COHORT PROFILE

Cohort Profile: The Jamaican 1986 Birth Cohort Study

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How did the study come about?
Previous studies on infant, perinatal and maternal mortality in Jamaica raised questions about the validity of vital events documented in official statistics.1–3 In order to resolve debates on the benefits of specialist antenatal and perinatal care vs basic community care (delivered by a midwife or general practitioner) on pregnancy outcomes, valid evidence on the true incidence, causes and risk factors for perinatal deaths in relation to these exposures was required. In 1985, the International Development Research Centre (IDRC) of Canada funded the Jamaica Perinatal Morbidity and Mortality Survey (JPMMS). It was a 1-year comprehensive, three-layered national population-based study which began in September 1986. It included all births in the first 2 months [September–October 1986: Jamaica Birth Cohort Study (JBCS)],4 neonatal admissions over 6 months (September 1986–February 1987: Neonatal Morbidity Study)5 and 1 year’s late fetal, neonatal6,7 and maternal deaths8 (September 1986–August 1987: Perinatal and Maternal Mortality Studies). Cohort babies who were admitted or died would have contributed data to the morbidity and/or mortality studies.

What does the study cover? (and how has this changed)
The initial study, which included follow-up of the mothers and babies in the puerperium, aimed to determine the perinatal mortality rates for Jamaica, identify the clinical and pathological causes and maternal and environmental risk factors associated with these outcomes and document early child care practices and development.8 It was our original intention to reassess the children at each juncture of their educational careers, at the end of their pre-school (6–7 years), primary (11–12 years) and secondary education (15–16 years), but lack of funds prevented the 6–7-year follow-up. The growing prevalence of violent and aggressive behaviour in the Jamaican society, often associated with poor school achievement, provided the opportunity to follow up the cohort at 11–12 years (JBCS I) and 15–16 years (JBCS II). These studies aimed to (i) determine the children’s behaviour patterns, cognition and educational attainment and factors influencing them, and (ii) their exposure to and experience of violence and their influence on behaviour and development.9

Chronic non-communicable diseases are now the leading causes of morbidity and mortality in Jamaica and the Caribbean.10 Many have their origins in the perinatal period11,12 and may be modulated by early life experiences, including socio-economic factors.13 This cohort provided an opportunity to accelerate our understanding of early life origins of chronic disease risk factors manifesting in late adolescence and young adulthood. The aims of JBCS III were to estimate the prevalence of obesity and other cardiovascular and respiratory disease risk factors among young adults, and the impact of perinatal and early childhood events on their cardiovascular and respiratory risk status.
Who is in the sample?

The birth cohort included all babies born anywhere in Jamaica in September and October, 1986. Given the propensity for wide variations in the risk of perinatal death by type of birthing facility, we felt that a national survey would address issues of selection bias. Mothers were interviewed at birth by hospital or community midwives, depending on where the birth occurred. When registered live births were compared with study infants, 94% of registered live births had been identified. The adolescent exercises (JBCS I and II) were limited because of funding to the sub-set attending school in the two urban parishes—Kingston and St Andrew (KSA)—which encompass the capital, Kingston. All schools in KSA and the dormitory community of Portmore, in the adjacent parish of St Catherine, were visited. School registers were used to identify students born in September–October 1986, all of whom were invited to participate. For JBCS III, all persons contacted at JBCS I and II as well as students registered at the University of the West Indies who were part of the original birth cohort were invited, whether or not they had participated in JBCS I or II.

How often have they been followed up, and what was attrition like?

The first follow-up, at 6 weeks to 3 months of age, occurred through post-natal clinics. Parents not attending these clinics were visited at home by community midwives and public health nurses. In total, 85% were located, 76% in the urban south-east region and 92–96% in the more rural regions. JBCS I, conducted from 1997–98, spanned their last year in primary school and the first year of secondary school. The Statistical Institute of Jamaica, our census bureau, indicated that based on the 1991 census, we could expect to identify 2048 11-year-old children resident in KSA who were born in September–October 1986. We located 1715 children in school at 11–12 years and 68 outside the school system (special care homes and other institutional settings), 83.7% and 87.1%, respectively of the expected population. The second follow-up of 1563 adolescents 15 to 16 years old (JBCS II) occurred between 2001 and 2003. For the third follow-up at 18–20 years (2005–07), of 1212 young adults contacted, 902 (74%) agreed to participate. At least one contact has been made with 2371 persons, 24% of those whom survived the perinatal period (Table 1). While follow-up activities focused on residents in two of four south-east—region parishes, Table 1 shows that 2–5% of children born in the other three regions also participated. Using these proportions as the upper and lower limits of internal migration, 60–150 of 2999 perinatal survivors resident in KSA should have been lost to internal migration (usually rural-urban, not urban–rural) and <100 due to death from 1986 to 1998, using 1998 age-specific mortality rates. The gap of approximately 700 children is likely due to external migration, which routinely absorbs ~60% of our natural population growth, and selectively favours reproductive-age persons, more often females. Eventually children follow.

