



# Harmonisation of body size data

## Will Johnson

# MRC Human Nutrition Research Maternal and Child Nutrition

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## Our areas of work

CLOSER works across four different areas in order to achieve its overarching objective to maximise the use, value and impact of cohort and longitudinal studies.

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#### Data harmonisation

CLOSER is working to make the data from longitudinal studies more comparable, so it is easier to find out how things are changing from generation to generation. The first four work strands in this area are:

- 1. Harmonisation of biomedical measures
- 2. Harmonisation of socio-economic measures
- 3. Harmonisation of analysis of biological samples
- 4. Harmonisation of measures of vision



#### RESEARCHARTICLE

How Has the Age-Related Process of Overweight or Obesity Development Changed over Time? Co-ordinated Analyses of Individual Participant Data from Five United Kingdom Birth Cohorts

#### William Johnson<sup>1</sup>\*, Leah Li<sup>2</sup>, Diana Kuh<sup>1</sup>, Rebecca Hardy<sup>1</sup>

 Medical Research Council Unit for Lifelong Health and Ageing at University College London, London, United Kingdom, 2 University College London Institute of Child Health, London, United Kingdom

William.Johnson@mrc-hnr.cam.ac.uk

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#### OPEN ACCESS

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Editor: Richard Lehman, University of Oxford, UNITED KINGDOM

#### Abstract

#### Background

There is a paucity of information on secular trends in the age-related process by which people develop overweight or obesity. Utilizing longitudinal data in the United Kingdom birth cohort studies, we investigated shifts over the past nearly 70 years in the distribution of body mass index (BMI) and development of overweight or obesity across childhood and adulthood.



One publication had investigated shifts over time in BMI trajectories using data from the UK birth cohort studies



Li L, Hardy R, Kuh D, Lo Conte R, Power C. Child-to-adult body mass index and height trajectories: a comparison of 2 British birth cohorts. Am J Epidemiol 2008; 168(9): 1008-15

Rest of our knowledge is based on studies in which data have been treated cross-sectionally or studies that are not representative and often span only a small part of the life course



We aimed to utilise the extensive longitudinal BMI data in the UK birth cohort studies to describe

- 1) Shifts over time in the distribution of BMI across age
- 2) Shifts over time in the development of overweight or obesity across age





What are the potential targets for harmonisation?

Intelligent? Go-Getter? > Devastationaly A Yes! Attractive ? Yes! The Dangers of Self-Report

### Measured vs. selfreported data



Precision of instrument (including metric vs. imperial)



Measurement protocol differences (including rounding & clothing)

#### Weights and heights were converted to kg and m.

Measured data were augmented self-reported data at the same age to maximise the amount of available information and to retrieve information from the upper end of the distribution that appeared to have been removed by the employment of a cut-off during data entry or cleaning

Missing observations of adulthood height were filled in with observations of height from previous adulthood sweeps.

Decimal age at assessment variables were computed from existing age variables or as the difference between date of birth and date of assessment (for sweeps that were missing a date or some component of a date variable: day, month, and/ or year was assigned to the whole cohort). Participants who were still missing decimal age were assigned the mean value for that cohort at that sweep.

Measurements taken while a woman was pregnant were excluded, where possible.

A standardised data cleaning protocol was applied. This involved removal of biologically implausible values using sensible yet arbitrary cut-offs (e.g., weight > 250 kg and height > 3 m) and inspection of a connected scatter plot of serial weight or height against age (i.e., a trajectory) for persons with a measurement or change in measurement between two consecutive ages greater than five standard deviations from the sex and study stratified mean.

