



Published in final edited form as:

Child Abuse Negl. 2007 ; 31(11-12): 1187–1199. doi:10.1016/j.chiabu.2007.04.008.

The Association between Maltreatment and Obesity among Preschool Children

Robert C. Whitaker, MD, MPH^a, Shannon M. Phillips, BA^a, Sean M. Orzol, MPH^a, and Hillary L. Burdette, MD, MS^{b,c}

^aMathematica Policy Research, Inc., PO Box 2393, Princeton, NJ, USA

^bDivision of Gastroenterology, Hepatology, and Nutrition, Children's Hospital of Philadelphia, Philadelphia, PA, USA

^cDepartment of Pediatrics, University of Pennsylvania School of Medicine, Philadelphia, PA, USA

Abstract

Objective—To determine whether child maltreatment is associated with obesity in preschool children.

Methods—Data were obtained from the Fragile Families and Child Wellbeing Study, a birth cohort study of 4898 children born between 1998 and 2000 in 20 large US cities. At 3 years of age, 2412 of these children had their height and weight measured, and mothers answered items on the Parent-Child Conflict Tactics Scales about three types of child maltreatment—neglect, corporal punishment, and psychological aggression. The frequency of each type of maltreatment behavior in the prior year was analyzed using categories—ever/never for neglect and quintiles for the other 2 types of maltreatment. Child obesity was defined as measured body mass index (kg/m^2) \geq 95th percentile.

Results—Eighteen percent of the children were obese, and the prevalence of any episode of neglect, corporal punishment, and psychological aggression was 11%, 84%, and 93%, respectively. The odds of obesity were increased in children who had experienced neglect (odds ratio 1.56, 95% confidence interval, 1.14–2.14), after controlling for the income and number of children in the household, the mothers' race/ethnicity, education, marital status, body mass index, prenatal smoking, and age, and the children's sex and birth weight. Neither the frequency of corporal punishment nor psychological aggression was associated with an increased risk of obesity.

Conclusions—In a sample of preschool children from 20 large US cities, maternal self-report of neglectful behavior was associated with an increased risk of childhood obesity, after controlling for birth weight, maternal obesity, and multiple socioeconomic factors.

Introduction

Despite increasing interest in the primary prevention of obesity, there are few modifiable behaviors that have been shown to increase the risk of obesity in early childhood (Reilly et al., 2005). Researchers have examined the diet and activity behaviors that lead to energy imbalance, but these behaviors are difficult to assess in young children, and obesity can result

Address all correspondence and reprint requests to: Robert C. Whitaker, MD, MPH, Mathematica Policy Research, Inc., P.O. Box 2393, Princeton, NJ 08543-2393, Email: rwhitaker@mathematica-mpr.com; Phone: (609) 750-4094; Fax: (609) 799-0005.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

from even small daily imbalances in energy intake and expenditure (Hill, Wyatt, Reed, & Peters, 2003; Leibel, 1995).

Energy balance is regulated by the hypothalamus (Schwartz & Porte, 2005), and the hypothalamus is influenced by inputs from cortical and other limbic regions in the brain, which are subject to a wide variety of environmental influences. In early childhood, parents are a major environmental influence. The interactions between parents and children shape children's responses to stress, and these responses have both a behavioral and a neuro-endocrine component (Caldji, Diorio, & Meaney, 2000). It is plausible that the early entrainment of these stress responses affects how the brain regulates energy balance. If so, the social and emotional aspects of the parent-child interaction may also affect children's obesity risk, even when these interactions are not directly related to feeding, eating, or physical activity.

Over 15 years ago, Christoffel and Forsyth reported cases of what they called "severe childhood obesity of psychosocial origin" in which family characteristics, such as disorganization, episodic separation of mother and child, and ineffective limit setting were related to obesity in early childhood (Christoffel & Forsyth, 1989). Two subsequent epidemiologic studies have demonstrated a relationship between obesity in adulthood and childhood maltreatment, including neglect, verbal abuse, and physical abuse (Lissau & Sorensen, 1994; Williamson, Thompson, Anda, Dietz, & Felitti, 2002). However, to our knowledge, no epidemiologic study has addressed the association of maltreatment and obesity during childhood.

Using data collected in 20 U.S. cities, we assessed the relationship between three types of parent-reported child maltreatment—neglect, corporal punishment, and psychological aggression—and obesity at 3 years of age. We hypothesized that children who experienced greater levels of maltreatment would have an increased risk of obesity.