Of the 2371 contacts, we have linked 1950 (82%) to their maternal records. While little difference is seen between the maternal characteristics of perinatal survivors and those seen at post-natal clinics, when those seen at least once (n = 1951), twice (n = 1165) and

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**Table 1** Recruitment into the 1986 Jamaica Birth Cohort Study: deliveries, surviving live births; infants seen in the post-natal period and between 11 and 20 years, by region of residence at birth

<table>
<thead>
<tr>
<th>Region of residence at birth</th>
<th>Total births island wide, including perinatal deaths</th>
<th>Total surviving live births (28 days)</th>
<th>Surviving infants seen: 6 weeks to 3 months n (%)</th>
<th>At least one contact between 11 and 20 years n (%)</th>
<th>11–12 years n</th>
<th>15–16 years n</th>
<th>18–20 years n</th>
</tr>
</thead>
<tbody>
<tr>
<td>South-east</td>
<td>5093</td>
<td>4881</td>
<td>3694 (76)</td>
<td>1778 (36)</td>
<td>1337</td>
<td>1242</td>
<td>721</td>
</tr>
<tr>
<td>North-east</td>
<td>1354</td>
<td>1293</td>
<td>1185 (92)</td>
<td>61 (5)</td>
<td>27</td>
<td>39</td>
<td>23</td>
</tr>
<tr>
<td>West</td>
<td>1920</td>
<td>1837</td>
<td>1759 (96)</td>
<td>42 (2)</td>
<td>18</td>
<td>19</td>
<td>12</td>
</tr>
<tr>
<td>South</td>
<td>2132</td>
<td>2043</td>
<td>1929 (94)</td>
<td>70 (3)</td>
<td>34</td>
<td>43</td>
<td>34</td>
</tr>
<tr>
<td>Total</td>
<td>10499</td>
<td>10054</td>
<td>8567 (85)</td>
<td>1951 (19) (82%)</td>
<td>1416 (83%)</td>
<td>1343 (86%)</td>
<td>790 (88%)</td>
</tr>
</tbody>
</table>

Total seen

|       | 2371 (24) | 1715 | 1563 | 902 |

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*aPercentage of total surviving live births (third column).
*bIncludes Kingston (the capital) and St Andrew (where JBCS I-III recruited), comprising two of the four parishes in this region.
*cPercentage of total seen who have been linked to their perinatal data.
*dIncludes those not yet linked to their perinatal data.
three times ($n = 495$) are compared with the initial cohort, female participants (48% at birth but 56% with three contacts) and children born to older, better educated women (tertiary education: 5% of births, 12% seen three times) were more likely ($P < 0.01$) to participate in the follow-up activities (Table 2). No difference in birth weight was seen between the original cohort and those who have been reassessed since the perinatal visit.

### What has been measured?

Table 3 summarizes the range of variables measured over time. From birth to 6 weeks, over 1200 variables recorded socio-demographic characteristics of the mother, her community, her household, her obstetric history and management of her antenatal, intrapartum and postpartum care. Infant outcome characteristics include birth weight, gestation, measures of fetal maturity and interventions in the puerperium. All babies admitted to neonatal care nurseries had their health care fully documented. These high-risk newborns ($n = 1823$) could potentially provide another cohort for follow-up. Babies who died during the perinatal period had the causes of their deaths documented, half of whom underwent a full perinatal postmortem examination as did mothers who died over the 1-year mortality study.

At the post-natal visit, the health of the mother and child were noted, including the mother’s acceptance of family planning, infant feeding practices, infant weight and height, possible illnesses in the infant and developmental milestones.

