# Perinatal Factors in Students Admitted to The University of the West Indies Data from the Jamaican Perinatal Study

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***ABSTRACT***

***Objective:*** *To compare perinatal and social factors in students admitted to The University of the West Indies (UWI), Kingston, Jamaica, at age 18 years with those in the rest of the Jamaican Perinatal Cohort.*

***Method:*** *The Jamaican Perinatal Survey recorded demographic and perinatal details in 10 527 or 97% of births in Jamaica in September and October 1986. Eighteen years later, 140 of these were admitted to the UWI in Kingston, Jamaica. The perinatal features of these UWI students have been compared with the rest of the Perinatal Survey Cohort.*

***Results:*** *Mothers of UWI students were older (*$p < 0.001$*), more likely to be married at the time of birth (*$p < 0.001$*), had earlier and more complete antenatal care (*$p < 0.05$*) and greater educational achievement at time of pregnancy (*$p < 0.001$*). These mothers of UWI students were also more likely to have diabetes (*$p < 0.01$*), operative deliveries (*$p < 0.01$*) and to attend private hospitals (*$p < 0.01$*). The UWI students had fewer siblings by their mothers (*$p < 0.05$*), were less likely to be low birthweight babies (*$p = 0.035$*) and more likely to be full term (37–42 weeks) than lower gestational age (*$p = 0.005$*). Differences in Apgar scores did not reach statistical significance.*

***Conclusions:*** *The students of the University of the West Indies were more likely to come from smaller families with features indicative of a better quality of life. They were also of higher birthweight and tended to be full term. The lack of association of Apgar scores with educational attainment is noteworthy.*

**Keywords:** Admission to university, perinatal, social factors

# Factores Perinatales en Estudiantes de Nuevo Ingreso en la Universidad de West Indies Datos del Estudio Perinatal de Jamaica

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***RESUMEN***

***Objetivo:*** *Comparar los factores perinatales y sociales en estudiantes aceptados para sus estudios en la Universidad de West Indies (UWI), Kingston, Jamaica, a la edad 18 años, con los del resto de la Cohorte Perinatal de Jamaica. .*

***Método:*** *El Estudio Perinatal de Jamaica registró los detalles demográficos y perinatales en el caso de 10 527 o 97% de nacimientos en Jamaica en septiembre y octubre de 1986. Dieciocho años después, 140 de ellos ingresaron a UWI en Kingston, Jamaica. Las características perinatales de estos estudiantes de UWI con el resto de la Cohorte del Estudio Perinatal.*

***Resultados:*** *Las madres de los estudiantes de UWI eran de mayor edad (*$p < 0.001$*), presentaban una mayor probabilidad de estar casadas al momento del nacimiento (*$p < 0.001$*), tuvieron cuidados*

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*prenatales más completos y más tempranos (p < 0.05), así como mayores logros en su educación al momento del embarazo (p < 0.001).*
*Estas madres de estudiantes de UWI presentaban también una probabilidad mayor de diabetes (p < 0.01), partos operativos (p < 0.01) y asistencia a hospitales privados (p < 0.01). Los estudiantes de UWI tenían menos hermanos y hermanas por parte de sus madres (p < 0.05), tenían una menor probabilidad de ser bebés de bajo peso al nacer (p = 0.035) y una mayor probabilidad de ser bebés de término completo (37–42 semanas) que tener una edad gestacional menor (p = 0.005). Las diferencias en puntuación de Apgar no alcanzaron a tener importancia estadística.*
***Conclusiones.*** *Los estudiantes de la Universidad de West Indies, presentaban una mayor probabilidad de provenir de familias más pequeñas con rasgos que indicaban una mayor calidad de vida. También poseían mayor peso al nacer y tendencia a término completo. La falta de correspondencia entre la puntuación de Apgar con los logros educacionales, fue cuestión de interés.*

**Palabras claves:** Ingreso a la universidad, factores perinatales, factores sociales

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## INTRODUCTION

Analysis of the factors in pregnancy and the neonatal period which are associated with cognitive development and subsequent academic performance may allow the design of interventions to improve these outcomes. Studies in North and South America have identified better socio-economic circumstances, lower parity and greater maternal intelligence and educational status (1–2) as predictors of early childhood well-being and cognitive development. Since socio-economic factors may be very different in the Caribbean, we have performed similar analyses utilising data from the Jamaican Perinatal Mortality and Morbidity Study (Perinatal Study) and using admission to the University of the West Indies at age 18 years or younger as the endpoint of academic achievement. These represent adolescents who have matriculated to university at the earliest possible time in their lives without apparent delays in movement through the different stages of the education process and indicate a significant achievement. The Jamaican Perinatal Study recorded social and perinatal details for all births in the island occurring in September and October 1986. At the beginning of the academic year for 2004, subjects born during the Perinatal Study would be aged 18 years and eligible for admission to the University of the West Indies (UWI). Analysis of UWI admission records identified 142 students born in Jamaica during this period, of whom 140 were successfully matched to their original birth records. This study compares social and perinatal details in those admitted to UWI with the rest of the Perinatal Study subjects.

