

Comparison between the British 1990 (UK 1990) and WHO 2006 growth references using data from two representative UK population based birth cohorts

Introduction and Comments:

This report was prepared in order to assess the impact of changing from the British 1990 to the WHO 2006 growth charts using available data from two 'representative' UK population-based studies.

Tim Cole's presentation had indicated that the WHO 2006 cohort were lighter at birth (mean birth weight 3.3 kg), but fairly similar to the UK 1990 by 2 months, and then lighter again after 6 months.

Page 2: Description of the two UK population-based studies, including numbers at each visit and the definition of breast-feeding used.

Page 3: Tables of Means, % above 98% centile and % below 2nd centile: for weight, length/height, and BMI according to each growth reference/standard.

Page 4: Similar selected tables, restricted to a breast-fed sub-group that is more representative of the WHO populations.

Comments:

- *The percentages highlighted in Light-blue illustrate the potential over-labelling of normal breast-fed infants as underweight using the UK 1990 reference. It is much harder to be underweight using WHO 2006.*
- *There would be an increase in overweight on changing from the British 1990 to the WHO 2006 charts, however the effect is less at 4-5 years than at earlier ages.*

Pages 5-8 present the above table data in graphical format.

Figures 1 & 4 best illustrate the differences in mean weight SD score (SDS) during infancy (in all children or breast-fed alone) based on British 1990 (thin black lines) or WHO 2006 (bold blue lines) data.

Comments:

- *Birth to 4 months: Using WHO 2006, both UK populations have relatively high birth weight SDS, and rapidly show relative 'catch-down' in weight SDS during the first couple of months. Note: a very similar pattern is seen if the UK 1990 median is plotted on WHO 2006, with weight at birth = +0.4 SDS; and weight at 2 months = -0.2 SDS (not shown).*
- *Length SDS shows a similar early pattern using WHO 2006 (Figure 6)*
- *4 months to 5 years: The expected larger weight SDS using WHO 2006 is most apparent during the first 2 years, but by 5 years there is little difference.*
- *Length SDS is unaffected by choice of chart beyond birth.*

Page 9 Shows the impact of using these data for longitudinal growth monitoring. As expected from inspection of the means, using WHO 2006 would greatly reduce the numbers of children who fall down though two centile spaces in weight between 0-12 months (a decline that serves as a primary care threshold for further investigation or concern).

Gateshead Millennium Baby Study (GMS)

Prospective population based cohort study of feeding and growth

1029 infants born between 1999-2000; 923 term Caucasian infants used for this analysis

Breast feeding: 50% @birth, 10% @4m

Routine weights and feeding information sent in by parents throughout first year

School entry measurements retrieved aged 4-5

Measurements available:

	Weight	Height
Birth	923	
12 days	806	
8 wks	788	
4m	796	
8m	601	
12m	764	
School entry (4-5)	399*	399*

*Only available for those measured <5yrs

Avon Longitudinal Study of Parents and Children (ALSPAC): "Children in Focus"

1335 infants born in Avon district 1991-2

Breast feeding: 46% @3m (includes up to 1 formula feed per day)

Measured at research study clinics

Measurements available:

	Weight	Height
Birth	1334	1115
4m	943	944
8m	1231	1230
12m	1164	1163
18	1088	1090
24	1049	977
5 years	929	927

ALL CHILDREN (Breast + Formula groups)**WEIGHT****1. Mean SD scores**

	ALSPAC		GMS	
	UK	WHO	UK	WHO
Birth	0.0	0.3	-0.2	0.2
12 days			-0.5	-0.1
8 weeks			0.0	-0.2
4mo	-0.1	-0.1	0.0	0.0
8mo	0.1	0.5	0.2	0.5
12mo	0.2	0.6	0.1	0.5
18mo	0.1	0.5		
25mo	0.1	0.4		
4-5 yrs	0.3	0.4	0.5	0.5

LENGTH / HEIGHT**2. Mean SD scores**

	ALSPAC		GMS	
	UK	WHO	UK	WHO
Birth	0.0	0.6		
4mo	-0.1	0.0		
8mo	0.1	0.2		
12mo	0.1	0.1		
18mo	0.0	-0.1		
25mo	-0.1	-0.1		
4-5 yrs	0.1	-0.1	0.0	-0.2

BMI**3. Mean SD scores**

	ALSPAC		GMS	
	UK	WHO	UK	WHO
Birth	0.2	0.0		
4mo	-0.1	-0.1		
8mo	0.1	0.5		
12mo	0.2	0.8		
18mo	0.1	0.8		
25mo	0.3	0.7		
4-5 yrs	0.4	0.6	0.7	0.9

