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EUSUHM 2015 – Tallinn, Estonia

Should we exclude children with overweight or obesity from height reference samples?

Mathieu Roelants[1], Bente Brannsether[2], Hege Kristiansen[3], Robert Bjerknes[4], Karel Hoppenbrouwers[1], Pétur B Júlíusson[4,5]

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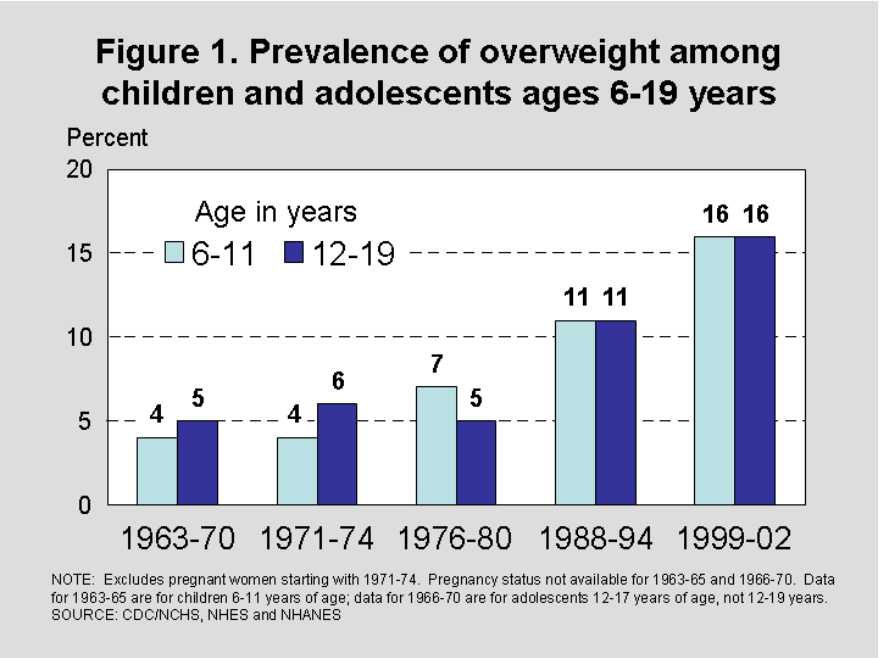
Introduction

- Growth references show how children grow in a particular population (genetic background), at a particular time (changing environment)
- Used to monitor overall health and wellbeing
- Children with conditions know to affect growth usually excluded
- Overweight/obese children:
  - Height also different
  - Increasing prevalence →
  - **Also exclude?**



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Materials and Methods (1)

- Cross-sectional data from 2 growth reference studies
- 12252 Belgian and 6159 Norwegian children
- 2 – 18 years of age
- Measured (height, weight → BMI) in 2002–2006

- Weight status defined by IOTF[1]:

  not overweight, overweight (excl. obese), obese

[1]Cole et al. BMJ, 2001

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Materials and Methods (2)

1) Is height different in these *"weight classes"* ?
   - height (cm) → SD scores
   - anova within age groups (both sexes combined)

2) Are height-by-age references affected?
   - Three height reference curves estimated:
     - All children (=*current national reference*)
     - Excluding *obese* children only
     - Excluding *overweight* and *obese* children
   - LMS method[2], same # edf

[2]Cole and Green, Stat. Med. 1992

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Results (1)

- Height SDS according to weight status[3]

