IS THE WHO CHILD GROWTH STANDARD APPROPRIATE FOR GROWTH MONITORING IN HONG KONG?

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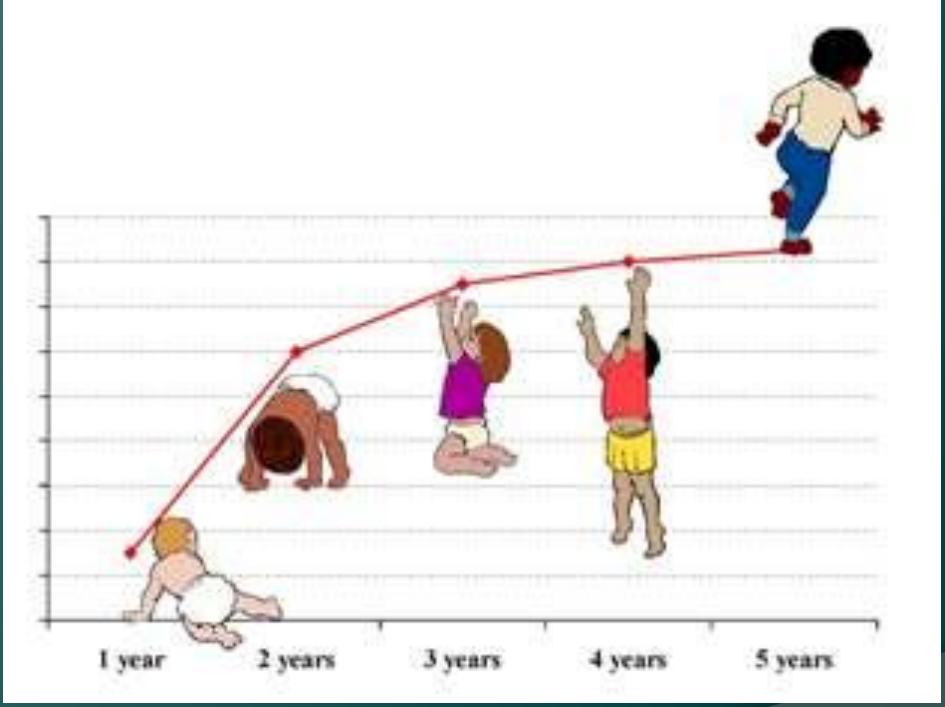
Outline

- Brief introduction to the WHO Child Growth Standards
- Comparing the height, weight & BMI of representative samples of HK children with those of the WHO CGS sample
- Impact of using the WHO CGS (instead of HK Growth Reference, 1993) on clinical practices

WORLD HEALTH ORGANIZATION CHILD GROWTH STANDARDS (0 – 5) [2006]



http://www.who.int/childgrowth/

The WHO Child Growth Standards (CGS)

- Recognition:
  - Significant difference between growth pattern of healthy breastfed infants and formula fed infants
  - Growth references are often used as standards
- Assumption:
  - Physical growth is principally determined by environment
- Multicentre Growth Reference Study (MRGS; 1997-2003)
  - Samples drawn from 6 sites with a diversity of ethnic and cultural backgrounds: Brazil (S. America), Ghana (Africa), India (Asia), Norway (Europe), Oman (Middle East), & USA (N. America)
  - Growth data collected from 8,500 children (0 – 5):
    - Longitudinal (0-24m); Cross-sectional (18-71m)
    - Brought up in optimal conditions with no environmental or economic constraint on growth
    - Parents followed recommended practices and behaviours, e.g. no maternal smoking; exclusive BF for 4 months, then up to 12 m with complementary foods

The WHO Child Growth Standards (CGS)

- WHO Child Growth Standards published in 2006
  - Height-for-age; weight-for-age; weight-for-height; BMI-for-age; head circumference-for-age; etc.
  - Establishes breastfeeding as the biological norm & breastfed infants as the standard for measuring healthy growth
  - Describes how healthy children in optimal environment *should* grow (a standard), rather than how children are growing (a reference)

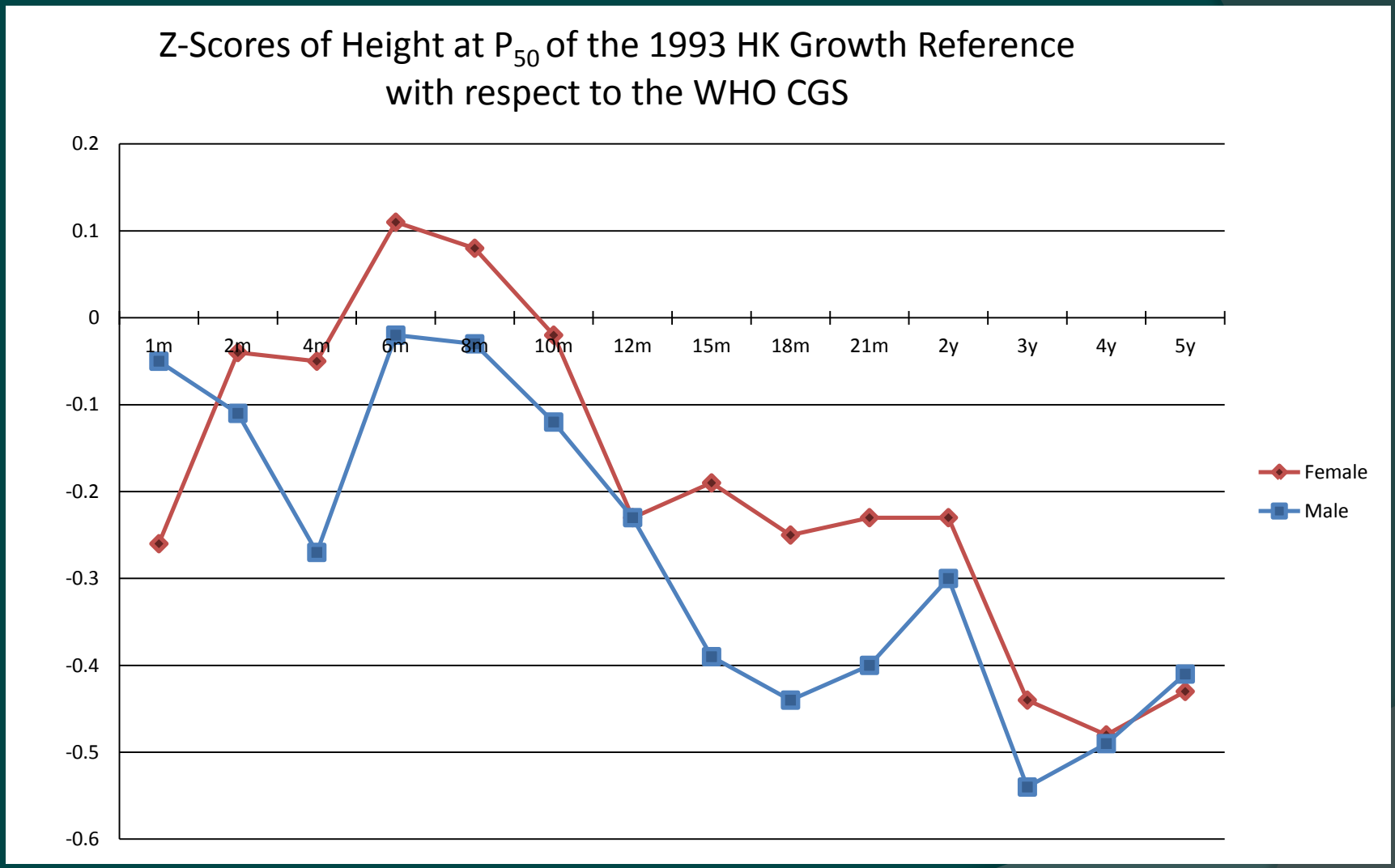
Difference in Linear Growth between Children of 1993-HKGR & WHO-CGS