#### Sex and study stratified analyses

1. LMS method used to describe the distribution of BMI across age

2. Binary logistic multilevel models used to produce trajectories describing the development of overweight or obesity (vs. normal weight) across age

 Thinness, overweight, and obesity defined according to IOTF cut-offs during childhood and cutoffs of 18.5, 25, and 30 kg/m<sup>2</sup> during adulthood





				Γ	Male					Fe	male	
	Sweep		BMI (kg/m²)	Thinness	s Overweight	Obesity		BMI (kg/	m²)	Thinness	Overweight	Obesity
	Target age (date)	Ν	Median (IQR)	%	%	%	Ν	Median (I	QR)	%	%	%
1946 NSHD	2 (1948)	2046 1	17.7 (16.3, 19.2)	7.7	16.8	17.0	1794	17.2 (16.1,	18.8)	7.2	21.8	14.9
2,598 males	4 (1950)	2198 1	16.2 (15.3, 17.2)	10.5	16.5	6.1	1986	15.9 (14.9,	17.1)	9.8	15.8	4.8
2,359 females	6 (1952)	2050 2	15.9 (15.0, 16.7)	6.7	9.0	0.8	1841	15.6 (14.8,	16.5)	8.2	10.3	1.3
	7 (1953)	2057 2	15.8 (14.9, 16.6)	5.9	6.2	0.4	1920	15.5 (14.7,	16.5)	9.6	7.4	1.1
	11 (1957)	2050 2	16.9 (15.9, 18.1)	9.0	6.6	0.8	1887	17.0 (15.7,	18.7)	12.5	8.5	1.8
	15 (1961)	1881 1	19.3 (18.0, 20.8)	8.2	7.4	0.8	1700	20.3 (18.6,	22.1)	8.8	11.0	1.7
	20 (1966)	1802 2	22.5 (20.9, 24.0)	2.3	12.8	1.2	1629	21.4 (19.8,	23.1)	8.0	8.7	1.7
	26 (1972)	18222	23.1 (21.5, 25.1)	1.8	23.0	2.6	1782	21.8 (20.2,	23.8)	5.3	13.9	2.8
	36 (1982)	16312	24.6 (22.7, 26.7)	1.2	37.8	6.2	1618	22.6 (20.9,	25.1)	3.7	18.5	7.1
	43 (1989)	16122	25.3 (23.3, 27.7)	0.6	44.9	10.4	1595	24.0 (22.1,	27.1)	1.6	25.8	13.8
	53 (1999)	14512	27.0 (24.7, 29.7)	0.3	49.2	22.7	1494	26.2 (23.7,	30.1)	0.3	36.3	25.8
	60-64 (2006-2010)	10592	27.6 (25.0, 30.3)	0.3	46.7	28.1	1155	26.9 (24.2,	31.0)	1.0	37.0	30.2
1958 NCDS	7 (1965)	6499 1	15.8 (15.0, 16.7)	8.9	6.6	1.3	6068	15.6 (14.6,	16.7)	9.7	8.7	2.2
7,927 males	11 (1969)	5931 1	16.8 (15.8, 18.2)	12.4	6.7	1.3	5687	17.1 (15.8,	18.9)	16.0	9.0	1.4
7,514 females	16 (1974)	5194 1	19.8 (18.5, 21.4)	10.3	6.8	1.5	4911	20.6 (19.0,	22.5)	9.9	10.3	1.6
	23 (1981)	56802	22.7 (21.2, 24.5)	2.4	17.7	2.4	5732	21.6 (20.1,	23.5)	6.4	11.6	3.1
	33 (1991)	50062	25.1 (23.1, 27.5)	1.0	40.4	10.9	4982	23.4 (21.5,	26.4)	3.4	23.2	11.8
	42 (2000)	50692	26.0 (23.9, 28.5)	0.5	46.4	15.6	5195	24.1 (22.0,	27.5)	1.7	26.6	15.4
	44 (2002)	42492	27.3 (25.0, 30.1)	0.3	49.6	25.6	4305	25.7 (23.1,	30.0)	0.8	32.8	23.5
	50 (2008)	38332	27.4 (24.9, 30.4)	0.3	46.6	27.9	3814	25.7 (22.9,	29.5)	1.3	32.9	22.9
1970 BCS	10 (1980)	5738 1	16.4 (15.5, 17.7)	10.5	6.3	0.2	5443	16.7 (15.5,	18.3)	12.1	10.3	0.5
7,111 males	16 (1986)		20.4 (19.0, 22.3)		9.3	1.9		20.9 (19.3,	•		11.3	1.6
6,781 females	26 (1996)		24.1 (22.1, 26.1)		29.9	6.4		22.3 (20.7,	•		16.9	6.6
	30 (2000)	47962	25.1 (23.0, 27.6)	0.9	39.8	11.5	5072	23.2 (21.1,	26.3)	3.2	21.9	11.1
	34 (2004)	4107 2	26.0 (23.7, 28.7)	0.6	43.2	17.6	4398	24.0 (21.6,	27.4)	2.2	25.4	15.5
	42 (2012)	3907 2	26.8 (24.4, 29.8)		44.7	23.8	4037	24.9 (22.3,	28.8)		29.0	20.3
1991 ALSPAC	7 (1998)		15.7 (14.9, 16.8)		9.2	2.5		15.9 (14.9,			13.1	4.0
4,461 males	8 (1999)		16.5 (15.5, 17.8)		12.3	3.4		16.8 (15.5,	•		17.5	4.6
4,404 females	9 (2000)		16.8 (15.6, 18.7)		13.5	3.6		17.3 (15.8,			18.0	4.5
	10 (2001)		17.3 (15.9, 19.5)		14.4	4.1		17.7 (16.1,			17.2	4.9
	11 (2002)		18.0 (16.5, 20.5)		16.2	4.4		18.6 (16.8,	•		18.6	4.6
	13 (2004)		18.7 (17.1, 21.1)	7.9	16.0	4.3		19.4 (17.6,		9.3	16.9	3.9
	14 (2005)		19.2 (17.7, 21.4)	8.0	13.4	3.9		20.1 (18.3,		9.3	15.8	3.8
	15 (2006)		20.4 (18.8, 22.5)		13.6	3.9		21.1 (19.4,			15.0	4.8
	18 (2009)		21.8 (20.0, 24.3)		15.9	5.9		22.0 (20.1,			16.7	7.4
2001 MCS	3 (2004)		16.8 (16.0, 17.8)		18.6	5.1		16.6 (15.7,			19.6	5.1
6,897 males	5 (2006)		16.1 (15.4, 17.1)		14.5	4.7		16.1 (15.2,			18.3	5.8
6,580 females	7 (2008)		16.2 (15.2, 17.4)		12.7	4.9		16.3 (15.2,			16.9	6.2
	11 (2012)	5169 1	18.1 (16.5, 20.6)	5.1	18.7	6.0	5037	18.7 (16.8,	21.5)	6.4	22.6	6.7