Methods

Study Design and Sample

The Fragile Families and Child Wellbeing Study is a birth cohort study, whose sampling design has been previously described (Reichman, Teitler, Garfinkel, & McLanahan, 2001). In brief, the cohort was drawn from births occurring in 1998-2000 in 75 hospitals across 20 large (population > 200,000) US cities in 15 states. Nonmarital births, so called "fragile families," were over sampled relative to marital births in a ratio of 3 to 1. Families were ineligible if the child was being placed for adoption, if the mother did not speak either English or Spanish well enough to understand the survey questions, or if she was too ill after delivery to participate in an interview. In addition, most hospitals did not allow mothers less than 18 years of age to participate. Among eligible mothers, 81.8% of those married and 87.2% of those unmarried agreed to participate. The institutional review boards at all 75 birth hospitals, as well as those at Princeton and Columbia Universities, approved the data collection procedures. All mothers gave informed written consent.

The mothers were surveyed in person at the birth hospital and then again by telephone approximately 1 and 3 years after delivery. At 3 years, an attempt was made to contact all 4898 mothers in the original birth cohort, and 2452 (50.1%) agreed to complete an additional in-home survey during which the children's and the mothers' heights and weights were measured. This report involves these 2452 children. In comparing these 2452 children to the 2446 not in the study sample, the mean household income was lower (income-to-poverty ratio at the child's birth, 1.70 vs. 1.99, $p < .001$) and the racial/ethnic composition was different (White, 19.3% vs. 22.8%; Black, 52.2% vs. 43.0%; Hispanic, 25.4% vs. 29.3%; and other race/ethnicity, 3.1% vs. 4.9%; $p < .001$). However, there was no significant difference between these two groups in the mothers' education level at the time of delivery.

Childhood Obesity

Interviewers were trained to measure height and weight in young children using a protocol modeled after the one established by the Centers for Disease Control and Prevention (1994). Children were weighed and measured in light clothes without shoes. Weight was obtained with an electronic scale (SECA 840 Bella Digital Scale, Hanover, MD), and stature was obtained with a portable stadiometer (SECA 214 Road Rod Stadiometer). Measurements were taken once and recorded to the nearest pound and to the nearest 0.1 centimeter. Body mass index (BMI) and BMI percentiles for age and sex were computed according to the Centers for Disease Control and Prevention 2000 growth reference (Kuczmarski et al., 2002). Using the nomenclature suggested by the Institute of Medicine (2005), all children with a BMI $\geq 95^{\text{th}}$ percentile were classified as “obese.”

Child Maltreatment

Child maltreatment was assessed by the Parent-Child Conflict Tactics Scales (CTSPC) (Straus, Hamby, Finkelhor, Moore, & Runyan, 1998). The full CTSPC contains 3 scales: (1) nonviolent discipline, which has 4 items about positive disciplinary practices, such as “time out” and redirection; (2) psychological aggression, which has 5 items about parental behaviors that can cause the child psychological pain or fear; and (3) physical assault, which has 13 items, ranging from corporal punishment, such as spanking, to extreme physical maltreatment, such as choking. In addition, the CTSPC contains a fourth supplemental scale called neglect, which has 5 items about the failure of parents to engage in behaviors that meet children’s developmental needs, such as giving children proper supervision.

The CTSPC items were administered in their specified order, but only 5 items on the physical assault scale were asked. These were 5 of the 6 items that comprise the subscale called corporal punishment, representing the mildest acts of physical assault. Although some of the behaviors on this corporal punishment subscale are common among parents of preschool children (Straus & Stewart, 1999), we still considered them in the spectrum of maltreatment because they have been shown to have both short and long-term impacts on children (Gershoff, 2002). Although the items in the nonviolent discipline scale were administered, we did not focus on this scale in our analysis, because these positive discipline practices are often highly correlated with the negative practices. This correlation likely reflects the fact that parents use both positive and negative disciplinary practices in dealing with their children’s misbehavior (Straus et al., 1998). In summary, we characterized child maltreatment using 15 items and three scales from the CTSPC: the neglect (5 items) and psychological aggression (5 items) scales plus the 5 of 6 items in the corporal punishment subscale of the physical assault scale (Table 1).

For each CTSPC item/behavior, there were 8 possible response options: “once,” “twice,” “3-5 times,” “6-10 times,” “11-20 times,” “more than 20 times” in the past year, “it has happened but not in the past year,” or “this never happened.” We converted these responses to numeric values (number of times parent reported doing behavior in the last year) in accordance with the published scoring recommendations for the CTSPC (Straus, 2004). We assigned a value of 0 to “this never happened” and to “it has happened but not in the past year,” a value of 1 to “once,” and a value of 2 to “twice.” In place of the ranges “3-5 times,” “6-10 times,” “11-20 times,” and “more than 20 times,” we substituted the values of 4, 8, 15, and 25, respectively.

For each scale we considered the child to have missing data for that scale if more than 1 item was missing. If only 1 item was missing, we assumed that parent had exhibited the behavior in the last year, and imputed a frequency value equal to the midpoint value of all parents who had ever reported doing that behavior. This assumption was based on prior research suggesting that respondents who skipped items on the physical assault scale of the Conflict Tactics Scales were likely to have engaged in the behavior but not reported it (McCarroll et al., 2000).

