

**Title:** Perceptions of health risk among parents of overweight children: a cross-sectional study within a cohort

**Authors:** Min Hae PARK<sup>a</sup>, Catherine L FALCONER<sup>a</sup>, Sonia SAXENA<sup>b</sup>, Anthony S KESSEL<sup>c</sup>, Helen CROKER<sup>d</sup>, Áine SKOW<sup>a</sup>, Russell M VINER<sup>e</sup>, and Sanjay KINRA<sup>a</sup>

**Affiliations:** <sup>a</sup> Department of Non-communicable Disease Epidemiology, London School of Hygiene & Tropical Medicine, Keppel Street, London WC1E 7HT, UK; <sup>b</sup> Child Health Unit, School of Public Health, Imperial College London, London, UK; <sup>c</sup> Faculty of Public Health and Policy, London School of Hygiene & Tropical Medicine, 15-17 Tavistock Place, London WC1H 9SH, UK; <sup>d</sup> Health Behaviour Research Centre, Department of Epidemiology and Public Health, University College London, 1-19 Torrington Place, London WC1E 6BT, UK; <sup>e</sup> Department of General and Adolescent Paediatrics, Institute of Child Health, University College London, 30 Guilford Street, London WC1N 1EH, UK

**Key words:** paediatric obesity, parental perception, health risk

**Corresponding author:** Min Hae Park, Department of Non-communicable Disease Epidemiology, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK. Telephone: +44(0)2079272633. Email: minhae.park@lshtm.ac.uk

**Data access and responsibility:** MHP had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

**Word count (main text): 2,499**

**Word count: (abstract): 200**

Abbreviations: BANES – Bath and North East Somerset; BMI – body mass index; CI – confidence interval; IMD – Index of Multiple Deprivation; NCMP – National Child Measurement Programme; OR – odds ratio; PCT – Primary Care Trust

## **ABSTRACT**

### Objective

To identify the socio-demographic and behavioural characteristics associated with perceptions of weight-related health risk among the parents of overweight children.

### Methods

Baseline data from a cohort of parents of children aged 4-11 years in five areas in England in 2010-2011 were analysed; the sample was restricted to parents of overweight children (body mass index  $\geq 91^{\text{st}}$  centile of UK 1990 reference; n=579). Associations between respondent characteristics and parental perception of health risk associated with their child's weight were examined using logistic regression analyses.

### Results

Most parents (79%) did not perceive their child's weight to be a health risk. Perception of a health risk was associated with recognition of the child's overweight status (OR 10.59, 95% CI 5.51 to 20.34), having an obese child (OR 4.21, 95% CI 2.28 to 7.77), and having an older child (OR 2.67, 95% CI 1.32 to 5.41). However, 41% of parents who considered their child to be overweight did not perceive a health risk.

### Conclusions

Parents that recognise their child's overweight status, and the parents of obese and older children, are more likely to perceive a risk. However, many parents that acknowledge their child is overweight do not perceive a related health risk.

## **INTRODUCTION**

Being overweight in childhood is associated with a number of health problems, both during childhood (Weiss et al., 2004, Freedman et al., 2007) and in later life (Reilly and Kelly, 2011). Consequently, childhood obesity represents one of the foremost public health concerns in the United Kingdom (UK), and reducing its prevalence is a major priority for the government.

Family involvement is key for the effective treatment of childhood obesity (Luttikhuis et al., 2009), therefore parents' recognition of excess weight and its associated health risks in their children are likely to be important steps towards successful intervention. Parents who perceive their child's weight to be a health problem are more likely to be prepared to make behaviour changes to help with weight management (Rhee et al., 2005). However, more than 60% of parents fail to recognise their child is overweight (Rietmeijer-Mentink et al., 2013). Furthermore, while some parents may be generally aware of childhood obesity as a health risk (Etelson et al., 2003), they are often unconcerned about the health implications of their own child's overweight status (Crawford et al., 2006, Lampard et al., 2008).

Risk perception has been shown to be consistently associated with readiness to change health behaviours, and inaccurate parental perceptions of childhood weight status and health risk may compromise the success of interventions (Brewer et al., 2007, Wee et al., 2005). However, little is known about the factors that influence parents' perceptions of risk. Identifying parents who are least likely to perceive their child's excess weight as a health problem may highlight where obesity interventions can be targeted. The aim of this study was to identify the socio-demographic and behavioural characteristics associated with parental perceptions of the health risks associated with their child's overweight status.

