V. The Child's Height

Contents

V.1   **Background**

V.2   **Birth length**

V.3   **Lengths/heights of the 10% subset 'Children in Focus' (ages 4 mo – 5y)**

V.4   **Heights in the Focus Clinics (ages 7-10y)**

V.5   **Data from health visitors**

V.6   **Parental heights**

V.7   **The variables and edits carried out**

V.8   **Suggested statistical exercises**

Keywords: birth length
childhood height
growth
maternal height
paternal height

Data sources: birth file, Children in Focus, Focus @ 7, Focus @ 8, Focus @ 9, Focus 10+, child health computer files, C, D and PA Questionnaires

The data are linked with information on maternal age (MZ028b) socio-economic group (NS-SEC) (C756a, C766a) and ethnic origins (C800a, C804). See ALSPAC main documentation for details.

Data set: All children within ALSPAC who survived the first year of life. (n=13988)

In order to preserve confidentiality, for the most part information on triplets and quads have been put to missing.

V.1 Background

There are many reasons for measuring heights including:

(a) birth length is a valuable measure of fetal growth;
(b) slow child growth may reflect poor nutrition, child neglect or chronic illness;
(c) child height/length is related to parental heights;
(d) for boys the spurt in growth is a good indicator of the start of puberty;
(e) in association with weight it can be used to calculate body mass index as an indicator or overweight and obesity;
(f) The vertical growth of the child is perceived as an important aspect of health, influenced by a variety of environmental and genetic factors.

Basic information

MZ010 = the number of individuals in the pregnancy
KZ021 = sex of child: 7224 boys and 6762 female; 2 lost to follow up were of unknown sex

V.2 Birth length

The initial plan had been to use the birth lengths as recorded in the obstetric or neonatal records. Pilot observation studies, however, revealed that the ways in which the midwives measured the infant were inconsistent and of poor methodology. [It is crucial to measure from the top of the head to the bottom of the heel with the trunk and legs in a straight line.]

In the two large maternity hospitals serving the ALSPAC area, staff employed by ALSPAC and trained by Dr Maria Bredow (local community paediatrician) were used. Dr Bredow had been trained by a team based at the Department of Professor Michael Preece at the Institute of Child Health, London.

The team visited the two major maternity hospitals (Southmead and Bristol Maternity Hospital/ St. Michael's) each morning and measured all available children for whom the mother gave permission. At this point they often enrolled new mothers into the study. The crown-heel length was measured using a Harpenden Neonatometer (Holtain Ltd), provided for the study by the Child Growth Foundation.
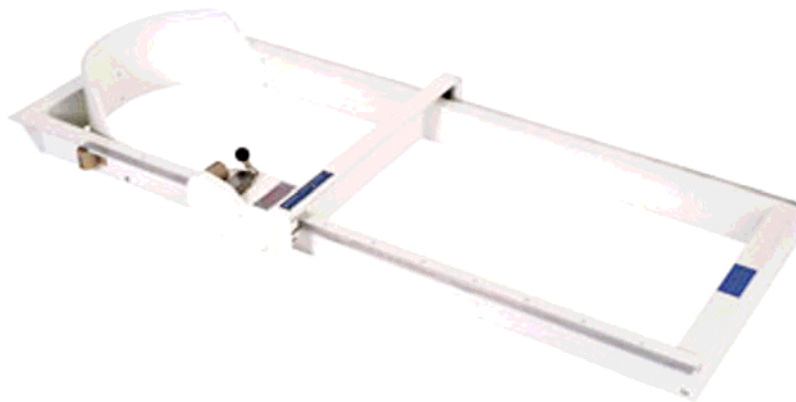
Missing measurements were biased in relation to place of delivery (those delivered at Weston General hospital and home deliveries did not get measured), and mothers who took early discharge were unlikely for their child to be measured.

The age of the baby in calendar days at measurement is given by KZ 028. In all 92% were measured within 4 days of birth.

The birth lengths based on the measurements made by the ALSPAC team are given in KZ032C. These are the preferred data. Measurements are given to the nearest cm. Information was available for 8487 children.

KZ032c Birth length using ALSPAC measurers
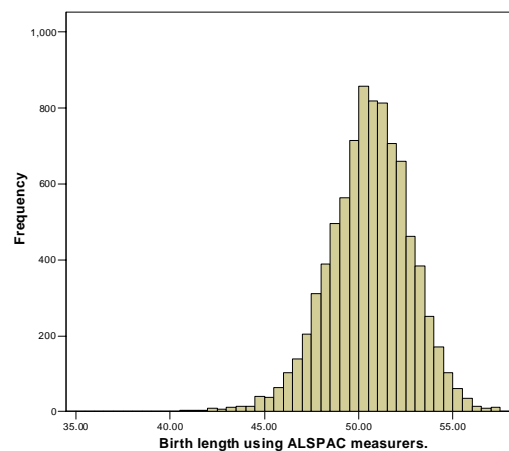
The variable (KZ032) uses the ALSPAC data where available combined with that from clinical records where that was the only source (n=10536). It should be used with caution. The provenance of the data is shown in KZ032A. Here code 1 indicates ALSPAC measurers and 2 the clinical records.