Although this may have slightly overestimated the scores on each scale, this would have had the effect of underestimating any association between maltreatment and obesity.

A summary score was created for each scale that summed the values across the items/behaviors in each scale. Because each scale had 5 behaviors, the scale scores took on the possible range of values from 0 (no behaviors in the scale ever occurred in the last year) to 125 (behaviors in the scale occurred 125 times in the last year).

Covariates

Interviewers also measured mothers' heights and weights, using the same equipment and methods that were used for the children. In two of the cities, heights were self-reported rather than measured. All mothers were weighed unless they were pregnant, exceeded the scale limit of 140 kg, or refused, in which case the subject was asked to report her current weight (or her pre-pregnant weight if she was pregnant).

Data on the number of children in the household and on the mother's education level and relationship status were obtained from the 3-year survey, but data on household income were not available from that survey. Income data from the 1-year survey was used unless these data were missing from the 1-year survey, in which case data from the survey at delivery was used (88 cases). The income-to-poverty ratio was calculated as the household income divided by the income at the federal poverty threshold for the year of the income report and household size. Data for other covariates were obtained from the birth survey and included the mother's race/ethnicity, age, and smoking status during pregnancy plus the child's sex and birth weight.

Statistical Analysis

Of the 2452 children with measured height and weight, we excluded 22 who did not live with their mother a majority of the time and 18 who were missing data on all 3 types of maltreatment. Therefore, the final analytic sample contained 2412 cases.

Each of the three types of child maltreatment was examined separately. Because the percentage of mothers who reported any of the neglect items was low (Table 1), we analyzed this type of maltreatment as a binary variable (ever/never in the last year). Children's exposure to corporal punishment and psychological aggression was categorized in quintiles with the upper quintile corresponding to those experiencing the highest frequency of maltreatment in the prior year. All covariates were analyzed as categorical variables. Chi-square tests were used to determine the significance of the association between the covariates and both maltreatment and obesity.

We then used a separate set of logistic regression models to examine the association between each measure of child maltreatment and the outcome, childhood obesity. In each set of models, we first entered the child maltreatment variable. In the next step, we added maternal BMI, because it was the covariate with the strongest relationship to childhood obesity, and in the final step we added the remaining covariates. In these regression analyses, the odds ratios for obesity associated with the child maltreatment variables were considered significant ($p < .05$) when the 95% confidence interval of the odds ratios excluded the value of 1.00. We also examined two-way interactions between the maltreatment variables and child sex, maternal race/ethnicity and household income. The models examining interactions contained all the covariates. We compared models with and without interaction terms using chi-square tests of differences in log likelihoods.

Results

The mean (SD) age of the children at the time of BMI measurement was 38.6 (3.2) months. Eleven percent of mothers reported an episode of neglect in the prior year, while an episode

of the other two types of maltreatment was more common (corporal punishment, 84% and psychological aggression, 93%). The most prevalent types of corporal punishment were spanking the child on the bottom with a bare hand and slapping the child on the hand, arm, or leg (Table 1). The two most prevalent types of psychological aggression were shouting, yelling, or screaming at the child and threatening to spank or hit the child but not actually doing it (Table 1). The prevalence of obesity in the children was 18.2%.

Tables 2 and 3 show the characteristics of the study population and their relationship to the types of maltreatment and childhood obesity. Almost half the children in the sample were living in households at or below the federal poverty threshold. Among the mothers, 52.1% were Black, 29.6% had not completed high school, 68.8% were unmarried, 18.8% were <20 years old at delivery, and 41.3% were obese (BMI ≥ 30 kg/m²). Women who had lower household income, were non-White, less educated, or single were more likely to report an episode of neglect. Children were more likely to experience corporal punishment and psychological aggression (i.e., were in the highest quintiles for each of these type of maltreatment) if they were male or had a mother who was Black, single, younger, or had a BMI ≥ 35 kg/m². The prevalence of obesity was higher among children who had higher birth weight or whose mothers were Hispanic, had less education, or had higher BMI.

Table 4 shows that the unadjusted prevalence of obesity was significantly higher in children who had experienced an episode of neglect in the prior year than in those who had not. However, there was no significant association between the prevalence of childhood obesity and the level of the children's exposure to corporal punishment or psychological aggression. This was also true when we examined corporal punishment or psychological aggression as binary variables (quintile 1 versus quintiles 2-5 [data not shown]).

These findings persisted after adjusting for maternal BMI plus multiple other covariates (Table 5). The adjusted odds ratio for obesity was 1.56 (95% confidence interval, 1.14-2.14) for children who had experienced neglect. After adjusting for covariates, there was still no significant association between childhood obesity and the other two measures of maltreatment. In multivariate analyses, there was no evidence of significant interaction between any type of maltreatment and child sex, maternal race/ethnicity, or household income (data not shown).