## **MATERIALS AND METHODS**

We sampled cross-sectional baseline data from a prospective cohort, which has been described previously (Falconer et al., 2012). The cohort comprised the parents of children enrolled in the National Child Measurement Programme (NCMP) in five Primary Care Trusts (PCTs, administrative bodies that commission and manage the provision of primary care services in a local area) in England in 2010/2011. The NCMP is a government initiative which aims to measure the height and weight of every child in reception (aged 4-5) and year 6 (aged 10-11) at state-funded primary schools in England, and provides parents with written

feedback about their child's weight status. Parents of all children enrolled in the NCMP in PCTs in Redbridge, Islington, and West Essex, parents of children aged 10-11 years in Bath and North East Somerset (BANES) PCT, and parents of children aged 4-5 years in Sandwell PCT were invited to participate in the study (n=18,000). At baseline (6 weeks before NCMP feedback), participants completed a self-administered questionnaire which included questions on perceptions of their child's weight and health, lifestyle, and socio-demographic characteristics. In this study, analyses were restricted to participants whose children were identified as overweight or obese, defined as body mass index BMI at or above the 91<sup>st</sup> and 98<sup>th</sup> centiles of the UK 1990 reference population, respectively (Cole et al., 1995). The study was approved by the London School of Hygiene and Tropical Medicine ethics committee.

The primary outcome was parental perception of the health risks associated with their child's weight status (yes, perceives a health risk or no, does not), based on responses to the question, *Do you think your child's current weight puts their health at risk?*

The main predictor variable was parental recognition of child's overweight status. Parents who described their child as *overweight* or *very overweight* were categorised as recognising overweight status.

The following parental and family characteristics were explored as predictors: 1) parental weight status (overweight or not overweight), based on self-reported height and weight, cut off at BMI $\geq$ 25 kg/m<sup>2</sup> (WHO, 2006); 2) parent education, categorised as none/compulsory (up to age 16) or higher education; 3) family history of chronic disease (yes or no, based on history of obesity, diabetes, heart disease, hypertension, cancer or arthritis); and 4) general knowledge of the future health risks associated with childhood overweight: in a scale developed for this study, respondents were awarded a point for each condition correctly identified (diabetes, cancer, hypertension, arthritis, and heart disease), and this score was categorised as 'low' 0-1, 'moderate' 2-3, or 'high' 4-5.

Indicators of child lifestyle behaviours were also included (Crocker et al., 2012). Child's diet was assessed using a healthy eating score, based on frequency of consumption of fruits, vegetables, sugary drinks, and snacks. For each food category, a score ranging from 1 to 7 was generated (higher score for increasing consumption of fruit and vegetables, the reverse for other food categories). The healthy eating score was generated as a mean of the scores for each food category, with a higher score indicating healthier eating behaviours. A child's physical activity was categorised according to whether the child met recommended levels

( $\geq 60$  minutes per day) (Department of Health, 2011). Screen time (television and video game use) was assessed in a similar way, with responses categorised according to whether the child met screen time recommendations ( $\leq 2$  hours per day) or not (National Obesity Observatory, 2012). A binary ‘unhealthy lifestyle’ variable was generated to identify children who had a healthy eating score  $< 5$  and did not meet physical activity and screen time recommendations.

Other predictor variables were the child’s weight status from the NCMP (overweight or obese), child’s BMI Z-score (from UK 1990 reference population), child’s sex, school year, ethnicity (White or non-White), local area deprivation tertiles based on the Index of Multiple Deprivation (IMD) score (The Information Centre) from postal code, and PCT.

### **Statistical analyses**

The association between each predictor variable and perception of health risk was initially explored using  $\chi^2$  tests for categorical variables and t-tests for differences in means. In adjusted analyses, models were adjusted for all other predictor variables with  $< 50\%$  missing data. The unhealthy lifestyle variable was included in the model instead of individual behaviours as a sensitivity analysis; the difference was minimal, therefore individual behaviours are presented. Potential modification of the main effect (parental recognition of overweight status on the outcome) by PCT, school year, and child’s overweight status was assessed by the inclusion of interaction terms. All analyses were conducted using Stata 12 (College Station, TX: StataCorp).

