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Impact of Psychosocial Risk on Outcomes among Families Seeking Treatment for Obesity

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Abstract

Objectives—To test the hypothesis that children with elevated psychosocial risk would have increased attrition and worse weight outcomes in weight management treatment.

Study design—This was a prospective cohort study of 100 new patients, ages 4-12, to a weight management clinic. Parents completed the Psychosocial Assessment Tool (PAT). Logistic regression analyses were conducted to calculate the odds of attrition from the clinic and a non-meaningful change in BMI z-score (decrease in BMI z-score less than 0.1 units) over six months based on psychosocial risk category, adjusting for child demographics and baseline weight category.

Results—The majority of patients were male (59%), Black (36%) or White (43%), and had severe obesity (55%). 59% of families were categorized as having moderate or high psychosocial risk. Over 6 months 53% of families were lost to follow-up and 67% did not have a clinically meaningful decrease in BMI z-score. Children in families with moderate or high psychosocial risk were 3.1 times more likely to be lost to follow-up (95% CI 1.3-7.2) and 2.9 times more likely to have a non-clinically meaningful change in BMI z-score (95% CI 1.1-7.9) compared with children of families with low psychosocial risk.

Conclusions—Children presenting with increased psychosocial risk have higher attrition and poorer weight outcomes, supporting the need for psychosocial screening as a standard component of pediatric weight management treatment.

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Keywords

Attrition; Weight; Behavior

Although overall prevalence of childhood obesity are beginning to stabilize in the United States, the prevalence of obesity and severe obesity are continuing to increase in certain subgroups.[1,2] This includes children of racial and ethnic minority backgrounds, especially those of low socioeconomic status, leading to significant health disparities.[1-5] Expert recommendations outline a step-wise approach to the management of obesity and severe obesity in children, including treatment in tertiary care weight management clinics (WMCs) for children not responsive to treatment in primary care settings.[6] The majority of children who attend WMCs consistently demonstrate an improvement in weight status.[7-8] However, most WMCs report attrition of greater than 50%,[9] limiting the number of patients who benefit from treatment.

Retrospective studies suggest that there is higher attrition in WMCs among children of racial minority groups,[10] with more severe obesity,[9-10] and with behavioral and academic problems.[9-10] In addition, family factors such as household financial difficulties, single parent household structures, presence of family conflict, and parental mental illness have been linked to attrition in WMCs.[10-14] Finally, families themselves report logistical and financial difficulties as primary barriers to attendance in WMCs.[9-10,15-17] Although these studies begin to describe individual psychosocial risk factors important to attendance in WMCs, no studies have prospectively examined the impact of cumulative psychosocial risk on attrition and weight outcomes. Therefore, the aim of this study was to prospectively assess the impact of cumulative psychosocial risk on attrition and weight outcomes among children in a WMC, with the hypothesis that children with increased psychosocial risk would demonstrate increased attrition and worse weight outcomes compared with children with lower psychosocial risk. A secondary exploratory aim was to identify the strongest psychosocial predictors of attrition and weight outcomes.

Methods

A prospective cohort study was conducted. Children between the ages of 4 and 12 years and a parent were recruited at their initial visit to a WMC between May 2014 and April 2015. Child-parent dyads were excluded if the child had a primary genetic syndrome (eg, Down Syndrome, Prader Willi Syndrome) or endocrine disorder (e.g. hypothyroidism, hypopituitarism) that would predispose them to excessive weight gain or if the child was taking a medication that might impact weight (e.g. antipsychotic medications, diabetes medications, steroids). Only 2 participants were excluded for these reasons. Dyads were also excluded if the child's parent was not their legal guardian or proficient in English or Spanish. Child-parent dyads that consented to participation in the study were followed for 6 months in the WMC. This study was approved by the Institutional Review Board.