The Hong Kong Growth Survey 1993

- Territory wide cross-sectional growth survey
- Participants: newborn to 18 years
- 24,709 Participants
  - Less than 3 years of age: 8 randomly selected MCHCs
  - 3 to 18 years of age : 1 kindergarten, 1 primary school and 1 secondary school were randomly selected from each of the 18 districts
- Grouping of age ranges
  - 1st 6 months – age range of 1 month (±5 days)
  - 2nd 6 months – 2 monthly (±7 days)
  - 1 to below 3 years – 3 monthly
  - 3 years or older - half yearly
- Measurement :
  - Weight – measured in lightest clothing
  - Supine length –below 3 years measured by Harpenden infanometer
  - Standing Height – 3 years or above measured by Harpenden stadiometer

Z-Scores of Height at P_{50} of the 1993 HK Growth Reference with respect to the WHO CGS

	Boys	Girls
6 mo	-0.06	0.01
12 mo	-0.03	0.10
18 mo	-0.28	-0.16
24 mo	-0.50	-0.40
36 mo	-0.50	-0.47
48 mo	-0.46	-0.53
60 mo	-0.43	-0.46


Z-Scores of Height at P_{50} of the 1993 HK Growth Reference with respect to the WHO CGS
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
1m
2m
4m
6m
8m
10m
12m
15m
18m
21m
2y
3y
4y
5y
Female
Male

Difference in Linear Growth between Children from More Recent Birth Cohorts & WHO-CGS

1997 Cohort

(Children of 1997) [HKU School of Public Health & Department of Health]

- Objective:
  - to investigate the impact of second-hand smoking on health
- Participants:
  - 8327 infants born in April and May of 1997, recruited from Maternal & Child Health Centres (MCHCs) * Over 90% newborns register with MCHCs
  - Exclusion: twins, pre-term, non-ethnic Chinese
- Data collection:
  - *Routine growth data* retrieved from MCHC Child Health Records
- Data set:
  - N=7,416 children (3880 boys; 3536 girls)
  - Longitudinal growth (height & weight) data

(Hui LL et al. Arch Dis Child 2008; 93: 561-565)

An MCHC Sample of the 2002 Birth Cohort

- Objective:
  - To study the impact on clinical services of using HK 1993-Growth Reference vs WHO-CGS, conducted in 2007
- The sample: 2-stage cluster sampling
  - Random selection of 13 MCHCs from each of 4 regions
  - Random sample of children born in 2002 from the registry of these MCHCs
  - Exclusion: preterm; congenital abnormalities; medical conditions; non-ethnic Chinese; less than 2 records available
- Data collection:
  - *Routine growth (weight & height) data* retrieved from Child Health Records
- Data set:
  - N = **1,276** (620 boys; 656 girls)
    - n = 107 (8.4%) had full / exclusive BF for 4 to 6 months
  - Longitudinal data (0 to 4 years)

The 2007 Survey

- Objective:
  - To study the prevalence of overweight & obesity in preschool children
- Participants: recruited through systematic sampling
  - 4-year-old (48 – 59 months) Children (born 2002 / 2003)
  - attended 15 MCHCs for vision screening between 1 May & 15 June 2007
  - Exclusion: non-ethnic Chinese; medical conditions
- *Prospective data* collection
  - Standardisation of equipments & measurement techniques
  - Measurement of Height & weight
- Data set:
  - N=1032 (Boys 531; Girls 501)
  - Cross-sectional height & weight data

An MCHC Sample of the 2006 Birth Cohort

- A computerised Growth Database was established in MCHCs since February 2011
- Weight & Height measurement:
  - Instruments & methods re-standardised in 2007
- Data collection:
  - Routine growth data from 4-year-old (48 to 60m) children who attended MCHCs for vision screening from February to December, 2011
- Data set
  - N = 3,691(1,922 boys; 1,769 girls)
  - Cross-sectional weight & height data

Mean z-score for Length / Height of 4 HK Samples wrt HKGR 1993

	1997 Cohort		MCHC Sample of 2002 Birth Cohort		2007 G. Survey (2002/03 Birth Cohort)		MCHC Sample of 2006 Birth Cohort	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Length								
3 m			0.30	0.40				
9 m								
Height								
36 – 47m			0.32	0.18				
48 – 59m			0.23	0.24	0.20	0.20	0.33	0.29

Mean z-score for Length / Height of 4 HK Samples wrt WHO CGS

	1997 Cohort		MCHC Sample of 2002 Birth Cohort		2007 G. Survey (2002/03 Birth Cohort)		MCHC Sample of 2006 Birth Cohort	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Length								
3 m	-0.18	-0.05	-0.04	0.13				
9 m	-0.19	-0.02						
Height								
36 – 47m	-0.34	-0.38	-0.19	-0.34				
48 – 59m			-0.23	-0.32	-0.27	-0.35	-0.21	-0.32

- Mean z-scores of Height of Hong Kong 3 to 4 year-old children fall within the range of $\pm$ 0.5 (considered as normal site variation by the MRGS)

Impact on Clinical practice

- Growth Monitoring in MCHCs
  - Schedule for **routine** Weight & Length / Height Measurement at MCHCs:

	1st Visit	1 month	2 months	4 months	6 months	12 months	18 months	48 months
Weight	*	*	*	*	*	*	*	*
Length / Height			*					*

Short stature

Height Monitoring

Identifying Children with Short Stature

	MCHC Sample of the 2002/03 Birth Cohort (2007 Growth Survey Data) [4-year-olds]		**MCHC Sample of the 2006 Birth Cohort** (2011 Routine Growth Data) [4-year-olds]	
Height Z-Score	**WHO-CGS**	**1993-HKGR**	**WHO-CGS**	**1993-HKGR**
< - 2	**2.13%**	**0.68%**	**2.42%**	**1.30%**
< - 2.65 [< $P_{0.4}$]	**0.29%**	**0**	**0.54%**	**0.35%**

Summary

- Children of the 1993 HKGR are ***shorter*** than those of the WHO CGS
  - The maximum z-score for P_{50} length / height of 1993 HKGR w.r.t. WHO CGS is -0.53
- Representative samples of children born in 1997, 2002/2003 and 2006 are ***shorter*** than those of the WHO CGS, but taller than children of the 1993 HKGR
  - A secular trend in height is evident
  - Mean z-score for height (at 4 years) for birth cohorts in the 2000s w.r.t. WHO CGS is around -0.25 (boys) & -0.35 (girls)
  - No larger than the “Standardised Site Effects” of the 6 MGRS sites
- Height Monitoring (using the WHO CGS)
  - Proportion of children identified as having short stature (indicated for further assessment / investigations) is within expectation

Weight Growth of HK Children

Birth Weights in Hong Kong

Mean Birth Weight 1984-2009

	Male		Female	
	Mean birth weight	WHO weight z score	Mean birth weight	WHO weight z score
1984	3.23	-0.24	3.13	-0.23
1989	3.25	-0.20	3.15	-0.18
1994	3.25	-0.20	3.14	-0.20
1999	3.24	-0.22	3.14	-0.20
2004	3.23	-0.24	3.12	-0.25
2006	3.21	-0.28	3.11	-0.27
2008	3.21	-0.28	3.11	-0.27
2009	3.21	-0.28	3.10	-0.29

