An Integrated Clinic-Community Partnership for Child Obesity Treatment: A Randomized Pilot Trial

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BACKGROUND AND OBJECTIVES: Effective treatment of childhood obesity remains elusive. Integration of clinical and community systems may achieve effective and sustainable treatment. However, the feasibility and effectiveness of this integrated model are unknown.

METHODS: We conducted a randomized clinical trial among children aged 5 to 11 presenting for obesity treatment. We randomized participants to clinical care or clinical care plus community-based programming at a local parks and recreation facility. Primary outcomes were the change in child BMI at 6 months and the intensity of the program in treatment hours. Secondary outcomes included health behaviors, fitness, attrition, and quality of life.

RESULTS: We enrolled 97 children with obesity, and retention at 6 months was 70%. Participants had a mean age of 9.1 years and a mean baseline BMI z score of 2.28, and 70% were living in poverty. Intervention participants achieved more treatment hours than controls (11.4 vs 4.4, SD: 15.3 and 1.6, respectively). We did not observe differences in child BMI z score or percent of the 95th percentile at 6 months. Intervention participants had significantly greater improvements in physical activity ($P = .010$) and quality of life ($P = .008$).

CONCLUSIONS: An integrated clinic-community model of child obesity treatment is feasible to deliver in a low-income and racially diverse population. As compared with multidisciplinary treatment, the integrated model provides more treatment hours, improves physical activity, and increases quality of life. Parks and recreation departments hold significant promise as a partner agency to deliver child obesity treatment.
Childhood obesity is an ongoing health concern involving cardiometabolic risk, reduced quality of life, and long-term health consequences. In current clinical guidelines, intensive behavioral treatment of children with obesity is recommended. The US Preventive Services Task Force (USPSTF) has found a threshold effect to treatment at their recommendation of ≥26 hours of exposure to the intervention. Nevertheless, achieving this threshold in clinical settings has been challenged by lack of capacity, poor payment for services, and high rates of attrition, particularly among low-income and racially diverse groups. Effective, accessible, and scalable treatment options are needed.

Integration of clinical and community systems may achieve more effective and sustainable treatment than either system alone. The members of the clinical system perform health screenings and medical treatment; the members of the community system provide recreational facilities and staff to deliver fitness programs, cooking classes, and group activities. This integrated model offers several advantages: clinic staff can provide individualized counseling and treatment to address the complications of obesity, and recreation centers are local, accessible, have extended hours, and have staff to provide social support to improve engagement of families.

Our team has developed an integrated clinic-community treatment model as a partnership between an academic medical center and a municipal parks and recreation agency. The goals of the current study are (1) to describe the implementation of an integrated clinic-community partnership for child obesity treatment and (2) to evaluate the effectiveness of integrated treatment on child BMI and health outcomes. We hypothesize that the integrated model is more effective in improving BMI and child health behaviors, as compared with clinical treatment alone.

**METHODS**

**Study Design**

We used a prospective, 2-group, nonblinded, randomized controlled trial design to compare the integrated clinic-community model with clinical-only treatment. The intervention was 6 months in duration. The clinical treatment in both groups was tertiary-care pediatric weight management, which is currently the most effective standard of care for clinical obesity treatment. The Duke Healthy Lifestyles clinic, a pediatric weight management program, served as the recruitment site. Participant enrollment occurred between October 29, 2015 and August 15, 2016, and we collected 6-month follow-up data at the end of the intervention, through March 13, 2017. The institutional review boards from Duke University (Pro00066366) and the University of North Carolina at Chapel Hill (15-1867) approved the study protocol.

**Study Participants**

Participants included a consecutive sample of patients aged 5 to 11 with a BMI ≥95th percentile, referred by their primary care provider to the Healthy Lifestyles clinic, along with each child’s adult primary caregiver (“parent”) aged 18 or older. We excluded children with a medical cause for obesity (hypothyroidism, Cushing’s syndrome, etc), those who lived more than 30 miles from the clinic or planned to move out of the area, and those whose parents could not speak or read English or Spanish. We compensated each parent-child dyad for completing study measurements with gift cards of $10 at baseline, $20 at 3 months, and $30 at 6 months, regardless of participation in programming.