## SUBJECTS AND METHODS

The Jamaican Perinatal Mortality and Morbidity Study (3) collected data on 10 527 (97%) of the 10 879 registered live births between September 1–October 31, 1986. There were 10 329 singleton live births and 99 pairs of twins providing 198 twin live births. Maternal interview with a structured questionnaire (4) recorded basic demography, marital status, sources of financial support, details of housing, past obstetric history, antenatal course and details of delivery. Admission records of UWI for the Autumn semester of 2004 contained 148 students born during the 2-months of the Perinatal Study. The UWI student records, which included name, date of birth and sometimes parish or hospital of birth, were matched against the neonatal records which included maternal name, place of birth and gender of child. Of the 148 students entering UWI, 6 were born outside of the country and so were not represented in the Perinatal Study and 140/142 (98.6%) were positively linked to their neonatal records. These are referred to as the UWI Cohort and compared with those not attending UWI (non-UWI Cohort). The study was approved by the Ethical Committee of the Faculty of Medical Sciences, UWI/University Hospital of the West Indies.

The following definitions were used for socio-economic indices for the mother at the time of birth. Post-secondary education referred to any formal training programme following completion of secondary school. Marital status was listed as married, common law union, visiting or separated. Occupational categories were defined as unskilled, semi-skilled, skilled, highly skilled, lower professional and higher professional according to the Jamaican Standard for Occupational Classification (5). Hospitals were categorized (6) as:

Type A – provided comprehensive essential obstetric care and other tertiary care;
Type B – provided comprehensive essential obstetric care, paediatrics, general medicine and surgery;
Type C – provided basic obstetric care without obstetrician.

Pregnancy history included parity (grand multiparae defined as ≥ 5 pregnancies), haemorrhage before or after 28 weeks, other complications during pregnancy including hypertension, pre-eclampsia and eclampsia and antenatal care (whether received at all, completeness of follow-up assessed

by trimesters attended, median gestational age at first attendance) and gestational age at which mother ceased regular employment. Gestational age of baby at birth was defined as pre-term (36 weeks and less), term (37–42 weeks) and post-term (43 weeks and over). Maternal history included hypertension or diabetes, whether the mother was seeking pregnancy and the use of tobacco, marijuana or alcohol during pregnancy. Birthweight was defined as normal (≥ 2500 g) or low (1500–2499 g) or very low (< 1500 g).

Initially, data analysis produced summary statistics for the demographic, health-related and socio-economic neonatal factors thought to be related to academic outcome. Bivariate analyses used the Fisher's exact test, Pearson chi-squared test, other non-parametric and parametric two-sample tests to determine statistically significant correlates of the outcome. Guided by the results of initial bivariate analyses, statistically significant correlates were subjected to logistic regression leading to adjusted and unadjusted odds ratios for academic outcome for given values of the relevant predictor. Variables included the mother's age at birth of child, marital status, exposure to post-secondary education, occupation of the major wage earner, parity and complications in pregnancy. Indices of antenatal care included the number of clinic visits in each trimester, the gestational age at first visit and at stopping work. Indices of neonatal performance included the gestational age at delivery and indices of birthweight.

## RESULTS

At the time of birth, mothers of UWI students were older, more likely to be married, more likely to have received post-secondary education, and the major wage earner was in higher grade employment (highly skilled or better); all relationships being highly significant before and after adjustment by multiple regression (Table).

Mothers of UWI students had fewer pregnancies, earlier and more complete antenatal care, and worked until later in pregnancy but logistic regression, adjusting for the mother's age at time of childbirth, showed that only gestational age at ceasing to work and parity remained significant