KZ032 All crownheel

3
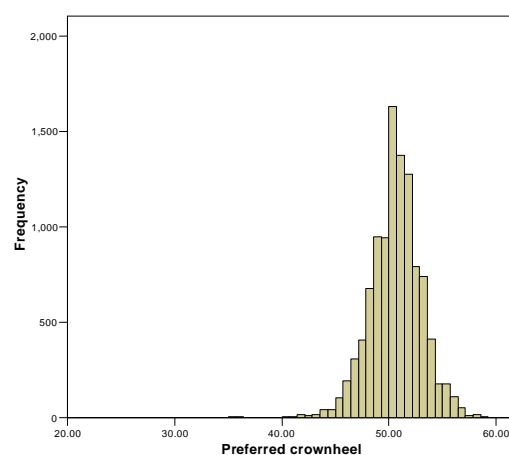
V.3 Lengths/heights of the Children in Focus subgroup aged 4 months - 5 years

The aim of 'Children in Focus' was to examine a subset of children accurately over time.

The Children in Focus cohort was chosen at random from the last 6 months of ALSPAC births, occurring from June 6th - December 11th 1992. Excluded were those mothers who had moved away from Avon or were 'lost to follow up' when they moved without forwarding addresses, those who had refused to participate or fill in questionnaires, and those whose baby had died or who had two or more pregnancies in the study.

Also excluded were those babies in the Avon Premature Infant Project (APIP) for very premature babies (i.e.<33 weeks) and their full-term controls, (a total of 52 babies out of 4257 eligible cases; 35 of these were preterm babies and 17 were controls). There was no selection on place of residence as long as it was within the study area at the time of the first invitation to join Children in Focus. Children who moved away subsequently were still invited to participate, although travel costs were unable to be met in full.

All twins born in the eligible time period were invited to take part.

Parents were invited to bring their children to the clinic at 4,8,12,18, 25, 31, 37, 43, 49 and 61 months of age.

Mothers of 1023 babies came to the 4-month clinic and were invited again at 8 months, together with 16 who had been willing but unable to come at 4 months. A further 550 cases were invited at 8 months to increase the size of the cohort and of these 389 came to the 8 month clinic. Children of parents who attended, or were willing at attend at 4 and/or 8 months formed the Children in Focus cohort who were invited to subsequent clinics. Only those who died or whose parents refused further participation in Children in Focus or in the main study were deleted. No new children were added.

In all 1432 children (69%) including 18 sets of twins were actually brought to at least one clinic. Unfortunately one baby who had been to the 4-month clinic, and another who had been to both the 4 and 8 month clinics subsequently died. They have been omitted from the present data set.

Clinic	Date	Children invited	Children seen	% of those invited
4 months	6.10.92 - 3.4.93	1509	1023*	68%
8 months	5.2.93 - 4.8.93	1589	1314*	83%
12 months	8.6.93 - 4.12.93	1398	1241	89%
18 months	7.12.93 - 10.6.94	1341	1183	88%
25 months	5.7.94 -12.1.95	1322	1127	85%
31 months	14.1.95 - 6.7.95	1305	1135	87%
37 months	10.7.95 - 13.1.96	1226	1081	84%
43 months	16.1.96 - 6.7.96	1249	1065	85%
49 months	9.7.96 - 8.1.97	1268	1032	81%
61 months	NA	NA	994	NA

NA: Data not available *These figures include the children who died

Response variables

Whether invited and whether attended. Unfortunately due to a computer glitch, the information concerning whether or not the child was invited at age 61m is not available.

	Not invited[†]	Invited and attended	Invited and refused	Invited did not attend	Invited did not respond	Invited unable this clinic
4m	557	1023*	130	62	276	18
8m	1	1314*	59	41	137	38
12m	-	1241	17	20	72	48
18m	32	1183	22	19	54	63
25m	31	1127	23	21	73	78
31m	40	1135	13	10	76	71
37m	45	1081	13	15	92	75
43m	44	1065	9	13	94	68
49m	21	1032	78	22	75	61
61m	NA	994	NA	NA	NA	NA

[†]code 6 used from 18m onwards - children from 18 months onwards were not invited because they had moved out of the area * includes the 2 children who died.
NA: Not available

Ages at attendance

The target ages for the children were:

- a) 3 months 3 weeks
- b) 8 months
- c) 12 months and 1 week
- d) 18 months and 1 week
- e) 25 months and thereafter at 6 month intervals until 49 months, and then at 61 months.

It was aimed to see children within a limited time of that ideal age and this 'window' of time varied with the needs of the tests at each clinic.

Because of illness or family commitments, some children could not be seen within these limits in spite of our best efforts. Rather than lose them for that visit, with the risk of losing them from the cohort altogether, some were seen outside the recommended 'window'. The ages are given by variables CF010 – CF019.

Clinic	Age 'window' for that clinic			% seen outside age 'window'
4 months	3 months 2 weeks	→	4 months 2 weeks	1.3
8 months	7 months 3 weeks	→	8 months 3 weeks	5.0
12 months	12 months	→	13 months	6.9
18 months	17 months 2 weeks	→	19 months	3.0
108 weeks (25 months)	106 weeks	→	110 weeks	1.7
134 weeks (31 months)	133 weeks	→	137 weeks	1.7
160 weeks (37 months)	158 weeks	→	163 weeks	2.0
186 weeks (43 months)	185 weeks	→	190 weeks	3.6
212 weeks (49 months)	208 weeks	→	216 weeks	3.3

The measurements

Accurate length/height measurements were taken at each clinic. Note that length is measured lying flat, and height standing vertically. The two are not identical, although not wildly different.

Equipment used

Length (crown-heel):   at 4 months, Harpenden Neonatometer (Holtain Ltd);
from 8 months to 25 months inclusive, Kiddimetre (Raven Equipment Ltd).

