies, etc., most of the data involved anthropometric or laboratory measurements. "Imputed" or interpolated values were not used. Gestation length calculated from the LMP was also used to categorize gestation–length groupings (pre-term, term and post-term) and birth weights were similarly categorized or used as continua.

A note on antecedent and outcome variables

In all, 15 of the 40 antecedent variables proved to be significantly related to such outcome variables as gestation length, birth weight, etc. or such outcome categories as short gestation length, low birth weight, etc. for the four race- and sex-specific groupings. However, according to various measures ranging from product–moment correlations to risk ratios, the maternal weight variables (pre-pregnancy weight (WTpp) and pregnancy weight gain) and the low-WTpp and low-weight-gain categories were most relevant.

The 15 maternal antecedent variables contributing to significantly elevated relative risks were:

1. Low maternal weight (<100 lbs or 45 kg)
2. Low maternal height (<57 inches or 145 cm)
3. Low ponderal index (<11 for HT^3/WT)
4. Low pregnancy weight gain (<0 lbs)
5. Low and high haemoglobin (<8 g, >13 g)
6. Low and high haematocrit
7. Smoking during pregnancy
8. Acetonuria
9. Coombs test: positive
10. Poverty ratio <1.0
11. Socioeconomic status index <0.3
12. Late registry (>2nd trimester)
13. Prior pregnancies: ≥4
14. Systolic blood pressure <80 mm
15. Systolic blood pressure >140 mm.

Some of the outcome variables considered in the data analysis were:
— birth length;
— birth weight;
— gestation length;
— placental weight;
— placental abnormalities;
— 48-hour haemoglobin and haematocrit;
— Apgar score 1 and 5 minutes;
— Bayley score at 8 months;
— 4-year I.Q. score.

Data analyses

Data analyses included simple partitioning of percentiles or other cut-off points of WTpp, product-

[1] Nutrition Unit, School of Public Health, Department of Anthropology and Center for Human Growth & Development, University of Michigan, Michigan, USA.

[2] Department of Anthropology, State University of New York, Buffalo, New York, USA.

moment correlations (and suitable coefficients to account for non-linear relationships), forward stepwise regression analyses (stopping with the maximum R), and risk ratios calculated for various cut-off points of antecedent variables, also using Mantel-Haenszel procedure, etc., with sample results included here for illustration. Throughout, analyses were conducted for Black (Afro-American) boys and girls separately and for White boys and girls separately — given differences in birth weight, gestation length, maternal WTpp distributions, maternal haematocrit and haemoglobin, and cigarette usage. Separate analyses were made practical by the large numbers per race or sex groupings. For some purposes a restricted maternal age subsample (20–29 years) was also explored in parallel fashion.

Sample results

Correlations

Significant correlates of birth weight (Pearson correlation coefficient) are given in the Table.[a]

	Boys		Girls	
Antecedent variable	White (n=9538)	Black (n=9184)	White (n=8878)	Black (n=9092)
Pre-pregnancy weight (WTpp)	**0.2285***	0.2031*	0.2292*	0.2310*
Maternal height (HT)	0.1415*	0.0994*	0.1302*	0.1227*
Body mass index (BMI)	0.1758*	0.1697*	0.1798*	0.1902*
Weight gain (Wt gain)	0.2265*	**0.2748***	**0.2442***	**0.2672***
Cigarettes/day (Cigs/day)	−0.1404*	−0.0388*	−0.1533*	−0.0507*
SES index (SES)	0.0568*	0.0458*	0.0432*	0.0387*
Systolic blood pressure (Sys bp)	0.0333*	−0.0081	0.0343*	0.0103*

[a] Highest coefficients in each group are in bold type. Correlation coefficients of ≥0.02 are generally significant and are marked with an asterisk.

Regression analysis

The results from a forward stepwise regression analysis using all predictor variables are:

For 10 570 White boys and birth weight
WTpp + Wt gain + Cigs/day + SES + Sys bp + HT $R = 0.386$
For 11 307 Black boys and birth weight
PPW + Wt gain + Cigs/day + SES + Sys bpp $R = 0.371$
For 7828 White girls and birth weight
PPW + Wt gain + Cigs/day + SES + Sys bp $R = 0.403$
For 11 139 Black girls and birth weight
PPW + Wt gain + Cigs/day + SES + Sys bp $R = 0.389$

Odds ratios

Ranking of odds ratios and risk ratios, by Mantel-Haenszel procedure, for different antecedent variables using the 15th centile cut-off point are given in the Table.

Rank	Antecedent variable	Outcome	Ratio	S.D.	Confidence intervals
Odds ratios					
2	WTpp	Birth weight	2.035	0.028	1.927–2.149
4	HT	Birth weight	1.505	0.024	1.421–1.594
3	BMI	Birth weight	1.878	0.030	1.769–1.993
1	Weight gain	Birth weight	2.517	0.029	2.379–2.663
Risk ratios					
2	WTpp	Birth weight	1.799	0.022	1.704–1.856
4	HT	Birth weight	1.399	0.024	1.336–1.465
3	BMI	Birth weight	1.663	0.024	1.588–1.742
1	Weight gain	Birth weight	2.092	0.022	2.004–2.184

Summary

As in our earlier analyses, WTpp and pregnancy weight gain together showed the strongest relationships to birth weight; the various body-mass indices including the BMI were less effective than weight alone and maternal height dropped out of the forward stepwise regression after 2–4 variables were included. Maximum values of R from the forward stepwise regressions approximated 0.4.

Reference

1. **Niswander KR, Gordon M.** *The women and their pregnancies.* Bethesda, MD, National Institutes of Health, 1972 (DHEW Publication No. 73–379).