4. Percentage below 2nd centile

	ALSPAC		GMS	
	UK	WHO	UK	WHO
Birth	3.3	2.2	5.7	2.8
12 days			7.6	3.7
8 weeks			2.9	3.6
4mo	2.4	2.0	2.4	2.2
8mo	2.6	0.7	2.4	1.0
12mo	2.4	0.3	2.7	0.4
18mo	2.9	0.6		
25mo	2.1	0.8		
4-5 yrs	1.5	0.4	1.1	0.3

5. Percentage below 2nd centile

	ALSPAC		GMS	
	UK	WHO	UK	WHO
Birth	2.6	0.8		
4mo	1.4	1.3		
8mo	1.6	1.5		
12mo	1.4	1.4		
18mo	2.2	2.8		
25mo	2.0	2.5		
4-5 yrs	1.2	1.9	1.8	2.3

6. Percentage below 2nd centile

	ALSPAC		GMS	
	UK	WHO	UK	WHO
Birth	2.4	2.9		
4mo	4.0	1.9		
8mo	3.1	0.7		
12mo	1.5	0.1		
18mo	2.2	0.2		
25mo	1.4	0.2		
4-5 yrs	0.9	0.1	0.6	0.0

7. Percentage above 98th centile

	ALSPAC		GMS	
	UK	WHO	UK	WHO
Birth	2.6	4.3	2.5	3.6
12 days			0.6	1.6
8 weeks			2.7	1.0
4mo	1.2	0.5	3.8	1.9
8mo	3.7	5.0	4.8	5.5
12mo	4.0	7.2	3.6	6.1
18mo	2.9	4.4		
25mo	3.4	3.5		
4-5 yrs	3.8	3.3	6.8	5.8

8. Percentage above 98th centile

	ALSPAC		GMS	
	UK	WHO	UK	WHO
Birth	2.0	9.4		
4mo	1.8	1.8		
8mo	2.1	2.9		
12mo	2.8	2.9		
18mo	2.1	1.7		
25mo	1.1	0.9		
4-5 yrs	1.7	0.8	2.2	1.5

9. Percentage above 98th centile

	ALSPAC		GMS	
	UK	WHO	UK	WHO
Birth	2.6	1.6		
4mo	1.7	1.5		
8mo	3.2	5.6		
12mo	2.7	8.7		
18mo	2.6	8.0		
25mo	4.3	7.5		
4-5 yrs	5.0	7.2	8.3	10.1

30/10/06

SACN/RCPCH/06/05

BREAST-FED (+ non-smoking; + no solids at 2mo)**WEIGHT****10. Mean SD scores**

	ALSPAC		GMS	
	UK	WHO	UK	WHO
Birth	0.1	0.5	0.0	0.3
12 days			-0.4	0.0
8 weeks			0.0	-0.1
4mo	-0.3	-0.2	-0.1	-0.1
8mo	-0.1	0.2	0.0	0.3
12mo	0.0	0.5	0.0	0.5
18mo	-0.1	0.4		
25mo	0.0	0.3		
4-5 yrs	0.3	0.3	0.4	0.2

BMI**11. Mean SD scores**

	ALSPAC		GMS	
	UK	WHO	UK	WHO
Birth	0.2	0.0		
4mo	-0.3	-0.3		
8mo	-0.1	0.3		
12mo	0.1	0.7		
18mo	0.0	0.7		
25mo	0.2	0.6		
4-5 yrs	0.4	0.6	0.4	0.4