There was a wide range in the frequency of self-reported behaviors for items in the corporal punishment and psychological aggression scales (Table 1). For these two scales, the quintile measure used in our analysis could have placed more emphasis on the frequent but less severe behaviors in each scale than on the infrequent but more severe behaviors. If only the less frequent behaviors in each scale were associated with childhood obesity, the quintile measure might miss this association. Therefore, we reran our analyses using an alternative binary variable (yes/no) for corporal punishment and for psychological aggression. To make this variable, each type of maltreatment was considered to have occurred in the past year only if the mother reported doing either of the two most severe (infrequent) behaviors on each scale: "pinch" or "shook" for corporal punishment and "threatened to send away" or "called lazy or dumb" for psychological aggression (Table 1). Using these binary variables, the frequency of corporal punishment and psychological aggression were 13.6% and 9.8%, respectively, and neither type of maltreatment was significantly associated with childhood obesity (odds ratio 0.87, 95% confidence interval: 0.63, 1.20 and odds ratio 1.29, 95% confidence interval: 0.94, 1.77, respectively).

Discussion

In a national study of over 2400 urban, 3-year-old children, the odds of obesity were 50% higher for those who experienced neglect in the prior year compared to those who never

experienced an episode of neglect, suggesting that some aspects of early parent-child interaction that are not directly related to diet and physical activity may influence the risk of childhood obesity. This finding for neglect persisted after adjusting for maternal obesity and multiple sociodemographic covariates. However, we found no association between obesity and two other types of child maltreatment—corporal punishment and psychological aggression.

There have been few population-based studies of the relationship between obesity and child maltreatment. To our knowledge this is the first study to have examined the association between child maltreatment and obesity during childhood. Excluding the area of sexual abuse, there have been only two studies of adult obesity and childhood maltreatment. In a prospective study of 756 Danish school children who were 9 to 10 years-of-age, Lissau and Sorenson (1994) found that the odds of obesity in young adulthood, 10 years later, were increased 7 to 10 times among those who were “neglected” as children. Children were considered neglected on the basis of being rated by their teacher as having “no parental support” or by the school medical service (mainly school nurses) as having hygiene that was “dirty and neglected.” The authors controlled for socioeconomic status and obesity in childhood, but not for parental obesity. Only 38 subjects (5.0%) were classified as obese adults ($BMI \geq 26.9 \text{ kg/m}^2$ for men and $\geq 26.3 \text{ kg/m}^2$ for women). In a California health maintenance organization, Williamson and colleagues (2002) studied 13,177 adults, one fourth of whom were obese ($BMI \geq 30 \text{ kg/m}^2$) at a mean age of 56 years. After controlling for multiple adult characteristics, including education, smoking, and physical activity, the authors demonstrated an approximately 30 to 40% increase in the odds of obesity among those who reported either frequent verbal or physical abuse before 18 years of age. Neglect was not assessed in this study.

The underlying mechanism by which child maltreatment may lead to later obesity is uncertain. One potential mechanism is that maltreatment conditions the child to respond to stress by increasing food intake and/or decreasing activity (Greeno & Wing, 1994; Steptoe, Wardle, Pollard, Cnaan, & Davies, 1996). Childhood maltreatment is a well-established risk factor for later depression and anxiety (Mullen, Martin, Anderson, Romans, & Herbison, 1996; Oakley-Browne, Joyce, Wells, Bushnell, & Hornblow, 1995; Portegijs, Jeuken, van der Horst, Kraan, & Knottnerus, 1996), and several studies have now shown that symptoms of depression and anxiety in childhood are associated with the later development of obesity, particularly in females (Anderson, Cohen, Naumova, & Must, 2006; Goodman & Whitaker, 2002; Hasler et al., 2005; Pine, Goldstein, Wolk, & Weissman, 2001; Richardson et al., 2003). Depression and/or anxiety resulting from maltreatment may be associated with neuro-endocrine responses that alter metabolism, activity levels, or appetite (Bjorntorp, 2001; Chrousos, 2000; Nemeroff, 2004).

Although there may be no true association between childhood obesity and either corporal punishment or psychological aggression, a true association could have been missed in this study for several reasons. The impact of these two forms of maltreatment on obesity may only occur when these types of maltreatment are of a more severe or chronic nature than we assessed. It is also possible that the impact on obesity does not become apparent until an older age. Although we saw a range of exposures to these two types of maltreatment, some form of each type of maltreatment was experienced by nearly all children in the study, making a truly “unexposed” group hard to identify.

The items in the corporal punishment and psychological aggression scales of the CTSPC are all common discipline techniques which parents use in response to their children’s misbehavior and which a young child might come to anticipate. In contrast, the neglect items are parent behaviors, which are not usually prompted by the child’s misbehavior and which, in the child’s mind, may not seem like a predictable consequence of misbehavior. It may be the unexpected or non-contingent nature of neglect that heightens the child’s emotional distress. In this regard,

the emotional impact of neglect may be more like those of sexual abuse, another form of maltreatment that the child might not perceive to be a consequence of misbehavior even if the child internalizes the maltreatment as a punishment. The relationship between childhood sexual abuse and later obesity, especially among females, has been shown in several studies (Gustafson & Sarwer, 2004).

