Use of a Pediatrician Toolkit to Address Parental Perception of Children's Weight Status, Nutrition, and Activity Behaviors

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Background.—Communication of children's weight status and targeted counseling by pediatricians may change parental perceptions or child dietary and physical activity behaviors. The aim of this study was to determine whether accuracy of parental perception of children's weight status and reports of related behaviors changed following a brief pediatrics resident intervention.

Methods.—Parents (N = 115) of children aged 4 to 12 years enrolled in Medicaid completed baseline questionnaires with providers about prior communication of weight status and/or body mass index (BMI), perceptions of their children's weight, and children's dietary and physical activity behaviors, and children were weighed and measured. Trained residents used a toolkit to communicate weight status to parents (via color-coded BMI charts) and counseled about mutually chosen healthy behaviors. Questionnaires were repeated at 1 and 3 months, and measurements were repeated for children with BMI ≥85%.

Results.—At baseline, 42% of parents of overweight children believed their children were at healthy weight. Most (n = 96; 83%) parents completed 1-month questionnaires, and 56% completed 3-month follow-up questionnaires. Improvements in fruit and vegetable consumption, sweet drinks, unhealthy snacks, frequency of restaurant food, lower-fat milk, and screen time occurred among both overweight and healthy weight children. There were also increases in discussions with providers about weight/BMI and parental accuracy of overweight assessment.

Conclusions.—Parent accuracy of weight status and short-term childhood dietary and physical activity behavior changes improved following resident pediatrician use of a toolkit to support communication of weight status and counseling. Further research needs to determine whether accurate parental perception motivates improved behavior change or healthier BMI trajectories.

KEY WORDS: BMI; childhood obesity; childhood overweight; counseling nutrition; physical activity; weight perception

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In the United States, as many as 32% of children and adolescents are considered overweight or obese using current expert panel definitions,[1–3] increasing their likelihood of developing many health problems, including type 2 diabetes, dyslipidemia, hypertension, and depression,[4] and of becoming obese adults.[5] Studies are ongoing to determine the most effective obesity treatment strategies and to determine which children are at greatest risk for adult obesity and related health problems. However, growing evidence and national policy statements suggest pediatricians should at least recommend to parents behavioral changes to promote healthy weight that carry no or minimal harm, such as limiting television, limiting sweetened drinks, and increasing physical activity, particularly for higher-risk children.[3,6] Helping young children actually achieve these healthier behaviors could be promoted through effective counseling by the pediatrician and motivation by the parents.

One of the barriers to improving behaviors may be that both providers and parents under-identify overweight and obesity in children and thus do not realize a need for behavior change. Parents fail to recognize when their children, particularly young children, are overweight or obese.[7–12] Some also do not perceive associated health risks.[10] Although we do not know if or how parental recognition of overweight matters, preliminary evidence suggests that parental perception of the child as overweight or obese relates to a greater readiness to make positive weight-related behavioral changes.[13]

At the same time, pediatric providers consistently under-diagnose weight problems, failing to document overweight for the majority in that category.[14] They also infrequently use recommended Centers for Disease Control and Prevention age- and gender-specific body mass index (BMI = kg/m^2) charts, designed to screen for unhealthy

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weight status.[15–17] This low identification may be because pediatricians have low self-efficacy in managing obesity and report that poor patient and parent motivation,[18,19] lack of parental perception of the problem, and lack of patient education tools contribute to their counseling difficulties.[20] Pediatricians also report a desire for better counseling tools to guide patients toward lifestyle modification and better tools to communicate weight problems to their patients.[20]

Given the multitude of tasks required of primary care pediatricians, effective brief strategies for targeted counseling and weight status communication are essential. Yet, only a few studies report on whether such interventions change dietary or physical activity behaviors in school-age children or parental perceptions of obesity,[21–24] and those that do usually focus only on overweight[23] or older children.[24] We designed an intervention to help pediatrics residents prevent and treat obesity and overweight in children, including young children, which encouraged communication between providers and parents regarding children's weight status by using color-coded BMI charts and incorporating an easy-to-use assessment of dietary and physical activity behaviors and counseling tips. We examined its effects on parents' reported discussions of weight status with providers and accuracy of understanding their children's weight status, as well as parent-reported dietary and physical activity behavior change.