Height: from 25 months onwards, Leicester height measure.

All equipment was donated by the Child Growth Foundation courtesy of Tam Fry.

We are indebted to Prof. Michael Preece, Head of the Department of Growth and Development, Institute of Child Health, London and to Les Cox from the same department, for their advice and assistance.

Validation and reliability

Before the 4 month clinic, staff repeatedly measured a metal rod of known length using the Harpenden Neonatometer. This was supervised and analysed by Dr. Maria Bredow. There were no statistically significant differences between observers.

At 12 months all measurements were done on the same 10 children by each of 5 measurers in turn, confirming their reliability.

At 25 months the measurers were asked to measure 10 children with each of the other 4 measurers separately, so that no child was measured more than twice. In practice 5 pairs measured either 9 or 10 children and the 6th pair measured 7. So, pairs 1 to 5 used 9 or 10 children, pair 6 used 7 children.

At 49 months, one experienced measurer, Hazel Blake, measured 20 children after each of the other measurers.

Information on the code of the tester is given in variables CF030-CF039, so that this may be taken into account if necessary. It should be noted that there were no biases in which children were allocated to which measurer – it was a matter of who was on duty on the particular day.

Measuring team: Raghda Alatia, Carol Billinghurst, Hazel Blake, Sarah Boon, Julie Brooks, Sarah Brown, Amanda Carmichael, Pauline Church, Susan Greer, Linda Lee,

Elizabeth Miller, Pauline Morgan, Sheilagh Murray, Terri Portch, Jenny Shine, Carol Smith, Miriam Walls.

Measurer

Clinic	Variable Name	Tester number *									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Missing**
4m	CF030	142	419	221	15	111	98	-			16
8m	CF031	117	25	436	334	290	85	27			
12m	CF032	240	420	97	334	14	8	114	14	-	-
18m	CF033	143	437	161	101	219	43	70	-	-	9
25m	CF034	33	599	36	315	52	91	-	-	-	1
31m	CF035	97	430	316	197	68	27	-	-	-	-
37m	CF036	339	47	161	124	39	75	293	-	-	3
43m	CF037	16	433	66	33	11	181	180	34	110	1
49m	CF038	195	203	253	112	95	56	118	-	-	-
61m	CF039	236	318	271	7	156	-	-	-	-	6

* Tester number is not the same person at each clinic

Crown heel length 4m-18m

CF050 Length at 4 mth
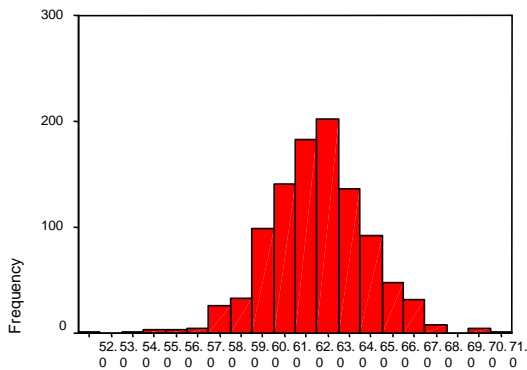
Length at 4 mth   [n = 1017]

CF051 Length at 8 mth
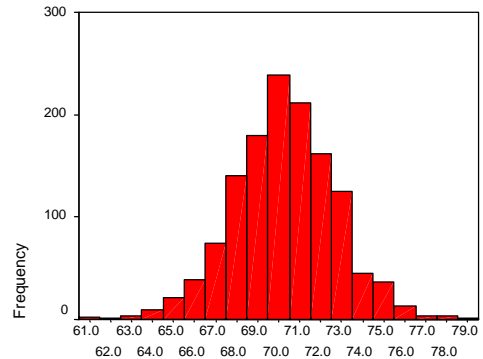
Length at 8 mth   [n = 1309]

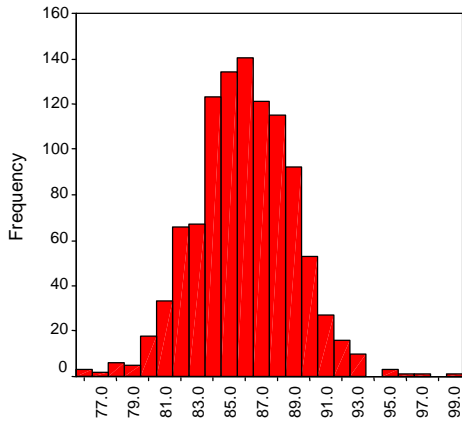CF052 Length at 12 mth
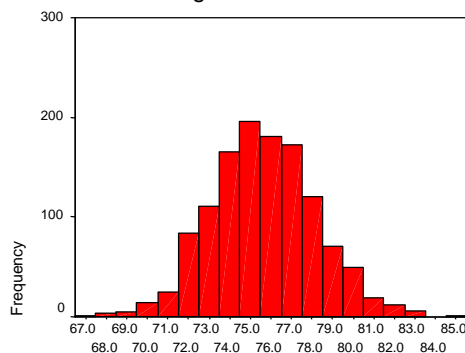
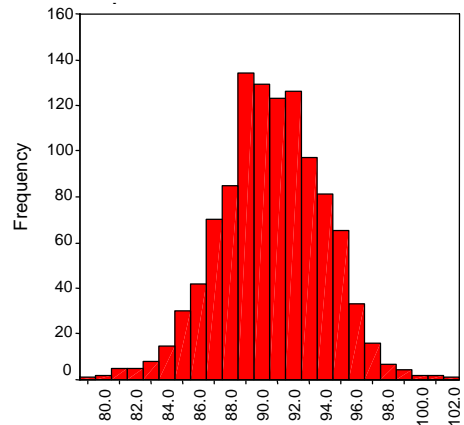Length at 12 mth   [n = 1238]

