# An 8-year follow up of treated obese children: children's, process and parental predictors of successful outcome

Ellen Moens[1], PhD, Caroline Braet[1], PhD & Myriam Van Winckel[2], PhD

[1]Department of Developmental, Personality and Social Psychology, Ghent University, H. Dunantlaan 2, Ghent, Belgium.

[2] Clinic of Paediatrics, University Hospital Ghent, Belgium

ellen.moens@ugent .be, caroline.braet@ugent.be & myriam.vanwinckel@ugent.be

Corresponding author:

Ellen Moens, Department of Developmental & Personality Psychology, Ghent University,

H. Dunantlaan 2,

9000 Ghent,

Belgium.

E-mail: ellen.moens@ugent.be

Tel : 0032 9 264.64.22

Fax : 0032 9 264.64.99

Abstract

**Objective** This study presents an 8-year outcome of overweight children who were treated in an outpatient program and aims to identify child and familial variables associated with long-term weight regulation. **Methods** A total of 90 children participated with a mean age of 10.1 years ± 2.6 at baseline and a mean adjusted BMI (actual BMI/50$^{th}$ percentile of BMI for age and gender x 100) of 153.1 ± 20.7% at baseline participated in the 8-year follow-up (retrieval rate 71%; response rate 89%). Children's and parental factors, administered at baseline and at follow-up were related to the success of the treatment. **Results** The children obtained a mean reduction of 8% in adjusted BMI at the 8-year follow-up. A total of 59 children (66%) were successful in obtaining weight control (i.e. maintaining their original % adjusted BMI); 40% even decreased their adjusted BMI by 10% or more. Analyses revealed that the child's age, the degree of overweight at baseline and the child's global self-worth were positive predictors of long-term weight loss 8 years after treatment, whereas psychopathology in the mother was a negative predictor. The total explained variance was $R^2$ = 35%. **Discussion** Treatment of childhood obesity by means of a multidisciplinary cognitive behavioural program enables the majority of children to control their weight in the long term. In order to predict the success of the treatment, it is recommended to take into account the child's age, its degree of overweight, its global self-worth and the occurrence of maternal psychopathology.

**Key Words** *childhood obesity, follow-up study, predictors, therapy success*

## Introduction

The increasing prevalence of childhood obesity is well established (Odgen, Flegal, Carroll, & Johnson, 2002). Being overweight has manifold consequences on health (Dietz, 1998) and psychological well-being (e.g. Gortmaker, Must, Perrin, Sobol, & Dietz, 1993), and several studies have tracked obesity from childhood to adulthood (Whitaker, Wright, Pepe, Seidel, & Dietz, 1997). Preventing obesity from emerging in childhood, as well as developing an effective treatment for overweight children have become important issues of concern. It is now generally accepted that there are numerous benefits to a multidisciplinary approach that focuses on healthy eating habits, moderate exercise and behavioural modification (Goldfield & Epstein, 2002). Several studies have shown positive and encouraging outcomes of such treatment in the short term. However, there is still a scarcity of long-term follow-up studies.

To our knowledge, only four studies reported the long-term follow-up results of treated obese children. Nuutinen and Knip (1992) found that after 5 years, the treated children showed a mean relative weight decrease of 12.8% (weight here is expressed as a percentage of the standard body weight for age, height and sex). Braet and Van Winckel (2000) presented data of a 4.6 year–outcome of obese children that had followed a cognitive-behavioural modification program. Overall, these children showed a mean reduction in their overweight of 11%. Although their mean adjusted BMI was still 42%, 25% of the children achieved a non-obese status. Also, Epstein, and colleagues found that significant weight losses could be maintained in children over a long term period (Epstein, McCurley, Wing and Valoski, 1990). In a 10 year follow-up, they found reductions varying between 8% and 20% across four studies (dependent on the specific group targeted and the specific focus of the intervention; Epstein, Valoski, Wing, & McCurley, 1994). Of the group they studied, 33% of the treated children were no longer obese. Finally, one other study conducted a 12-year follow-up to assess tracking for body weight from childhood to adulthood. This study (Togashi et al.,

2002) focused on Japanese obese children who had followed a weight control program. At discharge, the children exhibited a mean reduction of 18.9% in their relative weight. At the 12-year follow-up, however, their BMI levels were again comparable with those at entry. In 54.7% of all cases, childhood obesity tracked into adulthood obesity or overweight. Severely obese children (36.7%) were found to be more likely to be obese as an adult in comparison with moderately obese children (16.8%) (Togashi et al., 2002).

Despite different criteria to evaluate obesity and define successful weight loss, the results from these follow-up studies generally provide evidence for the benefits of weight control programs for approximately 50% of all obese treated children. However, why some children respond differently to obesity treatment remains unclear. Prompted by this heterogeneity of individual results, many studies have attempted to identify variables associated with weight outcomes. The validity of such research lies in the fact that, in order to improve obesity treatment, it is crucial to identify predictors that may enhance or impede weight control for children (Texeira, Going, Sardinha, & Lohman, 2005). Moreover, this line of research will eventually even allow for individuals to receive treatment that is tailored to their specific needs (Brownell, 1984).

Several process variables have been identified as affecting success in weight control programs, including program adherence (Valverde, Patin, Oliveira, Lopez, & Vitolo, 1998), satisfaction with obesity treatment in childhood (Togashi et al., 2002), initial treatment success (Braet, 2006), participation in exercise groups (Reinehr, Brylak, Alexy, Kersting, & Andler, 2003), self-monitoring weight (Epstein et al., 1994) and changes in dietary habits after treatment (Nuutinen & Knip, 1992; Togashi et al., 2002). These factors can be carefully assessed during treatment, but they cannot predict outcome at baseline.

Studies on the children's own characteristics found that initial relative weight was a good predictor of weight outcome (Braet, 2006; Epstein et al., 1994). Until now, only one

study has examined the predictive value of baseline symptomatology and psychopathology in children in the context of childhood obesity treatment. This study by Braet (2006) showed that psychological measures did not predict weight loss in a pediatric population of severely obese patients, whereas higher levels of baseline symptomatology did predict outcomes in terms of behavioural and psychological treatment changes.

The role of familial demographic variables as potential predictors of treatment outcome is a valid research topic for several reasons. The family context could determine whether parents can offer support and pay attention to their children's treatment. Following this line of thought, Epstein and Wing (1987) assumed that more stressful familial events (such as lower socio-economic position) could be negatively related to the amount of time that parents can spend on their children's eating behaviour. However, there are numerous studies in which the family's socio-economic situation did not emerge as a significant predictor (Braet, 2006; Epstein et al., 1994; Nuutinen & Knip, 1992; Reinehr et al., 2003).

