

BRIEF CUTTING EDGE REPORT

Pediatric Obesity

Attenuated efficacy of pediatric obesity treatment during the COVID-19 pandemic

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Abstract

Objective: This study examined whether the efficacy of a standard-of-care pediatric obesity treatment was affected by the COVID-19 pandemic.

Methods: Analyses leveraged data from an ongoing pediatric obesity treatment trial involving 230 lower-income, urban children aged 6 to 12 years. Mixed-effects regression models compared children who participated in a 12-month weight-management intervention before versus during the COVID-19 pandemic on change from baseline in BMI z score (Δz BMI) at 3, 6, 9, and 12 months.

Results: The observed pattern of Δz BMI was significantly different before versus during the pandemic ($\chi^2 = 22.73$, $p < 0.0001$). Children treated before the pandemic maintained an average weight loss of $-0.06 \Delta z$ BMI at 12 months, whereas children treated during the pandemic steadily gained weight over time, averaging a net gain of $0.11 \Delta z$ BMI at 12 months ($\chi^2 = 34.99$, $p < 0.0001$). Treatment session completion did not differ before versus during the pandemic (60.4% vs. 55.7%, respectively; $p = 0.30$) or account for differences in Δz BMI.

Conclusions: Similar reductions in intervention efficacy may be anticipated in other pediatric obesity treatment trials conducted during the COVID-19 pandemic. Many families that have struggled with managing their child's weight during this period may need encouragement to continue engaging in structured weight management as society renormalizes.

INTRODUCTION

The COVID-19 lockdown has had pervasive effects on children, including school closures, a shift to remote learning, and suspension of youth sports and recreational activities. Children gain weight at an accelerated rate when not in school (1), which has been attributed to greater engagement in obesogenic behaviors when children's days are unstructured (2). There is emerging evidence that children's physical activity, sedentary time, eating patterns, and sleep routines deteriorated during the COVID-19 lockdown (3-7) and that normal-weight children gained weight at an alarming pace (8).

The degree to which the pandemic interfered with weight-management efforts among children with overweight or obesity

has not been reported, to our knowledge, to date, particularly in low-income, racially diverse populations. Standard-of-care pediatric weight-management interventions generally produce modest, but sustained and meaningful, reductions in weight (9). However, their efficacy may have been diminished during the COVID-19 lockdown. Understanding the impact of the pandemic on weight-management interventions is important for ongoing treatment planning and for interpreting the results of pediatric obesity treatment trials conducted during this period. This study leveraged data from 230 low-income families participating in a clinical trial to examine the change in efficacy of structured, family-based pediatric obesity treatment delivered before versus during the COVID-19 lockdown.

METHODS

Analytic sample

Data for this analysis originated from an ongoing trial comparing home-based and clinic-based pediatric obesity treatment in lower-income families (ClinicalTrials.gov: NCT03195790). Both trial arms received the same 12-month, family-based pediatric obesity treatment and differed only in the location of treatment. This analysis pooled data across arms to examine changes in treatment efficacy related to the COVID-19 pandemic. The trial's design paper includes methodological details and a description of the intervention (10).

Children aged 6 to 12 years with a BMI percentile ≥ 85 were recruited from pediatric primary care practices at major Chicago, Illinois medical centers. Eligible families had household incomes $\leq 200\%$ of the federal poverty threshold. Participants in the analytic sample ($n = 230$) were a subset of trial participants ($n = 269$) who were randomized to treatment after August 2017 and completed at least one follow-up assessment before July 2021. COVID-19 stay-at-home orders at the study site (Chicago) took effect on March 16, 2020, and continued through mid-June 2021. Accordingly, children were categorized as participating before COVID-19 (randomized before March 16, 2019; $n = 106$) or during COVID-19 (randomized March 16, 2019, or later; $n = 124$). Given this cutoff date, the entire 12-month treatment period (and the follow-up assessment period) had concluded prior to the implementation of COVID-19 stay-at-home orders (in March 2020) for all children categorized as participating before COVID-19. The Institutional Review Boards of Rush University Medical Center (protocol 15120306) and University of Illinois at Chicago (protocol 20170452) approved the study, and informed consent and child assent were obtained upon enrollment.

Intervention delivery before and during COVID-19

The Creating Healthy Environments for Chicago Kids (CHECK) intervention is a standard-of-care pediatric obesity treatment program with 18 in-person sessions and 12 monthly telephone support calls (10). Following the issuance of public health guidelines in March 2020, in-person intervention visits were held via videoconference or telephone. As restrictions eased, in-person visits resumed, with close adherence to COVID-19 transmission precautions (e.g., masking, social distancing, meeting outdoors when feasible). Monthly telephone support calls continued according to protocol throughout the pandemic.