CF053 Length at 18 mth
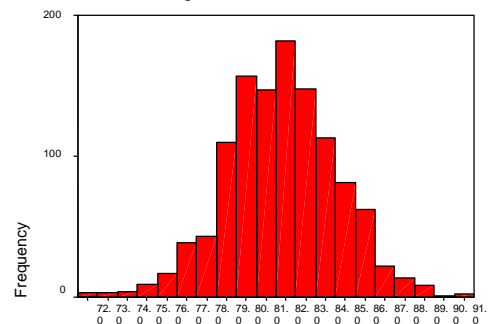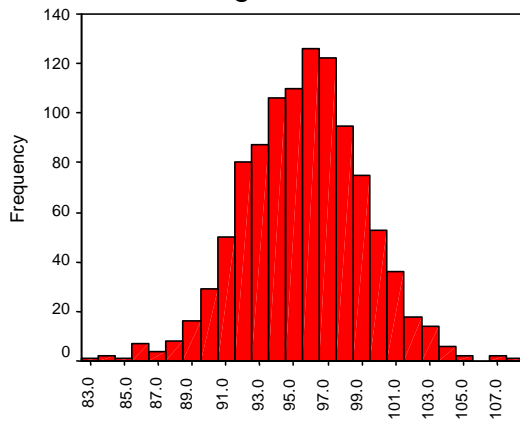
Length at 18 mth   [n = 1165]
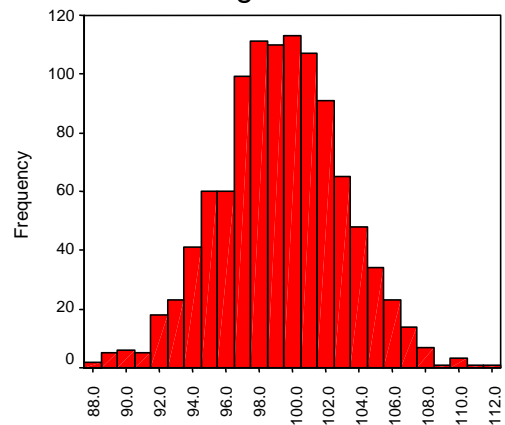
7

Height 25-61m
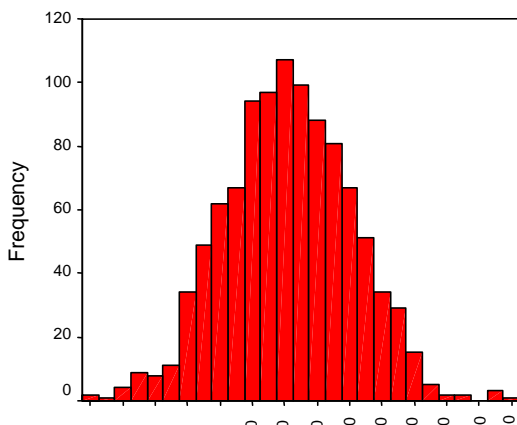
CF054 Height at 25

Height at 25 mth   [n = 1037]

CF055 Height at 31

Height at 31 mth   [n = 1083]

CF056 Height at 37

Height at 37 mth [n = 1051]

CF057 Height at 43 mth

Height at 43 mth [n = 1048]

CF058 Height at 49 mth

Height at 49 mth   [n = 1022]

CF059 Height at 61 mth

Height at 61 mth   [n = 985]
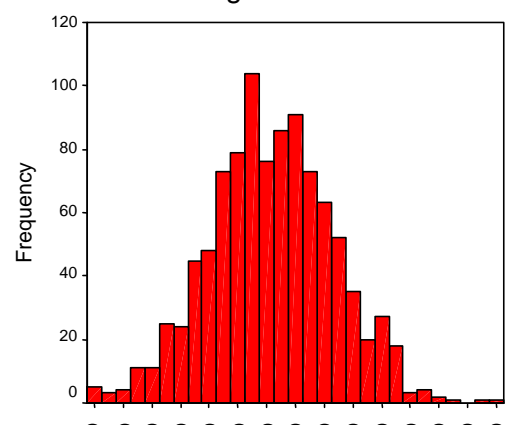
V.4   Heights in the Focus Clinics (ages 7 – 10)

From age 7 onwards the whole of the eligible cohort were invited annually to attend a 'clinic' in Bristol for half a day. Here we give the data for ages 7, 8, 9, 10.

Eligibility

Families were eligible to be invited on the ALSPAC database, they were flagged as:

1) Child alive,
2) Address not recorded as unknown,
3) Participating in the study (Not having refused the whole study; these families may have refused questionnaires).