# Prevalence at age 11 years has approximately tripledMales: 7.1 to 25.8%



# Prevalence at age 11 years has approximately tripledFemales: 11.3 to 31.1%



Shifts have occurred at the upper end of the BMI distribution, and in childhood this has contributed to a three-fold increase in overweight or obesity prevalence

Also age-related changes, that have contributed to the median UK adult currently being overweight, and shifts in these trajectories over time

These processes mean that more recently born cohorts are developing 1) Overweight or obesity earlier

2) Accumulating more exposure







## Strengths

- Extensive serial data; wide range of ages and birth years
- Robust analysis, not focusing on mean BMI

## Limitations

- Trajectories smoothed over ages where no data
- Normal limitations of BMI
- Measurement protocols not consistent

## Future possbilties

- Determinants and consequences of the secular trends
- Multilevel models that parameterise measurement protocol differences in level one variance





#### Trajectories

 Powerful approach to understand how something changes over age

## Cross-cohort comparisons of trajectories

- Different birth year cohorts: powerful approach to investigate how some age-related process has changed over time
- Different geographical cohorts: powerful approach to investigate how some age-related process differs between settings with different confounding structures

## Harmonisation and longitudinal methods

- Laborious but necessary
- Degree of harmonisation and which longitudinal method to use are dependent on each other and the research question

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