## **RESULTS**

Of the 3,397 parents who responded to the baseline questionnaire (response rate=18.9%), 579 (17.0%) had children who were classified as overweight (10.2%) or obese (6.8%), and formed the sample for these analyses; BMI Z-score ranged from 1.09 to 4.41). The majority of respondents were mothers (85.6%); fathers made up 14.1%.

Respondent characteristics are presented in Table 1. Among the parents of overweight and obese children, 21.4% ( $n=118$ ) perceived their child’s weight to be a health risk. More than half of parents who recognised overweight perceived their child’s weight to be a health risk, compared to 10.1% of parents that did not consider their child to be overweight. In unadjusted analyses, more educated parents were less likely to perceive a health risk than those with only pre-16 education, and respondents with a family history of chronic diseases were more likely to recognise a risk (Table 2). Parents of children with unhealthy lifestyle

were more likely to consider their child's weight to be a health risk, and this effect remained after adjusting for child's overweight status (odds ratio OR 1.74; 95% confidence interval CI 1.09 to 2.76). Parents of obese children were more likely than parents of overweight children to perceive their child's weight to be a health risk, as were parents of older children. Other variables were not associated with perceptions of health risk.

In adjusted analyses, parental perception of health risk was associated with recognition of child's overweight status, child's overweight status, BMI Z-score, school year, and PCT (Table 2). Parental recognition of overweight was associated with a more than 10-fold increase in odds of perception of health risk (OR 10.59, 95% CI 5.51 to 20.341). There was no evidence of effect modification by PCT, school year or extent of child's overweight. Parents of obese children had increased odds of perceiving a health risk than parents of overweight children (OR 4.21, 95% CI 2.28 to 7.77). Parents of children aged 10-11 years had more than double the odds of the outcome than parents of children aged 4-5 (OR 2.67, 95% CI 1.32 to 5.41). Compared to parents in Islington PCT (a deprived, ethnically diverse area), parents in Redbridge and BANES PCTs were more likely to perceive a risk (ORs 4.43 and 4.04, respectively). There were no associations with other predictors in the final model.

## **DISCUSSION**

Our analysis showed that three-quarters of parents of overweight children did not recognise their child's overweight status, while nearly 80% did not perceive their child's weight to be a health risk. Parents that recognised their child's overweight status were more likely to perceive a health risk, but 41% of parents that recognised their child's overweight status did not consider the child's weight to present a risk. Parental perception of risk was also associated with child overweight status, age, and PCT.

This study was limited by the relatively small number of overweight children in the wider sample. Furthermore, the low response rate, typical of school-based postal surveys (Analitis et al., 2009, Baron-Cohen et al., 2009), raises the possibility of non-response bias; comparison of the study sample with all children participating in the NCMP in the five PCTs (n=18,000) showed that among respondents there were lower proportions of overweight children, ethnic minority families, and parents from the most deprived areas. Ethnic minority and low socio-economic groups are typically less likely participate in public health interventions, and have lower awareness of health risks; our sample may represent parents that are most likely to be concerned about their child's weight. The way in which perception

of health risk was assessed could have introduced error because the question did not differentiate between current and future health risk; parents that considered their child's overweight status to be a health risk in the longer term but not immediately may have been unsure how to respond. Our study examined only one aspect of risk; other dimensions, such as the perceived severity of obesity health risks in relation to other health problems (Brewer et al., 2007) or concern about future health, may provide a more complete picture of parental perceptions.

Few parents perceived their child's overweight status to present a health risk. This finding is consistent with previous studies; in one study, just 18% of parents of overweight children reported concern about their child's weight (Lampard et al., 2008), while in a sample of more severely overweight children, less than half of parents perceived their child's weight to be a potential health problem (Young-Hyman et al., 2000).