Instead, it is probable that more proximal factors are involved, such as maternal BMI at entry (Favaro & Santonastaso, 1995; Reinehr et al. 2003; Togashi et al., 2002) and decrease in maternal BMI during treatment (Epstein et al., 1990; Nuutinen & Knip, 1992) . The role of these two aspects has been extensively researched, but few studies have evaluated broader parent characteristics and their relationship with children's outcome. In this context, White et al. (2004) pointed out that significant predictors for adolescent weight loss are parents' satisfaction with life and family satisfaction in particular. This is an interesting research domain that needs to be further explored. Is parental satisfaction related with parental coping behaviour or with parental psychopathology? Favaro & Santonastaso (1995) found that overweight children who lost less weight had an obese mother with a neurotic psychopathology. Replication and elaboration of this pilot-study is warranted, however. Parental coping behaviour was studied in terms of its course and adaptivity with chronic

disease in children. A study by Goldbeck, Braun, Storck, Tonnessen, Weyhreter, & Debatin (2001) indicated that a stable and active parental coping style is related to an increased quality of life for both chronically ill children and parents. Whether these relations also occur in families with obese children has not yet been investigated.

The main goal of this article is to present an 8-year outcome of overweight children treated in an outpatient program. Because variables other than the treatment program can influence the change in percentage overweight over the years, additional weight control attempts after the outpatient program were also questioned. It is our hypothesis that these attempts can interfere with long-term weight outcome, as was shown in previous research (e.g. Togashi et al., 2002).

Our second goal is to identify variables associated with long-term weight regulation. Based on the evidence that supports a family-based behavioural treatment of childhood obesity, we expect significant contributions of familial factors. So far, research has succeeded in identifying isolated predictors. Based on the review of Teixeira et al. (2005) on adult psychosocial pre-treatment predictors of weight control, we aim to further explore the impact of predictors by using a bio-psycho-social profile in order to conceive stronger predictive models. As such, we want to consider biological (children's and parents' weight status), behavioural (process variables: treatment adherence, initial treatment success and continuing participation in lasting weight control attempts), and psychosocial (children's and parents' psychological variables and familial socio-economic position) outcomes.

## Method

### *Subjects*

At admission the participating children (n=90) consisted of 34 boys and 56 girls; their mean age was 10.12 years (*SD* = 2.56) and they had a mean adjusted BMI of 153.12 % (SD = 20.65). The mean BMI *z*-score was 2.17 for boys (varying from 0.97 to 2.47) and 2.09 for

girls (varying from 0.97 and 2.64). Their mothers had a mean BMI of 26.26 (*SD* = 4.88), fathers had a mean BMI of 27.49 (*SD* = 3.54). At baseline, 87.5% of the participating families were intact. All economic classes were represented: 20% of the participating families were lower social class, 65% were middle class and 15% were classified as upper class (categorized according to the Hollingshead index, 1975).

*Procedure*

In this section we will describe: (1) the intake procedure, (2) the standard treatment protocol and (3) the long-term follow-up procedure.

Between January 1994 and December 1997, 230 children and their families sought advice for obesity at the Ghent University Children's Clinic. 142 children met the inclusion criteria for the treatment protocol: (1) child's age between 4 and 17 years and (2) overweight of 20%-80% (3) medical clearance from a physician (to screen for secondary overweight, caused by endocrinological, chromosomal, hypothalamic diseases or by mental retardation) and (4) living within a radius of 50 km from the Clinic. 88 children felt not within the criteria, mainly because the distance criterion.

The treatment consists of a non-diet healthy lifestyle program focusing on three major components: healthy eating habits, moderate exercise and cognitive behavioural techniques. The goal is the achievement of weight control, in stead of weight loss. The standard treatment package is directed to children with overweight (between 20% and 80% overweight) and can be implemented in a group or individual format. The training takes place over the period of 1 year, divided into 2 phases: a standard treatment phase and a follow-up phase. The standard treatment phase consists of 2 parts (in total 8 sessions): (a) screening and motivation with the family (2 sessions in 3 weeks): a paediatrician, a dietician and a psychologist are responsible for an intensive screening and motivation of the child and the family. Treatment modality depends upon the results of this phase and also takes into account the age of the child. Group

sessions are directed to children from 8 to 13 years of age, while children younger than 8 years and older than 13 years were automatically assigned to the individual format. 11 children between 8 and 13 year were nevertheless seen in an individual program due to too many barriers to follow the group program (motivational and practical circumstances); (b) an intensive treatment phase: includes six biweekly group/individual sessions (twelve weeks). Food and exercise diaries and contracts are reviewed each meeting which results in step to step dietary and physical activity guidelines and the setting of new personal goals. Behavioural modification techniques include self-regulation and problem-solving skills. The program is described in detail in Braet & Van Winckel (2000); (2) a follow-up phase: the standard treatment is followed by monthly meetings continuing for 4-8 months after the last session. Whereas in the 15-week standard treatment phase the focus is mainly on the child, the follow-up phase consists of meetings with the parents and child in order to establish lifestyle changes and motivate the family to continue weight control efforts like participating in exercise programs.

In 2002-2003, 8 years later ($M$ = 8.05 years, $SD$ = 1.34), this group of 142 children were contacted again. 101 children were retrieved (retrieval rate: 71%), 41 were categorized as missing mainly due to moving and/or change of telephone number. Among the group of 101 retrieved children 90 agreed to participate in the study (response rate of 89%), 10 refused and 1 had deceased by a traffic accident. All participants consented to be in the study and the protocol was approved by the Ethical Committee of the Ghent University. There were no significant baseline differences between participants, refusers and missing subjects (controlled for gender, age at admission, adjusted BMI at admission, parental BMI at admission, familial socio-economic position and children ‘s psychopathology measures). See Figure 1 for a participant flow through the study.

Measurements contained information gathered at baseline as well as variables collected at the 8-year follow-up by trained psychologists. At the initial contact height and weight of the child was measured by the physician and children and parents completed questionnaires regarding the child's general and eating psychopathology and the child's self-esteem. At the follow-up self-reported weight and height and the prevalence of parental psychopathology and coping behaviour was questioned. These latter variables were collected retrospectively by asking about behaviours over the last years. Of the 90 families participating in the follow-up study, 56 agreed to fill in additional questionnaires. Finally, information regarding additional care during the follow-up was questioned in all children (n = 90) to control for other potential factors contributing to improved weight status.

