

Effects of a Pediatric Weight Management Intervention on Parental Stress

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Abstract

Background: Few studies have examined the associations of pediatric weight management interventions (PWMI) with reduction in parental stress. We sought to examine the extent to which a PWMI reduces parental stress and whether changes in parental healthful feeding practices and support for physical activity are associated with reduction in parental stress.

Methods: We analyzed data from the Clinic and Community Approaches to Healthy Weight randomized controlled trial (RCT). Parental stress change over 12 months was analyzed using a multivariate mixed linear model. We then examined associations of changes in healthful feeding practices and support for physical activity over 12 months with changes in stress using a multivariate linear model.

Results: In multivariate-adjusted models, participation in a PWMI was associated with decrease in parental stress at 12 months, with a mean difference (MD) of -0.24 U [95% confidence interval (CI): $-0.45, -0.04$]. Increases in scores for exercising regularly [MD = -0.27 (95% CI: $-0.52, -0.03$)] and keeping healthy food at home [MD = -0.38 (95% CI: $-0.66, -0.10$)] were associated with decrease in stress.

Conclusions: Participation in a PWMI was associated with decrease in parental stress. Encouraging parents of children with overweight and obesity to keep healthy food in the house and exercise regularly may represent important strategies to improve parental stress. PWMI effectiveness studies should consider parental stress as an outcome while addressing social determinants of health that may influence parental stress.

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Keywords: childhood obesity; parental stress; pediatric weight management intervention

Introduction

The prevalence of childhood obesity remains at historically high levels, disproportionately affects non-Hispanic black and Hispanic children,¹ and has been associated with lower income and lower educational levels.² These populations are also at higher risk of experiencing stress related to poverty³ and racism.⁴ More recently, they have also been disproportionately affected by severe outcomes of the coronavirus disease 2019 (COVID-19) infection.⁵

Parental stress is associated with childhood obesity.^{6–10} Although the etiology of obesity is multifactorial, stress can influence changes in health-related behaviors.¹¹ When

considering how this has changed since the COVID-19 pandemic began, it is worrisome that an overall increase in parental stress has already been observed,¹² in addition to reports of worsening health-related behaviors during lockdown.^{13–17} In turn, progression of obesity and experiences of weight stigma can further exacerbate stress.¹¹

Pediatric weight management interventions (PWMI) have had modest effects on child BMI.^{18–20} A better understanding of how PWMI impact parental stress and whether parental healthful practices promoted by the PWMI reduce stress could lead to more effective PWMI. This becomes more critical now with evidence pointing to worsening parental stress and health-related behaviors in children during the pandemic.

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Higher perceived parental stress has been linked to lower physical activity in their children,²¹ serving more preprepared foods,²² restrictive and permissive feeding practices,²³ and increased screen time.^{23,24} Parental stress has been correlated with symptoms of depression and poor quality of life in their children with obesity.²⁵ Conversely, children of parents who met recommendations for fruit and vegetable intake were 10 times more likely to meet the fruit and vegetable intake recommendations,²⁶ and there is evidence that parents' own physical activity is associated with physical activity in their children.²⁷

To our knowledge, no other studies have evaluated whether specific parental behaviors around feeding and physical activity are associated with changes in stress. Given the role of parental stress in the development and persistence of childhood obesity, we sought to determine (1) the extent to which two PWMIs reduce parental stress and (2) whether improvements in parental healthful feeding practices and parental support of physical activity are associated with reduction in parental stress. We hypothesized that participation in a PWMI would be associated with decrease in parental stress and that changes in parental healthful feeding practices and parental support of physical activity would result in stress reduction.