Participants received standard weight management treatment, consistent with expert guidelines.[6,18] At their initial visit children underwent an assessment by a medical provider and received an individualized care plan. A typical plan included monthly clinic visits with

an interdisciplinary team, which could include a medical provider, health educator, exercise physiologist, dietitian, or psychologist depending on identified needs. Care provided during each visit included management of medical comorbidities, nutrition education, physical activity counseling, and discussion of behavioral strategies such as goal-setting and self-monitoring, with elements of motivational interviewing employed to encourage behavior change. Care was targeted towards the adoption of healthy lifestyle behaviors by the entire family.

The Psychosocial Assessment Tool (PAT) was used to measure psychosocial risk.[a] The PAT is a validated parent-report screener of family psychosocial risk that has strong internal consistency, test-retest reliability, and content validity.[19] The PAT is based on a socio-ecological approach and on the Pediatric Psychosocial Preventive Health Model,[20-21] which stratifies need for resources based on psychosocial risk related to seven domains: Structure and Resources, Social Support, Child Problems, Sibling Problems (if the patient had siblings), Adult Problems, Stress Reaction, and Family Beliefs (Table I). Originally developed for pediatric oncology populations, the PAT has successfully been adapted for other patient populations[21-28] and was adapted for this study following the guidance of the PAT inventor (Anne E. Kazak, PhD), in conjunction with weight management clinicians. This adaptation included removing the Stress Reaction domain which is relevant to families of children presenting with acute illness, modifying items in the Beliefs domain to be specific to healthy lifestyles and child weight, and inclusion of a Confidence domain to assess parental confidence adhering to weight management recommendations. Because this domain was new, it was not included in the total PAT score.

The PAT was completed at the initial visit, and 3 and 6 month follow-up visits. The PAT was written at a fourth grade reading level and took 10-15 minutes to complete. It was administered to parents in English (91%) or Spanish (9%), using a secure electronic questionnaire linked to the patient's electronic health record (EHR, 42%) or on paper (58%), depending on parent preference. A validated scoring system gives each domain a score of 0 to 1 with a total score in this study of 0 to 6 (higher scores representing increased risk). PAT scores were categorized as low psychosocial risk if scores were less than 1, moderate psychosocial risk if scores were between 1 and 2, and high psychosocial risk if scores were greater than 2. This categorization is based on the Pediatric Preventive Psychosocial Health Model, which outlines differing intensities of psychosocial clinical interventions needed based on psychosocial risk category.[19,23] PAT data collected from 10,401 participants across 90 sites indicates that 58% of families have low psychosocial risk, 31% have moderate psychosocial risk, and 9% of families have high psychosocial risk, with these findings consistent across settings and patient populations.[20]

A medical assistant trained in the measurement of children with obesity obtained the height and weight of each child at each visit to the WMC. Weight was measured to the nearest 0.1 kilogram with a calibrated digital platform scale. Height was measured to the nearest 0.1 cm with a wall stadiometer. Weight and height were entered into the EHR and BMI percentile

[a]The PAT is a copyrighted instrument and cannot be used without permission. Please contact us at psychosocialassessmenttool.org for information.

for age and BMI z-score were automatically calculated by the EHR according to current recommended formulations.[24] For children lost to follow-up, anthropometric measures from other visits in the healthcare network were extracted from the EHR if available.

The child's baseline weight was categorized as overweight (BMI 85-94% for age), obesity (95% to 120% above the 95% for age), or severe obesity (greater than 120% above the 95% for age).[29] A child was categorized based on whether or not they had an increase in BMI z-score or BMI percentile above the 95th percentile from their initial WMC visit to their last recorded visit in the EHR during the study time period. Whether they had a clinically meaningful change in BMI z-score during the study time period (defined as a decrease in BMI z-score greater than 0.1 units, given that 0.25 units is associated with improvements in cardiovascular outcomes in studies of longer duration[15]) was also documented.