An MCHC Sample of the 2008 Birth Cohort

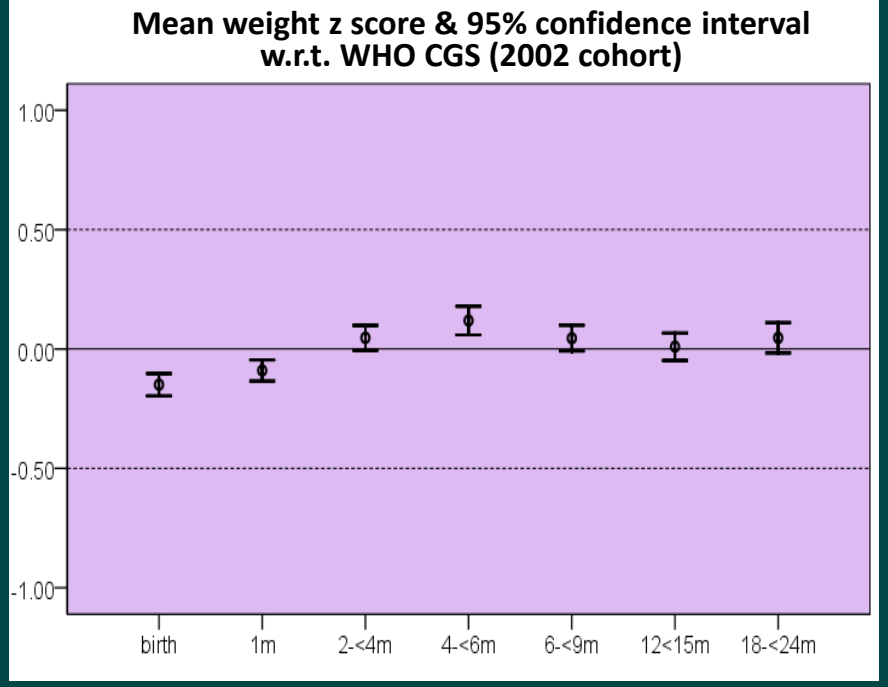
- Objective: Biennial infant feeding survey for monitoring breastfeeding rates in Hong Kong
- Study period: 13th to 31st July 2009
- Participants: Children who visited 31 MCHCs for MMR vaccination (Total N = 2,540)
- Data set:
  - 2244 term infants (1173 boys & 1071 girls),
    - 298 (13.3%) infants, exclusively breastfed for 4 to 6m (155 boys & 143 girls)
  - Routine longitudinal weight data retrieved from records (0 – 18 m)

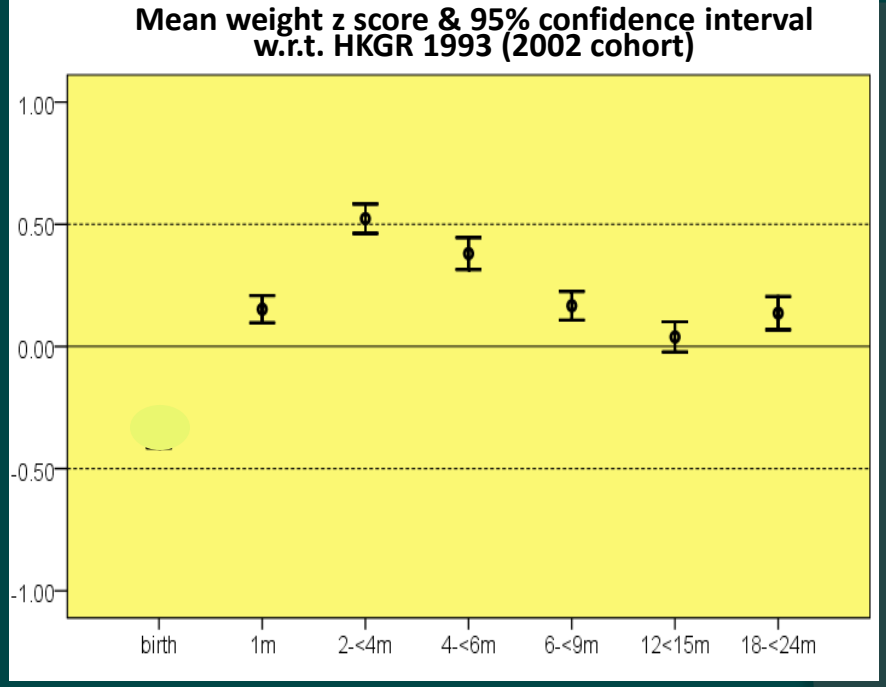
Mean z-score for weight of 5 HK Samples w.r.t HKGR 1993

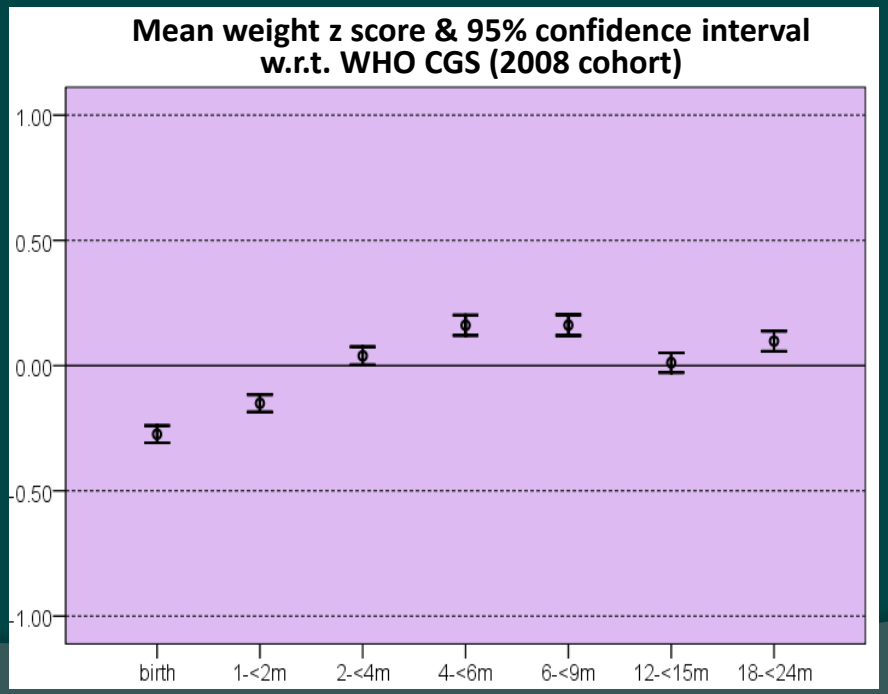
	1997 Cohort		MCHC sample of 2002 Birth Cohort		2007 G Survey (2002/03 BC)		MCHC Sample of 2006 Birth Cohort		MCHC Sample of 2008 Birth Cohort (Breastfed)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Birth										
2 m			0.53	0.52					0.55 (0.63)	0.48 (0.74)
3 m										
6 m			0.13	0.20					0.25 (0.17)	0.37 (0.38)
9 m										
12 m			0.09	-0.01					0.06 (-0.11)	0.03 (-0.07)
18 m			0.21	0.07					0.21 (0.11)	0.17 (0.04)
36 m										
48-59 m					0.23	0.26	0.20	0.25		

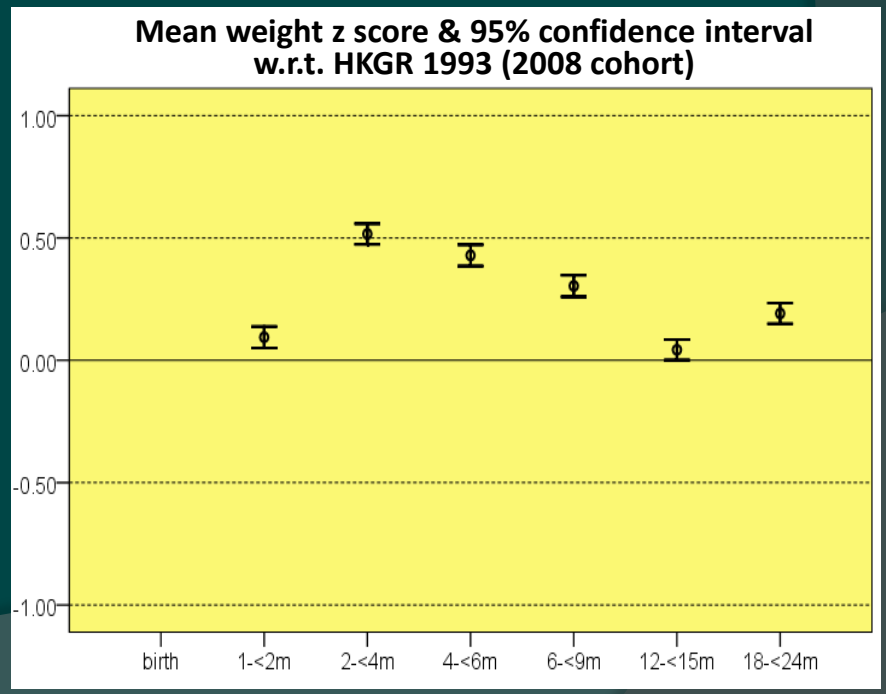
Mean z-score for weight of 5 HK Samples w.r.t WHO CGS