Table: Odds ratios and 95% confidence intervals (in brackets) for the association of socio-economic status and antenatal care indices with academic attainment

| Baseline index for comparison | Unadjusted OR (95% CI) | *p*-value | Adjusted[i] OR (95% CI) | *p*-value |
|---|---|---|---|---|
| **Maternal age < 19.5 years** | | | | |
| 19.5 – 24.4 | 2.9 (1.3, 6.5) | 0.013 | 2.3 (1.0, 5.2) | 0.057 |
| 24.5 – 29.4 | 7.1 (3.22, 2.8) | < 0.001 | 4.4 (1.9, 10.0) | < 0.001 |
| 29.5 – 34.4 | 10.2 (4.6, 22.9) | < 0.001 | 5.5 (2.4, 12.9) | < 0.001 |
| ≥ 34.5 | 7.1 (2.9, 17.3) | < 0.001 | 4.4 (1.7, 11.2) | 0.002 |
| **Mother being married** | | | | |
| Common-law | 0.2 (0.1, 0.3) | < 0.001 | 0.4 (0.2, 0.6) | < 0.001 |
| Visiting | 0.2 (0.2, 0.3) | < 0.001 | 0.6 (0.4, 0.9) | 0.010 |
| Separated | 0.2 (0.1, 0.6) | 0.002 | 0.4 (0.2, 1.1) | 0.093 |
| **Mother no post-2° education** | | | | |
| Had Post-secondary education | 7.5 (5.4, 10.5) | < 0.001 | 4.9 (3.4, 6.9) | < 0.001 |
| **Major wage earner unskilled** | | | | |
| Semi-skilled | 1.0 (0.4,2.2) | 0.97 | 0.9 (0.4, 2.0) | 0.82 |
| Skilled | 1.3 (0.7,2.3) | 0.45 | 1.1 (0.6, 2.0) | 0.83 |
| Highly Skilled | 5.3 (2.7,10.4) | < 0.001 | 3.7 (2.2, 8.0) | < 0.001 |
| Lower Professional | 7.2 (3.8,13.5) | < 0.001 | 4.2 (0.7, 4.2) | < 0.001 |
| Higher Professional | 20.0 (6.2,64.3) | < 0.001 | 8.8 (2.6, 29.4) | < 0.001 |
| Unclassified | 3.0 (1.2,7.4) | 0.02 | 2.1 (0.8, 5.3) | 0.112 |
| **Mother primipara** | | | | |
| Multiparae | 0.9 (0.6, 1.2) | 0.4 | 0.5 (0.3, 0.9) | 0.013 |
| Grand-multiparae | 0.3 (0.1,0.8) | 0.011 | 0.1 (0.02, 0.5) | 0.003 |
| **No complications in pregnancy** | | | | |
| Complications during Pregnancy | 2.1 (1.5, 3.1) | < 0.001 | 1.6 (0.97, 2.56) | 0.065 |
| **Antenatal Visit History** | | | | |
| Visit in 1 trimester | 0.3 (0.1, 1.1) | 0.07 | 0.3 (0.04, 2.72) | 0.315 |
| Visit in 2 trimesters | 1.0 (0.4, 2.3) | 0.96 | 0.8 (0.19, 3.77) | 0.820 |
| Visit in 3 trimesters | 5.3 (2.3, 12.0) | < 0.001 | 2.1 (0.49, 8.94) | 0.316 |
| **Gestational age: first clinic visit** | 0.88 (0.86, 0.91) | < 0.001 | 0.96 (0.92, 1.01) | 0.085 |
| **work stoppage** | 1.07 (1.04, 1.10) | < 0.001 | 1.04 (1.01, 1.07) | 0.022 |
| **Gestational age ≥ 36 weeks** | | | | |
| 37–42 weeks | 3.86 (1.57–9.48) | 0.003 | 3.64 (1.29, 10.34) | 0.015 |
| ≥ 42 weeks | 2.42 (0.47–12.58) | 0.292 | 2.86 (0.50, 16.32) | 0.237 |
| **Normal birthweight** | | | | |
| Low birth weight | 0.39 (0.18,0.83) | 0.015 | 0.44 (0.20, 0.94) | 0.035 |
| **Birthweight (100g increments)** | 1.04 (1.01,1.07) | 0.011 | 1.03 (1.00,1.06) | 0.055 |

at the 5% level. Every one-week increment in the time to work stoppage increased the likelihood of the child entering UWI by 4%. Grand-multiparae mothers were nearly 10 times less likely to be mothers of the UWI cohort (Table). Mothers of UWI students were more prone to haemorrhage and to other complications in pregnancy but these differences were no longer significant on multiple regression.

Mothers of UWI students were more likely to have diabetes ($p < 0.01$), less likely to use tobacco or alcohol (both $p < 0.05$) during pregnancy and more likely to have planned pregnancies ($p < 0.001$) but only the association with diabetes persisted after adjusting for maternal age. The presence of hypertension, pre-eclampsia or eclampsia did not differ between mothers of UWI students and controls.

Mothers of UWI students had more frequent Caesarean sections ($p < 0.001$), whether elective or emergency, a higher frequency of obstructed labour ($p = 0.001$) and were marginally more likely to have overall complications ($p < 0.045$ based on Fisher's exact test) and were more likely to be delivered in major hospitals or private hospitals ($p < 0.001$).