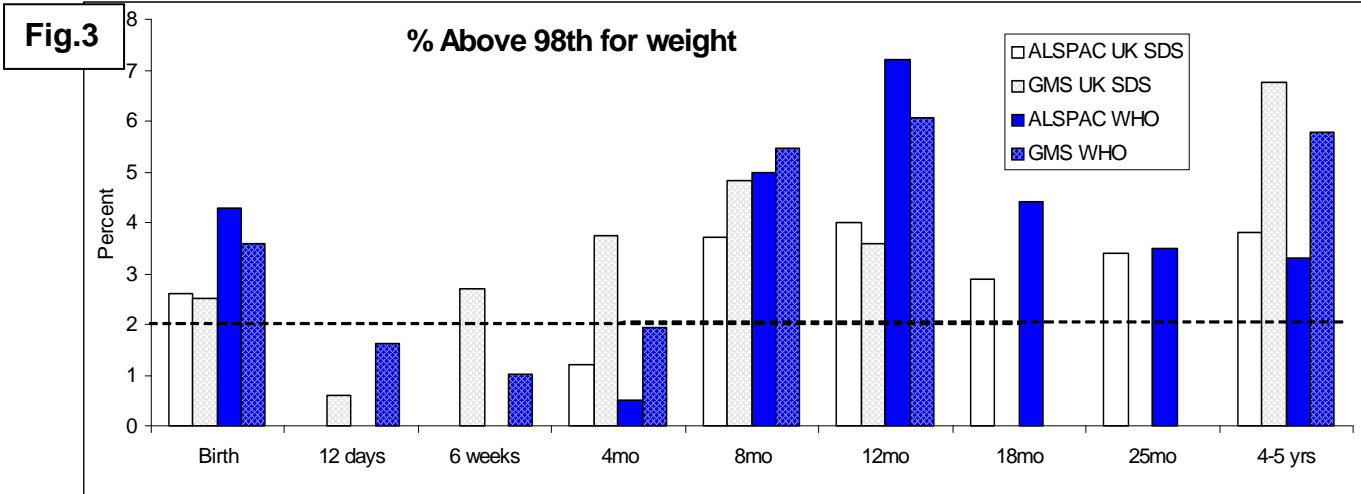
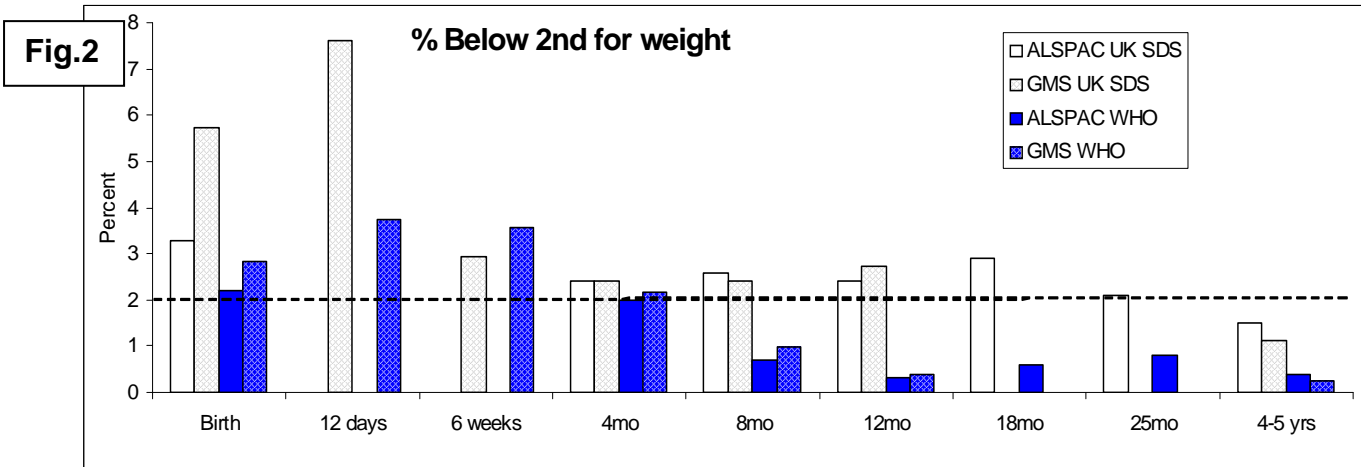
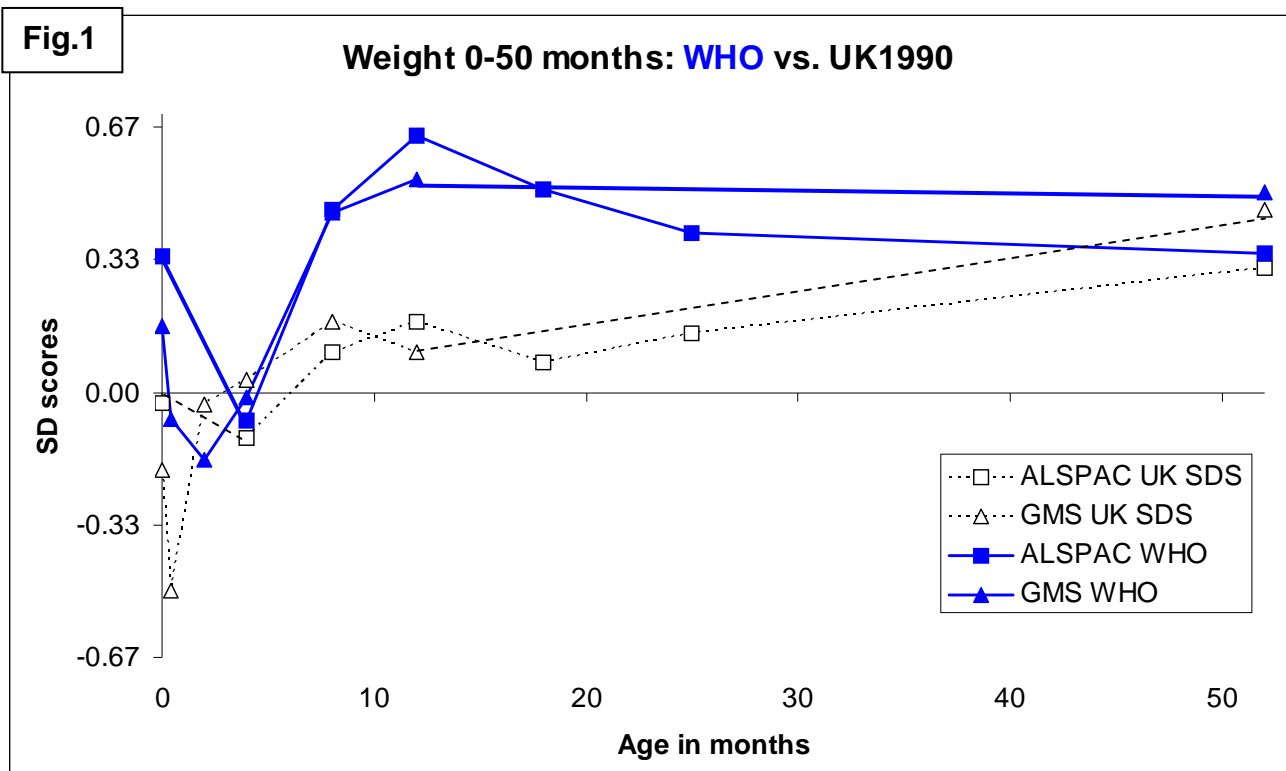
12. Percentage below 2nd centile