**Treatment Arms**

**Usual Care (Healthy Lifestyles Clinic)**

The Healthy Lifestyles weight management protocol and outcomes have been described previously. Briefly, patients with obesity and their families meet monthly with a multidisciplinary team (medical, nutrition, physical therapy, and mental health) to set and monitor lifestyle behavioral goals and manage health conditions. Program details can be found in Supplemental Table 4.

**Intervention (Integrated Clinic-Community Model)**

The integrated clinic-community model is a partnership between the Healthy Lifestyles pediatric weight management clinic and a recreation center operated by Durham Parks and Recreation. The program, Bull City Fit, has been operational since 2012 and primarily serves racially diverse and low-income families.

A shared use agreement outlines the terms of the partnership. Legal representatives from both Duke University and the Durham Parks and Recreation Department review and amend this agreement annually to ensure clear delineation of roles and responsibilities. Bull City Fit is open 6 days per week, from 6 PM to 8 PM on weekdays and 1 PM to 3 PM on weekends (Supplemental Table 4). All members of the immediate household may participate. Activities include structured games and team-building sports (6 days/week), cooking classes (1 day/week), swimming lessons (2 days/week), and peer support (1 day/week). Trained staff supervise and facilitate all activities.

From the beginning of the study, a research assistant texted intervention parents’ mobile devices with daily information about Bull City Fit activities. Starting in May 2016, because of low engagement in Bull City Fit, a research assistant also sent personalized text messages to...
parents to encourage more frequent attendance (Supplemental Table 4).

Procedures

We assigned participants to usual care or intervention with a 1:1 allocation ratio by using a computer-generated randomization (Excel, 2010; Microsoft, Redmond, WA), which we concealed in sequentially numbered envelopes and opened at enrollment. One research assistant generated the allocation sequence, and a different research assistant enrolled participants. We did not blind participants to group assignment. Intervention participants received standard clinical care at Healthy Lifestyles in addition to receiving free, unlimited access to Bull City Fit community-based programming. Control participants received standard clinical care at Healthy Lifestyles, in addition to receiving promotional materials about the local parks and recreation department. We invited control participants to participate in the intervention at the end of the study.

We collected data during routine clinic visits at baseline, 3 months, and 6 months, and we recorded all data in a REDCap database. Trained research staff collected all measures, either by administering survey-based instruments or by abstracting data from the medical record. Because of slow enrollment, all measures were translated into Spanish via an American Translators Association–certified translation service that used a process of 2 forward translations by different bilingual and bicultural translators, with discussions to reconcile differences and final approval by the company owner (Bilingual Communications, Inc, Cary, NC). We first enrolled monolingual Spanish-speaking participants in April 2016 (Pacific Interpreters; LanguageLine Solutions Company, Monterey, CA).

Measures

Treatment Intensity

Our primary outcome of treatment intensity was the total number of treatment hours over 6 months, which we calculated on the basis of Bull City Fit attendance and Healthy Lifestyles visits for the intervention and control groups. The details of possible clinical and Bull City Fit hours can be found in Supplemental Table 4. We measured attendance frequency and duration through administrative data in the medical chart and through sign-in software used on-site at Bull City Fit (Volgistics; Red Ridge Software Company, Byron Center, MI). On the basis of treatment hours, we assessed the percentage of participants meeting USPSTF’s recommended intensity for childhood obesity treatment (≥26 hours over 6 months). We measured satisfaction and perceptions of Bull City Fit by using a parent survey completed at 6 months.