A final explanation for our contrasting findings across types of maltreatment, is that the common practice of corporal punishment and psychological aggression toward preschoolers may reflect the level of the child's gross motor activity at an age when many parental disciplinary efforts are directed at trying to shape their children's natural impulses to explore their environment and to establish autonomy (Straus & Stewart, 1999). Two-year olds who are more frequently "on the move" may have lower BMI and also tend to experience more parental discipline.

In interpreting our results, several limitations must be considered. Although the sample contained families from 15 states with a broad range of household income and maternal education levels, our findings are not meant to apply to all US 3-year-old children. The children in the study were living in large metropolitan areas and a high proportion of the children were born to unwed parents. In addition, mothers who did not speak English or Spanish were excluded, as were some mothers less than 18 years of age. In addition, the study involved only half the original birth cohort. Our results were not weighted for this non-response or for the sampling design, and it is possible that either of these factors introduced bias. Those who had height and weight measurements had a different racial/ethnic composition and lower income levels than those who did not have these measurements. We cannot determine how these differences might have influenced our findings about the relationship between maltreatment and obesity. However, in multivariate analyses, we found no significant interactions between our maltreatment variables and either race/ethnicity or income.

Our measurements of child maltreatment were based on parental self-reports and did not include measures of severe physical maltreatment or sexual abuse. In addition, we are unable to make inferences about causality from this cross-sectional study—either that neglect causes obesity or that obesity causes neglect. There may also be unmeasured factors that confound the relationship between neglect and obesity. Theoretically, these unmeasured factors would include diet or activity behaviors, but previous studies of preschool children have not shown any consistent relationships between measures of these behaviors and obesity (Reilly et al., 2005). We did account for the factors which have shown the strongest relationship to obesity at this age—the children's birth weight and the mothers' BMI, race/ethnicity, education, income, and smoking status (Whitaker, 2004b).

Evidence is now emerging that child maltreatment may be associated with later obesity. Child maltreatment is already well-established as a precursor of several mental health disorders, particularly mood and anxiety disorders (Kessler, Davis, & Kendler, 1997). Together these findings support other evidence that poor mental health and obesity, which are common, costly, and difficult to treat, are also related to each other (Faith, Matz, & Jorge, 2002; Whitaker, 2004a). If it can be established that child maltreatment is a modifiable risk factor that is shared by these chronic adult conditions, this might lead to the development of new obesity prevention strategies—ones that begin very early in life, include efforts not solely focused on diet and activity, and prevent more than obesity.

In addition to conducting more epidemiologic investigations of the association between maltreatment and obesity, future research should also focus on understanding potential mechanisms for this association. Specifically, that research might attempt to determine whether a child's stress response, which is entrained early in life by maltreatment and which can later

be activated by other stressful situations (McEwen, 2003), alters the brain mechanisms that regulate appetite or activity level.

In conclusion, our findings indicate that 3-year-old children have an increased risk of obesity if they experienced neglect in the prior year. This study adds to the existing evidence that mental health conditions and obesity have some shared developmental origins. Maintaining a healthy weight may be another positive outcome for children that could result from efforts to prevent child neglect.

Acknowledgements

Research support for this study came from the National Institutes of Health (R01-HD41141 and R01-HD36916), and a consortium of private foundations. We thank Jeffery A. Wright, MD for his critical review of this manuscript.