*Measures*

*Antropometric and demographic measures*

At admission and after the last attented session of the standard treatment program, children were weighed at the clinic on a balance-beam scale. Height was measured with a wall-mounted stadiometer. At follow-up, weight and height were obtained by telephone. Given that self reported anthropometric data can suffer from underestimation, we asked the families whether their child could be weighed by a researcher during a home visit. At random, 10 families were requested and agreed to a home visit two weeks after the phone call. The findings revealed no significant differences between the self reported and measured weight and height. Nevertheless, we used the equations from Epstein et al. (1994) based on data of over 1,000 pairs of measured and self reported data: girls' weight, $Y_G = 2.472 + 1.006X_G$; boys' weight, $Y_B = 0.373 + 1.016X_B$; girls' height, $Y_G = 2.860 + .949X_G$; boys' height, $Y_B = 2.642 + 0.952X_B$ (with X = self reported weight or height and Y = the corrected weight or height).

At admission, the adjusted BMI for all children (Actual BMI/Percentile 50 of BMI for age and gender x 100) was calculated. Children's overweight (defined as adjusted BMI between 120% - 140%) and obese status (defined as adjusted BMI > 140%) was identified in relation to a European body mass norm group in 0-21 year olds (Frederiks, van Buuren, Wit, & Verloove-Vanhorick, 1997). At long term follow up, for youngsters of 22 years or older, the adjusted BMI was calculated with adult standards (Demarest et al., 1998). In addition, to compare the degree of overweight of the present European sample with US-studies on overweight, BMI percentiles and BMI z-scores were calculated using a program provided by the Centers for Disease Control and Prevention (CDC) (Centers for Disease Control and Prevention, 2000). For parents, the BMI for adults (weight/height$^2$) was calculated on the basis of parents' self-reported height and weight at intake.

The familial socio-economic situation was calculated using the Hollingshead Index of Social Position (ISP), which includes parents' education and occupation and results in an ISP-total score and five social position indexes (Hollingshead, 1975). In order to avoid cells with expected count less than five, we recoded the five social position indexes into three social classes (upper, upper middle into 'high' and middle into 'middle' and lower middle and lower into 'low').

*Measurement of children's psychological variables*

Children's eating behaviour was measured by the 'Dutch Eating Behaviour Questionnaire' – Child version and Parent Version (original DEBQ; van Strien, Frijters, Bergers & Defares, 1986; Child version and Parent version; Braet, 2006). This instrument assesses external eating (10 items), emotional eating (13 items) and restrained eating (10 items). Items are scored on a 5-point Likert scale and subscale scores are calculated by adding the individual item scores. In the Child version, the phrasing of the original DEBQ was slightly adapted in order to enhance the children's comprehension of the items. The content

was not modified. The parent version assesses the parental perspective on the child's eating behaviour. Recent research revealed satisfying internal consistency and external validity and a stable factor structure for the DEBQ Child version (Braet et. al., in press, Caccialanza et. al., 2004; Ricciardelli & McCabe, 2001) and the Parent version (Braet & van Strien, 1997). The present study found Cronbach alphas varying from .79 to .88 for the Child version and from .85 to .95 for the Parent version.

The 'Self-Perception Profile for Children' and the 'Self Perception Profile for Adolescents' (SPPC, Harter, 1985; Dutch version by Veerman, Staathof & Treffers, 1994; SPPA; Harter, 1988/1991) assesses self reports on different domains of the self-perception of children (8 to 12 years of age) and adolescents (older than 12 years). The domains define distinct factors that provide a differentiated and meaningful profile of youngsters' self-esteem: School Competency, Social Acceptation, Athletic Competency, Physical Appearance and Behavioural Conduct. A sixth scale provides an independent measure of Global Self-Perception. The internal consistency reliabilities for all six subscales are quite acceptable (alpha values vary from .68 to .79 for the child version; Veerman et al., 1994 and from .56 to .76 for the adolescent version; Wichstrom, 1995).

The 'Child Behaviour Checklist' (CBCL, Achenbach & Edelbrock, 1983; Dutch version by Verhulst, Koot, Akkerhuis, & Veerman, 1990) assesses the parental perspective on emotional and behavioural problems of children and adolescents between 4 and 18 years of age. Parents rate the presence and intensity of their child's display of 113 behaviours and symptoms over the past six months. The items represent eight syndromes of psychopathology that can be situated around two broadband dimensions: Internalizing versus Externalizing Behaviour. Finally, a total score can be calculated as a global index of the extent in which emotional and behavioural problems are present. Only the two broadband dimensions and the total score were included in the present study. The manual reports test-retest reliability

correlations between .82 and .95 for the eight subscales and of .93 for the Total Problem score. This is replicated in the Dutch version (Verhulst et.al., 1990). Studies of the predictive and the cross-cultural construct validity are satisfactory.

*Measurement of maternal psychological variables*

The Symptom Checklist (SCL-90; Derogatis, 1983; Dutch version by Arrindell & Ettema, 1986) is a 90-item self report questionnaire that measures psychological symptoms in adolescents and adults. It yields nine dimensions of psychological distress and a global index of functioning. The SCL-90 demonstrates adequate internal scale consistency (.77-.90) and sufficiently good test retest reliability. This is replicated in the Dutch version (Arrindell & Ettema, 1986). The present study found Cronbach alphas varying from .59 to .93. All scales were included in the present study.

The Utrechtse Coping List (UCL; Schreurs, Van De Willige, Brosschot, Tellegen, & Graus, 1993) is a questionnaire that measures the coping behaviour in confrontation with problems or important life-events that require adaptation. It consists of seven subscales representing different coping styles: Active problem solving, Palliative reaction, Avoidance, Socialization, Expression of Emotions and Self-encouragement. In this study, the mother was requested to report on their own coping behaviour with regard to the overweight problem of her child. In a Dutch population, the UCL has been found to have satisfactory psychometric properties with Cronbach alphas ranging from .64 to .82 and a adequate factorial structure (Schreurs et al., 1993). All scales were used in the analyses.

*Measurement of process variables*

*Treatment Adherence.* Treatment adherence was assessed by the total number of participated sessions and by dividing the participants into ‘completers’ and ‘non-completers’. Completers attended at least 4 sessions of the 15-week standard treatment (total = 8 sessions) and the non-completers participated in less than 4 sessions.

*Initial weight loss* The variable Initial weight loss was expressed as a change score (baseline adjusted BMI minus adjusted BMI at the last attended session of the standard treatment). We defined subjects who were successful in achieving weight control or weight loss at post treatment as 'maintainers' (even if they lost some weight during the treatment). Subjects who gained weight during treatment were categorized as 'gainers'.