	1997 Cohort		MCHC sample of 2002 Birth Cohort		2007 G Survey (2002/03 BC)		MCHC Sample of 2006 Birth Cohort		MCHC Sample of 2008 Birth Cohort (Breastfed)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Birth	-0.16	-0.14	-0.17	-0.13					-0.28 (-0.30)	-0.26 (-0.01)
2 m			0.04	0.05					0.06 (0.13)	0.02 (0.24)
3 m	0.10	0.11								
6 m			0.02	0.05					0.12 (0.06)	0.20 (0.19)
9 m	0.15	0.24								
12 m	-0.04	0.08	0.00	0.01					-0.03 (-0.19)	0.05 (-0.03)
18 m	0.02	0.11	0.04	0.05					0.06 (-0.05)	0.14 (0.03)
36 m	-0.06	-0.14								
48-59 m					-0.05	-0.16	-0.05	-0.16		

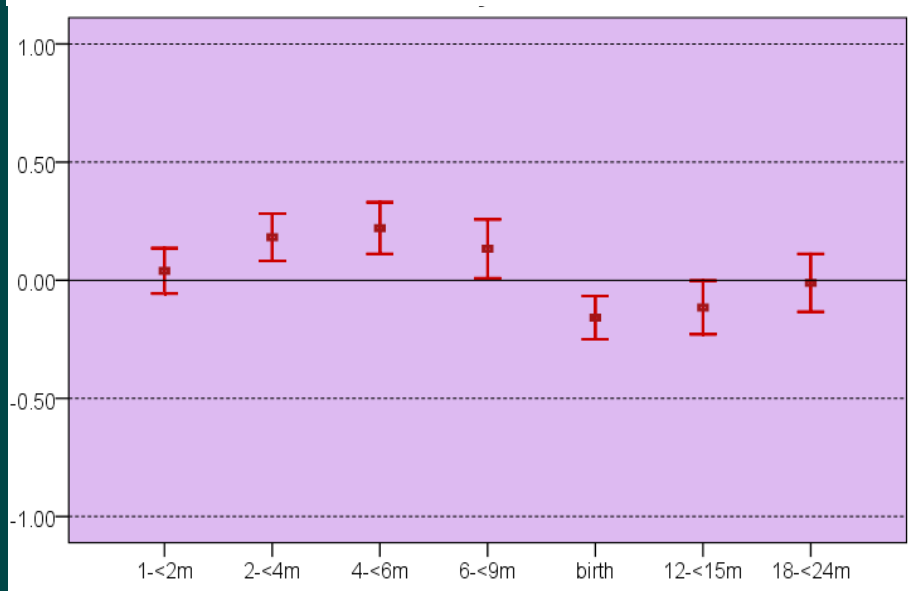

Mean weight z score & 95% confidence interval
w.r.t. WHO CGS (2002 cohort)
1.00
0.50
0.00
-0.50
-1.00
birth
1m
2-<4m
4-<6m
6-<9m
12<15m
18-<24m


Mean weight z score & 95% confidence interval
w.r.t. HKGR 1993 (2002 cohort)
1.00
0.50
0.00
-0.50
-1.00
birth
1m
2-<4m
4-<6m
6-<9m
12<15m
18-<24m

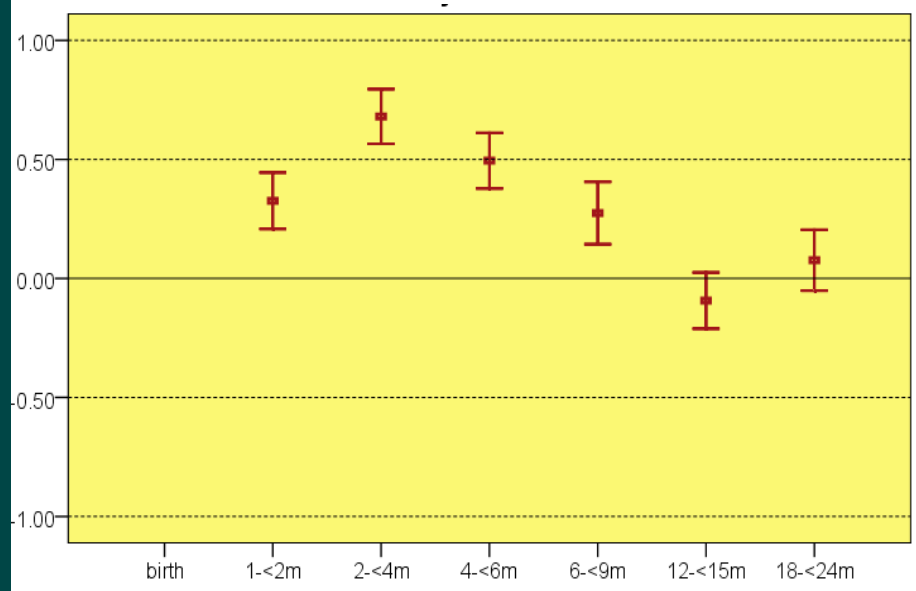

Mean weight z score & 95% confidence interval
w.r.t. WHO CGS (2008 cohort)
1.00
0.50
0.00
-0.50
-1.00
birth
1-<2m
2-<4m
4-<6m
6-<9m
12-<15m
18-<24m


Mean weight z score & 95% confidence interval
w.r.t. HKGR 1993 (2008 cohort)
1.00
0.50
0.00
-0.50
-1.00
birth
1-<2m
2-<4m
4-<6m
6-<9m
12-<15m
18-<24m

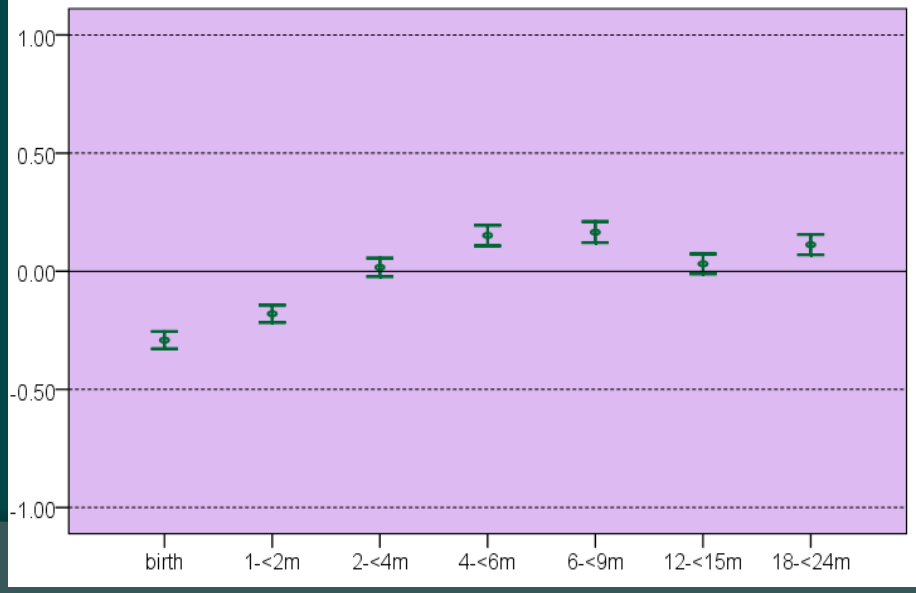
Mean weight z score & 95% confidence interval w.r.t. WHO CGS 2006
2008 cohort –children exclusively BF for at least 4 months