As expected, parents that recognised their child's overweight status were more likely to perceive a health risk than those that did not. However, 41% of parents that considered their child to be overweight did not perceive a risk. A previous review identified that many parents have a poor understanding of the relationships between obesity and health risks (Towns and D'Auria, 2009), but in our study, general knowledge did not predict parental perceptions of their own child's risk. A systematic review of qualitative studies exploring parental perceptions of healthy behaviours found that overweight was seen as problem for the future, and an issue that would affect other people's children rather than their own (Pocock et al., 2010). Another review suggested that parents of overweight children may use 'optimistic bias' as a way to cope with possible health risks (Towns and D'Auria, 2009). To some extent, the dissonance between parents' recognition of their child's overweight status and perceptions of weight-related health risk mirrors the lack of consensus about the prognostic value of childhood overweight (Owen et al., 2009, Li et al., 2011). Risk factors such as poor diet and sedentary lifestyle are also determinants of health risk; we show that parents of children with unhealthy lifestyle are more likely to perceive a health risk than parents of overweight children with a healthy lifestyle. However, 70% of parents of children with unhealthy lifestyle did not perceive a health risk.

Parents of obese children were more likely to perceive a health risk than parents of overweight children. This likely reflects the fact that very overweight children who are more likely to experience social problems, physical limitations, and health problems than those less

overweight (Hayden-Wade et al., 2005, Storch et al., 2007, Swallen et al., 2005). However, levels of perceived risk in both overweight categories were low. A recent German study (Warschburger and Kroller, 2012) showed that a fifth of parents would not engage in obesity prevention efforts until their child was very overweight (BMI >97<sup>th</sup> centile). Other studies have suggested that increasing prevalence of overweight in the population have changed perceptions of “normal” body size, leading to wide-spread underestimation of overweight (Johnson et al., 2008). More research into the factors influencing formation of parental perceptions of health risk, and the roles of social norms and information in this process, may provide insight into how key public health messages relating to childhood overweight can be communicated effectively.

Parents of older children were more likely to perceive a weight-related health risk than parents of younger children. One possible explanation for this finding is that parents view their child’s health in terms of the child’s lifestyle rather than their weight status (Campbell et al., 2006), and older children are more likely to have an unhealthy lifestyle (Dumith et al., 2011, Taveras et al., 2005). However, in this study, adjusting for lifestyle variables did not attenuate the association between child’s school year and perception of health risk. An alternative interpretation is that parents are more aware of the persistent nature of overweight in older children, while parents of younger children may feel that their child will outgrow their overweight status (Townes and D’Auria, 2009).

Parents in Redbridge and BANES PCTs were more likely to perceive their child’s overweight status to be a health risk than parents in Islington PCT. These effects were not explained by differences in the socio-demographic, lifestyle, or family characteristics assessed in this study. The differences may be due to residual effects of unmeasured variables, such as local health campaigns, or the outcome may appear variable due to the small number of PCTs sampled for this study.

## **CONCLUSIONS**

Parents may acknowledge that their child is overweight while not perceiving an associated health risk. Since parental recognition of the health risks associated with their child’s overweight status is a key step for families’ engagement with interventions, lack of perception could compromise efforts to tackle the childhood obesity epidemic at a population level. Interventions that focus on increasing recognition of childhood overweight status, and bridging the gap between recognition of overweight and perception of associated health risks,

are needed. Improved understanding of the formation of parental perceptions of health risk may inform how health professionals can better communicate the risks of overweight to parents and increase engagement with intervention efforts.

Table 1: Respondent characteristics: parents of overweight children aged 4/5 and 10/11 years participating in the National Child Measurement Programme in five areas in England in 2010/2011, by parental perception of the health risks associated with child's weight