*Additional care.* Information regarding additional care during the follow-up period was questioned via a standardized structured interview. All organized participation in sport clubs or self help groups and consultations with dietician and family doctors were categorized as 'self-directed care'. More specialized care in terms of residential treatment or bariatric surgery was categorized as 'advanced care'. The total number of additional care sought was also calculated. In the case of unclear answers (because the youngster did not remember any more or was not sure), we gave a score of 0. This was the case for two youngsters of the total sample.

*Overview of the statistical analyses*

Statistical analyses were carried out using SPSS 12.0. To examine the outcome of the 8-year follow-up, an ANOVA with repeated measures was executed with Weight change as a three-level within-subject factor (pre-, post-, and long-term follow-up measurement; respectively *M1, M2 and M3*), Additional care (no care vs. self-directed care vs. advanced care) as between subject factor while controlling for Treatment adherence and Initial weight loss (both entered as covariates). Where appropriate, post-hoc analyses were conducted using pairwise comparisons with a Bonferroni correction in order to protect against inflation of the per family type I error rate (Howell, 1997).

Finally, hierarchical regression analyses assessed independent and incremental correlates of changes in weight. The aim was to attempt as broad as a range of measures without overloading the analysis with possible redundant variables. Therefore, the selection of

potential predictors was based on preliminary correlation analyses. The variables were entered by blocks into the regression equation. As several child and process variables already have been identified as isolated predictors of long-term weight outcome and evidence regarding parental factors is still incomplete, children characteristics and process variables were entered respectively in a first and second block. Parental characteristics were entered in a third block to examine additional % explained variance over and above child and process variables.

## Results

### *Weight Change*

A repeated-measures analysis was conducted and revealed a significant main effect of the within subjects factor Weight change ($F$ (1, 85) = 5.89, $p < .02$). The Adjusted BMI of all participants showed significant decreases over the three measurements (*M1* = 153.12%, *M2* = 150.54%, *M3* = 144.83%). This was a mean reduction of 8% obtained at the 8 years follow-up. Pairwise comparisons showed significant differences between the pre- and post measurement ($t(89) = 2.86$, $p < .01$) and between the pre- and long-term follow-up measurement ($t(89) = 2.81$, $p < .01$). After applying the stringent Bonferroni correction (by lowering the significance level to .05/3 = .02), these results remain significant. At a descriptive level, we found that At admission, 28% of the children were classified as overweight and 72% as obese. At the 8-year follow-up 19% of the treated children were no longer overweight, 34% achieved the overweight status and 47% the obese status.

Furthermore, the ANOVA with repeated measures showed a significant main effect due to the between subject factor Additional care, $F(2,85) = 8.18$, $p < .001$. Next, two significant interaction effect were also found: Weight change x Additional Care ($F(2,85) = 3.23$, $p <.05$) and Weight change x Initial weight loss ($F(1,85) = 7.32$, $p <.01$) indicating different patterns of adjusted BMI evolution over the three measurements.

### *Additional care*

We further explored the interaction effect. Figure 2 shows the weight change in the no additional care group ($M1$ = 149.83%; $M2$ = 146.08%; $M3$ = 136.55%), the group who sought self-directed care ($M1$ = 148.46%; $M2$ = 144.45%; $M3$ = 146.98%) and the group with advanced care ($M1$ = 169.16%; $M2$ = 171.82%; $M3$ = 155.95%).

Sixty two percent of the participating subjects sought additional care over the 8 years of follow-up (varying from 0 to 4 attempts). The majority of the subjects (33.3%) reported 1 effort, 24.4% reported 2 efforts, 1.1% reported 3 efforts and 3.3% reported 4 efforts ($M$ = 1.03, $SD$ = 0.99). Approximately half of the efforts (51%) were self directed or easy accessible: 30% engaged in a sports club, 21.1% consulted a dietician, 11% participated in self-help groups and 10% consulted the family doctor. Other subjects engaged in advanced treatment programmes: 16.7% sought residential care and 6% of the youngsters were involved in bariatric surgery. Univariate analysis of variance revealed no significant differences in number of additional care sought across completers and non-completers.

Subjects reporting no additional care (n = 34), subjects who reported self-directed care (n = 38) and subjects who sought advanced care (n = 18) did not differ on gender, age, parental BMI, familial socio-economic position, children's psychological variables (as measured with the DEBQ and the SPPC-SPPA) and parental psychological variables (as measured with the SCL-90 and UCL).

One-Way ANOVA's (adjusted for multiple comparisons by the Bonferroni correction) revealed significant differences between groups on the adjusted BMI at baseline and initial weight loss, respectively $F(2,85) = 7.80$, $p < .001$ and $F(2,76) = 4.52$, $p < .05$. Descriptive statistics show higher adjusted BMI's at baseline for the group who sought advanced care ($M1$ = 169.16%) in comparison with the no care group ($M1$ = 149.83%; $p < .01$) and with the group who sought self-directed care ($M1$ = 148.46%; $p < .001$) While there was initial weight loss during the treatment program (M1-M2) for the groups with no care and with self-directed

care, the group who sought advanced care showed weight gain from pre to post measurement, and this difference was significant, $p < .05$.

*Treatment Adherence*

Although the decrease in adjusted BMI from pre measurement to long term follow up measurement was more obvious in the group who did not complete the treatment program (mean decrease of 15%) than in the group who completed treatment (mean decrease of 6%), no significant interaction effect Weight change x Treatment Adherence was observed in the ANOVA with repeated measure analysis.

Further descriptive analyses with the categorical variable showed that completers (n = 64 of which 44 completed 7 to 8 sessions and 20 completed 4 to 6 sessions) and non-completers (n = 26) did not differ with regard to gender, age, adjusted BMI at baseline, parental BMI, familial socio-economic position, children's psychological variables (as measured with the DEBQ and the SPPC-SPPA) and parental psychological variables (as measured with the SCL-90 and UCL). Both groups showed significant differences with regard to children's psychopathology at admission (as measured with the CBCL), $F(3, 80) = 4.06$, $p < .01$ The completers obtained the highest scores for psychopathology.

*Initial weight loss*

Descriptive analyses on a categorical level showed that maintainers (n = 64) and gainers (n = 26) did not differ with regard to gender, age, adjusted BMI at baseline, parental BMI, familial socio-economic position, children's psychological variables (as measured with the DEBQ, the CBCL and the SPPC-SPPA) and parental psychological variables (as measured with the SCL-90 and UCL).

Estimates show decreases in adjusted BMI in long-term for subjects who initially attained success in treatment ($M1 = 155.10\%$; $M2 = 149.34\%$; $M3 = 146.03\%$). However,

subjects gaining weight from pre to post measurement, also reduced their adjusted BMI at follow-up ($M1$ = 148.25%; $M2$ = 153.48%; $M3$ = 141.89%).