METHODS

Study Design and Participants

A pretest, posttest study was conducted over a 16-month period to measure the effects of a provider "toolkit" aimed at preventing and treating childhood obesity in a pediatric primary care setting. Children aged 4 to 12 years were consecutively recruited at the University of North Carolina Child and Adolescent General Clinic if they were being seen in the clinic for a well-child visit or a minor illness, were insured by North Carolina Medicaid or the State Children's Health Insurance Program (Health Choice), and had English-speaking parents or caregivers. This study was approved by the University of North Carolina at Chapel Hill School of Medicine Institutional Review Board (protocol 04-HPDP-771).

Intervention, Study Instruments, and Measurement

Pediatric resident physicians were invited to attend a one-hour noon conference training session which included a review of the epidemic of childhood overweight and instruction on how to deliver patient- and parent-focused interventions by using the "Healthy Weight" toolkit. This toolkit included color-coded BMI charts and a nutrition- and activity-focused "Starting the Conversation" (STC) assessment and counseling instrument. Training was required for study participation.

Color-coded BMI charts were used to plot the child's BMI according to age- and gender-specific norms set by the Centers for Disease Control and Prevention.[25] As described elsewhere,[26,27] we color coded the charts according to a stoplight motif (red, yellow, and green) based on the child's weight status to facilitate identification by the pediatrician and communication of BMI status with parents. Children were classified into measured BMI weight categories according to their gender and age as follows: <5th percentile, 5th to <85th percentile, 85th to <95th percentile, and ≥95th percentile. For most analyses, we collapsed 85th to <95th percentile and ≥95th percentile into 1 category due to small numbers in the 85th to <95th percentile group. For simplicity, particularly given the changing terminology around childhood weight categories, we refer to all of these children (≥85th percentile) as overweight.

Parents were asked to rate their child's weight by using then standard terminology describing the same 4 categories: "underweight," "healthy weight," "at risk for overweight," and "overweight." To determine accuracy of weight perceptions, parental responses were dichotomized by collapsing "at risk for overweight" with "overweight," because our goal was to help parents identify any nonhealthy weight status, and then compared with the collapsed categories of ≥85th percentile based on BMI as measured in the clinic. Thus, we classified parental reports as "accurately reported," "reported their child was thinner than he or she actually was," or "reported child was heavier than he or she actually was."

The STC nutrition and physical activity assessment and counseling instrument (from now on referred to as the STC instrument) was designed for use by primary care providers and is composed of evidence-based rapid assessment questions, with a section for physicians to provide tailored counseling messages. The STC instrument includes questions assessing current dietary and physical activity behaviors. Five dietary behavior questions are intended to measure behaviors that are likely to help to promote healthy weight: 1) number of servings of fruits and vegetables per day; 2) number of sugary drinks and fruit juice per day; 3) number of snacks like cakes, cookies, ice cream, candy, and chips per day; 4) frequency of eating food purchased away from home; and 5) type of milk that the child drinks most often. Five physical activity behavior questions ask parents to quantify the following: 1) hours of active play per day; 2) days per week the child plays outdoors; 3) hours of "screen time" (TV, video, computer games) the child gets each day; 4) involvement in sports teams and community groups; and 5) family activities per week. Respondents chose from three response categories (four for milk type) specific to each behavior (eg, "1 or fewer servings," "2–3 servings," ">3 servings"). Although our STC instrument was designed prior to release of the most recent American Academy of Pediatrics Policy Statement on Prevention of Pediatric Overweight and Obesity, the questions we used covered many similar behaviors and were developed based on previous research of behaviors related to weight status, face validity, and other research of assessment of weight-related behaviors (ie, use of outdoor playtime as a surrogate for physical

activity).[28] The complete toolkit has been previously described.[27]