References

- Anderson SE, Cohen P, Naumova EN, Must A. Association of depression and anxiety disorders with weight change in a prospective community-based study of children followed up into adulthood. *Archives of Pediatrics Adolescent Medicine* 2006;160:285–291. [PubMed: 16520448]
- Bjorntorp P. Do stress reactions cause abdominal obesity and comorbidities? *Obesity Reviews* 2001;2:73–86. [PubMed: 12119665]
- Caldji C, Diorio J, Meaney MJ. Variations in maternal care in infancy regulate the development of stress reactivity. *Biological Psychiatry* 2000;48:1164–1174. [PubMed: 11137058]
- Centers for Disease Control and Prevention. *Enhanced Pediatric Nutrition Surveillance System (PedNSS) Manual*. Atlanta, GA: Centers for Disease Control and Prevention; 1994.
- Christoffel KK, Forsyth BW. Mirror image of environmental deprivation: Severe childhood obesity of psychosocial origin. *Child Abuse & Neglect* 1989;13:249–256. [PubMed: 2743183]
- Chrousos GP. The role of stress and the hypothalamic-pituitary-adrenal axis in the pathogenesis of the metabolic syndrome: Neuro-endocrine and target tissue-related causes. *International Journal of Obesity and Related Metabolic Disorders* 2000;24(Suppl 2):S50–55. [PubMed: 10997609]
- Faith MS, Matz PE, Jorge MA. Obesity-depression associations in the population. *Journal of Psychosomatic Research* 2002;53:935–942. [PubMed: 12377306]
- Gershoff ET. Corporal punishment by parents and associated child behaviors and experiences: A meta-analytic and theoretical review. *Psychological Bulletin* 2002;128:539–579. [PubMed: 12081081]
- Goodman E, Whitaker RC. A prospective study of the role of depression in the development and persistence of adolescent obesity. *Pediatrics* 2002;110:497–504. [PubMed: 12205250]
- Greeno CG, Wing RR. Stress-induced eating. *Psychological Bulletin* 1994;115:444–464. [PubMed: 8016287]
- Gustafson TB, Sarwer DB. Childhood sexual abuse and obesity. *Obesity Reviews* 2004;5:129–135. [PubMed: 15245381]
- Hasler G, Pine DS, Kleinbaum DG, Gamma A, Luckenbaugh D, Ajdacic V, Eich D, Rossler W, Angst J. Depressive symptoms during childhood and adult obesity: The Zurich Cohort Study. *Molecular Psychiatry* 2005;10:842–850. [PubMed: 15838533]
- Hill JO, Wyatt HR, Reed GW, Peters JC. Obesity and the environment: where do we go from here? *Science* 2003;299:853–855. [PubMed: 12574618]
- Institute of Medicine. *Preventing Childhood Obesity Health in the Balance*. Washington, DC: The National Academies Press; 2005. p. 79–81.
- Kessler RC, Davis CG, Kendler KS. Childhood adversity and adult psychiatric disorder in the US National Comorbidity Survey. *Psychological Medicine* 1997;27:1101–1119. [PubMed: 9300515]
- Kuczumski RJ, Ogden CL, Guo SS, Grummer-Strawn LM, Flegal KM, Mei Z, Wei R, Curtin LR, Roche AF, Johnson CL. 2000 CDC Growth Charts for the United States: Methods and development. *Vital and Health Statistics* 2002;11:1–190. [PubMed: 12043359]
- Leibel RL. Obesity: A game of inches. *Pediatrics* 1995;95:131–132. [PubMed: 7770290]

- Lissau I, Sorensen TI. Parental neglect during childhood and increased risk of obesity in young adulthood. *Lancet* 1994;343:324–327. [PubMed: 7905145]
- McCarroll JE, Thayer LE, Newby JH, Ursano RJ, Fullerton CS, Norwood AE. Are respondents who omit Conflict Tactics Scale items more violent than those who omit none? A methodological note. *Journal of Interpersonal Violence* 2000;15:872–881.
- McEwen BS. Mood disorders and allostatic load. *Biologic Psychiatry* 2003;54:200–207.
- Mullen PE, Martin JL, Anderson JC, Romans SE, Herbison GP. The long-term impact of the physical, emotional, and sexual abuse of children: A community study. *Child Abuse & Neglect* 1996;20:7–21. [PubMed: 8640429]
- Nemeroff CB. Neurobiological consequences of childhood trauma. *Journal of Clinical Psychiatry* 2004;65(Suppl 1):18–28. [PubMed: 14728093]
- Oakley-Browne MA, Joyce PR, Wells JE, Bushnell JA, Hornblow AR. Adverse parenting and other childhood experience as risk factors for depression in women aged 18–44 years. *Journal of Affect Disorders* 1995;34:13–23.
- Pine DS, Goldstein RB, Wolk S, Weissman MM. The association between childhood depression and adulthood body mass index. *Pediatrics* 2001;107:1049–1056. [PubMed: 11331685]
- Portegijs PJ, Jeuken FM, van der Horst FG, Kraan HF, Knottnerus JA. A troubled youth: Relations with somatization, depression and anxiety in adulthood. *Family Practice* 1996;13:1–11. [PubMed: 8671097]
- Reichman NE, Teitler JO, Garfinkel I, McLanahan SS. Fragile Families: Sample and design. *Children and Youth Services Review* 2001;23:303–326.
- Reilly JJ, Armstrong J, Dorosty AR, Emmett PM, Ness A, Rogers I, Steer C, Sherriff A. Early life risk factors for obesity in childhood: Cohort study. *British Medical Journal* 2005;330:1357. [PubMed: 15908441]
- Richardson LP, Davis R, Poulton R, McCauley E, Moffitt TE, Caspi A, Connell F. A longitudinal evaluation of adolescent depression and adult obesity. *Archives of Pediatrics Adolescent Medicine* 2003;157:739–745. [PubMed: 12912778]
- Schwartz MW, Porte D Jr. Diabetes, obesity, and the brain. *Science* 2005;307:375–379. [PubMed: 15662002]
- Steptoe A, Wardle J, Pollard TM, Cnaan L, Davies GJ. Stress, social support and health-related behavior: A study of smoking, alcohol consumption and physical exercise. *Journal of Psychosomatic Research* 1996;41:171–180. [PubMed: 8887830]
- Straus, MA. Scoring the CTS2 and CTSPC. Durham, NH: 2004 [April 7 2006]. Available at <http://pubpages.unh.edu/~mas2/CTS28a3.pdf>
- Straus MA, Hamby SL, Finkelhor D, Moore DW, Runyan D. Identification of child maltreatment with the Parent-Child Conflict Tactics Scales: Development and psychometric data for a national sample of American parents. *Child Abuse & Neglect* 1998;22:249–270. [PubMed: 9589178]
- Straus MA, Stewart JH. Corporal punishment by American parents: National data on prevalence, chronicity, severity, and duration, in relation to child and family characteristics. *Clinical Child & Family Psychology Review* 1999;2:55–70. [PubMed: 11225932]
- Whitaker RC. Mental health and obesity in pediatric primary care: A gap between importance and action. *Archives of Pediatrics Adolescent Medicine* 2004a;158:826–828. [PubMed: 15289259]
- Whitaker RC. Predicting preschooler obesity at birth: The role of maternal obesity in early pregnancy. *Pediatrics* 2004b;114:e29–36. [PubMed: 15231970]
- Williamson DF, Thompson TJ, Anda RF, Dietz WH, Felitti V. Body weight and obesity in adults and self-reported abuse in childhood. *International Journal of Obesity and Related Metabolic Disorders* 2002;26:1075–1082. [PubMed: 12119573]