Characteristic	Total	Parent perceives that child's weight puts health at risk <sup>a</sup>		
		No n (%)	Yes n (%)	P value <sup>b</sup>
Parent recognises child's overweight status	N=555	n=427	n=116	
No	426 (76.8)	375 (89.9)	42 (10.1)	
Yes	129 (23.3)	52 (41.3)	74 (58.7)	<0.001
Parental weight status <sup>c</sup>	N=205	n=159	n=42	
Healthy weight	81 (39.5)	65 (81.3)	15 (18.8)	
Overweight/obese	124 (60.5)	94 (77.7)	27 (22.3)	0.543
Parental education	N=224	n=173	n=45	
None or pre-16	58 (25.9)	38 (69.1)	17 (30.9)	
Higher education	166 (74.1)	135 (82.8)	28 (17.2)	0.030
Family history of disease <sup>d</sup>	N=223	n=170	n=47	
No	98 (44.0)	81 (85.3)	14 (14.7)	
Yes	125 (56.1)	89 (73.0)	33 (27.1)	0.029
Parent knowledge of health risks <sup>e</sup>	N=507	n=391	n=108	
Low	75 (14.8)	61 (84.7)	11 (15.3)	
Moderate	118 (23.3)	87 (75.7)	28 (24.3)	
High	314 (61.9)	243 (77.9)	69 (22.1)	0.323
Child's healthy eating score <sup>f</sup>	N=536	n=413	n=111	
Mean (SD)	4.7 (0.95)	4.75 (0.95)	4.52 (0.97)	0.022
Child meets recommended physical activity requirement	N=555	n=427	n=115	
No	406 (73.1)	302 (76.1)	95 (23.9)	
Yes	149 (26.9)	125 (86.2)	20 (13.8)	0.011
Child meets screen time recommendation	N=554	n=424	n=117	
No	299 (54.0)	216 (74.0)	75 (26.0)	
Yes	255 (46.0)	208 (83.5)	41 (16.5)	0.007
Unhealthy lifestyle <sup>g</sup>	N=524	n=402	n=110	
No	363 (69.3)	289 (81.6)	65 (18.4)	
Yes	161 (30.7)	113 (71.5)	45 (28.5)	0.010
Child's weight status	N=579	n=433	n=118	
Overweight	348 (60.1)	290 (88.4)	38 (11.6)	
Obese	231 (39.9)	143 (64.1)	80 (35.9)	<0.001
Child's BMI Z-score	N=495	n=388	n=107	

Mean (SD)	2.01 (0.6)	1.91 (0.53)	2.38 (0.60)	<0.001
Child's sex	N=574	n=431	n=117	
Female	293 (50.6)	218 (77.6)	63 (22.4)	
Male	286 (49.4)	213 (79.8)	54 (20.2)	0.531
Child's school year	N=579	n=433	n=118	
Age 4/5	293 (50.6)	247 (88.5)	32 (11.5)	
Age 10/11	286 (49.4)	186 (68.4)	86 (31.6)	<0.001
Ethnicity	N=571	n=428	n=117	
White	302 (52.9)	226 (77.9)	64 (22.1)	
Black	60 (10.5)	48 (87.3)	7 (12.7)	
Asian	130 (22.8)	95 (75.4)	31 (24.6)	
Mixed/other	79 (13.8)	59 (79.7)	15 (20.3)	0.340
Area deprivation tertile <sup>h</sup>	N=555	n=415	n=112	
1 – most deprived	185 (33.3)	133 (76.4)	41 (23.6)	
2	191 (34.4)	149 (81.0)	35 (19.0)	
3 – least deprived	179 (32.3)	133 (78.7)	36 (21.3)	0.576
PCT	N=564	n=433	n=118	
Islington	109 (19.3)	87 (82.9)	18 (17.1)	
Redbridge	241 (42.7)	180 (75.6)	58 (24.4)	
West Essex	127 (22.5)	103 (82.4)	22 (17.6)	
BANES	46 (8.2)	30 (68.2)	14 (31.8)	
Sandwell	41 (7.3)	33 (84.6)	6 (15.4)	0.129
Total		433 (78.6)	118 (21.4)	

Note that n in subgroups may not add up to N in 'Total' column due to missing data. <sup>a</sup> Row percentages presented. <sup>b</sup> From  $\chi^2$  test for difference between groups or t-test for difference in means; <sup>c</sup> From self-reported height and weight; <sup>d</sup> Family history of any of: diabetes, heart disease, high blood pressure, obesity, cancer or arthritis; <sup>e</sup> Knowledge score: +1 for each health problem identified correctly, low= 0 to 1, moderate= 2 to 3, high= 4 to 5; <sup>f</sup> Diet score generated as mean of scores for consumption of fruit and vegetables (higher consumption=higher score) and sugary drinks and sweet and savoury snacks (higher consumption=lower score), range 1-7; <sup>g</sup> Diet score <5 and did not meet physical activity and screen time recommendations; <sup>h</sup> Based on Index of Multiple Deprivation (IMD) score from postcode.