Methods

Setting and Participants

We conducted a secondary analysis of data from 330 of the 407 (81%) participants in the Clinic and Community Approaches to Healthy Weight randomized controlled trial (RCT) who completed both baseline and 12-month surveys. The trial randomized children 6–12 years old with a BMI percentile ≥ 85 to PWMIs delivered at either a Healthy Weight Clinic (HWC) in two federally qualified health centers or a modified Healthy Weight and Your Child (M-HWYC) program in two YMCAs. The study took place in two communities in Massachusetts serving a large population of predominantly low-income Hispanic families. Participants were recruited starting in December 2016 through February 2018; data collection concluded in September 2019. Measures were collected through parent or caregiver telephone survey at baseline and 12 months. Additional details about recruitment, inclusion and exclusion criteria, and study components have been previously published.^{28,29} All study activities were approved by the Institutional Review Board at the Massachusetts Department of Public Health.

Main Exposures

Pediatric weight management interventions. Each PWMI was delivered over 30 hours of contact time, consistent with recommendations from the US Preventive Services Task Force. Participants in the HWC arm attended monthly individual visits (1.5 hours) for 12 months and monthly group visits (1.5 hours) for 6 months, with 10 minutes of phone follow-up coaching in between sessions

(biweekly for 6 months, then monthly). For the M-HWYC arm, all visits were 2 hours long and conducted in a group setting weekly for 16 sessions, then biweekly for 4 sessions, and ending with 5 monthly visits; these included time for physical activity. Additional details about visit type length and frequency have been published.^{28,29} Curriculum topics included healthy eating, physical activity, goal setting, sleep, bullying, and self-esteem, among others. Both groups were offered enrollment in a text messaging campaign for self-guided behavior change, as well as access to a community resource guide.^{28,29}

Parental healthful feeding practices. Parental healthful feeding practices were assessed by asking parents to rate their agreement with two statements: (1) "Most of the food I keep in the house is healthy" and (2) "I model healthy eating for my child by eating healthy foods myself." Participants rated their agreement with each statement on a scale of 1 to 4; a score of 1 corresponded to strong agreement with the statement, while a score of 4 corresponded to strong disagreement.

Parental support of physical activity. Parental support of physical activity was assessed by asking parents to rate their agreement with two statements: (1) "I exercise or am physically active on a regular basis" and (2) "I take my child to places where he/she can be active." Participants rated their agreement with each statement on a scale of 1 to 4; a score of 1 corresponded to strong agreement with the statement, while a score of 4 corresponded to strong disagreement.

Outcome

For all exposures, the main outcome was change in parental stress. Parents or caregivers were presented with the following statement and question: "Stress means a situation in which a person feels tense, restless, nervous, or anxious or is unable to sleep at night because his or her mind is troubled all the time. Do you feel this kind of stress these days?" Parents were then asked to rate the stress in their life using a scale of 1 to 5 (*i.e.*, not at all, only a little, to some extent, rather much, and very much); lower scores indicate lower stress. This question has been previously validated and is recommended by the Institute of Medicine for assessment of social and behavioral determinants of health.^{30,31}

Covariates

Covariates were selected *a priori* and included annual household income, child BMI category at baseline, relationship with the child, parental birthplace outside the United States, parental education, and parental depression.

Statistical Analysis

We examined baseline child and parent characteristics by calculating means and standard deviations (SDs) or frequencies and percentages. We also calculated mean

baseline scores of parental healthful feeding practices, support of physical activity, and parental stress.

To determine if there was a change in parental stress associated with participation in the PWMI, we analyzed mean parental stress scores longitudinally using a mixed linear model. We then stratified these results by intervention arm (HWC and M-HWYC). Next, we examined associations between changes in parental support of physical activity and healthful feeding practices (*i.e.*, exercising regularly, taking children to where they can be active, eating healthy foods themselves, and keeping healthy food in the house) and change in stress using a multivariate linear model. These results were also stratified by intervention arm (HWC and M-HWYC). Statistical significance was established at $p < 0.05$. The statistical analysis was conducted using SAS, version 9.4 (SAS Institute, Inc.).