*Factors associated with long-term weight loss*

First, correlation analyses of long term weight outcome with all 37 variables revealed significant correlations with age at baseline ($r$ = .29, $p$ < .01), adjusted BMI at baseline ($r$ = .39, $p$ < .001), child's self-worth ($r$ = .30, $p$ < .05), child's initial weight loss ($r$ = .23, $p$ < .05) and maternal psychopathology ($r$ = -.15, $p$ = .05). No significant correlations were found between long term weight outcome and child's eating behaviour and child's psychopathology, maternal BMI, familial ISP, maternal coping style, nor with two process variables (the number of sessions and additional care after the treatment protocol). As such, these variables were not entered into the regression analyses.

Table 1 summarises the results of the hierarchical regression analysis in which three children's characteristics, one process variable and one parental variable were entered consecutively to explain variance in long term weight outcome. The cumulative variance accounted for by the entire model ($R^2$cum), as well as the incremental variance accounted for ($R^2\Delta$) and significance level for each block are presented. Child characteristics at baseline accounted for 27% of the variance in long term weight outcome. This equation was significant, $F(3,41) = 5.16$, $p < .01$. Child's age at baseline (β = .33), adjusted BMI at baseline (β = .38) and global self-worth (β = .30) were significant predictors. The second block with initial weight loss did not significantly contribute. Adding the parental characteristics to the equation produced a significant increase of 8% in the explained variance over and above child and process variables, $F(1,39) = 4.75$, $p< .05$. This can be attributed to the significant negative contribution of maternal psychopathology (β = -.30). The entire model (including all predictor variables) accounts for a significant cumulative variance of 35% showing significant positive

contributions of child's age, adjusted BMI at baseline, child's global self-worth and a negative contribution of maternal psychopathology.

## Discussion

Although weight loss is difficult to achieve, it appears to be an even greater challenge to maintain it in the long term (Elfhag & Rössner, 2005). As weight stabilization seems a more attainable goal, attention is now focused on childhood obesity. Results from follow-up studies generally confirm the benefits of weight control programs for approximately half of the group of obese children. As such, a new generation of studies has attempted to identify variables associated with weight outcomes. Pre-treatment factors related to later weight stabilization have the greatest informative value for recommendations on treatment assignments (Elfhag & Rössner, 2005). The current study presents an 8-year outcome of overweight children treated in an outpatient program and sought to determine whether parental characteristics could account for incremental variance in long-term weight loss beyond that accounted for by children's and process variables.

As the children were on average 18 years of age at follow-up, this study was able to evaluate the effects of treatment from childhood into young adulthood. It was found that children who had participated in the childhood obesity treatment showed significant changes in adjusted BMI, with an average decrease of 8 % in adjusted BMI at the 8 year follow-up. At admission, 72% had been classified as being severely overweight or obese. At the 8-year follow-up, this percentage was reduced to 47%, and more than half of the youngsters achieved a non-obese status. These findings are consistent with previous long-term follow-up studies. Nuutinen and Knip (1992) observed that after 5 years, 49% of the treated children had achieved a decrease of at least 10% in relative weight. Braet and Van Winckel (2000) found a mean reduction of 11% in their overweight sample after 4.6 years. Similarly, Epstein et al. (1994) pointed out that 34% of the obese children had a reduced percentage overweight of

20% or more and that 30% were no longer obese, 10 years after treatment. These findings highlight how difficult it is to achieve long-term weight loss, but at the same time they are also encouraging, as they underline the value of treatment. This view is supported by studies that track the natural course that overweight runs from childhood into adulthood, without treatment. Whitaker et al. (1997) revealed that after six years of age, obese children stood more than a 50% chance of being obese as a young adult, compared with approximately 10% for non-obese children. Moreover, even small weight losses of 5-10% already reduce health risks substantially in adults (e.g. Blackburn & Kanders, 1987). Also, Togashi et al. (2002) found evidence that treatment of childhood obesity may protect against chronic disease in adulthood. In this context, it certainly seems recommended to rethink appropriate goals and focus on decreasing the relative risk of developing chronic diseases in adulthood.

In their review, Teixeira et al. (2005) considered a lack of treatment completion to be an important limitation in weight management trials, as completers-only analyses are sensitive to bias. To avoid this, the present study also included a non-completers analysis. Non-completers attended the screening and motivation phase but less than 4 sessions of the standard treatment protocol. Although not significant, a more obvious decrease of adjusted BMI was found in the non-completing condition (mean decrease of 15%) than in the completing condition (mean decrease of 6%). It could be hypothesized that baseline differences between completers and non-completers accounted for these findings. Indeed, at admission, the completers showed more psychopathology. Therefore, it seems reasonable to assume that this vulnerable group needed more sessions, while others required fewer consultations to achieve weight control. This was confirmed by Braet & Van Winckel (2001), who noted that some children who only received an advice-in-one-session intervention could still obtain positive results. Hence, it would be advisable to apply different intensity levels in treatment for different children and families, and in order to facilitate this, future research

should aim at further examining predictors of program completion as opposed to dropping out.

An analysis of the influence of initial weight loss showed a decrease in adjusted BMI in the long term for subjects who had initially been successful in their treatment. However, subjects who had even gained weight during treatment also managed to reduce their adjusted BMI at follow-up. One could therefore question whether additional care after the treatment is responsible for the positive outcomes in the long term.

Results revealed that 62% of the subjects had sought additional care, of which approximately half of the efforts were self-directed. Twenty-three percent of the youngsters had engaged in advanced care, 17% of which constituted residential care and 6% bariatric surgery. At baseline, the adjusted BMI's for the group who had sought advanced care were significantly higher compared to the adjusted BMI of the no care and the self-directed care group. Moreover, while there had been initial weight loss during treatment in the groups with no care and self-directed care, the advanced care group showed weight gain from pre- to post-measurement. In addition, a significant Weight change x Additional care interaction effect indicates significant different patterns of adjusted BMI evolution in the long term for the three groups. These findings lead us to suggest that for youngsters who gain weight during treatment and have a high adjusted BMI at baseline (> 160%), outpatient treatment is insufficient in its present format. The patterns also show that the group who engages in self-directed care keeps struggling in their attempts to achieve weight control. Apparently, for the majority of the participating subjects additional care is necessary but nevertheless does not automatically lead to success. Future research should focus on a more detailed examination of the duration and the effects of each additional weight control effort to clarify what happens after the last visit in the clinic.

The regression analyses revealed that next to the child's age and adjusted BMI at baseline, global self-esteem also was a significant predictor of long-term weight change. Braet (2006), in contrast, found no significant interference of self-esteem with the 2-years outcome of a residentially treated severely obese population. One possible explanation for this contradiction is that baseline self-esteem shows stronger correlations with the duration of weight loss maintenance than with the weight loss per se, as has already been established in adult literature (Nir & Neumann, 1995).