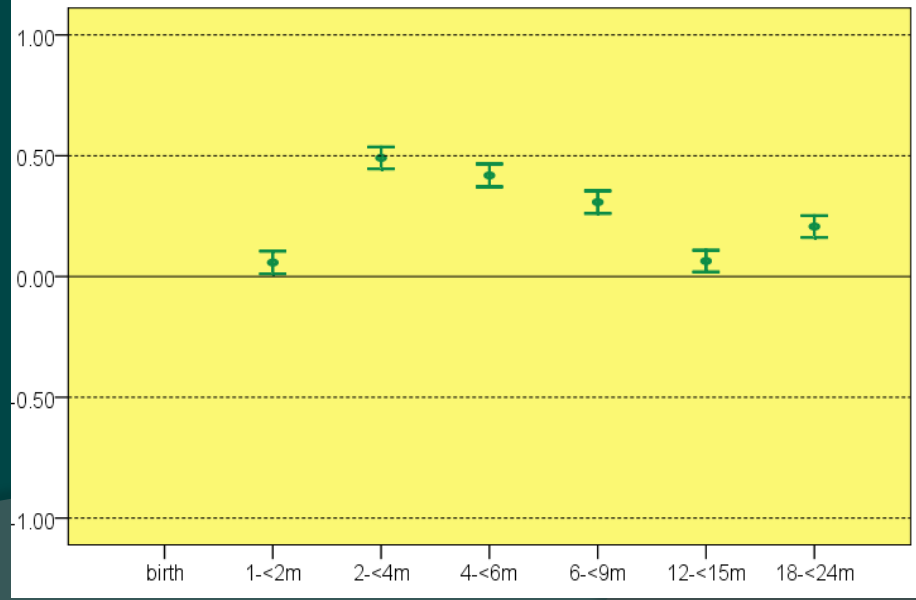
Mean weight z score & 95% confidence interval w.r.t. HKGR 1993
2008 cohort –children exclusively BF for at least 4 months



Mean weight z score & 95% confidence interval w.r.t. HKGR 1993
2008 cohort –formula fed children or EBF < 4 months



Mean weight z score & 95% confidence interval w.r.t. HKGR 1993
2008 cohort –formula fed children or EBF < 4 months



Under-weight & weight faltering

Weight Monitoring

“overweight” for age

The proportion of children identified as “overweight” for age (Weight z-score >2)

	MCHC Sample of the 2002 Birth Cohort		MCHC Sample of the 2008 Birth Cohort	
	WHO-CGS	1993-HKGR	WHO-CGS	1993-HKGR
1 m	0.2%	1.9%	0.3%	2.3%
2m	0.9%	5.1%	0.8%	5.9%
4 m	1.5%	4.0%	2.6%	6.1%
6 m	1.5%	2.6%	3.2%	4.4%
12 m	1.8%	2.1%	2.0%	2.4%
18 m	2.0%	2.8%	2.3%	3.0%

Under-weight

The proportion of children identified as underweight for age (Weight z-score < -2)

	MCHC Sample of the 2002 Birth Cohort		MCHC Sample of the 2008 Birth Cohort	
	WHO-CGS	1993-HKGR	WHO-CGS	1993-HKGR
1 m	1.3%	2.1%	1.8%	2.5%
2 m	0.6%	0.6%	0.9%	0.8%
4 m	1.3%	1.3%	1.0%	1.0%
6 m	1.3%	1.9%	1.3%	1.4%
12 m	0.8%	2.0%	1.6%	2.4%
18 m	0.8%	1.7%	1.0%	1.3%

Weight Faltering

- During the first few weeks of life
  - may be associated with underfeeding, especially due to problems in breastfeeding
  - Skilful assessment of the mother-baby dyad by medical practitioners
    - History – feeding, elimination
    - Physical examination – baby & mother
    - Observation of breastfeeding
  - Expert management by medical practitioner
    - ± Coaching by experienced nurses / lactation consultants
  - Close weight monitoring is important
    - Growth chart may not be useful for such purpose

Weight Faltering

- After the first few weeks
  - Detected through routine weight monitoring
  - Defined as a fall through > 2 centile spaces (>1.33 z-score) in the weight chart
  - An indication for medical assessment

Weight Faltering

Proportion of children identified as having Weight Faltering (Fall through 2 centile spaces (1.33 SD) between 2 & 12m)

MCHC Sample of 2002 Birth Cohort		MCHC Sample of the 2008 Birth Cohort		
WHO-CGS	1993-HKGR		WHO-CGS	1993-HKGR
1.59%	9.86%		2.09%	10.96%
		EBF	4.91%	21.13%
		Others	1.65%	9.38%

*The proportion of 2 UK cohorts meeting this definition was 1.7% and 1.6% respectively (Wright C, UK)

Summary

- The weight growth pattern of Hong Kong children fits better with the WHO-CGS than the 1993-HKGR, especially for breastfed infants

- On the WHO-CGS (vs 1993-HKGR)
  - Fewer infants from 1 to 6 months are classified as “overweight” for age (z-score > 2), especially for BF infants
  - No. of children identified as underweight (z-score < -2) is similar
  - Significantly fewer children will be identified as having “weight faltering” between 2 & 12 m

Over-weight & Obesity (Population Surveillance)

Surveillance of 4-year-old Children for Overweight and Obesity

	MCHC Sample of the 2002/03 Birth Cohort (2007 Survey Data)	**MCHC Sample of the 2006 Birth Cohort** (2011 Routine Data)
With reference to WHO CGS		
At risk of overweight 1< BMI ≤ 2	11.92%	15.78%
Overweight 2 < BMI ≤ 3	3.00%	4.17%
Obese BMI >3	1.36%	0.83%
International Obesity Task Force (IOTF) Definition		
Overweight ≡ Adult BMI ≧25 < 30	8.25%	7.6%
Obese ≡ Adult BMI ≧30	2.52%	2.6%

Global Prevalence of Overweight and Obesity

Overweight and Obesity in 4-year-old Children of EU Countries

	England	Spain	Italy	Czech
With reference to WHO CGS				
At risk of overweight 1< BMI ≤ 2	26.6%	33.3%	21.7%	14.5%
Overweight 2 < BMI ≤ 3	7.7%	8.6%	6.1%	3.9%
Obese BMI >3	2.6%	4.3%	4.1%	1.5%
International Obesity Task Force (IOTF) Definition				
Overweight ≡ Adult BMI ≧25 ＜30	15.5%	24.7%	14.4%	8.2%
Obese ≡ Adult BMI ≧30	5.7%	7.5%	7.8%	3.7%

Overweight & Obesity in infants and pre-school children in the European Union: a review of existing data. Cattaneo A, et al. Obesity review (2010) 11, 389-398

Global Prevalence & Trends of Overweight and Obesity among Preschool Children

- WHO Global Database on Child Growth and Malnutrition
- 450 national representative surveys from 144 countries
- Estimated prevalence of overweight and obesity (>2SD from weight-for-height median) in children 0 – 5 years based on WHO CGS

	1990	2000	2010
Developed Countries	7.9%	9.7%	11.7%
Eastern Asia	4.8%	5.0%	5.2%

De Onis, Blossner & Borghi Am J Clin Nutr 2010; 92: 1257-64

Is the WHO CGS appropriate for Growth Monitoring in HK?

- The variance of linear growth between HK children & WHO CGS is acceptable
- Clinical use:
  - Reasonable tool: Growth standard with breastfed infants as the norm
  - Education of health professionals is important
- Public Health use:
  - BMI at 4 years
    - Indicator of preschool childhood overweight / obesity
    - Indicator of effectiveness of population-based intervention programme
  - Allows comparability between countries
  - Supports promotion of breastfeeding

Issues to sort out

Continuity with

- Reference for prenatal growth & birth weight

- Reference for children 6 years and beyond

Acknowledgement: Dr. WY Luk: Data analysis

Thank You!

ASSESSMENT OF DIFFERENCES IN LINEAR GROWTH AMONG POPULATIONS IN THE WHO MULTICENTRE GROWTH REFERENCE STUDY

WHO MGRS GROUP

ACTA PAEDIATRICA, 2006; SUPPL 450: 56-65

The Appropriateness of a Single International Standard

1. Variance component analysis of length measurements in the longitudinal sample (0-24m)

- Results
  - Individuals within sites: 70% of variance
  - Among sites: 3.4% of variance
  - Random error: 26.6%

2. Assessment of “Standardised Site Effects”
   - Method
     - “Site mean – Pooled mean ÷ SD of pool mean” of each site at these ages
       - Birth, 6m, 12m,18m,24m (length)
       - 24-26m, 36-38m, 48-59m & 60-62m (height)
     - Pre-determined that pooling would be appropriate if differences < $\pm$ 0.5 SD

- Results
  - “Standardised Site Effects” values
    - Length: - 0.33 to + 0.49 SD
    - Height: - 0.41 to + 0.46 SD
    - Oman accounted for the most negative values
    - Norway & Brazil accounted for the most positive values
  - Excluding individual sites from the pooled sample resulted in minimal impact on the pooled statistics

- Conclusion: Appropriate to pool data from all 6 sites

Table III. Pooled and individual site sample sizes (n), means and standard deviations (SD) for length (cm).