Table 1
 Twelve-Month Prevalence of Maltreatment Events for 3-Year-Old Children as Self-Reported by Their Mothers (n=2412)

Parent-Child Conflicts Tactics Scales and Items	Ever in Last Year, %
Neglect ^d	
Were so caught up in your own problems that you were not able to show or tell your child that you loved him/her	7
Were not able to make sure your child got to a doctor or hospital when he/she needed it	3
Had to leave your child home alone, even when you thought some adult should be with him/her	2
Were not able to make sure your child got the food he/she needed	2
Were so drunk or high that you had a problem taking care of your child	1
Corporal punishment ^b	
Spanked him/her on the bottom with your bare hand	74
Slapped him/her on the hand, arm, or leg	63
Hit him/her on the bottom with something like a belt, hairbrush, a stick or some other hard object	26
Pinched him/her	9
Shook him/her	6
Psychological aggression ^b	
Shouted, yelled, or screamed at him/her	84
Threatened to spank or hit him/her but did not actually do it	80
Swore or cursed at him/her	20
Said you would send him/her away or kick him/her out of the house	6
Called him/her dumb or lazy or some other name like that	5

^aThese items were prefaced by the following statement: "Sometimes things can get in the way of caring for your child the way you would like to: for example, money problems, personal problems, or having a lot to do. Please tell me how many times in the last year this has happened to you in trying to care for your child. Please tell me how many times in the past year you (ITEM)."

^bThese items were prefaced by the following statement: "Children often do things that are wrong, disobey, or make their parents angry. We would like to know what you have done when your child did something wrong or made you upset or angry. I am going to read a list of things you might have done in the past year, and I would like you to tell me how often you have done each thing in the past year. How many times in the past year did you (ITEM)?"

Table 2
Prevalence of Maltreatment and Obesity by Level of Household and Child Characteristics

Characteristic, N ^a	%	Neglect, % Ever	Corporal Punishment, % Highest Quintile	Psychological Aggression, % Highest Quintile	Child Obese, % ^b
Income-to-poverty ratio					
<0.50	27.2	14.6	16.9	19.6	16.6
0.50 – 0.99	19.7	11.2	21.5	21.7	21.9
1.00 – 1.85	22.8	11.1	21.2	22.6	19.1
1.86 – 2.99	14.9	7.3	22.3	20.6	16.4
≥3.00	15.4	8.4	15.0	17.5	16.4
P value ^b		0.002	0.02	0.37	0.12
Number of children					
1	29.3	9.6	22.0	21.4	16.7
2-3	52.7	11.0	19.7	20.3	19.3
≥4	18.0	13.6	13.7	19.6	17.3
P value		0.12	0.002	0.74	0.32
Child sex					
Male	51.8	11.6	22.5	23.6	18.6
Female	48.2	10.5	15.8	17.3	17.7
P value		0.39	<0.001	<0.001	0.58
Birth weight (grams)					
<2500	9.6	14.3	17.8	19.5	13.4
25000-3999	83.2	11.1	19.3	20.6	17.9
≥4000	7.1	6.4	20.5	21.0	28.1
P value		0.04	0.78	0.91	<0.001

^a If N <2412, the subject was missing data for that item.

^b Body mass index ≥95th percentile.