Results

Baseline Participant Characteristics

Mothers responded to the survey for over 90% of the participants. Mean (SD) parent age was 35.0 (7.4) years and 84.4% of parents had a BMI ≥ 25 (Table 1). Mean child age was 9.5 (1.8) years. In our sample, 25.8% of children had overweight, 45.5% had obesity, and 28.8% had severe obesity at baseline. The majority of participants, 93.3%, were Hispanic; most parents, 63.5%, reported being born in the United States. Over 40% of parents reported some high school as their highest educational level. Most parents, 64.8%, denied having depression; at baseline, there was a statistically significant difference in parental depression between the HWC and M-HWYC arms ($p = 0.01$). Notably, we had (22%, 69/316) missing data for income, which is attributed to families of lower income extremes not knowing this information.

Baseline Scores for Parental Stress, Healthful Feeding Practices, and Support of Physical Activity

Baseline scores for parental stress, healthful feeding practices (parent eating healthy food and parent keeping healthy food in the house), and parent exercising regularly were similar between the two arms (Table 1). However, there was a statistically significant difference between the HWC and M-HWYC arms at baseline for taking children where they can be active ($p = 0.03$).

Changes in Parental Stress

In the overall unadjusted model, participation in a PWMI was associated with parental stress decrease at 12 months, with a mean difference overall (MD) of -0.18 [95% confidence interval (CI): $-0.36, -0.01$]. In the overall adjusted model, participation in a PWMI was also associated with parental stress decrease at 12 months, with MD = -0.24 (95% CI: $-0.45, -0.04$) (Table 2). A statistically significant association between participation in the HWC and reduction in parental stress was noted in the adjusted model [MD = -0.36 (95% CI: $-0.66, -0.05$)].

There were no statistically significant associations between participation in the M-HWYC and reduction in parental stress in the unadjusted or adjusted models.

Healthful Feeding Practices, Support of Physical Activity, and Change in Parental Stress

Increases in scores for parent exercising regularly [MD = -0.31 (95% CI: $-0.53, -0.10$)], parent eating healthy food [MD = -0.28 (95% CI: $-0.53, -0.04$)], and keeping healthy food at home [MD = -0.41 (95% CI: $-0.66, -0.16$)] were associated with decrease in parental stress in the overall unadjusted models. When stratifying by arm, increases in scores for parent exercising regularly [MD = -0.35 (95% CI: $-0.68, -0.03$)] and keeping healthy food at home [MD = -0.54 (95% CI: $-0.92, -0.16$)] were significantly associated with decrease in parental stress in unadjusted models for the HWC arm.

For the adjusted models, only increases in scores for parent exercising regularly [MD = -0.27 (95% CI: $-0.52, -0.03$)] and keeping healthy food at home [MD = -0.38 (95% CI: $-0.66, -0.10$)] were associated with decrease in parental stress. Notably, in the M-HWYC arm, there was a statistically significant association between increase in parent exercising regularly and decrease in stress [MD = -0.44 (95% CI: $-0.78, -0.10$)]. For the HWC arm, there was a statistically significant association between increase in keeping healthy food at home and decrease in stress [MD = -0.50 (95% CI: $-0.94, -0.06$)]. There was no statistically significant reduction in stress scores with taking their children where they can be active or parents eating healthy food themselves (Table 3).

Discussion

Our results show that overall participation in a PWMI was associated with decreased parental stress. In the adjusted model, only increases in scores for parent exercising regularly and keeping healthy food at home were significantly associated with decrease in parental stress.

When examining changes in parental stress by arm, participation in the HWC arm was significantly associated with decreased parental stress in the adjusted model. Additionally, for the HWC arm, keeping healthy food in the house was associated with decrease in parental stress in the adjusted model. Notably, only an increase in parent exercising regularly was associated with decreased parental stress in the adjusted model for the M-HWYC arm.