Month of attendance

Focus @ 7 – September 1998 – September 2000
Focus @ 8 – October 1999 – December 2001
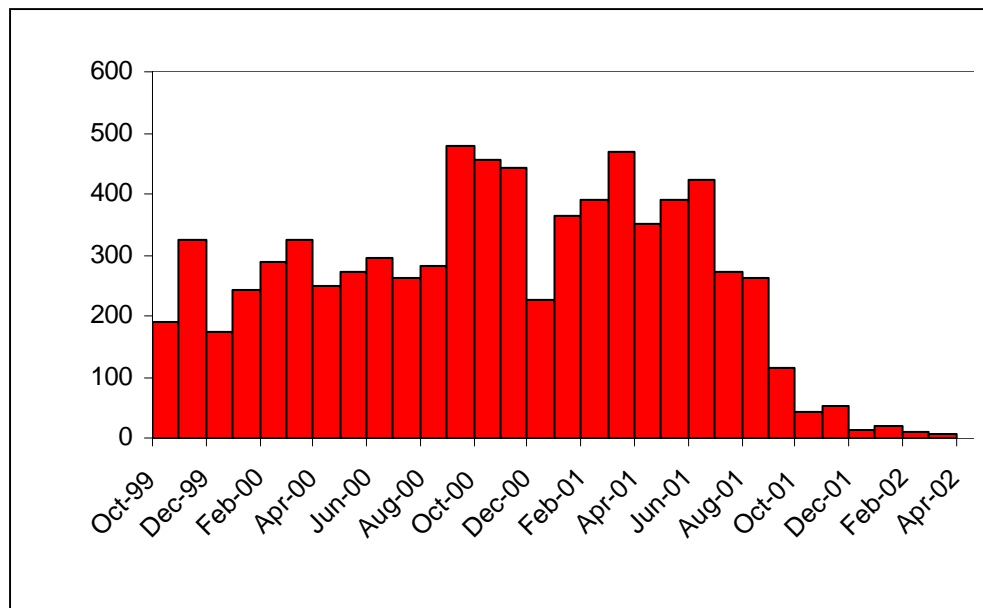Focus @ 9 – January 2001 – January 2003
Focus @ 10 – February 2002 – October 2003

The numbers attending per month varied with availability of staff, school examinations, holidays, etc.
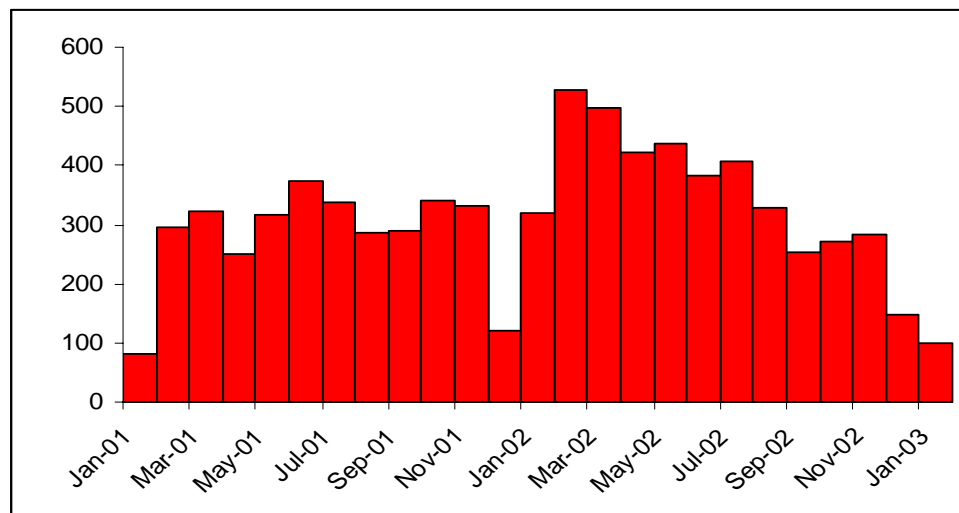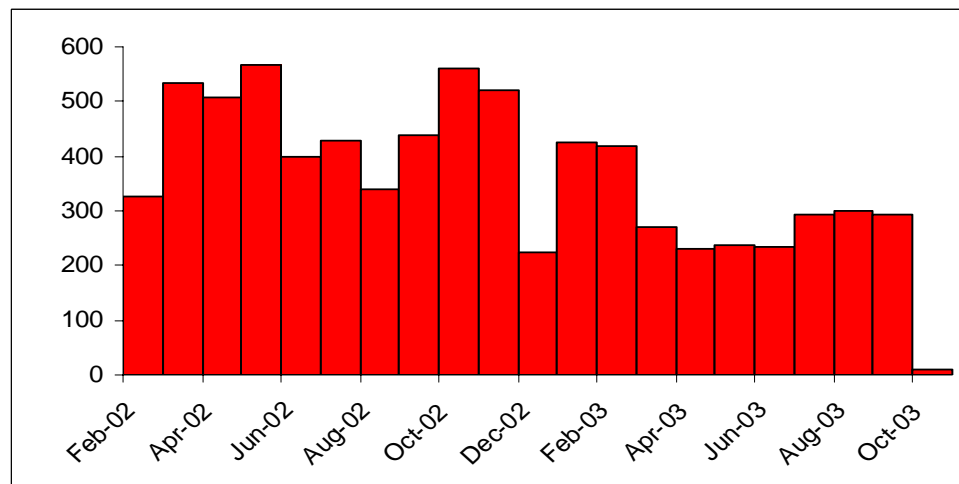
Focus @ 7   Month of attendance F7001
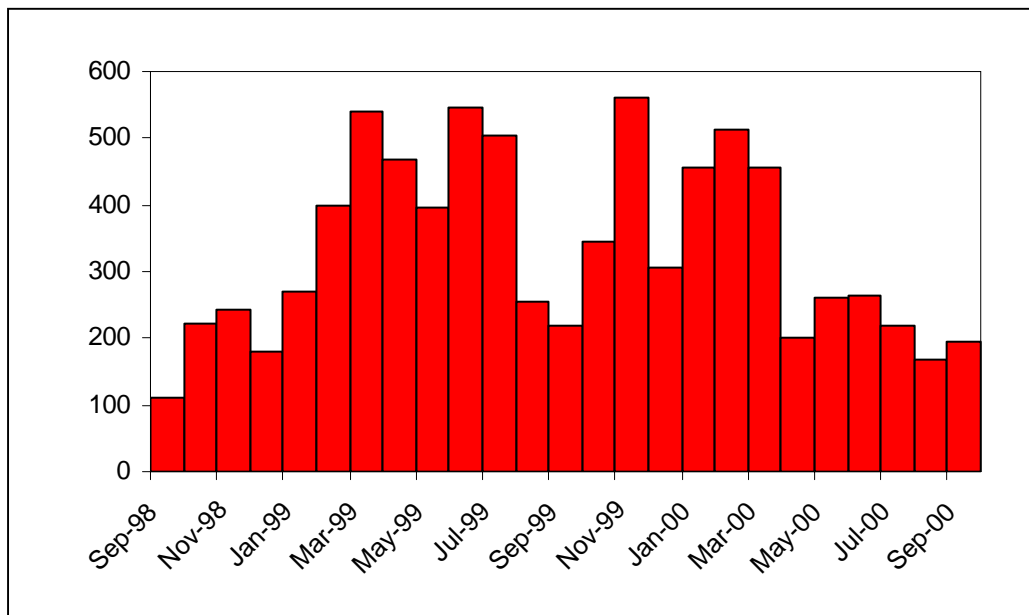
Focus @ 8   Month of attendance F8001