	ALSPAC		GMS	
	UK	WHO	UK	WHO
Birth	1.3	1.0		
12 days				
8 weeks				
4mo	4.1	2.7		
8mo	3.6	0.8		
12mo	3.9	0.3		
18mo	4.8	1.1		
25mo	2.8	1.0		
4-5 yrs	1.7	0.6		

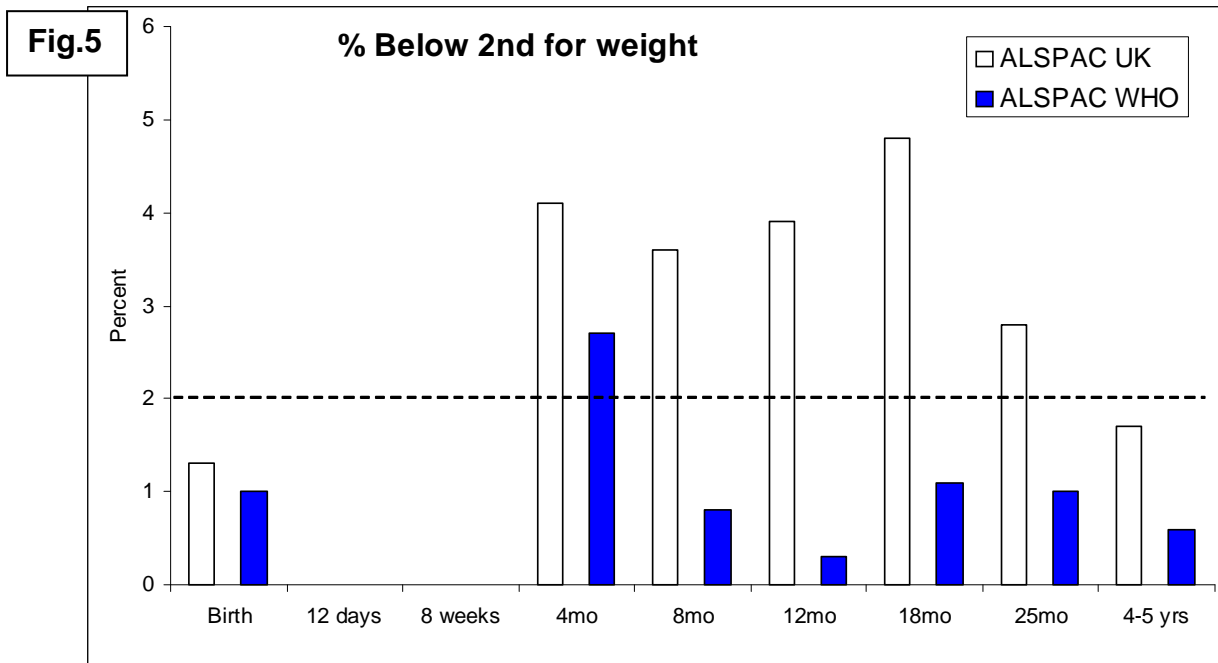
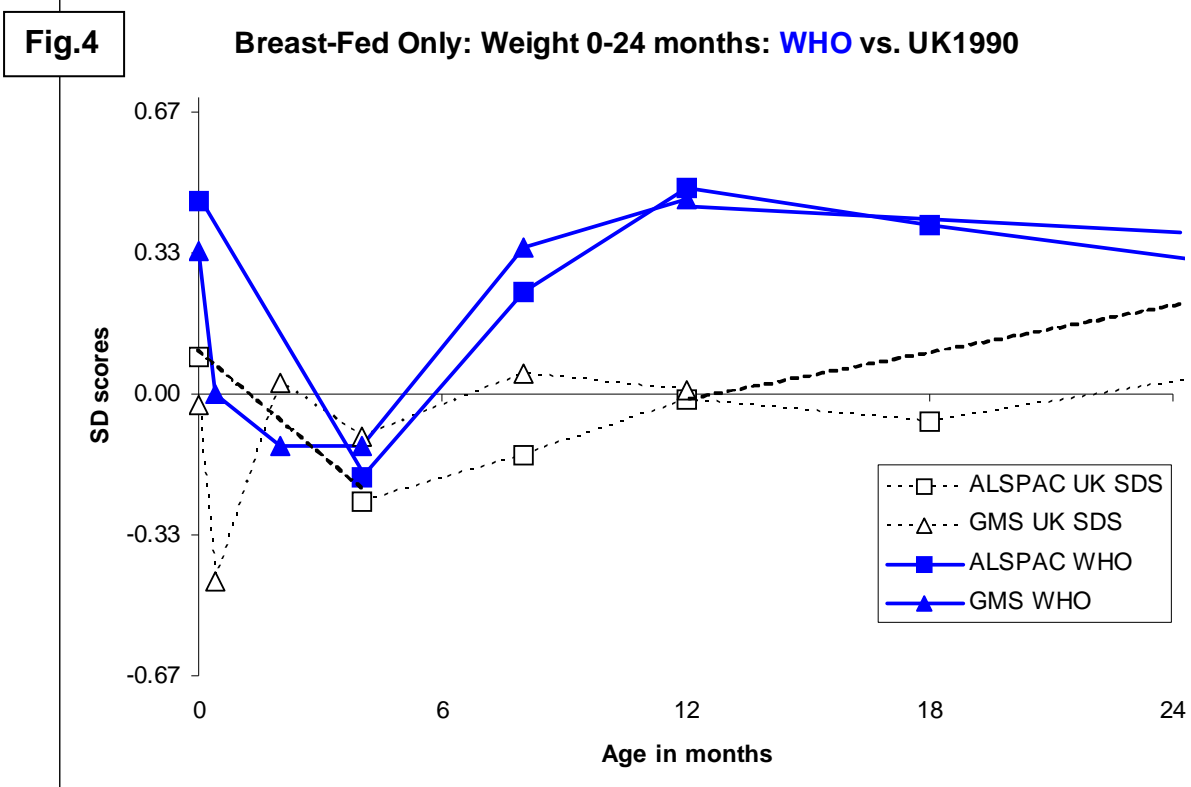
13. Percentage below 2nd centile