Measures

Weight change

Change from baseline in BMI z score (Δz BMI) was derived from objective height and weight measurements collected at baseline

Study Importance

What is already known?

- ▶ Greater weight gain and engagement in obesogenic behaviors have been reported among children during the COVID-19 pandemic lockdown.
- ▶ There is limited data on how the pandemic has affected the efficacy of pediatric weight-management interventions.

What does this study add?

- ▶ Data from this clinical trial shows that the efficacy of a standard-of-care pediatric weight-management intervention was substantially reduced during the COVID-19 pandemic.
- ▶ Many children who received the intervention during the pandemic demonstrated significant weight gain despite receiving a 12-month weight-loss intervention.

How might these results change the direction of research or the focus of clinical practice?

- ▶ Children's weight loss progress during the pandemic may not reflect their true potential for benefit, and families should be encouraged to continue structured weight-management efforts as society renormalizes.
- ▶ Other pediatric obesity treatment trials should report analyses characterizing change in intervention efficacy during the COVID-19 pandemic.

and at 3-, 6-, 9-, and 12-months post-randomization. In-person contact with participants was severely limited between March and mid-June 2020 because of stringent stay-at-home orders, including social distancing requirements and a prohibition against indoor gatherings. Research staff used various strategies to continue to collect objective height and weight measurements during this time, including collecting measurements outdoors or bringing sanitized, research-grade scales and stadiometers to participants' homes and witnessing measurements taken by caregivers (either in-person or via videoconferencing) while maintaining social distancing.

Intervention receipt

The proportion of scheduled in-person intervention visits completed (of those due given their point in the intervention) was determined for each participant.

Demographic variables

Child age (derived from date of birth), gender, and ethnicity/race were reported by caregivers at baseline.

Data analysis

Mixed-effects regression was used to model multiple observations of Δz BMI, nested within children, from the fixed effects of COVID-19 time period, assessment point (3, 6, 9, or 12 mo), and the interaction of COVID-19 time period and assessment point. Two *a priori* contrasts compared those participating before versus during COVID-19 at the 3-month and 12-month assessments, representing the end of intensive treatment and the end of intervention, respectively. Models included random intercepts and were adjusted for age (mean-centered), gender, race/ethnicity, and baseline z BMI (mean-centered) as potential confounders. The proportion of in-person visits completed during each 3-month follow-up interval, relative to the number scheduled in that same timeframe per trial protocol, was included as a time-varying covariate.

RESULTS

Characteristics of the analytic sample are shown in Table 1. Outcome data were available from 742 assessments, representing 87.9% retention overall. Owing to families being in various stages of follow-up, there were 208, 200, 164, and 170 observations available at 3, 6, 9, and 12 months, respectively.

A significant interaction was found between COVID-19 time period and assessment point in predicting Δz BMI ($\chi^2 = 22.73$, $p < 0.0001$). As depicted in Figure 1, participants receiving treatment

before and during COVID-19 did not significantly differ on Δz BMI at the 3-month assessment point (-0.05 vs. -0.01 Δz BMI, respectively; $\chi^2 = 3.06$, $p = 0.08$). However, children treated before COVID-19 generally maintained their initial weight loss, whereas children treated during COVID-19 subsequently gained weight for the remainder of follow-up. At the final 12-month assessment, Δz BMI was -0.06 among children treated before COVID-19 compared with a net gain of 0.11 Δz BMI among children treated during COVID-19 ($\chi^2 = 34.99$, $p < 0.0001$). Age (estimate = 0.002 , $p = 0.68$), female gender (estimate = 0.004 , $p = 0.85$), baseline z BMI (estimate = -0.04 , $p = 0.10$), and race ($\chi^2 = 3.02$, $p = 0.22$) were not associated with Δz BMI. The proportion of completed treatment sessions did not significantly differ between children treated before and during COVID-19 (60.4% vs. 55.7% , respectively; $t_{(228)} = 1.05$, $p = 0.30$), and session completion was not associated with Δz BMI (estimate = -0.03 , $p = 0.36$) when included in the model.

DISCUSSION

The efficacy of structured, family-based pediatric obesity treatment was significantly attenuated during the COVID-19 pandemic among low-income, urban, racially diverse children. Children who received treatment prior to the pandemic demonstrated an initial weight loss that was largely maintained across 12 months, whereas children treated during the pandemic showed similar initial weight loss but subsequently gained weight until reaching a net Δz BMI gain well above baseline.