Weight, Health, Behavioral, and Psychosocial Outcomes

Our primary health outcome was child BMI. A nurse measured child and parent height by using a stadiometer (Health o meter Professional CE#92977; Health o meter, McCook, IL) and measured weight by using a digital scale (Seca CE#96990; Seca, Chino, CA), which we used to calculate the BMI z score (BMIz) and percent of the 95th percentile for children and the BMI for parents. Additional child outcomes included a 1-minute recovery heart rate after a 3-minute stepping test, blood pressure, waist circumference, body fat percentage, and fasting laboratory values, including lipids, glucose, hemoglobin A1c (HbA1c), and insulin. We measured child dietary intake with 43 items from the Food Frequency Questionnaire, in the domains of fruit, vegetable, sugar-sweetened beverage, and sweet snack intake, which was completed by the parent on behalf of the child. We measured child physical activity with a modified version of the Physical Activity Questionnaire, which involved a parent-assisted interview with the child. A research assistant interviewed the child by using Sizing Me Up, an obesity-specific instrument that measures quality of life, divided into 5 subscales with scaled scores out of 100: emotional, teasing/marginalization, physical, social avoidance, and positive attributes. We assessed parent motivation with the Parent Motivation Inventory.

Analysis

According to power calculations, a sample size of 100 participants would provide >80% power to detect a mean treatment difference of −0.14 in BMIz by using a 2-sided \( \alpha = .05 \), assuming an SD of 0.20 and a 30% attrition rate. Given emerging evidence of the limitations of BMIz among children with severe obesity, we also included an exploratory analysis of the changes in the percent of the 95th percentile for BMI. We used intent-to-treat analysis for all participants, regardless of their engagement level in the intervention. We used descriptive statistics to report baseline findings. We compared intervention and control groups at 3 and 6 months by using paired \( t \) tests. We performed statistical analyses using Stata 14.1 (StataCorp, College Station, TX).

RESULTS

We randomly assigned 100 child-parent dyads to intervention (\( n = 50 \)) or control (\( n = 50 \)) and collected baseline data from 97 child-parent dyads. Approximately 60% (\( n = 56 \)) of child-parent dyads completed 3-month assessments, and 70% of child-parent dyads (\( n = 68 \)) completed 6-month assessments (see the Consolidated Standards of Reporting Trials diagram, Fig 1). The total retention rate at 6 months was...
70%. We observed no significant differences between groups at baseline (Table 1). Children were 53% female, 51% African American, and 34% Hispanic. The mean child age was 9.1 years (SD: 1.9). Parents were 87% female, 48% single, and 26% monolingual in Spanish. Approximately one-fourth (23%) had a total household income <$5000 per year. We observed no adverse events.

Primary Outcomes

Fidelity to USPSTF Intensity Guidelines

Intervention participants had an average of 11.7 hours (range: 2–67.8; SD: 15.3) of total treatment (clinic plus Bull City Fit sessions) compared with an average of 4.4 hours (range: 2–9; SD: 1.6) in control participants (clinic sessions only). Six intervention participants and no control participants achieved the recommended ≥26 hours of treatment (Supplemental Table 5).

Child BMI

At baseline, mean child BMI z was 2.28 (SD 0.36) and mean percent of the 95th percentile was 125.0 (SD: 17.7) (Table 2). We observed no significant changes between intervention and control participants at 3 or 6 months (Table 3).

Secondary Outcomes

Attendance

The average number of clinic visits attended after the initial enrollment visit at Healthy Lifestyles was 3.4 (95% confidence interval [CI]: 2.78 to 4.08) by intervention participants and 3.3 (95% CI: 2.90 to 3.77) by control participants (P = .82). Eight control participants and 6 intervention participants only attended the enrollment visit at Healthy Lifestyles (Supplemental Table 5). Overall, 70% (n = 35) of intervention participants attended at least 1 Bull City Fit session, and 38% (n = 19) attended more than 1 session. After a personalized texting protocol was added, more participants attended at least 1 session (56% before vs 87% after, P = .016).

Patient Satisfaction

At 6 months, 82% of intervention parents (n = 31) completed a satisfaction survey (Supplemental Table 6). Most parents reported that they were getting what they wanted to get out of Bull City Fit “all the time” (46%) or “most of the time” (29%). The largest barriers to participation were adult work...
We noted a statistically significant improvement in intervention participants’ physical activity at 6 months (+0.25 vs −0.21 activity score, 95% CI: −0.79 to −0.11, P = .010). Paradoxically, we observed a small increase in daily sugar-sweetened beverage intake in the intervention group at 6 months (+0.34 vs −2.3, 95% CI: −5.15 to −0.13, P = .040). Other changes in self-reported dietary and fitness habits did not differ between groups (Table 3).