Study Procedures

Electronic and manual patient visit schedules in the University of North Carolina Child and Adolescent General Clinic were reviewed several times per week to identify potentially eligible study participants. All parents of eligible children were approached by study research assistants in the patient examination rooms prior to the physicians' assessments. The research assistant described the research study expectations for the parents and children. Caregivers, primarily female (92%), then completed the baseline STC instrument (described above) and a baseline parent survey inquiring about the weight-related, nutrition, and physical activity information received from their primary care physician at the last clinic visit, and their own assessment of their children's weight status. The patient's weight and height were measured in clinic by using standardized equipment (model 5002 [Scale-Tronix, White Plains, NY] and model S100 [Ayrton Stadiometer, Ayrton Corporation, Prior Lake, Minn]) and plotted on the color-coded BMI chart by the research assistant. Prior to the clinician-patient encounter, the research assistant met with the resident physician for approximately 1 minute to review the STC instrument responses and BMI color-coded chart.

During the clinician and patient/parent encounter, the precise method of using the toolkit was left to the discretion of the resident pediatrician. Generally, the resident reviewed the patient's BMI with the parent and explained the child's weight status by using the color-coded BMI chart. The resident physician also used the completed STC instrument to identify dietary and physical activity behaviors that could put the child at risk for overweight, reviewed the responses with the parent, provided positive feedback for healthy behaviors, gave advice for 1 to 2 mutually chosen healthy behavior changes, circled recommended behavior changes, and gave a copy of the STC instrument with circled recommended behavior changes to the parent. One copy of the STC instrument was included in the medical record so that the clinician could monitor patient behavior changes from one visit to another. The intervention was designed to take 2 to 3 minutes of discussion between parents and residents.

The STC instrument and parent survey were repeated approximately 1 month and 3 months after the parent and child received the clinic-based counseling intervention.

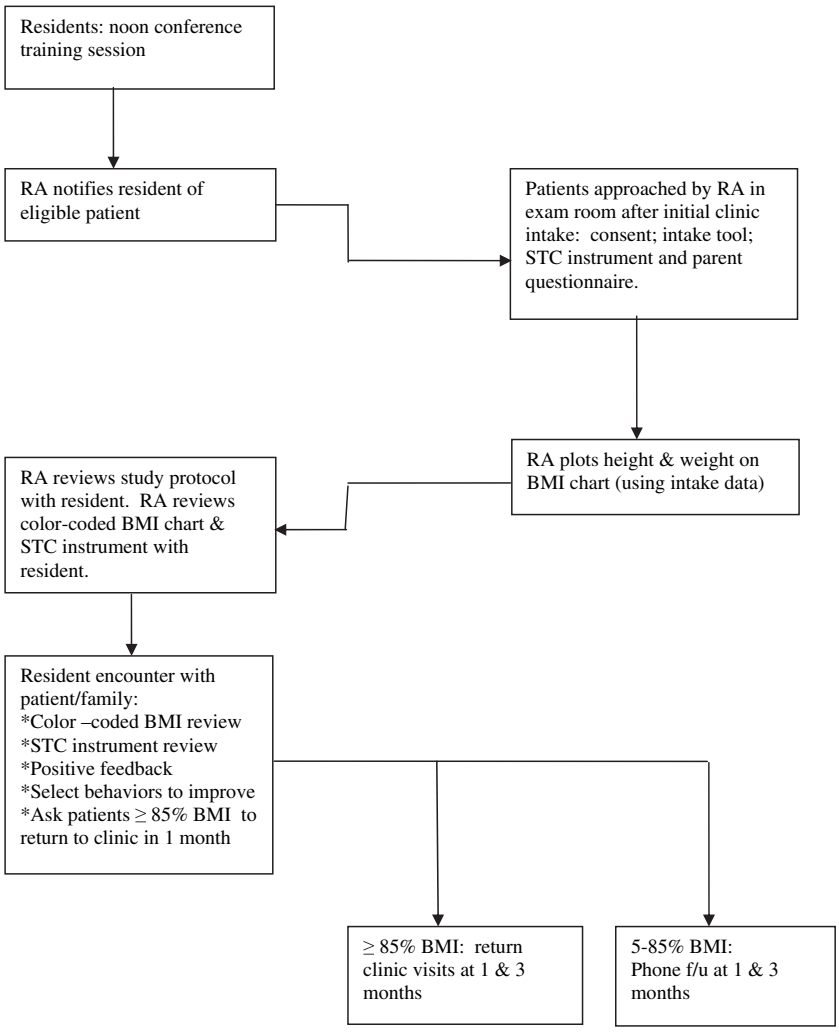

Figure. *Study procedures. RA = research assistant; STC = Starting the Conversation; BMI = body mass index.*