AGE	Not overweight			Overweight (excl. obese)			Obese			anova
	n	mean SDS	(95%CI)	n	mean SDS	(95%CI)	n	mean SDS	(95%CI)	
Belgium										
2 – 5	2594	**-0.04**	(-0.08 – 0.00)	213	**0.36**	(0.21 – 0.51)	47	**0.30**	(0.00 – 0.61)	p < 0.001
6 – 8	2122	**-0.08**	(-0.12 – -0.03)	227	**0.49**	(0.35 – 0.62)	81	**0.65**	(0.42 – 0.88)	p < 0.001
9 – 11	2331	**-0.09**	(-0.13 – -0.05)	338	**0.38**	(0.27 – 0.48)	80	**0.73**	(0.52 – 0.94)	p < 0.001
12 – 14	2010	**-0.04**	(-0.08 – 0.01)	258	**0.21**	(0.09 – 0.33)	70	**0.36**	(0.12 – 0.60)	p < 0.001
15 – 17	1574	**0.02**	(-0.03 – 0.07)	199	**0.02**	(-0.12 – 0.15)	56	**-0.03**	(-0.35 – 0.30)	p = 0.3
Norway										
2 – 5	1151	**-0.05**	(-0.11 – 0.01)	148	**0.14**	(-0.02 – 0.30)	18	**0.49**	(-0.08 – 1.07)	p < 0.001
6 – 8	989	**-0.12**	(-0.18 – -0.06)	149	**0.43**	(0.27 – 0.59)	56	**0.72**	(0.44 – 0.99)	p < 0.001
9 – 11	944	**-0.09**	(-0.16 – -0.03)	162	**0.42**	(0.27 – 0.56)	29	**0.50**	(0.08 – 0.91)	p < 0.001
12 – 14	1074	**-0.05**	(-0.11 – 0.02)	121	**0.12**	(-0.09 – 0.32)	13	**0.24**	(-0.23 – 0.70)	p < 0.001
15 – 17	1130	**-0.01**	(-0.07 – 0.05)	129	**-0.09**	(-0.26 – 0.08)	26	**-0.15**	(-0.57 – 0.27)	p = 0.6

[3]prevalence of overweight (incl. obesity) and obesity = 13.0% and 2.8% in the Belgian sample and 13.8% and 2.3% in the Norwegian sample.

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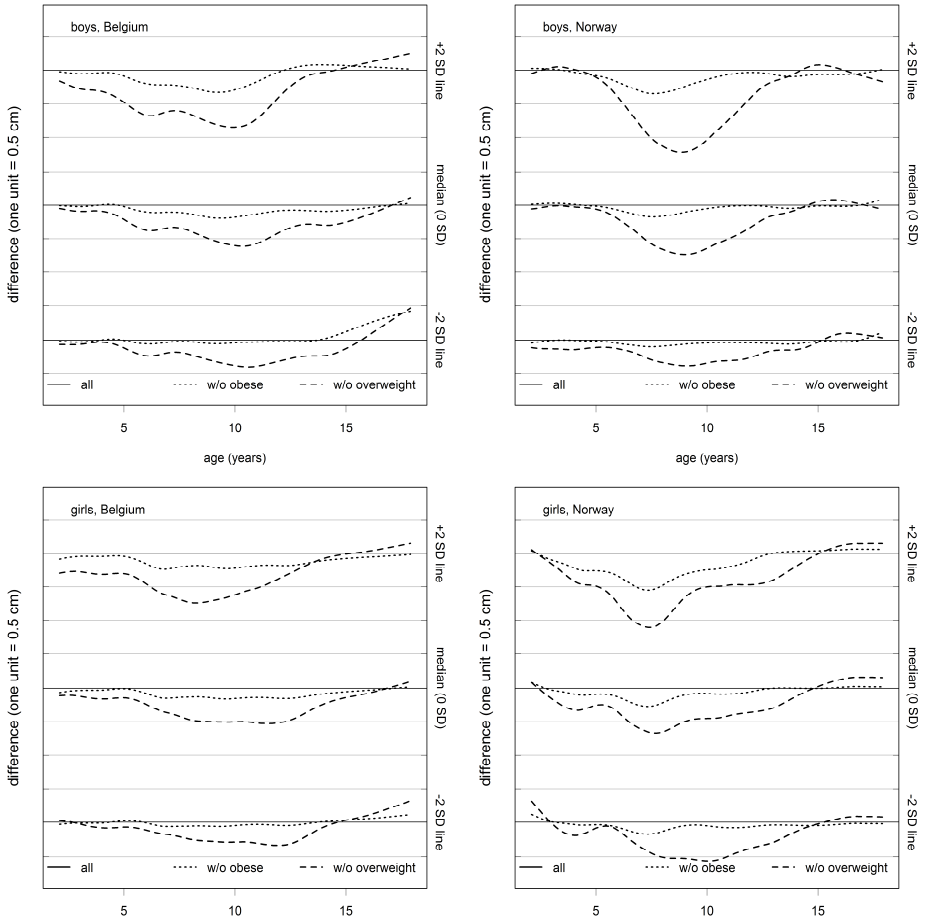
Results (2)

