The association between weight perception and BMI – 9 year old cohort

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UCC

Background

- **Body mass index (BMI) measurement**
- **Gold standard is clinically measured body mass index**
- **Not practical**
- **Usually self-reported height and weight, with a subsample of measured height and weight**
- **Neither valid or reliable**
- **Self-reported height is over-reported and self-reported weight is underreported**

BMC
Public Health

Prior Research

Temporal trends in misclassification patterns of measured and self-report based body mass index categories - findings from three population surveys in Ireland

Frances Shiely[1,2*], Ivan J Perry[1], Jennifer Lutomski[1], Janas Harrington[1], C Cecily Kelleher[3], Hannah McGee[4], Kevin Hayes[5]

Abstract

PLOS | ONE

Height and Weight Bias: The Influence of Time

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Abstract

Background: We have previously identified in a study of both self-reported body mass index (BMI) and clinically measured BMI that the sensitivity score in the obese category has declined over a 10-year period. It is known that self-reported weight is significantly lower that measured weight and that self-reported height is significantly higher than measured height. The purpose of this study is to establish if self-reported height bias or weight bias, or both, is responsible for the declining sensitivity in the obese category between self-reported and clinically measured BMI.

Growing Up in Ireland
National Longitudinal Study of Children

Children are just as inaccurate in predicting their own weight status

Ask the parents

- **Ask parents to report their children's height and weight**
- **International literature is inconsistent as to the magnitude and direction of error**

But……

- **It does lead to misclassification**
- **Shown to be correlated with lower socio-economic status, lower education level, parental obesity and child obesity**
- **Height underestimation is the biggest problem**
- **Over reporting and under reporting of extreme values observed**

What do we know?

- **Systematic review by Rietmeijer-Mentink et al.** *Maternal and Child Nutrition,* **2013**
- **Difference between parental perception and actual weight status of children**
- **Review of 35,103 children**
- **11,530 were overweight**
- **62% of parents with overweight children incorrectly perceive them as normal weight**
- **86% in children aged 2-6**

- **Explore new methods to obtain accurate measurements of BMI**

- **Primary outcome**
  - To examine the possibility that weight perception, either a child's self-perception or a mother's perception of a child, is a viable alternative to measured height and weight in determining BMI classification

- **Secondary outcomes**
  - To determine the influence of a mother's BMI on her ability to categorise the child's BMI
  - To determine the ability of a child to recognise his/her own BMI

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ORIGINAL ARTICLE

The association between weight perception and BMI: report and measurement data from the growing up in Ireland Cohort Study of 9-year olds

F Shiely[1,2], NG Hon Yan[3], EM Berkery[4], C Murrin[5], C Kelleher[5] and K Hayes[4]

BACKGROUND: The gold standard for categorisation of weight status is clinically measured by body mass index (BMI), but this is often not practical in large epidemiological studies.

OBJECTIVES: To determine if a child's weight perception or a mother's perception of a child's weight status is a viable alternative to measured height and weight in determining BMI classification. Secondary outcomes are to determine the influence of a mother's BMI on her ability to categorise the child's BMI and a child's ability to recognise his/her own BMI.

METHODS: Cross-sectional analysis of the growing up in Ireland cohort study, a nationally representative cohort of 8568 9-year-old children. The variables considered for this analysis are the child's gender, BMI (International Obesity Taskforce grade derived from measured height and weight) and self-perceived weight status, and the mother's weight perception of the child, BMI (derived from measured height and weight) and self-perceived weight status. Cohen's weighted-kappa was used to evaluate the strength of the agreement between pairwise combinations of the BMI variables. Cumulative and adjacent categories logistic regression were used to predict how likely a person rates themselves as under, normal or overweight, based on explanatory variables.

RESULTS: Mothers are more accurate at correctly classifying their child's BMI ($\kappa = 0.5$; confidence intervals (CI) 0.38–0.51) than the children themselves ($\kappa = 0.25$; CI 0.23–0.26). Overweight mothers are better raters of their child's BMI ($\kappa = 0.51$; CI 0.49–0.54), compared with normal ($\kappa = 0.44$; CI 0.41–0.47) or underweight mothers ($\kappa = 0.4$; CI 0.22–0.58), regardless of whether the mother's BMI is derived from measured height and weight or self-perceived. The mother's perception of the child's weight status is not an

Methods

- **99% (n=8465) of the primary care-givers are female**
- **Biological mothers (n=8357)**
- **Adoptive mothers (n=54)**
- **Foster**
- **Other**
- **Unrelat**