The date of each visit to the WMC was extracted from the EHR. Attrition was documented for three time points, each analyzed as an outcome measure: (1) after the initial visit if there was no second visit to the WMC, (2) by 3 months if there was no WMC visit between 2 and 4 month after the initial visit, and (3) by the end of the study if there was no WMC visit between 5 and 9 months after the initial visit. Ranges for each time point were allowed because of potential scheduling difficulties that might prohibit a WMC follow-up visit exactly at 3 or 6 months.

Data on the child's age, sex, and insurance type were extracted from the EHR. Parents provided data about the child's race and ethnicity and biological parent height and weight (for calculation of maternal and paternal BMI) at baseline. Information on whether a patient received psychology services as a component of their weight management treatment was also extracted from the EHR.

Statistical Analyses

Child demographics, baseline child and parent weight status, the use of psychological services, and PAT scores were summarized using descriptive statistics. Because only 8 families had a PAT score that was categorized as high psychosocial risk, families were categorized dichotomously for analysis into those who had moderate or high psychosocial risk and those who had low psychosocial risk. Psychosocial risk categorization was compared between groups based on child demographics, baseline child and parent weight status, and receipt of psychology services. Odds ratio analyses were conducted to determine the odds of moderate or high psychosocial risk among this study cohort compared with other patient populations that have completed the PAT. Confirmatory factor analysis was conducted to investigate the construct validity of the PAT in this cohort. Odds ratio analyses were conducted to determine the odds of each outcome (attrition at each time point, increase in BMI z-score, increase in BMI-percentile, and lack of clinically meaningful change in BMI z-score) among families with moderate or high psychosocial risk compared with families with low psychosocial risk. Logistic regression analyses were conducted to determine the odds of each outcome, adjusting for any covariates, including child demographics, child and parent baseline weight status, and change in PAT over time, found to be associated with outcomes in bivariate analysis. Finally, a bifactor model (where a common factor shared between domains is delineated from the unique contribution of each

individual domain and included in the model) was used to determine which PAT domain was associated with each outcome, adjusting for covariates as needed.[30-33] M-plus version 8 was used for analysis.

Results

One hundred participants were enrolled in the study (Table 2). The majority of children were male (59%), non-Hispanic black (36%) or white (43%), and had severe obesity (55%). Nearly half had Medicaid. The majority of children also had mothers (67%) and fathers (51%) with obesity. Fourteen children received psychology services as a component of their weight management treatment.

Mean PAT score was 1.2 (SD 0.6). Scores were highest in the domains of Child Problems (mean 0.33, SD 0.22), Adult Problems (mean 0.26, SD 0.24), and Structure and Resources (mean 0.26, SD 0.16). Eight percent of families had a high psychosocial risk score, 51% had a moderate psychosocial risk score, and 41% had a low psychosocial risk score. Compared with data on all-completers of the PAT, families in this study were 2 times more likely to have a moderate to high risk score (95% CI 1.3-3.0). Children of mothers with obesity were 3.4 times more likely to have a moderate or high psychosocial risk score (95% CI 1.3-8.7). No other child or parent characteristic was significantly associated with baseline psychosocial risk (Table 2).

Confirmatory Factor Analysis

Because of low response rates to items on the optional domain, Sibling Problems, it was not included in confirmatory factor analysis. Of the 49 items on the PAT that were scored, all but 4 loaded onto the domain they intended to measure with strong or moderately strong loadings (0.36-0.83). A 4-factor model was tested on the four domains related to psychosocial risk (Structure and Resources, Social Support, Child Problems, and Adult Problems) and accounted for 42.7% of the variance. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (0.688) and Bartlett's Test of Sphericity (X^2 (210) = 650.512, $P < .001$) indicated that the data were suitable for factor analysis. In this model, the three domains of Structure and Resources, Child Problems, and Adult Problems were moderately or strongly correlated with each other (r = 0.40-0.56). A 2-factor model was tested on the 2 domains related to resilience (Family Beliefs and Confidence). The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (0.760) and Bartlett's Test of Sphericity (X^2 (66) = 435.340 p < 0.001) indicated that the data were suitable for factor analysis. The 2 domains were strongly correlated with each other (r = 0.57) and accounted for 42.6% of the variance.