Age	Sample	n	Mean (cm)	SD	Standardized site effects[a]
Birth	Pooled	1742	49.55	1.91	0.00
	Brazil	309	49.61	1.89	0.03
	Ghana	329	49.45	1.92	−0.05
	India	301	48.99	1.79	−0.29
	Norway	300	50.40	1.86	0.45
	Oman	295	49.18	1.72	−0.20
	USA	208	49.74	1.96	0.10
6 mo	Pooled	1648	66.72	2.35	0.00
	Brazil	296	66.75	2.35	0.01
	Ghana	306	66.57	2.29	−0.06
	India	287	66.60	2.28	−0.05
	Norway	286	67.88	2.37	0.49
	Oman	274	66.07	2.04	−0.27
	USA	199	66.30	2.39	−0.18
12 mo	Pooled	1594	75.02	2.62	0.00
	Brazil	290	75.39	2.69	0.14
	Ghana	301	75.16	2.69	0.05
	India	279	74.96	2.53	−0.02
	Norway	272	75.47	2.55	0.17
	Oman	265	74.43	2.41	−0.22
	USA	187	74.47	2.73	−0.21
18 mo	Pooled	1535	81.76	2.90	0.00
	Brazil	285	82.40	2.97	0.22
	Ghana	293	81.95	2.84	0.06
	India	268	81.50	2.86	−0.09
	Norway	255	82.06	2.77	0.10
	Oman	259	80.87	2.73	−0.31
	USA	175	81.70	3.01	−0.02
24 mo	Pooled	1524	87.40	3.18	0.00
	Brazil	280	88.35	3.17	0.30
	Ghana	289	87.48	3.04	0.03
	India	269	87.00	3.15	−0.13
	Norway	257	87.75	3.06	0.11
	Oman	260	86.36	3.08	−0.33
	USA	169	87.38	3.33	−0.01

[a] Standardized site effects are the differences between the indicated site means and the corresponding pooled (all sites) mean divided by the pooled standard deviation.

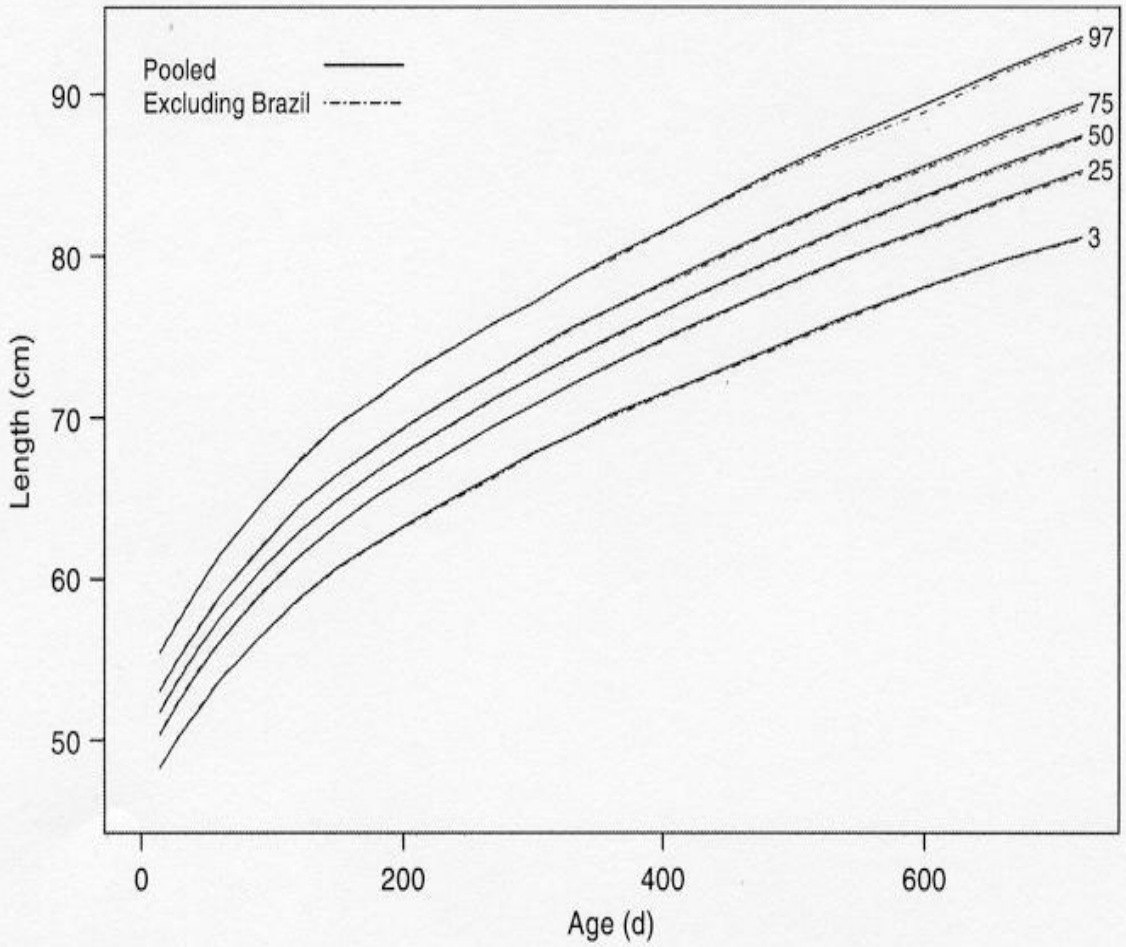


Figure 3. Length (cm) at selected percentiles for the pooled sample (solid line) and the sample following the exclusion of Brazil (dashed lines) from birth to 730 d.