Follow-up occurred by telephone for those at healthy weight (BMI <85%) at baseline and in person at the clinic during a follow-up visit to check in with the family and reinforce counseling for those identified as overweight (BMI ≥ 85%). The Figure documents the study procedures in flowchart format.

Statistical Analysis

We hypothesized that parental reports of dietary and physical activity behaviors, as measured by the STC instrument, would improve following the intervention. The analyses in this report used baseline, 1-month, and 3-month follow-up data and focus on preintervention to postintervention changes for the 5 dietary questions and the 5 physical activity questions on the STC instrument. We examined differences in these ordinal responses by using Wilcoxon signed-rank tests. Dichotomous differences, such as those between overweight and healthy weight children, were examined using *t* tests or chi-squared tests, as appropriate. All analyses were performed using Stata version 10.0 (StataCorp LP, College Park, Tex).

RESULTS

Study Sample and Patient Characteristics

Of 52 potentially eligible pediatric resident physicians, 49 (94%) enrolled in the study, participated in patient enrollment and/or follow-up, and completed the posttest survey. Of the 115 children aged 4 to 12 years who enrolled in this study, 96 completed the 1-month follow-up questionnaires, either by telephone or in person depending on BMI weight category, for an 83% completion rate at 1 month, and 64 completed the 3-month follow-up, for a 56% completion rate at 3 months (60 completed 3-month follow-up of nutrition and physical activity behaviors). There were no significant differences between those who did and did not complete either follow-up interview in terms of age, gender, race, ethnicity, actual weight status, or parent-perceived weight status. Additionally, the only significant differences in baseline behaviors between those who did and did not complete 1-month follow-up were that those not returning were more likely to report fewer than 2 days of family activity per week and more likely to report eating out more than once per week. There were no baseline differences in behaviors between those who did and did not complete 3-month follow-up.

At 1-month follow-up, the children's average age was 7.6 years and 46.9% were male (Table 1). More than 90% of study participants were non-Hispanic and 64.6% were black/African American. Because all participants were insured by North Carolina's Medicaid or State Children's Health Insurance Program, all families had household incomes under 200% of the federal poverty guidelines. Use of the toolkit by the resident physician (BMI charts and STC instrument) required, on average, 2 to 3 minutes per study participant encounter and were generally regarded as alternative approaches for discussing topics that are routine components of the well-child visit rather than additional responsibilities.

Table 1. Demographic Characteristics of the Sample at Baseline and Each Follow-Up*

Characteristic	Baseline (n = 115)	1 Month (n = 96)	3 Months (n = 64)
Child age, y	7.5	7.6	7.6
Child gender			
Male	50.4	46.9	51.6
Parent gender			
Female	92.2	92.7	95.2
Child ethnicity			
Hispanic	7.8	9.4	10.9
Non-Hispanic	92.2	90.6	89.1
Child race			
White	20.9	22.9	23.4
African American	66.1	64.6	60.9
Other	13.0	12.5	15.6
Language preference			
English	95.7	94.8	95.3
Other	4.3	5.2	4.7

*Values are percentages unless otherwise indicated. *P* values from McNemar's exact test were nonsignificant for all variables.

Reported Dietary Behavior Changes

Significant differences in a healthy direction emerged at 1-month follow-up for reported consumption of fruits and vegetables, sugary drinks, unhealthy snacks, and lower-fat milk consumption for all children (Table 2). Even larger differences in a healthy direction were seen at 3-month follow-up, including improvements in consumption of fruits and vegetables, sugary drinks, unhealthy snacks, restaurant food, and lower-fat milk. Similar differences are noted when examining only overweight and obese children (data not shown).