Focus @ 9   Month of attendance F9001

**Focus @ 10+ Month of attendance Fd001**

Age at attendance

The age of the child at attendance was calculated from the date of the visit and the child's date of birth. It is represented by variables F7003C, F8003C, F9003C and Fd003C for the 4 ages.

Method of measuring height

Height was measured to the last complete mm using the Harpenden Stadiometer. Children were positioned with their feet flat and heels together, standing straight so that their heels, calves, buttocks and shoulders came into contact with the vertical backboard of the stadiometer. The headboard was lowered down the backboard until it touched the child's head and a 1 Kg weight was placed on the headboard to ensure head contact and to minimise the effect of hair thickness. The child was asked to relax their shoulders and stretch up but keeping their heels in contact with the ground.

As far as possible all children were measured in their underclothes with their shoes removed.

F7MS010: Height (cm) F @ 7

F8LF020: Child height (cm): F@8
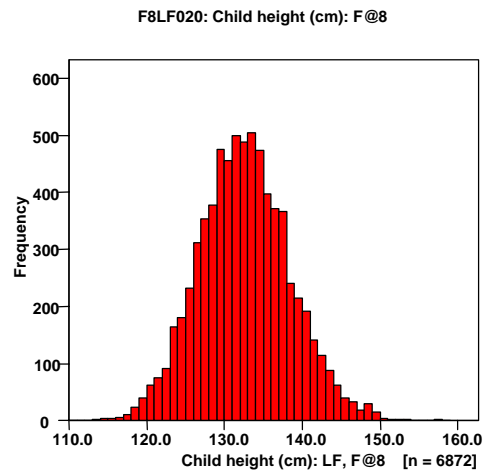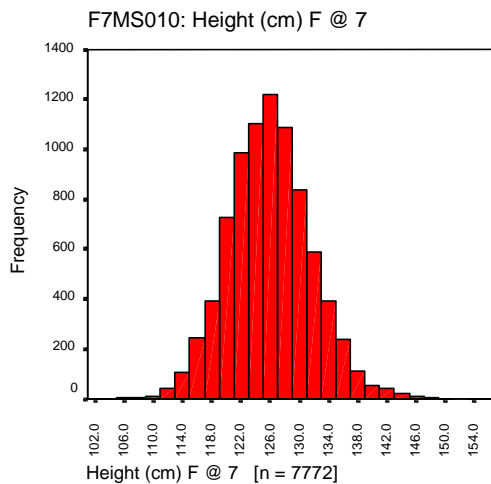
It should be noted that when comparing data from Focus @ 9 with that obtained from Focus 10+ there were clear errors for 64 children who had appeared to shrink over time. On investigation it was discovered that these children all attended Focus @ 9 in the same week and it has been assumed that there was a problem with the stadiometer for that week (there were no such errors for sitting height). As such these cases have been put to missing for height.

F9MS010: Height (cm): F@9

Height (cm): F@9 [n = 7238]

FDMS010: Height (cm):