Primary care givers referred to as mothers

- **103 primary care-givers were fathers; excluded from this analysis**

Methods

Variable	Underweight	Normal	Overweight
IOTF grade BMI (measured child)	Thinness grade 1 Thinness grade 2 Thinness grade 3	Normal weight	Overweight Obesity
Child's self-perceived weight status	A bit skinny Very skinny	Just the right size	A bit overweight Very overweight
Mother's weight perception of child	Slightly underweight Moderately underweight Very underweight	About the right weight	Slightly overweight Moderately overweight Very overweight
Mother's self-perceived weight status	Slightly underweight Moderately underweight Very underweight	About the right weight	
BMI of mother (measured)	BMI < 18.5	BMI 18.5- < 25	BMI≥ 25

Statistical Methods

- **Cohen's weighted kappa was used to evaluate the strength of the agreement between pairwise combinations of the key variables**

Kappa Value	Level of agreement
K <20	Poor
K= 0.21-0.4	Fair
K= 0.41-0.6	Moderate
K = 0.61-0.8	Good
K = 0.81	Very good

- **Cumulative logistic regression models to determine probability of correct classification, given the measured BMI**

- **Adjacent categories logistic regression, allowing the relationship between multiple raters to be examined**

N= 7986		Child's Self-perceived Weight status			Squared Kappa
		Underweight n(%)	Normal n(%)	Overweight n(%)	**Fair**
Child's Measured BMI	Underweight	228 (45.5%)	261 (52.1%)	12 (2.5%)	0.25 [0.23-0.26]
	Normal	1150 (21.7%)	3923(74.2%)	218 (4.1%)	
	Overweight	149 (6.8%)	1665 (75.9%)	380 (17.3%)	

		Child's Self-perceived Weight status			Squared Kappa
		Underweight n(%)	Normal n(%)	Overweight n(%)	**Fair**
Child's Measured BMI	Underweight	228 (45.5%)	261 (52.1%)	12 (2.5%)	0.25 [0.22
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Mothers are better raters of their children's weight status than the children themselves

Mother's Weight Perception of Child

A κ value of 0.32 for both subjective measures

		Underweight n(%)	Normal n(%)	Overweight n(%)	**Moderate**
Child's Measured BMI	Underweight	204 (40.6%)	294 (58.4%)	5 (1.0%)	0.5 [0.48-0.51]
	Normal	620 (11.7%)	4586 (86.3%)	110 (2.0%)	
	Overweight	37 (1.7%)	1133 (51.0%)	1050 (47.3%)	

- **Does the mother's BMI influence her perception of her child's weight status?**

N= 3725		Mother's Weight Perception of Child (Normal weight mother)			Squared Kappa
		Underweight n(%)	Normal n(%)	Overweight n(%)	**Moderate**
Child's Measured BMI	Underweight	112 (37.1%)	186 (61.6%)	4 (1.3%)	0.44 [0.41-0.47]

Overweight mothers are better raters of their children's weight status than either normal or underweight mothers

N = 3		Mother's Weight Perception of Child (Overweight mother)			Squared Kappa
		Underweight n(%)	Normal n(%)	Overweight n(%)	**Moderate**
Child's Measured BMI	Underweight	74 (45.1%)	89 (54.2%)	1 (0.6%)	0.51 [0.49-0.54]
	Normal	283 (12.3%)	1971 (85.7%)	45 (2.0%)	
	Overweight	24 (1.8%)	649 (48.1%)	675 (50.1%)	

Child's Correct Perception given their BMI category

		Child's Self-perceived Weight Status		
		Underweight (probability)	Normal (probability)	Overweight (probability)
Child's Measured BMI	Underweight	0.50	0.48	0.01
	Normal	0.21	0.74	0.05
	Overweight	0.07	0.77	0.16

Mother's Correct Perception given child's BMI category

		Mother's Weight Perception of Child		
		Affirmation that mothers are better raters of their children's weight status than children		
Child's Measured BMI	**Underweight**	**0.62**	**0.38**	**0**
	Normal	**0.1**	**0.86**	**0.05**
	Overweight	**0.01**	**0.57**	**0.42**