- Effect of exclusion on the growth chart



(standard curve) - (new curve)

All children = std: $\Delta=0$
Excluding ob < std
Excluding ow + ob << std

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Results (3)

- Theoretical referral rates (all children, different reference):

Reference based on:	Percentage (95%CI) below -2SD			Percentage (95%CI) above + 2SD		
	All	Non overweight/ obese	Non obese	All	Non overweight/ obese	Non obese
Belgium						
2-5	2.2 (1.7 – 2.9)	2.2 (1.7 – 2.8)	2.2 (1.7 – 2.9)	2.5 (2.0 – 3.2)	3.0 (2.4 – 3.7)	2.6 (2.0 – 3.3)
6-8	2.1 (1.6 – 2.8)	1.8 (1.3 – 2.4)	2.0 (1.5 – 2.7)	2.0 (1.5 – 2.6)	2.5 (1.9 – 3.2)	2.0 (1.5 – 2.7)
9-11	2.0 (1.5 – 2.6)	1.7 (1.3 – 2.3)	2.0 (1.5 – 2.6)	2.7 (2.1 – 3.4)	3.1 (2.5 – 3.8)	2.7 (2.2 – 3.4)
12-14	2.3 (1.7 – 3.0)	2.2 (1.6 – 2.9)	2.3 (1.7 – 3.0)	2.2 (1.6 – 2.9)	2.2 (1.7 – 2.9)	2.1 (1.6 – 2.8)
15-17	2.5 (1.8 – 3.3)	2.5 (1.9 – 3.4)	2.5 (1.9 – 3.4)	1.8 (1.3 – 2.6)	1.7 (1.2 – 2.4)	1.9 (1.3 – 2.6)
Norway						
2-5	2.7 (1.9 – 3.8)	2.6 (1.8 – 3.6)	2.7 (1.9 – 3.8)	2.4 (1.6 – 3.4)	2.8 (2.0 – 3.9)	2.5 (1.8 – 3.5)
6-8	2.3 (1.5 – 3.3)	2.0 (1.3 – 3.0)	2.2 (1.5 – 3.2)	2.1 (1.4 – 3.1)	3.3 (2.4 – 4.5)	2.6 (1.8 – 3.7)
9-11	1.5 (0.9 – 2.4)	1.3 (0.8 – 2.2)	1.5 (0.9 – 2.4)	2.5 (1.7 – 3.7)	3.3 (2.4 – 4.6)	2.8 (2.0 – 4.0)
12-14	3.0 (2.1 – 4.1)	2.9 (2.1 – 4.1)	3.0 (2.1 – 4.1)	2.2 (1.5 – 3.3)	2.6 (1.8 – 3.7)	2.3 (1.6 – 3.4)
15-17	2.1 (1.4 – 3.1)	2.1 (1.4 – 3.1)	2.1 (1.4 – 3.1)	2.3 (1.6 – 3.4)	2.3 (1.6 – 3.4)	2.3 (1.6 – 3.4)

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Conclusion

- Typical height pattern confirmed:
  - Overweight and obese children are on average taller before puberty
  - Earlier maturity?
- Similar effect on the growth chart when excluding children with overweight or obesity
  - Effect of additional exclusion depends on *effect size* and *prevalence*: larger for overweight!
  - Could be larger in populations with higher prevalence
- Minor consequences for clinical cut-offs

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Should we exclude children with overweight or obesity from height reference samples? Data from Belgium and Norway shows that it makes little difference!

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