**Health Behaviors**

We observed clinically meaningful improvements in child quality of life among children in the intervention group (Fig 2, Table 3). This difference was large and significant at 3 months (+10.43 vs +0.42, 95% CI −15.40 to −4.62, P < .001) and 6 months (+12.66 vs +3.31, 95% CI: −16.15 to −2.56, P = .008). Quality of life improvements were greatest at 6 months on the positive attributes subscale (+11.85 vs −0.54, 95% CI: −23.21 to −1.57, P = .026).

**Psychosocial Outcomes**

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**Health Outcomes**

Waist circumference increased less in the intervention group than in the control group at 6 months (+0.93 vs +4.92 cm, 95% CI: −0.01 to 7.97, P = .051). We observed no significant differences in blood pressure, body fat percentage, or cardiovascular fitness between intervention and control participants at 3 or 6 months (Table 3).

**DISCUSSION**

This pilot study is 1 of few randomized controlled trial designs in which a clinic-community partnership model for pediatric obesity treatment is evaluated.30,31 Previous studies have, like ours, revealed minimal changes in weight and BMI, with modest improvements in health behaviors.30–34 In contrast to the populations in previous studies, our population was more racially and ethnically diverse, had a lower socioeconomic status, and had a higher degree of obesity. With our study, we add key information to demonstrate enrollment feasibility in a low-resource environment in addition to adding significant health outcomes, including improvements in child physical activity and, most significantly, quality of life. This quality-of-life finding is consistent with findings in our previous research, in which parents of Bull City Fit participants reported that the supportive family environment improved their child’s emotional and social well-being (M. Andrews, C. Sawyer, J. H., L. F., A. C. S., S. A., unpublished observations).

The significant improvement in child quality of life is noteworthy. Quality of life is associated with improved long-term health indicators, lower use of health care resources, and greater stability in employment and relationships.35 Unfortunately, quality of life among youth with obesity is lower than for many other chronic childhood conditions.
including cancer. Long-term studies have revealed that obesity interventions that improve quality of life lead to improvements in weight status. It is possible, therefore, that the short duration of our study did not allow us to observe longer-term changes in weight status.

The authors of previous studies of clinic-community models for child obesity treatment have incompletely assessed child quality of life. Of the 5 comparable trials, only 1 included the measurement of health-related quality of life. The authors of this study measured quality of life by using a different scale and found a significant improvement; however, a prospective cohort design was used, which limited the conclusion that quality-of-life changes were caused by the intervention. Our randomized controlled design is supportive of the conclusion that a clinic-community model enhances the lives of children in meaningful ways by directly improving quality of life.

We also demonstrated the feasibility of delivering child obesity treatment in collaboration with parks and recreation departments. The National Recreation and Park Association and its member organizations are well-suited partners for community-based wellness programming. The National Recreation and Park Association is a nonprofit organization that promotes public parks, recreation, and conservation; their 3 pillars are “conservation, health/wellness, and social equity.” Parks and recreation departments are nearly ubiquitous in communities across the United States, with 1 recreation center for every 26 650 residents offered within its member communities, and centers are typically located in low-resource communities.

In addition to delivering a child obesity program, the partnership with parks and recreation departments provides mutual benefit to the clinic and the parks and recreation agency. In our previous studies, clinic staff report high satisfaction with the ability to “refer” patients to a free, local fitness program. Durham Parks and Recreation leadership reported that, since the partnership began in 2012, the recreation center hosting Bull City Fit has become the most highly used parks and recreation facility in the city. Because of high volume, this center receives a higher proportion of city appropriations, which can be used to add staff, equipment, and complete needed repairs to the facility.
One of our key primary outcomes was intensity of the program in terms of treatment hours and meeting current USPSTF recommendations (≥26 hours over 6 months). We designed the program to address known barriers to achieving this goal, including being open 6 days per week, with after-school and work access hours, free programming, engaging group activities, family participation, digital support through mobile devices, incentives and/or prizes for participation, and geographic location within the community. Although the intervention did lead to increased hours of treatment (11.7 vs 4.4 in the clinic-only group), only 6 intervention participants, and no control participants, achieved ≥26 hours of treatment. This is consistent with findings in previous studies that have revealed difficulty meeting recommended treatment hours, which suggests that meeting time-specific treatment targets may be poorly feasible in low-resource communities.