While process variables did not contribute to the prediction of long-term weight change beyond and above children's variables, parental characteristics did have a significant influence. In the present study, maternal psychopathology emerged as a major negative determinant of treatment outcome in obese children, which is in agreement with Favaro and Santonastaso (1995), adding a complementary 8% of explained variance. Maternal BMI, familial socio-economic position and maternal coping skills, however, did not correlate with long-term weight outcome. Whereas previous research pointed at the negative influence of parental BMI on the child's treatment outcome (Epstein et al., 1994; Favaro & Santonastaso, 1995; Reinehr et al. 2003; Togashi et al., 2002), previous findings regarding the relationship between SES and the child's weight and treatment outcome were more scattered. Recently, O'Dea and Wilson (2006) have found evidence for the significant contribution of a lower SES to high BMI in children, mediated by the low nutritional quality of breakfast. Similarly, Campbell et al. (2002) noted different food environments for children across SES. The food environment of low-educated mothers was characterized by more frequent use of takeaway meals and less availability of healthy food, thus increasing the risk of a higher BMI. However, these studies did not rule out the impact of maternal psychopathology. Future research should therefore further elaborate on the influence of a broad range of parental variables and their interrelatedness with the child's food environment, in order to clarify possible moderating

relationships with BMI and treatment outcome. In this context, it would also be useful to examine the lack of correlation between maternal coping skills and treatment outcome that was found in the present study. It could be hypothesized that maternal psychopathology and parenting, instead of general coping skills, would be more related to treatment outcome, via moderating relationships with the child's everyday life.

The results must be interpreted with several caveats in mind. First, several authors have pointed out that no objective definition of successful treatment outcome is available. In adult literature, successful weight loss is sometimes defined as 'achieving intentional weight loss of at least 10% of initial body weight and maintaining this body weight for at least one year'(Wing & Hill, 2001), and other times as 'losing at least 5% of baseline body weight between baseline and follow-up and maintaining that weight for a further two years' (Crawford, Jeffery, & French, 2000). For children, the definitions are even more diverging than for adults. In line with the goal of the treatment currently evaluated, this study defined successful outcome as weight stabilization over the 8-year follow-up period. Nevertheless, a clear definition of what constitutes weight maintenance should first be considered. Secondly, it cannot be established whether the observed improvements are caused by the treatment period per se, since there was no control group without intervention in this study.

Some caution should be exercised when giving clinical recommendations. We have already stressed the clinical importance of predictors of long-term weight maintenance studies. These studies help professionals focus efforts on those people that are most likely to benefit and suggest alternative treatments for those less likely to succeed (Texeira et al., 2005). Moreover, they also generate an awareness in professionals of exposing the patient to failure experiences in treatment (Wooley & Garner, 1991). The long-term results of the present study again stress the value of formulating appropriate and realistic goals, especially in the case of treatment of childhood overweight. It is equally significant that parental

variables were related to the children's success in the present study. This emphasizes the importance of involving the parents and providing additional screening, since especially maternal psychopathology negatively affected treatment outcome. In order to avoid failure experiences, these mothers should be given more attention and they should be guided as to how they can support their child.

Although obesity treatment is not effective for all obese children, the results of this study suggest that overweight children who modify their daily dietary and exercise habits may be protected against further weight gain and chronically severe obesity. This implies that effective treatment interventions should be approached from a health-centered rather than a weight-centered perspective (Golan & Crow, 2004). In spite of the several methodological challenges these predictor studies are faced with, future research should further focus on the question why weight control is so difficult to achieve.

## References


Achenbach, T.M. & Edelbrock, C.S. (1983). *Manual for the Child Behavior Checklist and Revised Child Behavior Profile.* Burlington, Vt.: University of Vermont Department of Psychiatry.

Arrindell, W.A., & Ettema, J.H.M. (1986). SCL-90: Manual for a multidimensional indicator of psychopathology. Lisse, The Netherlands: Swets & Zeitlinger.

Blackburn, G.L., & Kanders, B.S. (1987). Medical evaluation and treatment of the obese patient with cardiovascular disease. *American Journal of Cardiology, 60,* 55-58.

Braet, C. (2006). Patient characteristics as predictors of weight loss after an obesity treatment for children. *Obesity, 14,* 148-155.

Braet, C., & Van Winckel, M. (2000). Long-term follow-up of a cognitive behavioral treatment program for obese children. *Behavior Therapy, 31,* 55-74.

Braet, C., Claus, L., Goossens, L., Moens, E., Soetens, B. & Van Vlierberghe L. (2008) Differences in eating style between overweight and normal-weight youngsters. *Journal of Health Psychology,* 13, 733-743.

Braet, C., & van Strien, T. (1997). Assessment of emotional, externally induced and restrained eating behaviour in nine to twelve-year-old obese and non-obese children. *Behaviour Research and Therapy, 35,* 863-873.

Brownell, K.D. (1984). Behavioral, psychological, and environmental predictors of obesity and success at weight reduction. *International Journal of Obesity, 8,* 543-550.

Caccialanza, R., Nicholls, D., Cena, H., Maccarini, L., Rezzani, C., Antonioli, L., et al. (2004). Validation of the Dutch Eating Behaviour Questionnaire parent version (DEBQ-P) in the Italian population: a screening tool to detect differences in eating behaviour amonf obese, overweight and normal-weight preadolescents. *European Journal of Clinical Nutrition, 58(9),* 1217-1222.

Campbell, K., Crawford, D., Jackson, M., Cashel, K., Worsley, A., Gibbons, K., & Birch, L.L. (2002). Family food environments of 5-6-year-old-children: does socio-economic status make a difference? *Asia Pacific Journal of Clinical Nutrition, 11,* 553-561.

Crawford, D., Jeffery, R.W., & French, S.A. (2000). Can anyone successfully control their weight? Findings of a three year community-based study of men and women. *International Journal of Obesity, 24,* 1107-1110.

Centers for Disease Control and Prevention (2000). EpiInfo's Nutrition program, NutStat. Retrieved January 19, 2005, from www.cdc.gov/epiinfo.

Demarest, S., Leurquin, P., Tafforeau, J., Tellier, V., Van der Heyden, J., & Van Oyen, H. (1998). Health interview survey in Belgium. Wetenschappelijk instituut Volksgezondheid (D/1998/2505/).

Derogatis, L. (1983). *SCL-90-R Administration, scoring and procedures manual*. Clinical Psychometric Research, Towson, M.D.