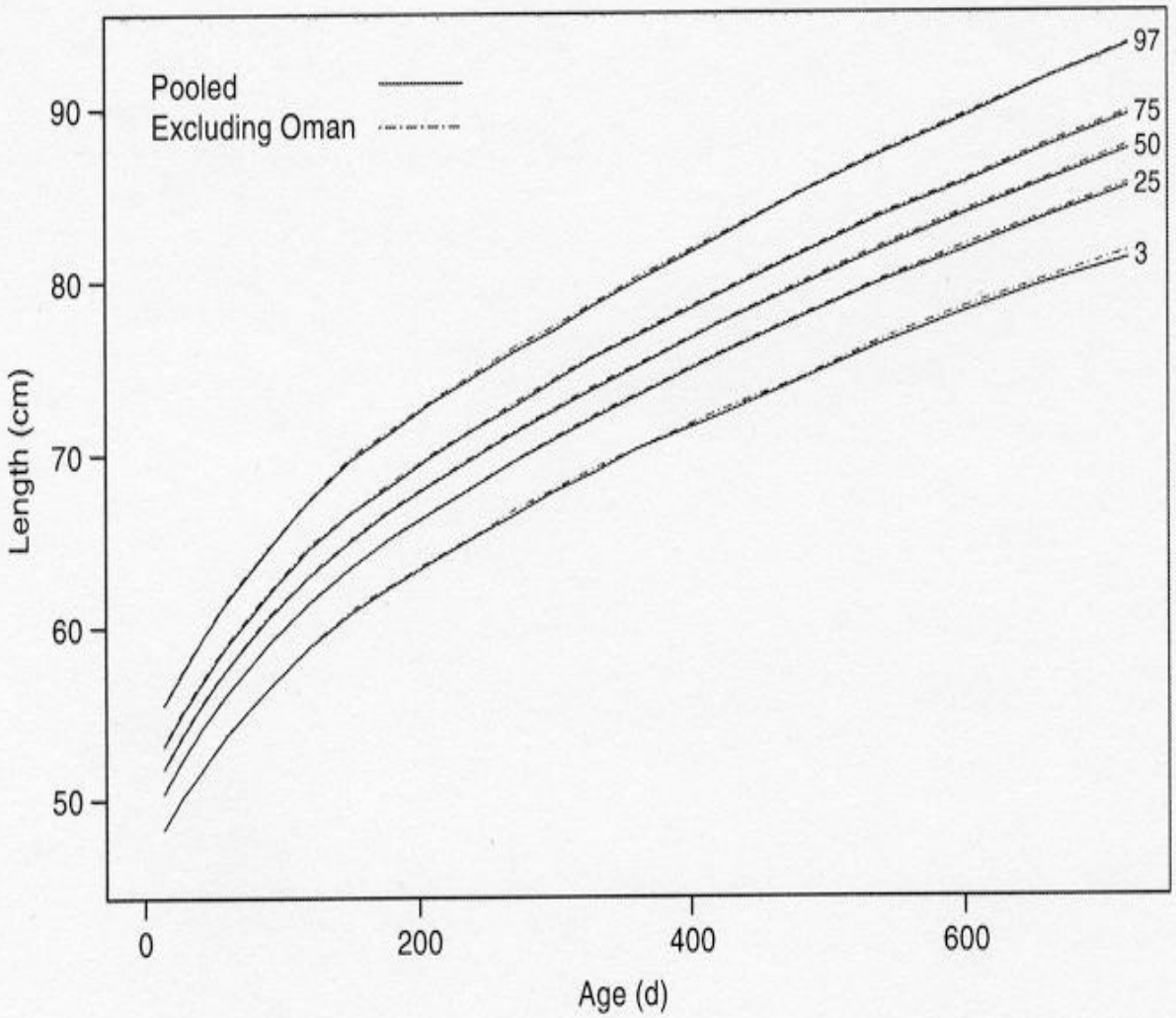


Figure 4. Length (cm) at selected percentiles for the pooled sample (solid line) and the sample following the exclusion of Oman (dashed lines) from birth to 730 d.

The Growth of Children in China in the last 30+ years

The Fourth National Growth Survey of Children under 7 Years in Nine Cities in China

- Conducted in 2005
- Urban & rural areas of 9 cities (From E to W; N to S)
  - Harbin, Beijing, Xian
  - Shanghai, Nanjing, Wuhan
  - Fuzhou, Guangzhou, Kunming
- Total sample = 138, 775
  - 22 age groups (n = 100 – 150)
  - Measurement of weight, height/length, sitting height, chest circumference, head circumference
- A new growth reference was constructed based on data from 69 760 urban children

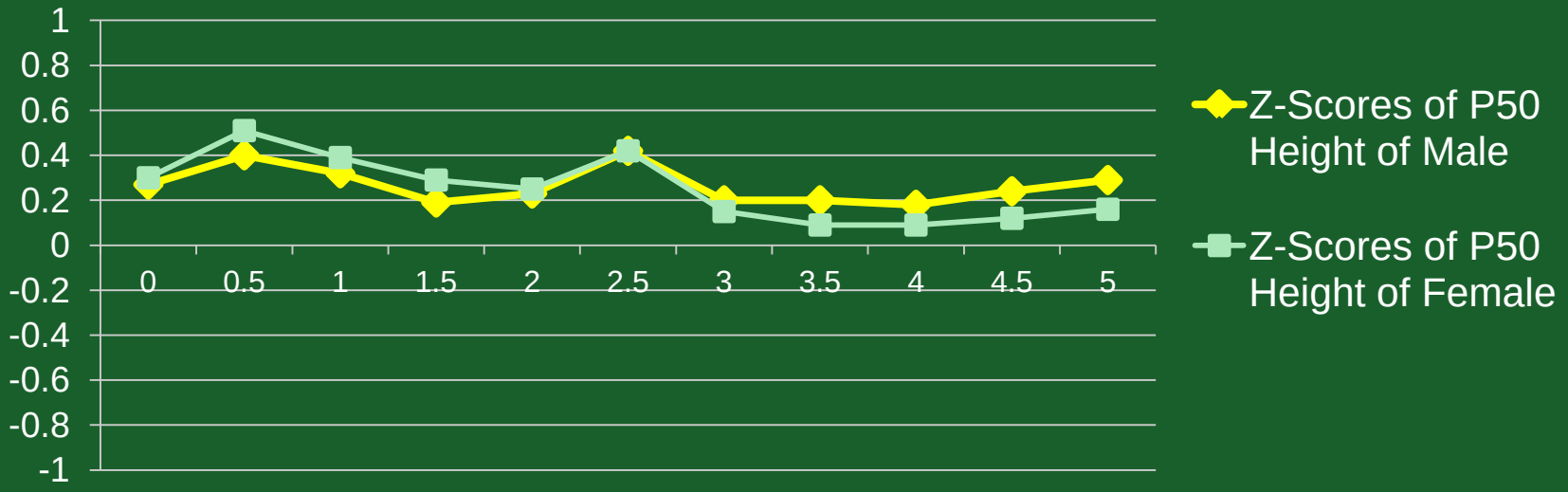

Harbin
Beijing
CHINA
中国
Xi'an
Nanjing
Shanghai
Wuhan
Fuzhou
Kunming
Guangzhou

Z-Scores of P50 Weight and Height of the Chinese Growth Reference (2005) on WHO CGS

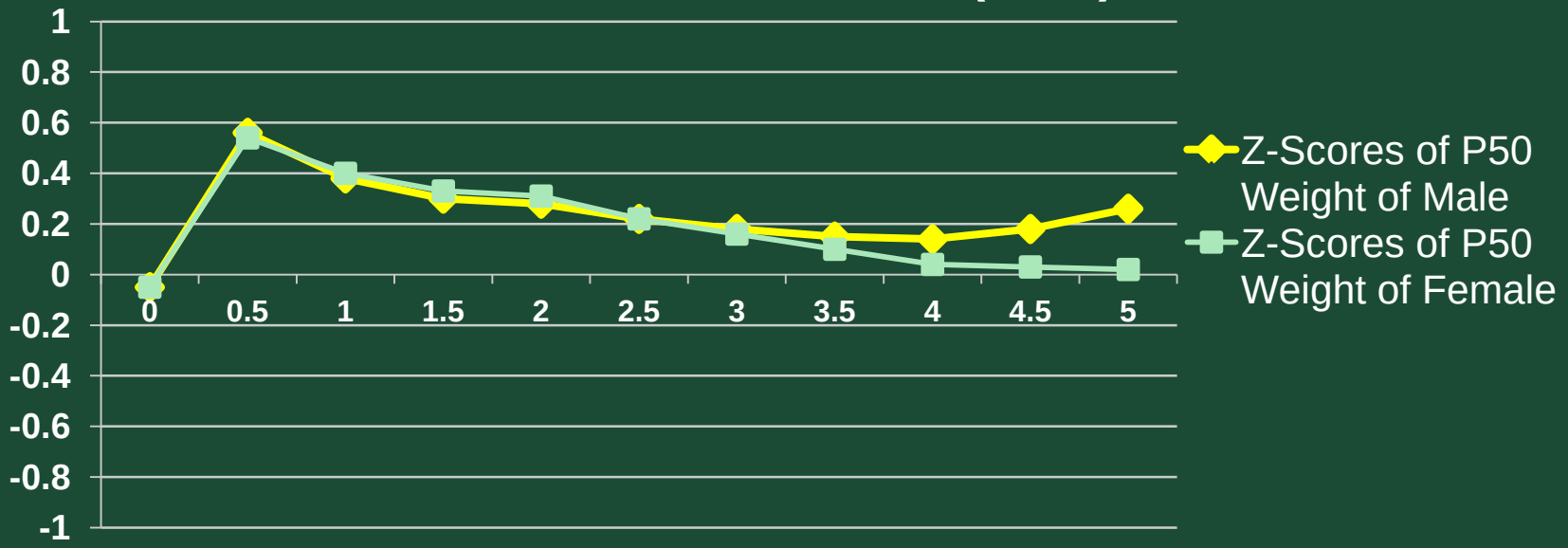
Age (yr)	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
Height (Boys)	0.27	0.4	0.32	0.19	0.23	0.42	0.2	0.2	0.18	0.24	0.29
Height (Girls)	0.30	0.51	0.39	0.29	0.25	0.42	0.15	0.09	0.09	0.12	0.16
Age (yr)	**0**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**	**5**
Weight (Boys)	-0.05	0.56	0.38	0.3	0.28	0.22	0.18	0.15	0.14	0.18	0.26
Weight (Girls)	-0.05	0.54	0.40	0.33	0.31	0.22	0.16	0.10	0.04	0.03	0.02