Table 2. Associations between respondent characteristics and parental perceptions of health risks associated with their child's weight among parents of children aged 4/5 and 10/11 years participating in the National Child Measurement Programme in five areas in England in 2010/2011 – results from unadjusted and adjusted logistic regression models

Characteristic	Unadjusted OR (95% CI)	Adjusted OR (95% CI) <sup>a</sup>
Parent recognises child's overweight status (ref: no)	<b>12.71</b> (7.89, 20.47)	<b>10.59</b> (5.51, 20.34)
Parental weight status (ref: healthy weight)	1.24 (0.61, 2.52)	-
Parental education (ref: none/pre-16)	<b>0.46</b> (0.23, 0.94)	-
Family history of chronic disease (ref: no)	<b>2.15</b> (1.07, 4.29)	-
Parent knowledge of health risks of obesity (ref: low)	1.15 (0.85, 1.55)	1.07 (0.69, 1.65)
Child's healthy eating score (per unit increase)	<b>0.78</b> (0.62, 0.96)	1.15 (0.83, 1.59)
Child meets physical activity recommendation (ref: no)	<b>0.51</b> (0.30, 0.86)	0.68 (0.32, 1.45)
Child meets screen time recommendation (ref: no)	<b>0.56</b> (0.37, 0.86)	0.95 (0.50, 1.84)
Child's overweight status (ref: overweight)	<b>4.27</b> (2.76, 6.60)	<b>4.21</b> (2.28, 7.77)
Child's BMI Z-score (per unit increase) <sup>b</sup>	<b>3.69</b> (2.53, 5.40)	<b>3.24</b> (1.86, 5.67)
Child's sex (ref: female)	0.88 (0.58, 1.32)	0.97 (0.53, 1.78)
Child's school year (ref: age 4/5)	<b>3.57</b> (2.28, 5.59)	<b>2.67</b> (1.32, 5.41)
Ethnicity (ref: white)	0.93 (0.61, 1.40)	0.65 (0.31, 1.41)
Area deprivation (per tertile from most to least deprived)	0.93 (0.72, 1.21)	0.65 (0.41, 1.03)
PCT (reference: Islington)		
Redbridge	1.56 (0.87, 2.80)	<b>4.43</b> (1.54, 12.70)
West Essex	1.03 (0.52, 2.05)	1.70 (0.53, 5.41)
BANES	2.26 (1.00, 5.08)	<b>4.04</b> (1.03, 15.90)
Sandwell	0.88 (0.32, 2.41)	2.08 (0.38, 11.29)

OR – odds ratio. <sup>a</sup> Adjusted for predictor variables with <50% missing data; final model includes all variables in table except for parental weight status, parental education, family history of chronic disease, and BMI Z-score. <sup>b</sup> BMI Z-score included instead of child weight status. ORs in bold indicate p-value <0.05.

Abbreviations: BANES – Bath and North East Somerset; BMI – body mass index; CI – confidence interval; IMD – Index of Multiple Deprivation; NCMP – National Child Measurement Programme; OR – odds ratio; PCT – Primary Care Trust

## **ACKNOWLEDGEMENTS**

We thank the Primary Care Trusts, schools, parents and children who participated in this study.

## **CONFLICTS OF INTEREST**

AK is also Director of Public Health Strategy and Medical Director of the Health Protection Agency. The views expressed in this paper are those of the authors, and are not intended to represent the views of the Health Protection Agency. The other authors have no conflicts of interest relevant to this article to disclose. The authors have no financial relationships relevant to this article to disclose.

## **FUNDING**

This article presents independent research funded by the National Institute for Health Research (NIHR) in England under its Programme Grants for Applied Research programme (RP-PG-0608-10035). The views expressed in this publication are those of the authors and do not necessarily reflect those of the NHS, the NIHR, or the Department of Health. SS is funded by an NIHR postdoctoral fellowship.