Table 3 depicts attrition after the initial visit (26%), at 3 months (41%), and by the end of the study (53%). Families with moderate to high risk scores on the PAT had a 2.3 times increased risk of attrition by 3 months (95% CI 1.1-5.4) and a 3.1 times increased risk of attrition by the end of the study (95% CI 1.4-7.2). Sex was the only covariate associated with attrition, with females having a 2.4 times increased risk of attrition by the end of the study than males (95% CI 1.1-5.6). In logistic regression analysis, even when adjusting for sex, families with moderate to high psychosocial risk still had a 3.1 times increased risk of attrition by the end of the study (95% CI 1.3-7.2, Nagelkerke $R^2 = 0.15$). Notably, the 14

patients who received psychology services as a component of their weight management treatment experienced lower attrition than those who did not (29% vs. 57%, p = 0.05)

Of the 88 children who had at least one additional set of anthropometric measures recorded in the EHR within 9 months of the initial visit, 34 (39%) had an increase in BMI z-score, 37 (42%) had an increase in BMI percentile for age, and 59 (67%) did not have a clinically meaningful decrease in BMI z-score (Table 4). Families with moderate to high psychosocial risk were 2.6 times more likely to have a BMI-z increase (95% CI 1.1-5.4) and 3.2 times more likely to not have a meaningful change in BMI z-score (95% CI 1.3-8.0). Age was the only covariate associated with change in BMI z-score ($r = 0.56$, $p < 0.001$). However, in logistic regression analysis, even when adjusting for age, having moderate to high psychosocial risk was still associated with a 2.9 times increased risk of not having a clinically meaningful change in BMI z-score (95% CI 1.1-7.9, Nagelkerke $R^2 = 0.32$). There were no significant differences in weight outcomes between patients who received psychology services as a component of their weight management treatment and those who did not.

In bifactor modeling, the domains of Structure and Resources, Child Problems, and Adult Problems were found to load onto a common factor underlying the total PAT, and the domains of Social Support, Family Beliefs, and Parent Confidence did not. Because of low response rates to the optional domain of Sibling Problems, it was not included in analysis. A bifactor model testing the independent effects of the common factor and the unique features of each domain on the outcomes of attrition and change in BMI z-score was used. In this model, Child Problems predicted attrition ($\beta = 0.25$, $p = 0.03$) and the common factor, representing the underlying construct shared between Structure and Resources, Child Problems, and Adult Problems, predicted change in BMI z-score ($\beta = 0.24$, $p = 0.07$). Family Beliefs, Parent Confidence, and Social Support did not have a significant association with either outcome.

Discussion

The majority of families of children with obesity *in* this cohort had elevated psychosocial risk scores at their initial visit to the WMC and were 2 times more likely to have an elevated psychosocial risk score compared with other diverse patient populations in which the PAT has been used.[21] This is not surprising given the associations between psychosocial risk factors and childhood obesity demonstrated in other studies.[34-42] This study confirms these associations, but uses the more comprehensive and standardized PAT, which demonstrated validity in this patient population on confirmatory factor analysis, to provide greater insight into the types of psychosocial risk factors that are most frequently endorsed by families of children with obesity. Indeed, PAT scores were highest in the domains of child behavioral problems (PAT domain Child Problems), mental health issues and adverse events for adults in the child's household (PAT domain Adult Problems), and family financial difficulties (PAT domain Structure and Resources). This finding of elevated psychosocial risk scores among families of children with obesity across several domains suggests that universal psychosocial screening at the onset of weight management treatment may be important to identify family psychosocial needs, especially in clinical settings where a social worker or behavioral health

specialist may not be available to perform these assessments. Even in clinical settings where psychosocial support staff exist, screening with a tool like the PAT may offer advantages because of its ability to efficiently and consistently screen for psychosocial problems across many domains.