Dietz, W.H. (1998). Prevalence of obesity in children. In: G.A. Bray, C. Bouchard, & W.P.T. James (Eds.), *Handbook of Obesity*, 93-102, New York: Marcel Dekker.

Elfhag, K., & Rössner, S. (2005).Who succeeds in maintaining weight loss? A conceptual review of factors associated with weight loss maintenance and weight regain. *Obesity Reviews, 6,* 67-85.

Epstein, L.H., & Wing, R.R. (1987). Behavioral treatment of childhood obesity. *Psychological Bulletin, 101,* 331-342.

Epstein, L.H., & McCurley, J., Wing, R.R., Valoski, A. (1990). Five-year follow-up of family-based treatments for childhood obesity. *Journal of Clinical and Consulting Psychology, 58(5),* 661-664.

Epstein, L.H., Valoski, A., Wing, R.R., & McCurley, J. (1994). Ten-year outcomes of behavioural family-based treatment for childhood obesity. *Health Psychology, 13,* 373-383.

Favaro, A., & Santonastaso, P. (1995). Effects of parents psychological characteristics and eating behaviour on childhood obesity and dietary compliance. *Journal of Psychosomatic Research, 39,* 145-151.

Frederiks, A. M., van Buuren, S., Wit, J. M., & Verloove-Vanhorick S. P. (2002). Body index measurements in 1996-1997 compared with 1980. *Archives of Diseases in Childhood, 82,* 107-112.

Golan, M., & Crow, S. (2004). Targeting parents exclusively in the treatment of childhood obesity: long-term results. *Obesity Research, 12,* 357-361.

Goldbeck, L., Braun, J., Storck, M., Tonnessen, D., Weyhreter, H., & Debatin, K.M. (2001). Adaptation of parents to the diagnosis of a chronic disease in their child. *Psychotherapie Psychosomatik Medizinische Psychologie, 51,* 62-67.

Goldfield, G.S., & Epstein, L.H. (2002). Management of obesity in children. In C.G. Fairburn & K.D. Brownell (Eds.), *Eating disorders and obesity, a comprehensive handbook* (pp. 524-528). New York, London: The Guilford Press.

Gortmaker, S.L., Must, A., Perrin, J.M., Sobol, A.M., & Dietz, W.H. (1993). Social and economic consequences of overweight in adolescence and young adulthood. *New England Journal of Medicine, 329,* 1008-1012.

Harter, S. (1985). *Manual for the Self-Perception Profile for Children.* University of Denver, Denver.

Harter, S. (1988). *Manual for the Self-Perception Profile forAdolescents.* University of Denver, Denver.

Hollingshead, A.B. (1975). Four Factor Index of Social Status. New Haven, CT: Yale University.

Howell, D.C. (1997). Statistical methods for psychology, 4th edition. Duxbury Press, New York

Nir, Z., & Neumann, L. (1995). Relationship among self-esteem, internal-external locus of control and weight change after participation in a weight reduction program. *Journal of Clinical Psychology, 51,* 482-490.

Nuutinen, O., & Knip, M. (1992). Predictors of weight reduction in obese children. *European Journal of Clinical Nutrition, 46,* 785-794.

O'Dea, J.A., & Wilson, R. (2006). Socio-cognitive and nutritional factors associated with body mass index in children and adolescents: possibilities for childhood obesity and prevention. *Health Education Research, 21,* 796-805.

Ogden, C.L., Flegal, K.M., Carroll, M.D., & Johnson, C.L. (2002) Prevalence and trends in overweight among US children and adolescents. *Journal of the American Medical Association, 288(14)*, 1728-1732.

Ricciardelli, L.A., & McCabe, M.P. (2001). Children's body image concerns and eating disturbance: A review of literature. *Clinical Psychology Review, 21,* 325-344.

Reinehr, T., Brylak, K., Alexy, U., Kersting, M., & Andler, W. (2003). Predictors to success in outpatient training in obese children and adolescents. *International Journal of Obesity, 27,* 1087-1092.

Schreurs, P.J.G., Van De Willige, G., Brosschot, J.F., Tellegen, B., & Graus, G.M.G. (1993). *Herziene handleiding De Utrechtse Coping List, UCL.* Swets & Zeitlinger, Lisse.

Teixeira, P.J., Going, S.B., Sardinha, L.B., & Lohman, T.G. (2005). A review of psychosocial pre-treatment predictors of weight control. *Obesity Reviews, 6,* 43-65.

Togashi, K., Masuda, H., Rankinen, T., Tanaka, S., Bouchard, C., & Kamiya, H. (2002). A 12-year follow-up study of treated obese children in Japan. *International Journal of Obesity, 26,* 770-777.

Valverde M.A., Patin, R.V., Oliveira, F.L.C., Lopez, F.A., & Vitolo, M.R. (1998). Outcomes of obese children and adolescents enrolled in a multidisciplinary health program. *International Journal of Obesity, 22,* 513-519.

van Strien, T., Frijters, J.E.R., Bergers, G.P.A., & Defares, P.B. (1986). The Dutch Eating Behaviour Questionnaire (DEBQ) for assessment of emotional, external and restrained eating behaviour. *International Journal of Eating Disorders, 5,* 295-313.

Veerman, J.W., Straathof, M.A.E. & Treffers, P.D.A. (1994). *Handleiding Competentiebelevingsschaal voor Kinderen, CBSK.* Duivendrecht: Paedologisch Instituut.

Verhulst, F.C., Koot, J.M., Akkerhuis, G.W. & Veerman, J.W. (Eds.) (1990). *Praktische Handleiding voor de CBCL.* Van Gorcum. Assen/Maastricht.

Wichstrom, L. (1995). Harters' self-perception profile for adolescents – reliability, validity, and evaluation of the question format. *Journal of Personality Assessment, 65,* 100-116.

Whitaker, R.C., Wright, J.A., Pepe, M.S., Seidel, K.D., & Dietz, W.H. (1997). Predicting obesity in young adulthood from childhood and parental obesity. *New England Journal of Medicine, 337,* 869-873.