Mean birthweight was 3221g (SE 41.2) among UWI subjects compared with 3098g (SE 5.8) among controls (t test, $p = 0.02$) and very low birthweight did not occur among the UWI Cohort compared with 1.6% of controls. Greater birthweight (100g increments) contributed significantly to the likelihood of entering UWI ($p = 0.011$) although this difference just failed to reach significance ($p = .0.055$) after adjustment for other factors (Table). The higher birthweight among UWI subjects was even more marked considering the lower gestational age at delivery among UWI subjects (proportion ≤ 36 weeks: 14.2% UWI subjects, 4.1% controls). There were no differences in head circumference, mean Apgar scores or prevalence of convulsions or jaundice between the groups.

## DISCUSSION

The present study provides evidence that academic achievement, arbitrarily indicated as admission to the University of the West Indies by the age of 18 years, is associated with older, married and better educated mothers, who worked later in pregnancy, had fewer babies and more complete antenatal care. Full-term and normal weight babies were more likely to enter UWI than pre-term and low birthweight babies. Mothers of UWI students were more likely to have operative deliveries and delivery in major public or private hospitals, a difference which was probably secondary to the higher educational or social status of these families. Although few of these observations are unique, they have been confirmed in a longitudinal study made possible by the geographical limitation of an island community.

Adolescent pregnancies were infrequent among mothers of the UWI cohort (5% versus 23%), the associated handicaps (less mature mothers, interrupted education, inadequate preparation for employment) were therefore less likely to limit their potential and contribute to poorer academic achievement as in inner city communities (7). The UWI cohort tended to have fewer siblings at birth but the difference only became significant among grand multiparae (3.5% vs 10.1%). The mothers of the UWI cohort were more likely to attend the clinics for antenatal care. Consequently, the better medical surveillance of the mothers was likely to detect and address adverse developments more quickly and may have improved fetal outcome in as yet unmeasured ways. More frequent attendance at clinic among the UWI cohort could also explain the higher levels of diabetes detected in this group.

Better antenatal care among mothers of the UWI cohort probably reflected their greater educational level and perhaps less social and economic pressures allowing them to keep appointments (8). Mothers of the UWI cohort were more likely to be delivered at major public or private institutions, the latter perhaps reflecting their better resources. It is tempting to suggest that this may also have contributed to the greater frequency of Caesarean sections which may be influenced by social factors although the greater frequency of obstructed labour in this group suggests other mechanisms. Age of mother at the time of the child's birth was a confounder in the relationship between diabetes in pregnancy and academic outcome although this relationship persisted after adjustment for age. While efforts to ensure adequate antenatal and neonatal care could lower the likelihood of poor academic achievement, the effects of neonatal medical risk factors become less critical over time, as environmental influences play a more dominant role in cognitive outcome (8).

Birthweight is of particular interest in relation to subsequent academic performance but much of the published data relate to low birthweight (1001–2000 g) and very low birthweight babies (501–1000 g). The Pune (India) low birthweight study showed that by age 12 years, the low birthweight group had lower mean IQ and less mathematical skills compared to normal controls (9). In that study, the IQ was significantly related to mother's education and mathematical performance to the father's education. However, differences in cognitive performance had disappeared by age 11 years in a cohort of low birthweight babies followed in Norway suggesting that environmental factors may become more important with increasing age (10). In the present study, low birthweight was less common among the UWI Cohort (5% versus 11%) and none had very low birthweight compared with 1.5% of the control group. Since higher birthweight appears to predict better academic performance, it would be interesting to know whether measures to improve birthweight improve cognitive skills but this has yet to be demonstrated in prospective studies.

This study has used the arbitrary endpoint of admission to UWI at age 18 years. It is clearly feasible that, at this age, some students would have attended other institutions of tertiary education locally or internationally. If we were able to identify these additional members of the birth cohort, the

numbers would likely be small in relation to the 10 387 members of the non-UWI Cohort and while accepting this possibility, it seems unlikely that this potential bias would have affected the results of this study.

While confirming many of the previously demonstrated relationships between academic achievement and perinatal features, these relationships require caution in interpretation. Many of the features of these results such as the relationship with completeness of antenatal care simply reflect more intelligent and educated parents and it cannot be inferred that improving antenatal care alone will improve subsequent academic achievement. The more important determinants are likely to be the higher maternal age, greater marital stability, lower parity and better socio-economic status consequent on the major wage earner being skilled or professional. Addressing these issues would require a long term process of socio-economic improvement.

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