Height (cm): F@10+ [n = 7104]
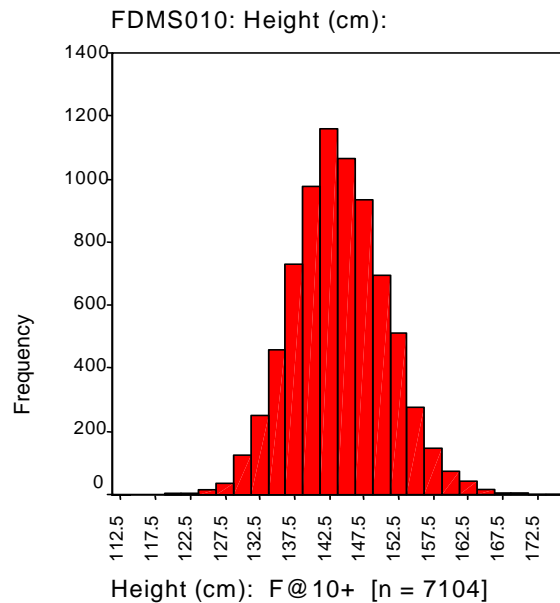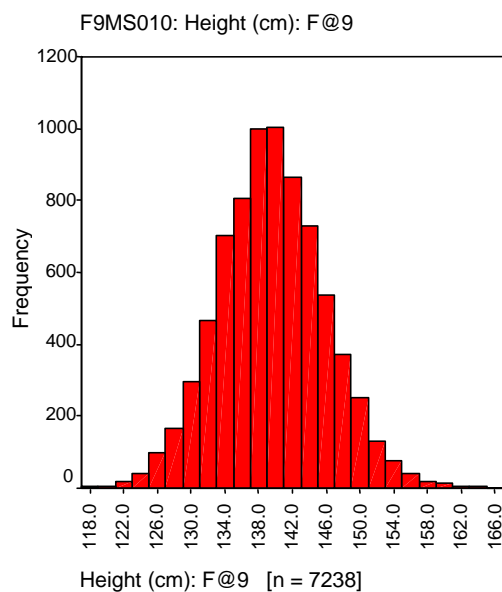
V.5 Data from health visitors

As part of primary care, health visitors measure the infants periodically. Prior to the start of ALSPAC, Professor Alan Emond (community paediatrician) provided simple equipment to all health visitors to assist in the measurements of crown-heel length. They were then trained in how to use them. Although this was not as accurate as using the equipment used in Children in Focus, they were considerably more accurate than the previous methods used by the health visitors.

Normal primary health care undertaken by health visitors entails measuring the length/height at approximately 6 weeks, 9 months, 18 months and 42 months. The data given here are as they appeared on the child health computer, with the minimum of editing. We suggest the user makes appropriate decisions and takes account of the fact that the data are less than perfect when using these data.

The ages at the assessments identified by the health visitor are given by ch202 (n=12849), ch402 (n=12771), ch502 (n=12282), and ch602 (n=11042), and the lengths/heights by ch211 (n=12083), ch411 (n=11596), ch511 (n=10666) and ch611 (n=10606) for the 6 week, 9, 18 and 42 month examinations respectively.

V.6 Parental heights

The mother was asked "How tall are you?" in the questionnaire "About Yourself" which became the D files. Answers could be given in feet and inches or cm. In the event, very few parents gave their heights in cm. The data are therefore provided in inches (cm. having been converted as appropriate).
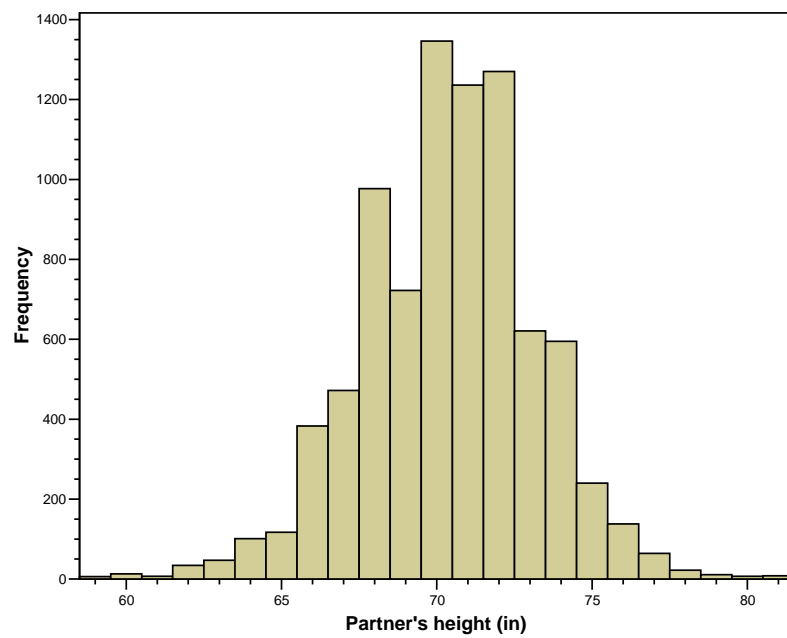
The mother's partner was asked a similar question in the questionnaire "You and your environment", (PA files) and the data have been treated in the same way.

dw020 Mother's height (in)
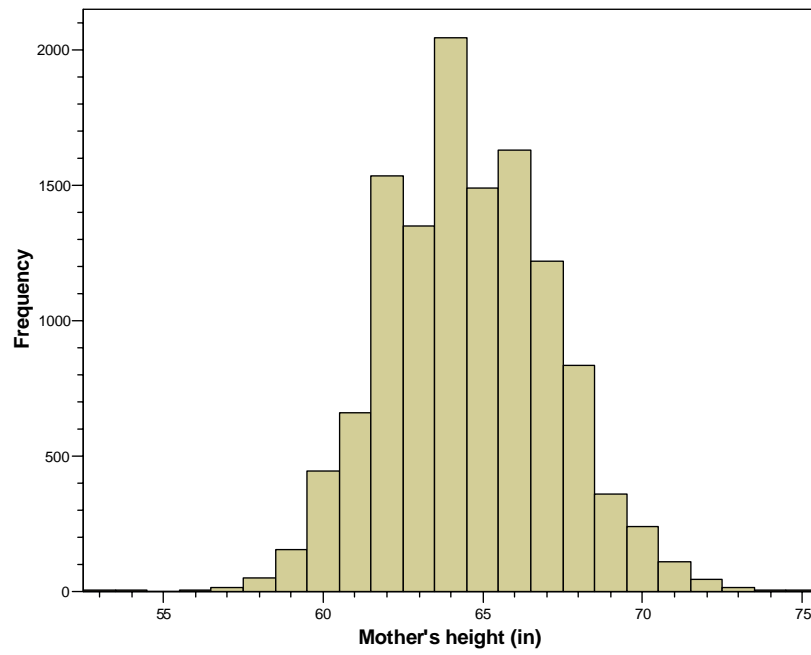
[n = 12291]

paw009 partner's height (in)