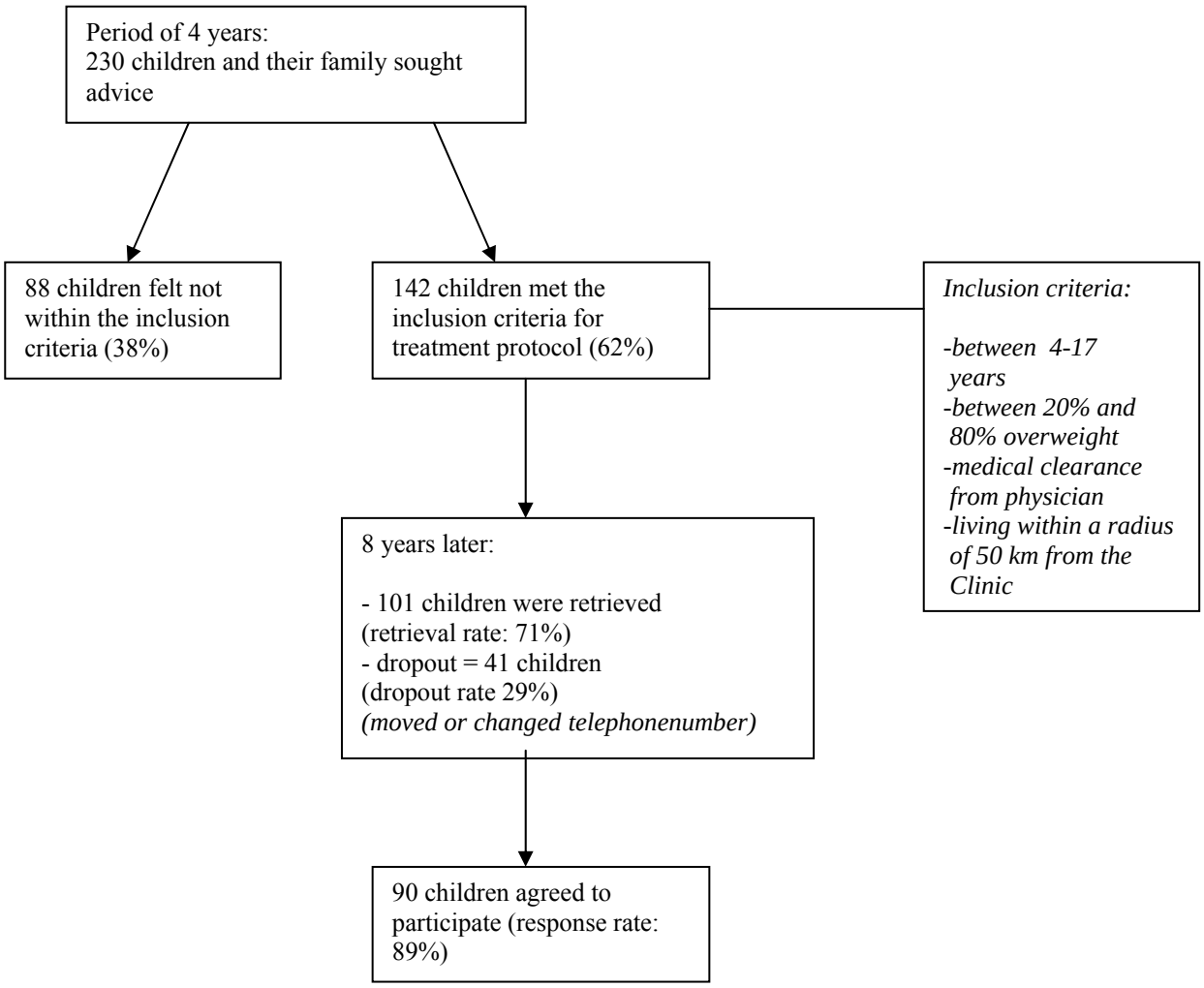
White, M.A., Martin, P.D., Newton, R.L., Walden, H.M., York-Crowe, E.E., Gordon, S.T., Ryan, D.H., & Williamson, D.A. (2004). Mediators of weight loss in a family-based intervention presented over the Internet. *Obesity Research, 12,* 1050-1059.

Wing, R.R., & Hill, J.O. (2001). Successful weight loss maintenance. *Annual Review of Nutrition, 21,* 323-341.

Wooley, S.C., & Garner, D.M. (1991). Obesity treatment – the high cost of false hope. *Journal of the American Dietetic Association, 91,* 1248-1251.

Figure 1

*Participant flow through the study.*



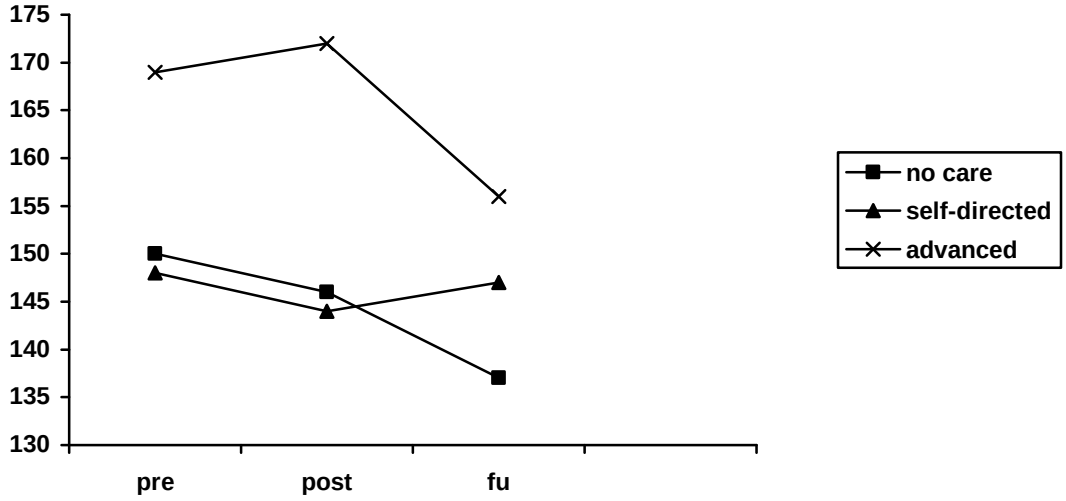



Figure 2. *Weight change in the no care, the self-directed care, and the advanced care group. X-axis: three measurements; Y-axis: % adjusted BMI.*

Table 1

*Hierarchical Regression Models of children's, process and parental characteristics on long-term weight loss.*

| | B | SE B | β | t |
|---|---|---|---|---|
| Block 1 | | | | |
| age at baseline | 4.44 | 1.81 | 0.33 | 2.45* |
| adjusted BMI at baseline | 0.51 | 0.19 | 0.38 | 2.77** |
| global self-worth | 13.46 | 6.09 | 0.30 | 2.21* |
| $R^2\Delta$ = .27** | | | | |
| Block 2 | | | | |
| initial weight loss | 0.04 | 0.50 | 0.01 | 0.09 |
| $R^2\Delta$ = .0 | | | | |
| Block 3 | | | | |
| maternal psychopathology | -0.19 | 0.09 | -0.30 | -2.018* |
| $R^2\Delta$ = .08* | | | | |
| $R^2$ cum = .35** | | | | |

* $p < .05$,** $p < .01$, .