## REFERENCES

- ANALITIS, F., VELDERMAN, M. K., RAVENS-SIEBERER, U., DETMAR, S., ERHART, M., HERDMAN, M., BERRA, S., ALONSO, J., RAJMIL, L. & GROUP, A. T. E. K. 2009. Being Bullied: Associated Factors in Children and Adolescents 8 to 18 Years Old in 11 European Countries. *Pediatrics*, 123, 569-577.
- BARON-COHEN, S., SCOTT, F. J., ALLISON, C., WILLIAMS, J., BOLTON, P., MATTHEWS, F. E. & BRAYNE, C. 2009. Prevalence of autism-spectrum conditions: UK school-based population study. *The British Journal of Psychiatry*, 194, 500-509.
- BREWER, N. T., CHAPMAN, G. B., GIBBONS, F. X., GERRARD, M., MCCAUL, K. D. & WEINSTEIN, N. D. 2007. Meta-analysis of the relationship between risk perception and health behavior: The example of vaccination. *Health Psychology*, 26, 136-145.
- CAMPBELL, M., WILLIAMS, J., HAMPTON, A. & WAKE, M. 2006. Maternal concern and perceptions of overweight in Australian preschool-aged children. *Medical Journal of Australia*, 184, 274.
- COLE, T. J., FREEMAN, J. V. & PREECE, M. A. 1995. Body mass index reference curves for the UK, 1990. *Arch Dis Child*, 73, 25-9.
- CRAWFORD, D., TIMPERIO, A., TELFORD, A. & SALMON, J. 2006. Parental concerns about childhood obesity and the strategies employed to prevent unhealthy weight gain in children. *Public Health Nutrition*, 9, 889-95.
- CROKER, H., LUCAS, R. & WARDLE, J. 2012. Cluster-randomised trial to evaluate the 'Change for Life' mass media/ social marketing campaign in the UK. *BMC Public Health*, 12, 404.
- DEPARTMENT OF HEALTH 2011. Physical activity guidelines for children and young people (5-18 years): Factsheet 3. Crown Copyright.
- DEPARTMENT OF HEALTH CROSS GOVERNMENT OBESITY UNIT 2008. Healthy Weight, Healthy Lives; A Cross-Government Strategy for England. *In: HEALTH* (ed.). London.
- DUMITH, S. C., GIGANTE, D. P., DOMINGUES, M. R. & KOHL, H. W. 2011. Physical activity change during adolescence: a systematic review and a pooled analysis. *International Journal of Epidemiology*, 40, 685-98.

- ECKSTEIN, K. C., MIKHAIL, L. M., ARIZA, A. J., THOMSON, J. S., MILLARD, S. C., BINNS, H. J. & PEDIATRIC PRACTICE RESEARCH, G. 2006. Parents' perceptions of their child's weight and health. *Pediatrics*, 117, 681-90.
- ETELSON, D., BRAND, D. A., PATRICK, P. A. & SHIRALI, A. 2003. Childhood Obesity: Do Parents Recognize This Health Risk? *Obesity*, 11, 1362-1368.
- FALCONER, C., PARK, M., SKOW, A., BLACK, J., SOVIO, U., SAXENA, S., KESSEL, A., CROKER, H., MORRIS, S., VINER, R. & KINRA, S. 2012. Scoping the impact of the national child measurement programme feedback on the child obesity pathway: study protocol. *BMC Public Health*, 12, 783.
- FREEDMAN, D. S., MEI, Z., SRINIVASAN, S. R., BERENSON, G. S. & DIETZ, W. H. 2007. Cardiovascular Risk Factors and Excess Adiposity Among Overweight Children and Adolescents: The Bogalusa Heart Study. *The Journal of Pediatrics*, 150, 12-17.e2.
- HAYDEN-WADE, H. A., STEIN, R. I., GHADERI, A., SAELENS, B. E., ZABINSKI, M. F. & WILFLEY, D. E. 2005. Prevalence, Characteristics, and Correlates of Teasing Experiences among Overweight Children vs. Non-overweight Peers[ast][ast]. *Obesity*, 13, 1381-1392.
- JOHNSON, F., COOKE, L., CROKER, H. & WARDLE, J. 2008. Changing perceptions of weight in Great Britain: comparison of two population surveys. *BMJ*, 337.
- LAMPARD, A. M., BYRNE, S. M., ZUBRICK, S. R. & DAVIS, E. A. 2008. Parents' concern about their children's weight. *International Journal of Pediatric Obesity*, 3, 84-92.
- LI, L., PINOT DE MOIRA, A. & POWER, C. 2011. Predicting cardiovascular disease risk factors in midadulthood from childhood body mass index: utility of different cutoffs for childhood body mass index. *The American Journal of Clinical Nutrition*, 93, 1204-1211.
- LUTTIKHUIS, H. O., BAUR, L., JANSEN, H., SHREWSBURY, V. A., O'MALLEY, C., STOLK, R. P. & SUMMERBELL, C. D. 2009. Interventions for treating obesity in children. *Cochrane Database of Systematic Issue 1 Art. No.: CD001872*. DOI:10.1002/14651858.CD001872.pub2.
- NATIONAL OBESITY OBSERVATORY 2012. TV viewing and obesity in children and young people: evidence on a page. In: OBSERVATORY, N. O. (ed.).
- OWEN, C. G., WHINCUP, P. H., ORFEI, L., CHOU, Q. A., RUDNICKA, A. R., WATHERN, A. K., KAYE, S. J., ERIKSSON, J. G., OSMOND, C. & COOK, D. G.