Overall, between one fifth and one half of children reported behavior improvements from baseline to both 1-month and 3-month follow-up (Table 3). Overweight children were significantly more likely than healthy weight children to report drinking a lower-fat milk at both follow-up periods and also more likely to report improvements (decreases) in the frequency of eating restaurant meals at 3-month follow-up.

Reported Physical Activity Behavior Changes

Screen time improved, with more parents reporting that their children engaged in 2 hours or less of screen time per day at 1-month follow-up (Table 2) than at baseline (61.7% vs 48.9%; $P < .01$), and at 3-month follow-up compared with baseline (67% vs 45%; $P < .01$). There were no significant differences in other activities measured. As with dietary findings, similar results were seen when examining only overweight or obese children. There were also no significant differences by weight status in the proportion of children reporting improvements in physical activity (Table 3).

Weight-Based Communication Changes

A significantly greater percentage of parents of healthy weight children reported discussions of weight (68.6% vs 39.2%; $P < .001$) and BMI (52.9% vs 9.8%; $P < .001$) with their physician at 1-month follow-up compared to

Table 2. Percentage Reporting Diet and Exercise Behaviors

	Children Seen at 1-Month Follow-Up (n = 94)			Children Seen at 3-Month Follow-Up (n = 60)		
Behavior	Baseline	1 Month	*P* Value	Baseline	3 Months	*P* Value
Servings of fruits or vegetables each day						
Less than 3	44.7*	37.2	.022	43.3*	33.3	.011
3–4	45.7	45.7		50.0	50.0	
5 or more	9.6	17.0		6.7	16.7	
Sugary drinks per day						
1 or fewer	29.8**	44.7	.001	25.0**	50.0	.002
2	26.6	24.5		35.0	23.3	
More than 2	43.6	30.9		40.0	26.7	
Snacks per day						
1 or fewer	53.2*	64.9	.031	46.7**	73.3	.001
2–3	40.4	33.0		43.3	23.3	
More than 3	6.4	2.1		10.0	3.3	
Times eating out per week						
1 or fewer	54.8	66.7	.101	46.6**	67.2	.007
2–3	35.5	21.5		39.7	22.4	
More than 3	9.7	11.8		13.8	10.3	
Usual milk type						
Skim or 1%	11.7**	18.1	.001	11.7**	25.0	.004
2%	28.7	36.2		31.7	31.7	
Whole	53.2	39.4		51.7	36.7	
None	6.4	6.4		5.0	6.7	
Hours of active play per day						
Fewer than 1	6.4	8.5	.531	6.7	8.3	.889
1–2	31.9	33.0		30.0	28.3	
More than 2	61.7	58.5		63.3	63.3	
Days per week plays outside						
0–2	13.8	13.8	.399	13.3	11.7	.835
3–4	31.9	25.5		28.3	36.7	
5 or more	54.3	60.6		58.3	51.7	
Hours of screen time per day						
0–2	48.9**	61.7	.003	45.0**	66.7	.001
3	22.3	20.2		21.7	18.3	
More than 3	28.7	18.1		33.3	15.0	
Involved in sports teams or community groups						
Rarely/never	52.2	47.8	.131	46.6	43.1	.093
Once a week	23.9	20.7		27.6	12.1	
More than once a week	23.9	31.5		25.9	44.8	
Days per week family or community activities						
Less than 2	32.3	30.1	.285	35.6	32.2	.262
2–3	47.3	41.9		39.0	33.9	
More than 3	32.6	28.0		25.4	33.9	

Values are percentages unless otherwise indicated.
*$P < .05$. Wilcoxon signed-rank test.
**$P < .01$. Wilcoxon signed-rank test.

baseline. Additionally, a greater percentage of parents of overweight children reported discussions of weight (86.4% vs 68.2%; $P = .031$) and of BMI (71.1% vs 36.8%; $P = .002$) at 1-month follow-up. These questions were not asked at the 3-month time period.

Accuracy of Weight Perceptions

At baseline, 100% of parents of healthy weight children correctly perceived their child's weight; only 56.5% of parents of overweight children did ($P < .001$, *t* test). At the 1-month follow-up, 100% of parents of healthy weight children and 68.9% of parents of overweight children had an accurate perception of their child's weight ($P < .001$, *t* test). The changes from baseline to one-month follow-up were not significant ($P = .200$, *t* test). At 3-month follow-up, 74.1% of parents of overweight children had an accurate perception of their child's weight, a statistically significant improvement from baseline ($P < .05$, *t* test).