	ALSPAC		GMS	
	UK	WHO	UK	WHO
Birth	2.0	2.6		
12 days				
8 weeks				
4mo	6.1	2.7		
8mo	4.6	0.5		
12mo	2.3	0.3		
18mo	3.8	0.0		
25mo	1.9	0.3		
4-5 yrs	0.9	0.3		

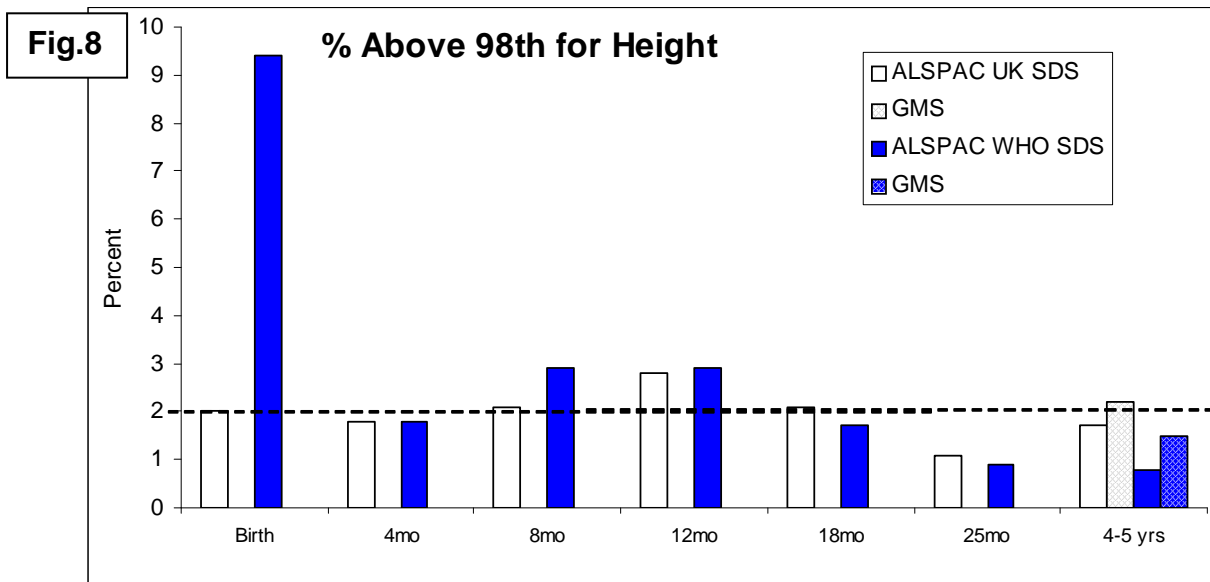
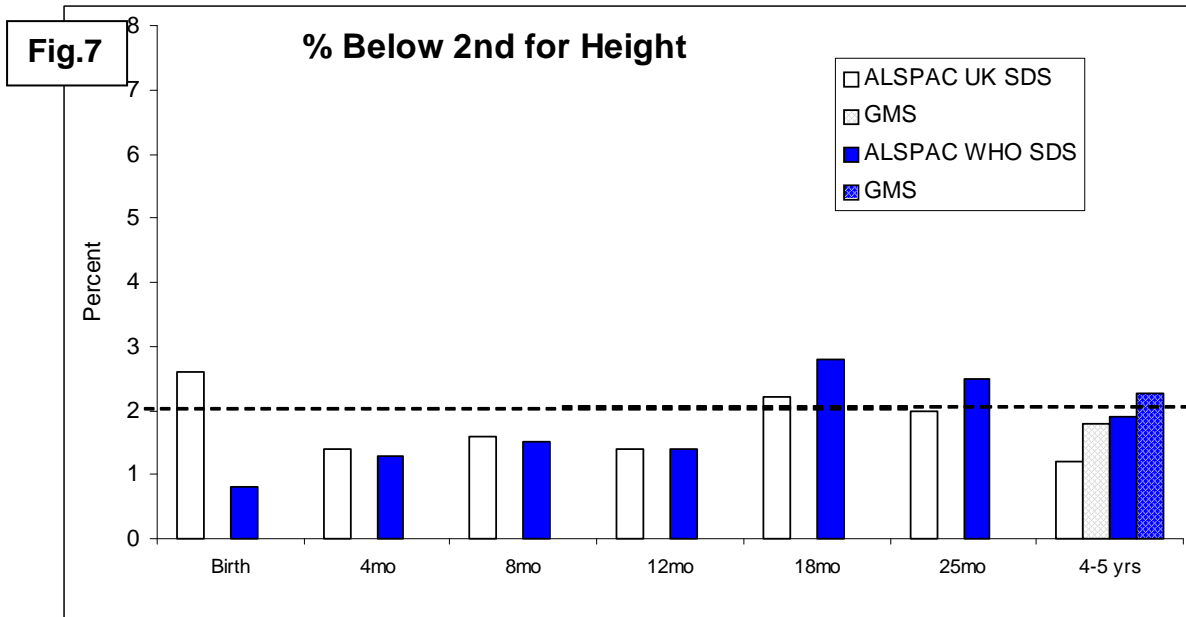
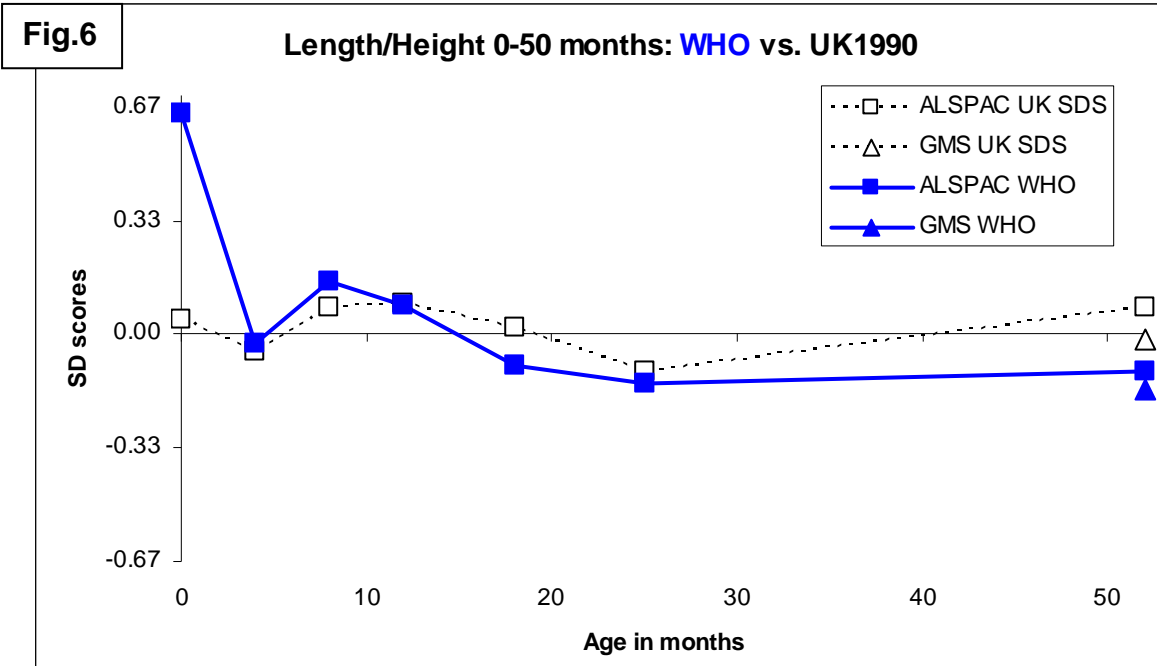
Weight: All Children