[n = 8437]

V.7 The variables in addition to the core variables, and edits carried out

MZ010 = no. of fetuses in pregnancy
KZ021 = sex of child

Birth measurement

KZ028 = age in days [group 13-58 = 13+]

KZ032C = birth length using ALSPAC measurers

KZ032 = all birth lengths
KZ032A = provenance

[N.B. Data on give KZ032C and KZ032 have been rounded to nearest cm. (i.e. 39.5-40.4 = 40) because of major digit preference]

Children in Focus

CF010 Age (wk) at 4m visit

CF030 Measurer at 4m

CF050 Length at 4m [<57 = 57.0 and >68.0 = 68.0; the remaining figures are rounded to the nearest cm]

CF011 Age (wk) at 8m visit [recode 32 = 33; 40+ = 40]

CF031 Measurer at 8m

CF051 Length at 8m [<63.50 = 63.5; >75.5 = 75.5; all others rounded to nearest half cm (e.g. 72.8 – 73.2 = 72.0, 73.3 – 73.7 = 73.5)]

CF012 Age at 12m visit [58 – 62 = 58]

CF032 Measurer at 12m

CF052 Length at 12m [<69.8 = 69.5; >81.2 = 81.5; all others rounded to nearest half cm]

CF013 Age at 18m visit [<77 = 77; >84 = 85]

CF033 Measurer at 18m

CF053 Length at 18m [<75.8 = 75.5; >88.2 = 88.5; all others rounded to nearest half cm]

CF014 Age at 25m visit [>111 = 111]

CF034 Measurer at 25m

CF054 Height at 25m [<80.8 = 80.5; >93.7 = 94.0; otherwise rounded to nearest half cm]

CF015 Age at 31m visit [132 = 133; 140 = 138]

CF035 Measurer at 31m

CF055 Height at 31m [<85.0 = 85.0; >98.5 = 98.5; else to nearest half cm]

CF016 Age at 37m visit [155 = 156; >164 = 164]

CF036 Measurer at 37m

CF056 Height at 37m [<88.2 = 87.0; >102.7 = 103.0; else to nearest half cm]

CF017 Age at 43m visit [>191 = 191]

CF037 Measurer at 43m

CF057 Height at 43m [<91.3 = 91.0; >107.2 = 107.5; else rounded to half cm]

CF018 Age at 49m visit [<210 = 210; >217 = 218]

CF038 Measurer at 49m

CF058 Height at 49m [<95.3 = 95.0; >110.7 = 111.0; else rounded to half cm]

CF019 Age at 61m visit

CF039 Measurer at 61m

CF059 Height at 61m [<101.8 = 101.5; >118.7 = 119.0; else rounded to half cm]

Focus clinics

F7001 Month of 7 year visit

F7003C Age at 7 year visit (in months) [<86 = 85; >103 = 103]

F7MS010 Height at 7 [<112.0 = 112.0; >140.2 = 140.5; then grouped in half cms]

F8001 Month of 8 year visit

F8003C Age at 8 year visit (months) [<98 = 98; >123 = 123]

F8LF020 Height at 8 years [<118.3 = 117.0; >149.2 = 149.5; else grouped in half cms]

F9001 Month of 9 year visit

F9003C Age at 9 year visit (months) [<112 = 111; >136 = 137]

F9MS010 Height at 9 years {<124.6 = 124.4; >156.0 = 156.0; else grouped in half cms as for 8]

FD001 Month of 10 year visit

FD003C Age at 10 year visit (months) [<122 = 122; >143 = 144]

FDMS010 Height at 10 years [129.0 = 128.5; 160.2 = 161.0; then in half cms]

Health visitor measures

CH202 Age at 6 week assessment

CH211 Height at 6 week assessment [>200 put to missing]

CH402 Age at 9 month assessment

CH411 Height at 9 month assessment

CH502 Age at 18 month assessment

CH511 Height at 18 month assessment

CH602 Age at 42 month assessment

CH611 Height at 42 month assessment

Parental heights

DW020 Mother's height

PAW009 Partner's height

V.8 Suggested Statistical Exercises: V. Children's heights

1. In what ways do the growth trajectories differ for boys and girls?

2. Is there a social class difference in growth? Does it vary with gender?

3. Does the age of the mother matter; in particular do children of teenage mothers have poor growth, even allowing for social class?

4. Is it important to allow for features of season of the year in analysing growth data between 7 and 10?

5. Do different measurers of young children show different results, and should they be taken into account?

6. Are multiple births at a growth disadvantage during childhood?

7. In what way does parental height relate to the growth of the child? Is this similar for boys and girls?

8. What biases are there between the children examined and those not examined at different ages?

9. How do the health visitor measures of height differ from those measured accurately by the ALSPAC measurers?