Children of families with elevated psychosocial risk were three times more likely than children of families with low psychosocial risk to stop attending the WMC and not have a clinically meaningful decrease in their weight status. This is consistent with retrospective studies that have shown associations between psychosocial risk factors and attrition in WMCs,[9-10] but more clearly and definitively demonstrates the impact of psychosocial risk on attrition because of the prospective nature of this study. This study also confirms the impact of psychosocial risk factors on child weight outcomes during treatment that has been demonstrated in a few other, mostly international, studies.[43-45] This study demonstrated an impact of psychosocial risk on outcomes that was the same regardless of child demographics or baseline weight status, which is different than other studies.[9-10]

The bifactor model analysis provides new information delineating which psychosocial risk factors are most predictive of outcomes in weight management treatment in a way that acknowledges the complex interactions among these risks. The combined effect of child behavior problems, parent mental health issues, and family financial difficulties had the most impact on weight outcomes. Although resilience factors like family beliefs, parental confidence, and family social support are certainly important constructs to pediatric weight management treatment, the dominant role of psychosocial risk factors over these resilience factors speaks to the need to address them early in treatment. The finding that the PAT domains of Child Problems, Adult Problems, and Structure and Resources share a common underlying factor and that Adult Problems has no unique qualities beyond this common factor is also worth noting. Several studies have found important relationships between parental stress, especially maternal depression, with a child's general behaviors and eating behaviors. Importantly, these studies have emphasized the important mediating role of negative parenting and non-responsive feeding styles to these relationships and have found that these relationships are exacerbated in low socioeconomic environments.[46-50] Coupled with the findings in this study, including the finding of reduced attrition among families who received psychology services as part of their weight management treatment plan, this suggests that screening for and addressing parental mental health and child behavioral issues may be important to improving outcomes in children with obesity, especially among vulnerable, socially disadvantaged families.

There were limitations to this study. First, the sample size was small and follow-up was limited by attrition and the short duration of this study. However, because attrition was a primary outcome in this study, attempts to avoid influencing this variable were made. Furthermore, follow-up anthropometric data were obtained in 88% of children in this study by leveraging data available in the EHR. Second, BMI z-score was used as a weight outcome, which has limitations for children with severe obesity.[24] Because of this, we did evaluate BMI percentile above the 95th percentile, but it did not offer additional insights beyond what was found using BMI z-scores in this cohort. A third limitation of this study was the lack of generalizability to adolescents, children of diverse ethnic backgrounds, and

children outside of the WMC setting. Future studies should evaluate the long-term impact of psychosocial risk and provision of psychosocial resources to families of children with obesity and severe obesity of different backgrounds in multiple clinical settings.

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Abbreviations

WMC	Weight Management Clinic
HER	electronic health record
PAT	Psychosocial Assessment Tool

Table 1

Psychosocial Assessment Tool©[1] Domains

Domain	Example Items
Structure & Resources	Family composition
	Areas of financial difficulty
Social Support	Support for healthcare plan
	Financial support
Child Problems	Mood and behavioral concerns
	Developmental and social concerns, adverse events
Sibling Problems (Optional)	Same as Child Problems but for child's siblings
Adult Problems	Mental health concerns and adverse events
	Relationship problems
Family Beliefs	Importance of managing weight to a child's health
	Parent's responsibility as a role model
Parent Confidence	Parent's confidence in their ability to make lifestyle changes
	Parent's confidence in their ability to make WMC appointments