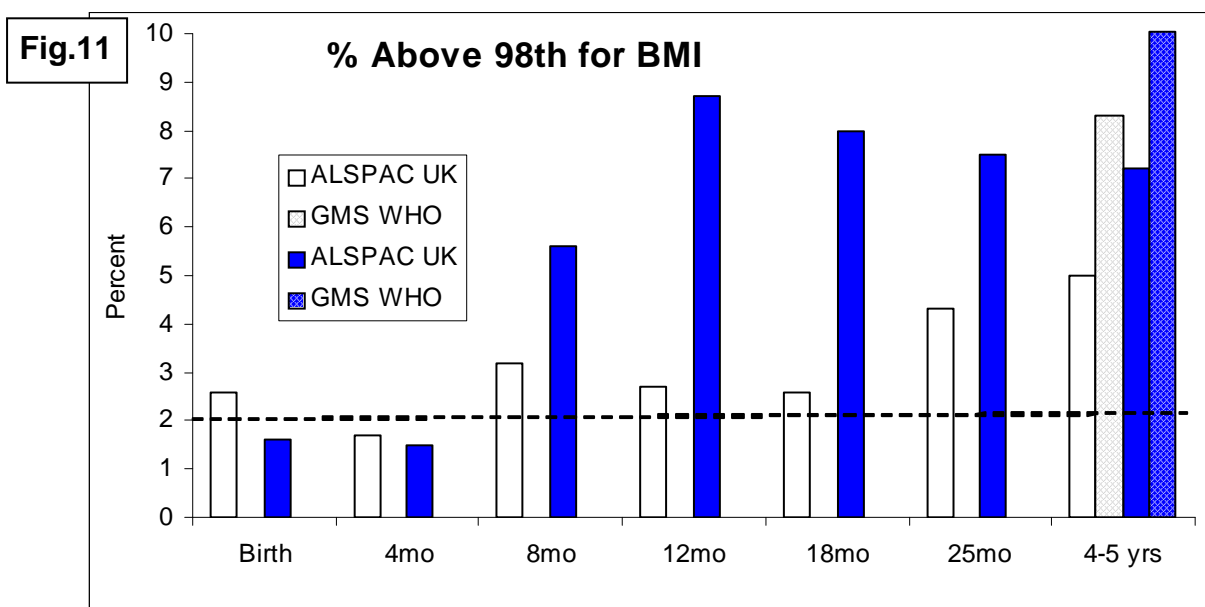
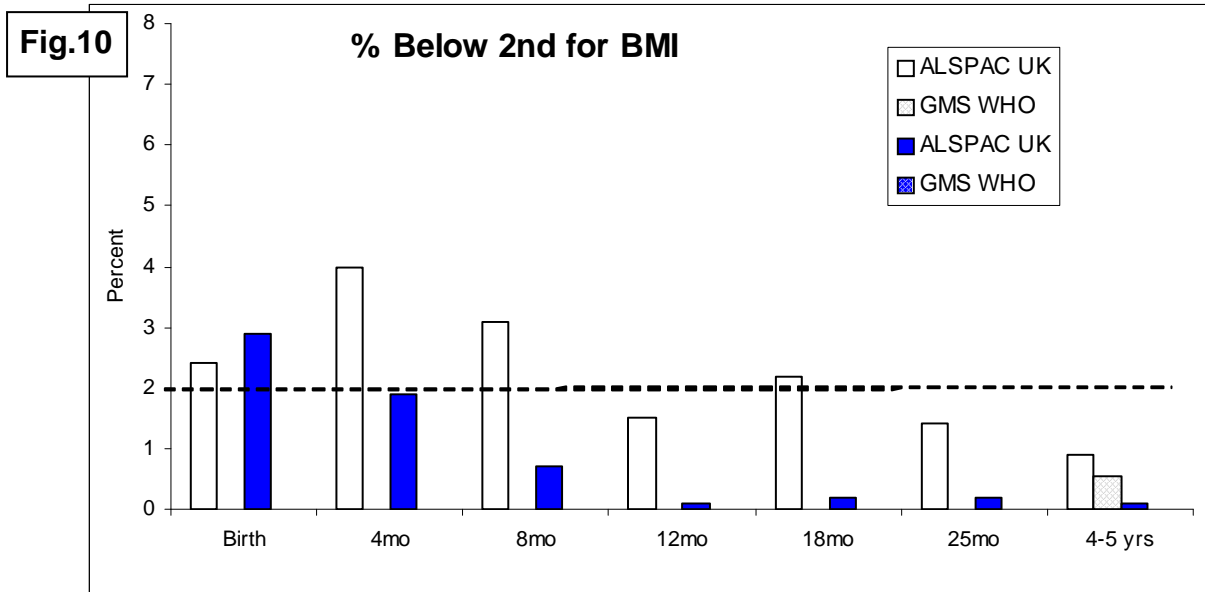
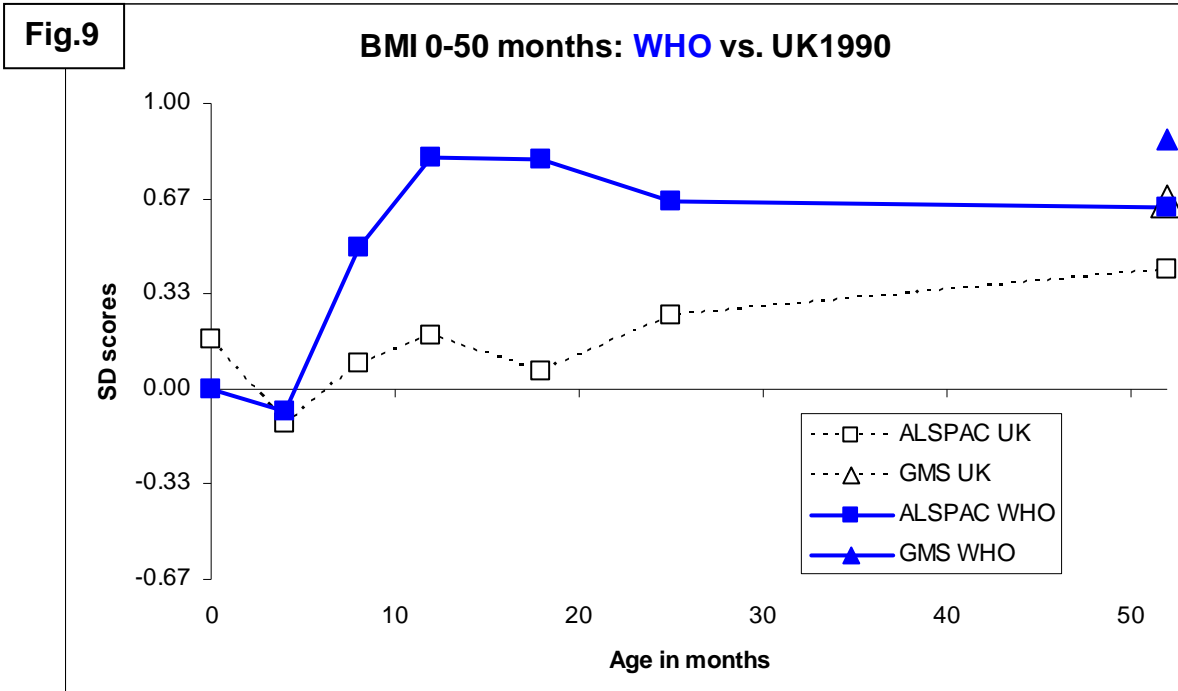
Weight: Breast-Fed Only



Length/Height: All Children



BMI: All Children



CONDITIONAL WEIGHT GAIN

Proportion of children crossing down through centile spaces from birth

NB one centile space = 0.67 SD

Changes in Weight SD scores were adjusted for baseline (i.e. conditional on birth weight)

Percentage of all children with relative weight loss 0-4 months:

0 to 4 months	ALSPAC		GMS	
	UK	WHO	UK	WHO
>1 centile space	22.5	29.3	16.5	23.4
>2 centile spaces*	7.3	8.8	3.5	5.0
>3 centile space	1.1	1.5	0.6	0.8

Percentage of all children with relative weight loss 0-12 months:

0 to 12 months	ALSPAC		GMS	
	UK	WHO	UK	WHO
>1 centile space	24.5	8.2	17.6	8.1
>2 centile spaces*	7.1	1.7	5.4	1.6
>3 centile space	1.5	0.2	0.9	0.1

*NB at present a fall though two centile spaces serves as a primary care threshold for further investigation or concern.