2009. Is body mass index before middle age related to coronary heart disease risk in later life[quest] Evidence from observational studies. *Int J Obes*, 33, 866-877.
- POCOCK, M., TRIVEDI, D., WILLS, W., BUNN, F. & MAGNUSSON, J. 2010. Parental perceptions regarding healthy behaviours for preventing overweight and obesity in young children: a systematic review of qualitative studies. *Obesity Reviews*, 11, 338-53.
- REILLY, J. J. & KELLY, J. 2011. Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. *Int J Obes*, 35, 891-898.
- RHEE, K. E., DE LAGO, C. W., ARSCOTT-MILLS, T., MEHTA, S. D. & DAVIS, R. K. 2005. Factors Associated With Parental Readiness to Make Changes for Overweight Children. *Pediatrics*, 116, e94-e101.
- RIETMEIJER-MENTINK, M., PAULIS, W. D., VAN MIDDELKOOP, M., BINDELS, P. J. E. & VAN DER WOUDE, J. C. 2013. Difference between parental perception and actual weight status of children: a systematic review. *Maternal & Child Nutrition*, 9, 3-22.
- STORCH, E. A., MILSOM, V. A., DEBRAGANZA, N., LEWIN, A. B., GEFFKEN, G. R. & SILVERSTEIN, J. H. 2007. Peer Victimization, Psychosocial Adjustment, and Physical Activity in Overweight and At-Risk-For-Overweight Youth. *Journal of Pediatric Psychology*, 32, 80-89.
- SWALLEN, K. C., REITHER, E. N., HAAS, S. A. & MEIER, A. M. 2005. Overweight, Obesity, and Health-Related Quality of Life Among Adolescents: The National Longitudinal Study of Adolescent Health. *Pediatrics*, 115, 340-347.
- TAVERAS, E. M., BERKEY, C. S., RIFAS-SHIMAN, S. L., LUDWIG, D. S., ROCKETT, H. R. H., FIELD, A. E., COLDITZ, G. A. & GILLMAN, M. W. 2005. Association of Consumption of Fried Food Away From Home With Body Mass Index and Diet Quality in Older Children and Adolescents. *Pediatrics*, 116, e518-e524.
- THE INFORMATION CENTRE. *Index of Multiple Deprivation* [Online]. Available: <http://www.ic.nhs.uk/services/population-geography-information/geographical-information/index-of-multiple-deprivation> [Accessed August 2012].
- TOWNS, N. & D'AURIA, J. 2009. Parental Perceptions of Their Child's Overweight: An Integrative Review of the Literature. *Journal of Pediatric Nursing*, 24, 115-130.

- WARSCHBURGER, P. & KROLLER, K. 2012. Childhood overweight and obesity: maternal perceptions of the time for engaging in child weight management. *BMC Public Health*, 12, 295.
- WEE, C. C., DAVIS, R. B. & PHILLIPS, R. S. 2005. Stage of readiness to control weight and adopt weight control behaviors in primary care. *J Gen Intern Med*, 20, 410-5.
- WEISS, R., DZIURA, J., BURGERT, T. S., TAMBORLANE, W. V., TAKSALI, S. E., YECKEL, C. W., ALLEN, K., LOPES, M., SAVOYE, M., MORRISON, J., SHERWIN, R. S. & CAPRIO, S. 2004. Obesity and the Metabolic Syndrome in Children and Adolescents. *N Engl J Med*, 350, 2362-2374.
- WHO. 2006. *BMI classification* [Online].  
[http://www.who.int/bmi/index.jsp?introPage=intro\\_3.html](http://www.who.int/bmi/index.jsp?introPage=intro_3.html) Accessed 13th January 2009.
- YOUNG-HYMAN, D., HERMAN, L. J., SCOTT, D. L. & SCHLUNDT, D. G. 2000. Care Giver Perception of Children/'s Obesity-Related Health Risk: A Study of African American Families. *Obesity*, 8, 241-248.