Upon consideration of the differences between the HWC and M-HWYC arms, we found that parents in the HWC arm were more likely to have improvement in stress. Interestingly, at baseline, there were a greater number of parents in the HWC arm who reported receiving a diagnosis of depression. As participants (and therefore their families) were randomized, we believe this difference in depression is due to chance. This could have influenced the differences in parental stress levels between arms as there was behavioral health support provided through the HWC

Table 1. Baseline Sample Characteristics

	Overall (n = 330)	HWC (n = 158)	M-HWYC (n = 172)	p
Child age, years (mean ± SD)	9.48 ± 1.84	9.49 ± 1.91	9.47 ± 1.77	0.89
Parent age, years (mean ± SD)	35.04 ± 7.36	35.03 ± 7.72	35.05 ± 7.04	0.98
Ethnicity, n (%)				0.50
Hispanic or Latino	308 (93.3)	149 (94.3)	159 (92.4)	
Non-Hispanic or Latino	22 (6.7)	9 (5.7)	13 (7.6)	
Child BMI category, n (%)				0.83
Overweight	85 (25.8)	40 (25.3)	45 (26.2)	
Obesity	150 (45.5)	70 (44.3)	80 (46.5)	
Severe obesity	95 (28.8)	48 (30.4)	47 (27.3)	
Parental BMI, n (%)				0.71
<25	47 (15.6)	21 (14.8)	26 (16.4)	
≥25	254 (84.4)	121 (85.2)	133 (83.6)	
Annual income, n (%)				0.11
≤\$20,000 per year	182 (70.3)	82 (65.6)	100 (74.6)	
>\$20,000 per year	77 (29.7)	43 (34.4)	34 (25.4)	
Relationship with the child, n (%)				0.73
Mother	300 (90.9)	143 (90.5)	157 (91.3)	
Father	18 (5.5)	10 (6.3)	8 (4.6)	
Other	12 (3.6)	5 (3.2)	7 (4.1)	
Parental birthplace outside the United States, n (%)				0.89
Yes	120 (36.5)	57 (36.1)	63 (36.8)	
No	209 (63.5)	101 (63.9)	108 (63.2)	
Parental education, n (%)				0.42
Some high school or less	142 (43.3)	63 (40.1)	79 (46.2)	
High school degree	110 (33.5)	58 (36.9)	52 (30.4)	
Some college or higher	76 (23.2)	36 (22.9)	40 (23.4)	
Parental depression, n (%)				0.02
Yes	116 (35.2)	66 (41.8)	50 (29.1)	
No	214 (64.8)	92 (58.2)	122 (70.9)	
Parental stress score, (mean ± SD)	2.45 ± 1.47	2.51 ± 1.44	2.39 ± 1.50	0.47
Parent eating healthy food score, (mean ± SD)	2.87 ± 0.57	2.91 ± 0.58	2.84 ± 0.56	0.26
Parent keeping healthy food in the home score, (mean ± SD)	2.88 ± 0.56	2.89 ± 0.57	2.87 ± 0.55	0.74
Parent exercising regularly score, (mean ± SD)	2.61 ± 0.66	2.64 ± 0.71	2.58 ± 0.63	0.42
Parent taking children where they can be active, (mean ± SD)	2.88 ± 0.56	2.95 ± 0.56	2.82 ± 0.55	0.03

Bold values represent statistically significant findings.

HWC, Healthy Weight Clinic; M-HWYC, modified Healthy Weight and Your Child; SD, standard deviation.

for children as well as one-on-one coaching phone calls with parents. Another possibility, considering the decrease in stress overall, is that our study may have been underpowered to detect a statistically significant decrease in stress in the M-HWYC arm.

The differences in specific parental behaviors associated with decrease in stress in the adjusted models for each arm are likely related to the characteristics of each program. For instance, the association between an increase in parents keeping healthy food in the house and decrease in stress for

Table 2. Longitudinal Change in Parental Stress during the Intervention

Sample	Unadjusted MD (95% CI)	Adjusted ^a MD (95% CI)
Overall (n=330)	-0.18 (-0.36, -0.01)	-0.24 (-0.45, -0.04)
HWC (n=158)	-0.23 (-0.50, 0.04)	-0.36 (-0.66, -0.05)
M-HWYC (n=172)	-0.15 (-0.38, 0.09)	-0.14 (-0.41, 0.13)

Bold values represent statistically significant findings.