Li H, et al. Height and weight standardized growth charts for Chinese children and adolescents aged 0 to 18 years. Chin J Pediatr 2009.47;487-492

WHO Z-Scores of P50 Height of the Chinese Growth Reference (2005)



WHO Z-Score of P50 Weight of the Chinese Growth Reference (2005)



	1975	1985	1995	2005
Sample Size	158,400	152,874	157,362	138,775
6 – 7 Year Group: Weight Increment				
Urban Boys	← 3.26 Kg →			
Urban Girls	← 2.88 Kg →			
Rural Boys	← 2.68 Kg →			
Rural Girls	← 2.58 Kg →			
6 – 7 Year Group: Height Increment				
Urban Boys	← 5.3 cm →			
Urban Girls	← 5.0 cm →			
Rural Boys	← 7.6 cm →			
Rural Girls	← 7.5 cm →			
U/R height difference (B)	4.9 cm			2.6 cm
5 – 6 Year group				
Weight Increment		0.58 Kg	1.02 Kg	1.67 Kg
Height Increment		1.5 cm	2.0 cm	2.6 cm

Summary

- The growth and nutrition of Chinese children have improved over the past 30 years
- The secular trend in height and weight is continuing (& accelerating)
- The urban and rural difference in growth is significant but reducing
- The weight and height of Chinese children in nine cities have reached or surpassed that of the new WHO child growth standards

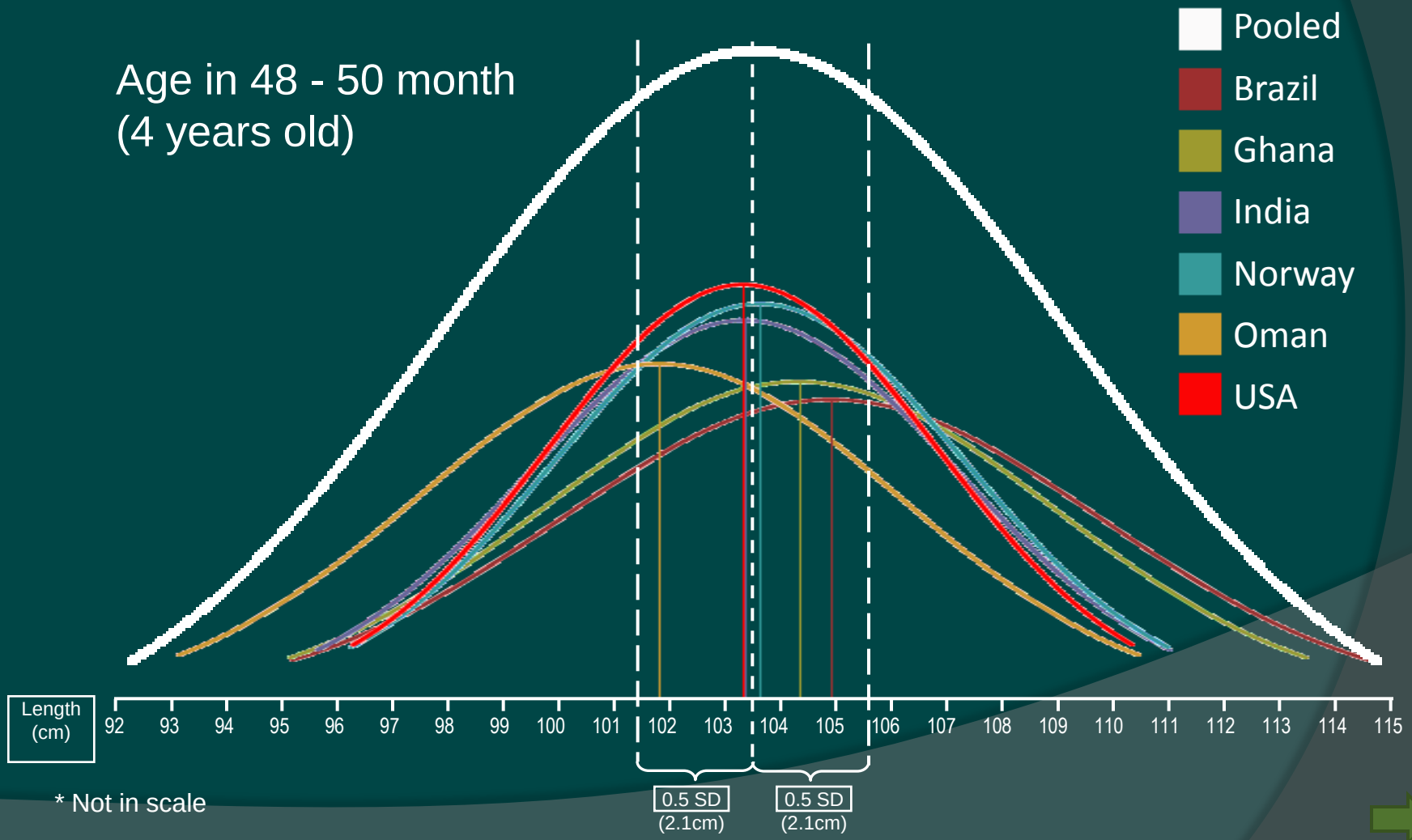
Coordinating study Group of Nine Cities on Physical Growth & Development of Children, Capital Institute of Pediatrics A National Survey on Growth of Children under 7 Years of age in Nine Cities of China, 2001 Zhonghua Er Ke Za Zhi 2007 Aug; 45(8): 609-14

Li H, Zhang YQ, Zhu ZH. Physical Growth trend of Chinese Children under 7 Years Old, in 1975 – 2005. Zhonghua Er Ke Za Zhi. 2009 Mar; 43(3): 182-6

*Comparing Hong Kong with Mainland Chinese Children

- Comparison between
  - 2007 growth survey data (HK)
  - The Chinese Growth Reference (2005)
- At 4 years, the mean height of Hong Kong boys and girls are 0.45 and 0.44 z-scores **shorter** than their mainland Chinese counterparts

Height Distribution of the 6 Country Samples and the WHO Pooled Sample



BMI OF HONG KONG CHILDREN

Mean z-score for BMI of 3 Samples of 3 & 4-year-old Children w.r.t WHO CGS

	1997 Cohort (3-year-olds)		2007 Survey Data (2002/03 Birth Cohort: 4-year-olds)		2011 Routine Data (2006 Birth Cohort: 4-year-olds)	
	Boys	Girls	Boys	Girls	Boys	Girls
Mean z-score for height	-0.34	-0.38	-0.27	-0.35	-0.21	-0.32
Mean z-score for weight	-0.06	-0.14	-0.05	-0.16	0.06	-0.16
Mean z-score for BMI	0.22	0.14	0.18	0.07	0.3	0.06

Mean z-score for BMI of 3 Samples of 3 & 4-year-old Children w.r.t HKGR 1993

	1997 Cohort (3-year-olds)		2007 Survey Data (2002/03 Birth Cohort: 4-year-olds)		2011 Routine Data (2006 Birth Cohort: 4-year-olds)	
	Boys	Girls	Boys	Girls	Boys	Girls
Mean z-score for height			0.20	0.20	0.33	0.29
Mean z-score for weight			0.23	0.26	0.25	0.20
Mean z-score for BMI			0.14	0.21	0.27	0.26

- Given the shorter height of our children, they are heavier than they should be
- Mean BMI is higher with reference to the WHO standard
- If a BMI chart were constructed based on weight & height of HK children and used as a reference, high BMI will be normalised (or under-diagnosed)