### TABLE 3 Change in BMI, Health Parameters, and Psychosocial Outcomes

<table>
<thead>
<tr>
<th>Change From Baseline to 3 mo</th>
<th>N</th>
<th>Control</th>
<th>Intervention</th>
<th>95% CI</th>
<th>N</th>
<th>Control</th>
<th>Intervention</th>
<th>95% CI</th>
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<tr>
<td></td>
<td></td>
<td>n = 29</td>
<td>n = 27</td>
<td></td>
<td></td>
<td>n = 30</td>
<td>n = 38</td>
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<tr>
<td>BMIZ</td>
<td>56</td>
<td>0.04</td>
<td>0.03</td>
<td>-0.05 to 0.06</td>
<td>68</td>
<td>0.04</td>
<td>0.01</td>
<td>-0.06 to 0.13</td>
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<td>BMI percent of 95th percentile</td>
<td>56</td>
<td>-0.66</td>
<td>-0.002</td>
<td>-13.3 to 12.0</td>
<td>68</td>
<td>0.24</td>
<td>5.49</td>
<td>-13.5 to 3.1</td>
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<td>Drop in obesity class, %</td>
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<td>0.04</td>
<td>0.00</td>
<td>-0.03 to 0.11</td>
<td>68</td>
<td>0.10</td>
<td>0.05</td>
<td>-0.08 to 0.18</td>
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<td>Systolic blood pressure percentile</td>
<td>56</td>
<td>-2.53</td>
<td>8.06</td>
<td>-25.20 to 3.99</td>
<td>68</td>
<td>3.30</td>
<td>2.60</td>
<td>-14.70 to 16.0</td>
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<td>Diastolic blood pressure percentile</td>
<td>56</td>
<td>-3.30</td>
<td>-1.03</td>
<td>-17.42 to 12.88</td>
<td>68</td>
<td>-1.90</td>
<td>-2.84</td>
<td>-8.73 to 3.87</td>
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<td>Drop in blood pressure category, %</td>
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<td>0.15</td>
<td>0.03</td>
<td>-0.04 to 0.27</td>
<td>68</td>
<td>0.20</td>
<td>0.00</td>
<td>0.07 to 0.33</td>
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<td>2.44</td>
<td>-1.80 to 4.17</td>
<td>62</td>
<td>4.92</td>
<td>0.93</td>
<td>-0.01 to 7.97</td>
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<td>Body fat percentage, %</td>
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<td>1.08</td>
<td>0.73</td>
<td>-1.15 to 1.85</td>
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<td>1.26</td>
<td>-1.28 to 1.86</td>
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<td>3-min step test: 1-min recovery heart rate, beats/min</td>
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<td>3.75</td>
<td>3.92</td>
<td>-2.79 to 18.09</td>
<td>59</td>
<td>-1.16</td>
<td>4.14</td>
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<td>HDL</td>
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<td>-5.80 to 1.20</td>
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<td>-0.70 to 60.10</td>
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<td>BMIa</td>
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<td>53</td>
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<td>Sugar-sweetened beverages</td>
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<td>-1.07</td>
<td>-3.12 to 1.31</td>
<td>61</td>
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<td>0.34</td>
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<td>-0.55</td>
<td>-2.10 to 0.94</td>
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<td>-6.04 to 25.09</td>
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<td>Total</td>
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<td>-15.40 to -4.62</td>
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<td>3.31</td>
<td>12.66</td>
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<td>-26.24 to -0.77</td>
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<td>11.67</td>
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<td>2.00</td>
<td>15.38</td>
<td>-29.49 to 2.73</td>
<td>63</td>
<td>5.17</td>
<td>17.16</td>
<td>-24.88 to 0.92</td>
</tr>
<tr>
<td>Positive attributes</td>
<td>53</td>
<td>1.79</td>
<td>9.05</td>
<td>-17.44 to 2.92</td>
<td>65</td>
<td>-0.54</td>
<td>11.85</td>
<td>-23.21 to -1.57</td>
</tr>
<tr>
<td>Social avoidance</td>
<td>53</td>
<td>-4.49</td>
<td>10.86</td>
<td>-24.75 to -5.96</td>
<td>65</td>
<td>1.15</td>
<td>7.22</td>
<td>-14.83 to 2.88</td>
</tr>
</tbody>
</table>