[1] Available at psychosocialassessmenttool@nemours.org

Table 2
Child and Parent Characteristics by Psychosocial Risk Category

	Low Psychosocial Risk [a]	Moderate-High Psychosocial Risk [b]	p
Gender [N (%)]			0.46
Female	15 (36.6)	26 (63.4)	
Male	26 (44.1)	33 (55.9)	
Race/Ethnicity [N (%)]			0.12
Non-Hispanic Black	13 (35.1)	24 (64.9)	
Non-Hispanic White	16 (36.4)	28 (63.6)	
Hispanic	7 (70.0)	3 (30.0)	
Other Race	5 (55.6)	4 (44.4)	
Mean age in years, (SD)	9.4 (2.3)	10.0 (1.9)	0.18
Insurance [N (%)]			0.07
Private or Self-Pay	27 (49.1)	28 (50.9)	
Public	14 (31.1)	31 (68.9)	
Mean BMI z-score, (SD)	2.4 (0.5)	2.4 (0.5)	0.72
Weight Category [N (%)]			0.58
Overweight (BMI 85-94% for age)	1 (25.0)	3 (75.0)	
Obesity (BMI 95% to 120% above the 95% for age)	19 (46.3)	22 (53.7)	
Severe obesity (BMI > 120% above the 95% for age)	21 (38.2)	34 (61.8)	
Maternal Weight Category [N (%)]			0.01
Maternal non-obesity [BMI < 30]	18 (62.1)	11 (37.9)	
Maternal obesity [BMI ≥ 30]	19 (32.2)	40 (67.8)	
Paternal Weight Category [N (%)]			0.67
Paternal non-obesity [BMI < 30)	18 (47.4)	20 (52.6)	
Paternal obesity [BMI ≥ 30]	17 (42.5)	23 (57.5)	
Received Psychology Care as Part of Weight Management Treatment			0.11
Yes	3 (21.4)	11 (78.6)	
No	38 (44.2)	48 (55.8)	

[a] Low psychosocial risk© was defined as a Psychosocial Assessment Tool© score < 1.

[b] Moderate-high psychosocial risk© was defined as Psychosocial Assessment Tool© score ≥ 1. Because only 8 families had a Psychosocial Assessment Tool© score that categorized as high psychosocial risk, families with moderate and high psychosocial risk were grouped together for analysis.

Table 3
Attrition by Psychosocial Risk Category

Psychosocial Risk Category [N (%)]	Low Risk [a]	Moderate Risk [b]	High Risk [c]	p [d]
Attrition after Initial Visit (N = 26)	7 (26.9)	17 (65.4)	2 (7.7)	0.09
Attrition by 3 Months (N = 41)	12 (29.3)	25 (61.0)	4 (9.7)	0.05
Attrition by End of Study [e] (N = 53)	15 (28.3)	32 (60.4)	6 (11.3)	0.01

[c] Low risk© was defined as a Psychosocial Assessment Tool© score < 1

[d] Moderate risk© was defined as Psychosocial Assessment Tool© score 1-2

[e] High risk© was defined as Psychosocial Assessment Tool© score > 2

[f] Significance value comparing low risk to moderate-high risk. Because only 8 families had a Psychosocial Assessment Tool© score that categorized as high psychosocial risk, families with moderate and high psychosocial risk were grouped together for analysis.

[g] End of study was defined as 6-9 months after the initial visit to the WMC

Table 4
Weight Outcomes by Psychosocial Risk Category

Psychosocial Risk Category [N (%)]	Low Risk [a]	Moderate Risk [b]	High Risk [c]	p [d]
Increase in BMI z-score (N = 34)	10 (29.4)	21 (61.8)	3 (8.8)	0.04
Increase in BMI % for age [e] (N = 37)	12 (32.4)	22 (59.5)	3 (8.1)	0.08
ΔBMI-z not clinically meaningful [f] (N = 59)	20 (33.9)	34 (57.6)	5 (8.5)	0.01

[a] Low risk was defined as a Psychosocial Assessment Tool© score < 1

[b] Moderate risk was defined as Psychosocial Assessment Tool© score 1-2

[c] High risk was defined as Psychosocial Assessment Tool© score > 2

[d] Significance value comparing low risk to moderate-high risk. Because only 8 families had a Psychosocial Assessment Tool© score that categorized as high psychosocial risk, families with moderate and high psychosocial risk were grouped together for analysis.

[e] BMI% for age was calculated as % above the 95%

[f] A change in BMI-z was defined as not clinically meaningful if change in BMI-z > -0.1 units