The reduction in treatment efficacy was not attributable to decreased intervention session completion. Considering reports of COVID-19-related weight gain in nontreated adults and children (3,8,11,12), the attenuation in treatment efficacy likely reflects the broader influence of COVID-19 pandemic stay-at-home orders on

TABLE 1 Characteristics of children whose participation in pediatric obesity treatment occurred before or during the COVID-19 pandemic

	Total (n = 230)	Before COVID-19 (n = 106)	During COVID-19 (n = 124)
Age, y, mean (SD)	9.7 (1.9)	9.2 (1.8)	10.0 (1.9)
Baseline Δz BMI ^a , mean (SD)	2.1 (0.5)	2.1 (0.5)	2.1 (0.5)
Baseline weight status ^b , n (%)			
Overweight	46 (20.0)	23 (21.7)	23 (18.6)
Obesity	184 (80.0)	83 (78.3)	101 (81.5)
Female gender, n (%)	114 (49.6)	59 (55.7)	55 (44.4)
Race/ethnicity, n (%)			
Black	106 (46.1)	66 (62.3)	40 (32.3)
Hispanic	113 (49.1)	35 (33.0)	78 (62.9)
Non-Hispanic White/other	11 (4.8)	5 (4.7)	6 (4.8)

"Before COVID-19" participants were randomized to treatment before March 16, 2019, at least 12 months prior to the implementation of pandemic public health measures. "During COVID-19" participants were randomized on March 16, 2019, or later.

^a Δz BMI = BMI z score for age and sex;

^bOverweight was defined as BMI percentile 85.0 to 94.99. Obesity was defined as BMI percentile ≥ 95.0 .

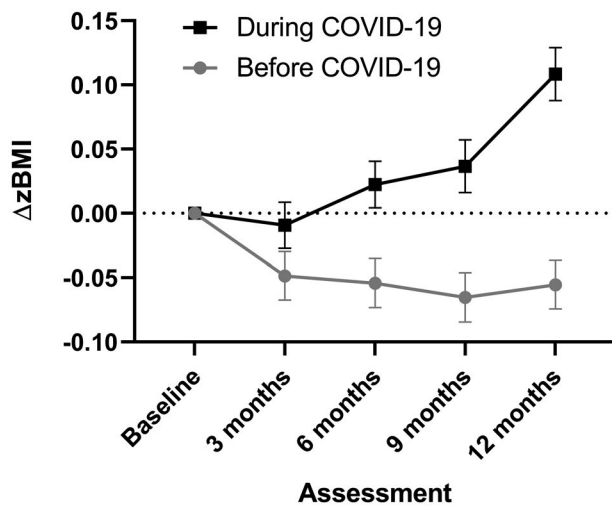


FIGURE 1 Change in BMI z score ($\Delta z\text{BMI}$) among children whose participation in pediatric obesity treatment occurred before versus during the COVID-19 pandemic. Bars represent standard errors

household routines and children's obesogenic behaviors. We cannot rule out the possibility that treatment efficacy was affected by COVID-19-related changes in the modality of intervention delivery, such as conducting sessions via videoconferencing. However, this is unlikely, as telephone-based and in-person interventions typically produce comparable weight-loss benefits (13-15). Further investigation into the mechanisms that explain the attenuated intervention efficacy during COVID-19 is warranted and may yield insights that remain relevant beyond the pandemic.

A key takeaway from this study is that a family's (lack of) success in managing their child's weight during the pandemic does not necessarily represent their true potential to be successful within a structured intervention. It may be important to normalize the experience of families who struggled to lose weight during the pandemic and encourage continued engagement in structured weight-loss programs. The present findings also suggest that normalization of society (school reopenings, resumption of youth sports and activities) may be a necessary condition for successful weight management in children.

The present findings also have implications for the interpretation of ongoing pediatric obesity treatment trials. As of July 2021, there were over 120 active clinical trials focused on pediatric obesity listed in ClinicalTrials.gov. In addition to other statistical procedures (16), investigators should conduct and report supplementary analyses that characterize changes in treatment efficacy associated with the pandemic.

Several strengths and limitations of the study are noteworthy. Given its timeline, the parent trial was uniquely positioned to examine changes in pediatric obesity treatment efficacy following the COVID-19 lockdown. The study focused on low-income children aged 6 to 12 who were predominantly of a racial minority, a group with a high burden of pediatric obesity (17) and poorer engagement and outcomes in weight-management interventions (18,19). However, findings may not generalize to other populations, and

the sample's composition did not enable comparisons with higher-socioeconomic status or nonminority children.

CONCLUSION

The efficacy of pediatric obesity treatment was markedly attenuated during the COVID-19 pandemic. Although this effect is presumably attributable to the impact of stay-at-home orders on children's obesogenic behaviors, the specific contextual and behavioral mechanisms that impeded weight loss during the pandemic deserve further examination. The impact of the pandemic on pediatric obesity treatment efficacy should be considered and addressed when interpreting clinical research conducted during this time and when developing treatment plans for children with overweight or obesity. **O**

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CONFLICT OF INTEREST

The authors declared no conflict of interest.

CLINICAL TRIAL REGISTRATION

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