For JBCS I and II, parents completed questionnaires on the family’s socio-economic status and the child’s health. Parents and teachers completed the parent and teacher form, respectively, of the Jamaican Youth Behaviour Checklist and a Behaviour and Emotional Rating Scale. Children completed questionnaires: (i) About me, my family and friends; (ii) About my health; (iii) About my home, my school, my jobs and my community and (iv) About my emotions, feeling and behaviour, with age-appropriate variations between JBCS I and II. Standard tests documented cognitive and academic skill levels (WRAT Spelling, Reading and Arithmetic Tests; Peabody Picture Vocabulary Test and Ravens’ Progressive Matrices, both proxy IQ tests). At 15–16 years, salivary cortisol specimens were also collected.
Table 3 Variables measured at birth, 6 weeks, 11–12/15–16 years and 18–20 years: Jamaica Birth Cohort Study

<table>
<thead>
<tr>
<th>Study round</th>
<th>Area of information</th>
<th>Type of data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth (reported by mother)</td>
<td>Socio-demographic</td>
<td>Age, union/marital status, education; household size and composition; occupation of mother and major wage earner; work during pregnancy; home ownership and quality (size, sanitation, water supply)</td>
</tr>
<tr>
<td>Community</td>
<td></td>
<td>Access to social services, including primary health care</td>
</tr>
<tr>
<td>Reproductive history</td>
<td></td>
<td>Age of sexual debut, contraceptive use, gravidity/parity, previous complications of pregnancy and pregnancy outcome, inter-pregnancy interval, sexual activity during pregnancy</td>
</tr>
<tr>
<td>Social history</td>
<td></td>
<td>Tobacco, cannabis, alcohol use; prescription, over-the-counter, herbal products used; mental health during pregnancy</td>
</tr>
<tr>
<td>Health service utilization</td>
<td></td>
<td>Source of antenatal, delivery care; gestation of first visit, total visits; antenatal education; screening (Hb, syphilis, hypertension, weight gain; height); interventions (tetanus immunization, iron/folate); complications (e.g. pre-eclampsia, diabetes, other health problems); referral; antenatal hospitalization</td>
</tr>
<tr>
<td>Birth (documented from medical records)</td>
<td>Labour and delivery</td>
<td>Initiation of and duration of labour, presentation, method of delivery, attendant at birth, use of oxytocin and analgesia, complications (e.g. eclampsia, haemorrhage, prolonged labour, cord prolapse, fetal distress), interventions (e.g. C-section, transfusion, pharmaceuticals)</td>
</tr>
<tr>
<td>Post-natal follow-up (6 weeks to 3 months)</td>
<td>Maternal health status</td>
<td>Puerperal complications (e.g. mastitis, depression, PPH), post-partum admission, return of menses, social support, screening (Hb, blood pressure, weight), contraceptive plans/use</td>
</tr>
<tr>
<td></td>
<td>Infant health status</td>
<td>Screening (Hb, weight, crown–heel length, head circumference, measures of maturity (nipple appearance, sole creases, testes/labia appearance); Apgar score; feeding; complications (seizures, jaundice etc); interventions (eye drops, vitamin K, BCG (anti-TB) vaccine); full system examination; anomalies; admission to neonatal care</td>
</tr>
<tr>
<td>Neonatal admissions (clinical records)</td>
<td></td>
<td>Signs, symptoms and diagnoses; tests administered and findings; interventions (e.g. ventilation, IV fluids, transfusion, drugs); nutrition, discharge status, length of stay, prognosis</td>
</tr>
<tr>
<td>Perinatal deaths</td>
<td>All deaths</td>
<td>Plurality; place of death; relative time of death (e.g. ante/intrapartum fetal death, neonatal death; age at death; Wigglesworth classification)</td>
</tr>
<tr>
<td>Cases under going post mortem</td>
<td></td>
<td>Histology; placental review; system investigation and findings; congenital anomalies identified; diagnoses</td>
</tr>
<tr>
<td>11–12 years and 15–16 years</td>
<td>My health and nutrition (child)</td>
<td>Anthropometric measures (weight, height), use of health services; substance use and abuse; child’s knowledge of family history; hearing, vision, speech, physical disability; nutrition; exercise; leisure activity; food frequency questionnaire; eating habits; puberty</td>
</tr>
<tr>
<td></td>
<td>Child health (parent)</td>
<td>Developmental milestones; immunization; health problems (chronic or infectious diseases; accidents, injuries, hospitalizations, referral for therapy); prescription medication; vision, dental, hearing screening and related defects; physical limitations; family history; household use of alcohol, tobacco, cannabis, illicit drugs</td>
</tr>
<tr>
<td>My family and friends (child)</td>
<td></td>
<td>Social environment; family size, relations and function; parental occupation, education; crowding; possessions; housing quality/amenities; teenage sexuality, including pregnancy; religious practice; television exposure; leisure reading; hobbies</td>
</tr>
</tbody>
</table>

(continued)
At 18–20 years, the focus shifted to risk factors for chronic disease and assessment took a more clinical approach. Background socio-economic data continue to be collected along with information on leisure-time physical and social activity and personality characteristics. Anthropometric and biological measures focus on risk for cardiovascular, respiratory and bone mineral density perturbations. Biological samples and clinical tests evaluated bone mineral density; respiratory function; fasting blood glucose, fasting insulin; cholesterol, triglycerides, high-density lipoprotein; creatinine, haemoglobin, microalbumin. Sera have been stored to measure inflammatory markers of cardiovascular disease (CVD).