Sex of Child	IOTF grade	Mother's Perception of Child	Child's Self-Perceived Weight Status		
			Underweight (probability)	Normal (probability)	Overweight (probability)
Boy	Underweight	Underweight	0.63	0.37	0
		Normal	0.35	0.64	0.02
		Overweight	0.14	0.79	0.07
	Normal	Underweight	0.45	0.54	0.01
		Normal	0.2	0.76	0.04
		Overweight	0.07	0.8	0.14
	Overweight	Underweight	0.28	0.69	0.02
		Normal	0.11	0.8	0.09
		Overweight	0.03	0.72	0.25
Girl	Underweight	Underweight	0.6	0.4	0
		Normal	0.32	0.66	0.02
		Overweight	0.12	0.8	0.07
	Normal	Underweight	0.42	0.57	0.01
		Normal	0.18	0.77	0.05
		Overweight	0.06	0.79	0.15
	Overweight	Underweight	0.26	0.71	0.03
		Normal	0.09	0.8	0.1

Question

- **Does the mother's perception of the child influence the child's perception of him/herself?**

Sex of Child	IOTF grade	Mother's Perception of Child	Child's Self-Perceived Weight Status		
			Underweight (probability)	Normal (probability)	Overweight (probability)
Boy	Underweight	Underweight	0.63	0.37	0
		Normal	0.35	0.64	0.02
		Overweight	0.14	0.79	0.07
	Normal	Underweight	0.45	0.54	0.01
		Normal	0.2	0.76	0.04
		Overweight	0.07	0.8	0.14
	Overweight	Underweight	0.28	0.69	0.02
		Normal	0.11	0.8	0.09
		Overweight	0.03	0.72	0.25
Girl	Underweight	Underweight	0.6	0.4	0
		Normal	0.32	0.66	0.02
		Overweight	0.12	0.8	0.07
	Normal	Underweight	0.42	0.57	0.01
		Normal	0.18	0.77	0.05
		Overweight	0.06	0.79	0.15
	Overweight	Underweight	0.26	0.71	0.03
		Normal	0.09	0.8	0.1

Sex of Child	IOTF grade	Mother's Perception of Child	Child's Self-Perceived Weight Status		
			Underweight (probability)	Normal (probability)	Overweight (probability)
Boy	Underweight	Underweight	0.63	0.37	0
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		Overweight	0.14	0.79	0.07
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Girl	Underweight	Underweight	0.6	0.4	0
			66		0.02
					0.07
	Normal	Underweight	0.42	0.57	0.01
		Normal	0.18	0.77	0.05
		Overweight	0.06	0.79	0.15
	Overweight	Underweight	0.26	0.71	0.03
		Normal	0.09	0.8	0.1

Mother's perception of the child's weight status is not an influencing factor on the child's ability to correctly classify him/herself

Same finding for girls

Sex Child	IOTF grade	Mother's Perception of Child	Child's Self-Perceived Weight Status		
			Underweight (probability)	Normal (probability)	Overweight (probability)
Boy	Underweight	Underweight	0.63	0.37	0
		Normal	0.35	0.64	0.02
		Overweight	0.14	0.79	0.07
	Normal	Underweight	0.45	0.54	0.01
		Normal	0.2	0.76	0.04
		Overweight	0.07	0.8	0.14
	Overweight	Underweight	0.28	0.69	0.02
		Normal	0.11	0.8	0.09
		Overweight	0.03	0.72	0.25
Girl	Underweight	Underweight	0.6	0.4	0
		Normal	0.32	0.66	0.02
		Overweight	0.12	0.8	0.07
	Normal	Underweight	0.42	0.57	0.01
		Normal	0.18	0.77	0.05
		Overweight	0.06	0.79	0.15
	Overweight	Underweight	0.26	0.71	0.03
		Normal	0.09	0.8	0.1
		Overweight	0.03	0.7	0.27

Sex Child	IOTF grade	Mother's Perception of Child	Child's Self-Perceived Weight Status		
			Underweight (probability)	Normal (probability)	Overweight (probability)
Boy	Underweight	Underweight	0.63	0.37	0
		Normal	0.35	0.64	0.02
		Overweight	0.14	0.79	0.07
	Normal	Underweight	0.45	0.54	0.01
		Normal	0.2	0.76	0.04
		Overweight	0.07	0.8	0.14
	Overweight	Underweight	0.28	0.69	0.02
		Overweight	0.05	0.72	0.23
Girl	Underweight	Underweight	0.6	0.4	0
		Normal	0.32	0.66	0.02
		Overweight	0.12	0.8	0.07
	Normal	Underweight	0.42	0.57	0.01
		Normal	0.18	0.77	0.05
		Overweight	0.06	0.79	0.15
	Overweight	Underweight	0.26	0.71	0.03
		Normal	0.09	0.8	0.1
		Overweight	0.03	0.7	0.27