CI, confidence interval; MD, mean difference.

^aAdjusted for annual household income, child BMI category at baseline, relationship with the child, parental birthplace outside the United States, parental education, and parental depression. Sample sizes for adjusted models reduced due to missingness in covariates (overall n=245, HWC n=118, and M-HWYC n=127).

the HWC could be related to more direct support received from registered dietitians and community health workers in this arm, which could have led to these parents having greater knowledge about healthy food shopping and community resources for obtaining it. Conversely, the M-HWYC arm included physical activity time for children and parents, which could explain the association of increased physical activity in parents with decreased parental stress.

While few studies have examined changes in parental stress during participation in a PWMI, to our knowledge, this is the first study that demonstrates associations between

specific parental behaviors and a decrease in parental stress when participating in a PWMI. Before our study, Berry et al. examined changes in stress in parents of PWMI participants.³² They analyzed data from one RCT conducted among low-income, rural child-parent dyads of African American and white families.³² In this trial, participants received coping skills training as part of the intervention and they found that white parents reported better stress management at the conclusion of the study; they attributed this to the potential presence of other stressors such as unemployment, housing instability, and overall financial hardships.³²

Other studies examining parental stress outcomes have been conducted as pilot studies for obesity prevention interventions, which did not exclusively recruit children with overweight or obesity. One study examined the feasibility and acceptability of a family-based obesity prevention program that included content aimed at improvement of general parenting skills, in addition to modification of weight-related behaviors, and found decreased parenting stress.³³ Another implemented an intervention that included mindfulness, physical activity, and nutrition in its content. The intervention was found to be feasible, but did not result in change in parental stress levels; this may be due to a small sample size and 8-week follow-up period.³⁴ Hruska et al. evaluated changes in general and parenting stress as part of a home-based obesity prevention program (pilot RCT) in Ontario, Canada. Immediately following the intervention and at 12 months, there was no change in general or parenting stress. The authors note that their study population may limit generalizability as most participating families were white and over 40% had an annual income of over \$100,000 (Canadian dollars).³⁵

Table 3. Parental Healthy Modeling Behaviors and Change in Stress

	Sample	Unadjusted MD (95% CI)	Adjusted ^a MD (95% CI)
Parent exercising regularly	Overall (n=316)	-0.31 (-0.53, -0.10)	-0.27 (-0.52, -0.03)
	HWC (n=151)	-0.35 (-0.68, -0.03)	-0.17 (-0.55, 0.21)
	M-HWYC (n=165)	-0.28 (-0.58, 0.02)	-0.44 (-0.78, -0.10)
Parent taking children where they can be active	Overall (n=314)	-0.03 (-0.29, 0.24)	-0.09 (-0.40, 0.21)
	HWC (n=150)	-0.04 (-0.46, 0.37)	-0.25 (-0.72, 0.23)
	M-HWYC (n=164)	-0.02 (-0.36, 0.33)	0.003 (-0.43, 0.44)
Parent eating healthy food	Overall (n=315)	-0.28 (-0.53, -0.04)	-0.22 (-0.49, 0.05)
	HWC (n=151)	-0.28 (-0.65, 0.09)	-0.23 (-0.66, 0.20)
	M-HWYC (n=164)	-0.29 (-0.62, 0.03)	-0.26 (-0.64, 0.12)
Parent keeping healthy food at home	Overall (n=316)	-0.41 (-0.66, -0.16)	-0.38 (-0.66, -0.10)
	HWC (n=151)	-0.54 (-0.92, -0.16)	-0.50 (-0.94, -0.06)
	M-HWYC (n=165)	-0.29 (-0.62, 0.04)	-0.30 (-0.68, 0.09)

Bold values represent statistically significant findings.