**What has it found?**

**Perinatal mortality**

The perinatal study documented the incidence and causes of perinatal deaths and the influence of social and environmental risk factors, maternal behaviour, poor obstetric history, medical complications and quality of antenatal and intrapartum care. This has informed public policy and practice from continuing education for community midwives, modernization of the vital registration system, improved community-based general and specialist antenatal services, health promotion empowering women to respond appropriately to obstetric emergencies to locally derived growth charts for Jamaica newborns.

**JBCS I and II**

JBCS I and II demonstrated the positive contribution of stable parental unions (common-law and legal marriage), to child development. Children from less emotionally stable homes (visiting unions, single parent with a biological and surrogate parent) had more behavioural problems and lower cognitive and academic achievement. As children who attended small publicly subsidized community pre-schools (ages 2½–5 years) performed less well academically than private pre-school attendees, regardless of social status, minimum standards were developed for these institutions as part of a comprehensive early childhood development strategy.
Nutritional status
At 11–12 years, more boys (10.6%) than girls (7.1%) were thin; however, the main nutritional challenge at 11–12 years was overweight (girls 11.7%, boys 8.4%), which persisted into older adolescence (females 18.6%, males 12.2%) and young adulthood (18–20 years: females 18.6%, males 12.4%). More females (11.5%) than males (6%) were now obese. Children at both extremes of anthropometric measures had more behavioural problems than normal-weight peers.

Exposure to violence, behaviour, aggression and school performance
Adolescent delinquency and aggression were associated with not only exposure to violence and impaired family functioning but also inadequate pre-school and primary school environments. By 18–20 years, one in five young men, especially out-of-school youth living independently, reported involvement in aggressive behaviour.

Predictors of health status in later childhood and adulthood
At 18–20 years of age, low-birth-weight (LBW < 2500 g) babies were tracking higher CVD risk factors compared with their normal-birth-weight (NBW > 2500 g) peers, starting with impaired fasting glucose (5.1% LBW and 0.8% in NBW; P = 0.005).

What are the main strengths and weaknesses?
The main strength of the cohort is its representative population base. This cohort is one of a handful of such birth cohorts and the largest in the developing world. The potential to inform health policy and practice in these countries remains immense.

We have linked birth data (previously anonymized) to 82, 86 and 88% of records in the 11–12, 15–16 and 18–20 years data sets, respectively. One challenge to linking the data sets has been the culture of using ‘pet’ names or aliases, instead of given first names. As children often reported their mothers’ ‘pet’ names, these did not match the given names on record until the search was expanded to include ‘pet’ names recorded at birth. Then the match rate increased from ~60% to >80%. As we complete the building of an index from the paper records, all cohort members will be united with their maternal birth records, creating a single identification number for future follow-up activities.

Our main challenge has been attracting international financing, because of our relative socio-economic status, an issue for middle-income developing countries capable of undertaking high-quality research and supporting less experienced teams in lower income countries. Most of the support for JBCS I-III has come from local sources. Were rural children’s experiences different from their urban counterparts? With no contact between their post-natal period and 11 years, opportunities were lost to examine early life influences on growth and development.

Issues of statistical power must enter into the discussion when numbers dwindle but we hope to encourage greater participation from cohort members not just in the Kingston metropolitan area but across the island and even into the Diaspora where some may now be dispersed.

Can I get hold of the data?
Where can I find more?
We are interested in joint analysis of the data, especially groups wishing to compare the experience of the Afro-Caribbean population now dispersed throughout the developed world, with those in the Caribbean. Some of the 1986 data are available through the Institute of Social and Economic Research Data Bank, University of the West Indies, Mona. We have had successful relationships with the University of Bristol, Michigan State University and are currently working with the Liggins Institute. Postgraduate students are encouraged to access this rich source of data for secondary analysis, which has already supported three master’s and four PhD degrees.

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Conflict of interest: None declared.

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