Child's recognition of overweight is poor

Question

- **Does the child's perception of him/herself influence the mother's perception of the child?**

Sex of Child	IOTF grade	Child's Self-Perceived Weight Status	Mother's Weight Perception of Child		
			Underweight (probability)	Normal (probability)	Overweight (probability)
Boy	Underweight	Underweight	0.77	0.23	0
		Normal	0.52	0.48	0
		Overweight	0.26	0.73	0.01
	Normal	Underweight	0.23	0.76	↑ 11%
		Normal	0.09	0.87	
		Overweight	0.03	0.85	0.13
	Overweight	Underweight	0.02	0.83	0.14
		Normal	0.01	0.65	0.35
		Overweight	0	0.37	0.62
Girl	Underweight	Underweight	0.72	0.28	0
		Normal	0.46	0.54	0
		Overweight	0.21	0.78	0
	Normal	Underweight	0.19	0.8	0.02
		Normal	0.07	0.88	0.05
		Overweight	0.02	0.82	0.16
	Overweight	Underweight	0.02	0.80	0.18
		Normal	0	0.59	0.41

Sex of Child	IOTF grade	Child's Self-Perceived Weight Status	Mother's Weight Perception of Child		
			Underweight (probability)	Normal (probability)	Overweight (probability)
Boy	Underweight	Underweight	0.77	0.23	0
		Normal	0.52	0.48	0
		Overweight	0.26	0.73	0.01
	Normal	Underweight	0.23	0.76	0.01
		Normal	0.09	0.87	0.04
		Overweight	0.03	0.85	0.13
	Overweight	Underweight	0.02	0.83	0.14
		Normal	0.01	0.65	0.35
		Overweight	0	0.37	0.62
Girl	Underweight	Underweight	0.72	0.28	0
		Normal	0.46	0.54	0
		Overweight	0.21	0.78	0
	Normal	Underweight	0.19	0.8	
		Normal	0.07	0.88	↑ 8%
		Overweight	0.02	0.82	
	Overweight	Underweight	0.02	0.80	0.18
		Normal	0	0.59	0.41

Sex of Child	IOTF grade	Child's Self-Perceived Weight Status	Mother's Weight Perception of Child		
			Underweight (probability)	Normal (probability)	Overweight (probability)
Boy	Underweight	Underweight	0.77	0.23	0
		Normal	0.52	0.48	0
		Overweight	0.26	0.73	0.01
	Normal	Underweight	0.23	0.76	0.01
		Normal	0.09	0.87	0.04
		Overweight	0.03	0.85	0.13
	Overweight	Underweight	0.02	0.83	0.14
		Normal	0.01	0.65	0.35
		Overweight	0	↑ 37%	0.62
Girl	Underweight	Underweight	0.72		0
		Normal	0.46	0.54	0
		Overweight	0.21	0.78	0
	Normal	Underweight	0.19	0.8	0.02
		Normal	0.07	0.88	0.05
		Overweight	0.02	0.82	0.16
	Overweight	Underweight	0.02	0.80	0.18
		Normal	0	0.59	0.41

Sex of Child	IOTF grade	Child's Self-Perceived Weight Status	Mother's Weight Perception of Child		
			Underweight (probability)	Normal (probability)	Overweight (probability)
Boy	Underweight	Underweight	0.77	0.23	0
		Normal	0.52	0.48	0
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		Normal	0.01	0.65	0.35
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		Overweight	0.21	0.78	0
	Normal	Underweight	0.19	0.8	0.02
		Normal	0.07	0.88	0.05
		Overweight	0.02	0.82	
	Overweight	Underweight	0.02	0.80	
		Normal	0	0.59	0.41

Child's self-perceived weight status influences the mother's ability to correctly classify the child

↑ 41 %

Conclusions

- **Mother's are better raters of their children's weight status than children themselves**

- **Overweight mothers are better raters of their children's weight status than either underweight or normal weight mothers**

- **This does not change if the mother's self-perceived weight status is used to measure BMI**

- **Higher probability that mother's will perceive their child to be overweight given the child's measured BMI than the child themselves**

- **Mothers perception of child's weight status is not an influencing factor on the child's ability to correctly classify him/herself but the child's self-perception influences the mother**

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