^aAdjusted for annual household income, child BMI category at baseline, relationship with the child, parental birthplace outside the United States, parental education, and parental depression; sample size decreased due to different guardians responding.

Our study adds to the known literature by proposing specific behaviors that parents can practice, which could lead to decreased parental stress. However, for families to execute these recommendations, PWMIs need to continue to provide, and perhaps augment, adequate support to address social determinants of health that may affect each family's ability to be physically active and consume healthy foods, particularly in light of the ongoing economic crisis brought on by COVID-19, and the negative effects on health-related behaviors that have already been documented.^{13–17}

Our findings of an increase in parent exercising regularly having an association with decreased parental stress are in line with the findings of previous studies evaluating physical activity in adults. In one study, implementation of a group-based intervention aimed at increasing moderate to vigorous physical activity was associated with decreased stress³⁶; in another, even low to moderate physical activity was associated with lower stress and lower negative affect.³⁷ Some authors have proposed that exercise has anxiolytic and antidepressant effects and leads to decreased sensitivity to stress.³⁸ Physiologically, greater physical fitness has been linked to blunted adrenal responses (*i.e.*, lower release of cortisol) in the presence of stressors,^{39–41} which could explain our findings.

In our sample, an increase in keeping healthy food in the house was associated with a decrease in parental stress. Although healthy eating is linked to better physical health, the effect of healthy eating on psychological health, including stress reduction, has not been extensively studied. One study linked greater consumption of fruits and vegetables to greater eudaemonic well-being, which is characterized by feelings of engagement, meaning, and purpose.⁴² One RCT found improvements in overall psychological well-being for participants receiving two additional daily servings of fruits and vegetables⁴³; another study, using ecological momentary assessment, did not find any associations between healthy eating and decrease in stress.³⁷ On the biological level, healthier foods could modulate emotional health by providing the necessary nutrients for production of neurotransmitters. Alternatively, participation in this trial could empower parents with better self-efficacy skills that could potentially help lower stress.

A major strength of our study is that we were able to examine longitudinal data from an RCT, which evaluated programs conducted in both clinical and community settings. We were also able to evaluate a low-income predominantly Hispanic population, which can be disproportionately overburdened by stressors and childhood obesity.

Our study does have some limitations. First, our findings may not be generalizable to populations of different ethnicities or socioeconomic status groups. Additionally, parental self-report of behaviors could make the findings of our study subject to social desirability bias. Another limitation in our data is the potential for bidirectionality of associations, which has been previously reported.³⁷ In our evaluation, healthful feeding practices and parental support of physical

activity questions are single items, subjective, and do not provide information about the specific composition of what parents reported as a healthy diet or the specific amount of time parents spent being physically active. We also used a single item to evaluate stress to alleviate the survey burden of the participants, but while it is validated, it does not identify the source of the stressors a caregiver might be experiencing. Baseline differences in parental depression could also account for some of the findings. Finally, our missing income data limited our sample size as we only analyzed cases with complete data, which could have led to the differing results for unadjusted and adjusted models.

Conclusions

In our study, participation in both PWMIs was associated with decrease in parental stress. Encouraging parents to keep healthy food in the house and exercise regularly may represent important strategies to improve parental stress in this population. Researchers should consider evaluating parental stress as an outcome in PWMI effectiveness studies. Moreover, following the economic crisis brought on by the COVID-19 pandemic, special attention to addressing social determinants of health is necessary to support each family's ability to regularly incorporate these behaviors into routine.

Disclaimer

The content is solely the responsibility of the authors and does not necessarily represent the official views of the Centers for Disease Control, Agency for Healthcare Research and Quality, the National Institutes of Health, or any other funders.

Authors' Contributions

D.S.V. and L.F. developed the study design, conducted data interpretation, and drafted the manuscript. D.S.V. conducted the literature search. M.L. conducted the data analysis. M.S., I.C., M.P., and E.M.T. contributed to data interpretation and manuscript reviewing and editing. All authors were involved in writing the article and had final approval of the submitted and published versions.

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