Data represent the change in values between baseline and 3 mo and the change between baseline and 6 mo, with 95% CIs. HDL, high-density lipoprotein; LDL, low-density lipoprotein; PAQ, Physical Activity Questionnaire; —, not applicable.

*a* Measured at baseline and 6 mo only. See citations of original articles for details on each measure.
We observed an unexpected significant increase in sugar-sweetened beverage consumption in the intervention group. Potential explanations include increased consumption of sports beverages or sugary drinks because of increased physical activity or increased usage of vending machines with sugar-sweetened beverages located on-site at the parks and recreation facility. Recall bias could also explain this observation, because Bull City Fit provides nutrition education, and intervention parents might have monitored and reported their drink consumption more closely.

There are several limitations to our study. The initial exclusion of monolingual Spanish-speaking families, because of limited study resources, excluded a large proportion of the catchment population of interest. This exclusion made recruitment unfeasible, but the addition of resources later during the recruitment phase allowed us to include Spanish-speaking families. However, deviating from the initial protocol may have affected study outcomes. The adaptation of our trial highlights the importance of designing interventions to meet the linguistic and cultural needs of the population of interest. This is necessary not only for the generalizability of study outcomes but also to ensure that treatment interventions are appropriate for and inclusive of the population being served.

Because Bull City Fit primarily serves a low-income and diverse population, the curricula were designed to be flexible, engaging for all ages, and relatively unstructured. For example, attendance expectations discussed at enrollment were adaptable to each family’s individual schedule. This flexibility is a strength in terms of inclusivity, but the lack of structure and accountability is also a limitation. Incorporating personalized text messaging boosted attendance, and additional structured accountability measures should be considered in the future to improve intensity.

Although a randomized controlled trial design was a strength, another limitation was the relatively high drop-out among participants randomly assigned to the control group who wanted access to the intervention (n = 7).

We are building on our work from this pilot through a larger study recently funded by the American Heart Association to evaluate the implementation of the integrated model in diverse community settings. This randomized controlled clinical trial (n = 350) will compare the clinic-community integrated model with standard primary care obesity treatment over a 12-month period. This design will expand our sample size and duration of the intervention and will incorporate the texting protocol and the inclusion of monolingual Spanish-speakers to enhance recruitment and reduce dropout. Enrollment is expected to begin in January 2018.

CONCLUSIONS

In this study, we demonstrate the feasibility of delivering an integrated clinic-community partnership for child obesity treatment, delivered at a parks and recreation facility. The integrated model leads to greater engagement than clinical care alone and results...
in a meaningful improvement in child quality of life.

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Abbreviations

BMIz: BMI z score
CI: confidence interval
HbA1c: hemoglobin A1c
USPSTF: US Preventive Services Task Force

The satisfaction survey designed by the study team for this trial and completed by parents in the intervention group to assess satisfaction with Bull City Fit and potential barriers to participation.

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References


15. Innovative Care for Chronic Conditions. *Building Blocks for Action - Global*


26. Kowalski KC, Crocker P, Donen RM. The Physical Activity Questionnaire for Older Children (PAQ-C) and Adolescents (PAQ-A) Manual. Saskatoon, Canada: University of Saskatchewan College of Kinesiology; 2004


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