Table 3
Prevalence of Maltreatment and Obesity by Level of Maternal Characteristics

Characteristic, N ^a	%	Neglect, % Ever	Corporal Punishment, % Highest Quintile	Psychological Aggression, % Highest Quintile	Child Obese, % ^b
Race/ethnicity					
White, non-Hispanic	19.4	6.0	17.5	16.6	14.7
Black, non-Hispanic	52.1	12.3	24.5	25.2	16.0
Hispanic (any race)	25.4	12.4	10.1	13.1	25.5
Other race, non-Hispanic	3.1	12.0	17.3	28.0	16.0
P value	0.002	0.002	<0.001	<0.001	<0.001
Education					
Less than high school	29.6	13.6	16.6	19.3	21.3
High school degree	29.2	11.1	21.9	21.2	17.4
Some college	30.4	10.9	22.1	23.4	17.2
College graduate or more	10.8	4.6	12.0	14.3	14.3
P value	0.002	0.002	<0.001	0.01	0.04
Relationship status					
Married	31.1	8.3	17.4	16.5	16.5
Cohabiting	30.8	10.8	17.5	19.6	19.6
Single	38.0	13.6	22.4	24.6	18.2
P value	0.002	0.002	0.011	<0.001	0.29
Age at delivery (years)					
<20	18.8	12.8	26.7	22.1	15.4
20-24	36.1	11.3	22.6	24.4	20.7
25-29	23.2	11.6	15.2	19.1	15.2
≥30	22.0	8.7	11.9	14.3	19.4
P value	0.19	0.19	<0.001	<0.001	0.02
Body mass index (kg/m ²)					
<25.0	31.2	12.4	18.4	17.8	12.6
25.0-29.9	27.5	9.6	17.5	19.3	16.4
30.0-34.9	19.6	9.2	18.4	21.8	21.4
≥35.0	21.7	13.0	25.5	26.1	23.0
P value	0.11	0.11	0.004	0.004	<0.001
Smoking in pregnancy					
None	80.9	10.3	18.8	19.2	18.4
<1 pack/day	16.8	14.8	21.7	26.5	15.3
≥1 pack/day	2.2	11.1	20.4	24.1	29.6
P value	0.03	0.03	0.38	0.004	0.03

^aIf N <2412, the subject was missing data for that item.

^bBody mass index ≥95th percentile.

Table 4
Prevalence of Obesity by the Level of Exposure to Types of Maltreatment

	Prevalence of Obesity, %
Neglect	
No	17.5
Yes	23.6
P value ^a	0.01
Corporal punishment	
Quintile 1 (0-1 times/yr)	19.8
Quintile 2 (2-6 times/yr)	19.8
Quintile 3 (7-14 times/yr)	18.4
Quintile 4 (15-30 times/yr)	15.0
Quintile 5 (31-104 times/yr)	17.8
P value ^b	0.12
Psychological aggression	
Quintile 1 (0-5 times/yr)	19.7
Quintile 2 (6-16 times/yr)	18.0
Quintile 3 (17-29 times/yr)	17.5
Quintile 4 (30-49 times/yr)	17.4
Quintile 5 (50-125 times/yr)	18.0
P value ^b	0.45

^aP value for the χ^2 test (Pearson).

^bP value for the χ^2 test (Cochran-Armitage trend test).

Table 5
Unadjusted and Adjusted Odds Ratios for Obesity Associated with Types of Maltreatment

	Unadjusted	Adjusted for Maternal BMI ^a	Adjusted for Maternal BMI and other Covariates ^b
Neglect ^c	1.46 (1.08-1.97)	1.48 (1.09-2.02)	1.56 (1.14-2.14)
Corporal punishment ^d	0.88 (0.68-1.13)	0.86 (0.67-1.12)	0.94 (0.72-1.24)
Psychological aggression ^e	0.88 (0.64-1.20)	0.87 (0.67-1.11)	0.90 (0.70-1.18)

^aMaternal BMI was missing for 145 cases (6%). In the logistic regression models, maternal BMI was entered as 4 dummy variables (25-29.9 kg/m², 30-34.9 kg/m², ≥35 kg/m², and missing BMI) with the omitted (reference) category being BMI <25 kg/m². An alternative specification of the models that excluded cases with missing BMI yielded similar results (data not shown).

^bCovariates include the following: the household's income-to-poverty ratio and number of children; the mother's race/ethnicity, education, relationship status, BMI, prenatal smoking status, and age at delivery; and the child's sex and birth weight.

^cChildren who experienced any episode of neglect the prior year compared to those who never experienced an episode.

^dChildren experiencing ≥2 episodes of corporal punishment in the prior year (exposure quintiles 2 to 5) compared to those who experienced <2 episodes (exposure quintile 1).

^eChildren experiencing ≥6 episodes of psychological aggression in the prior year (exposure quintiles 2 to 5) compared to those who experienced <6 episodes (exposure quintile 1).