Weight Changes

At 1-month follow-up, all of the 46 children who were above the 85th percentile for BMI were measured again. Of these, 39 of the subjects remained in the same weight category as baseline. Of the 7 who changed weight categories, 3 shifted from overweight (85th–95th percentile) to obese (>95th percentile) and 4 improved: 3 from obese to overweight and one from overweight to healthy weight (<85th percentile). These changes were not statistically significant ($P = .706$, Wilcoxon signed-rank test). At 3-month follow-up, all of the 30 children who were above the 85th percentile at baseline were measured again, with 23 remaining in the same weight category. Of those who

Table 3. Percentage of Children Showing Improvement in Diet and Physical Activity Behaviors, by Weight Status at Baseline*

	Time 1–Time 2 (n = 94)			Time 1–Time 3 (n = 60)		
	Overweight	Healthy Weight	P Value	Overweight	Healthy Weight	P Value
Servings of fruits or vegetables each day	21.7	27.1	0.547	23.3	26.7	0.766
Sugary drinks per day	43.5	31.3	0.220	50.0	36.7	0.297
Snacks per day	28.3	25.0	0.721	40.0	30.0	0.417
Times eating out per week	30.4	17.0	0.128	**46.7***	**21.4**	**0.043**
Lower-fat milk	**32.6***	**12.5**	**0.019**	**36.7***	**13.3**	**0.037**
Hours of active play per day	13.0	12.5	0.937	10.0	23.3	0.166
Days per week plays outside	30.4	14.6	0.065	26.7	33.3	0.573
Hours of screen time per day	39.1	20.8	0.052	43.3	36.7	0.598
Involved in sports teams or community groups	19.6	28.3	0.328	26.7	32.1	0.647
Days per week family or community activities	26.7	31.3	0.627	31.0	26.7	0.711

Values are percentages unless otherwise indicated.
*$P < .05$, chi-squared test comparing overweight and healthy weight children. Bold indicates statistics that are significant.

changed weight categories, 2 who were in the overweight category became obese, whereas 2 more improved to become healthy weight. Three obese children improved their weight status: 2 to overweight and one to healthy weight. These changes were not significant ($P = .246$, Wilcoxon signed-rank test).

DISCUSSION

In our study, we were able to show that important short-term dietary and physical activity behavior changes were reported by parents of children aged 4 to 12 years following a relatively easy-to-implement intervention in a single pediatrics continuity clinic. Confirming prior research,[7,11,12] many parents of children in this age group whose BMIs are ≥85% perceive their children as at a healthy weight. Our intervention resulted in an improvement in the rate of parents correctly identifying their child's weight status. Although not as simple as weight alone, BMI flags risk for overweight and obesity better than traditional growth charting,[16] and our findings confirm previous research that simple modifications like color coding the BMI chart may facilitate documentation, discussion, and understanding of BMI.[26,29,30] However, based on published literature, ours may be the first intervention to change parental recognition of overweight through a simple clinic-based intervention.

Providers who use BMI may be more likely to recognize mild overweight at an earlier age, when treatment may require less significant behavior change. These providers may also be more likely to provide nutrition and activity counseling for overweight children. Also, we know from prior study that parents perceive doctors' nonchalance about overweight at early ages as a barrier to changing health habits.[31] Importantly, in our study, which focused on communicating BMI status and providing targeted behavior counseling, there were significant short-term (3-month) improvements in reported dietary and physical activity behaviors. Our study suggests that the clinical setting can be an effective site to address at least short-term behavior changes to improve obesity and echoes recent research demonstrating that physicians' assessment of parental confidence and readiness to change is associated with parental confidence to make changes.[32]

One of the most important strengths of our study is that it was a real-life, brief, and user-friendly intervention that could be implemented in most pediatrics clinics, especially ones that have electronic medical records and a system for handing out questionnaires in the waiting room. The population was also heterogeneous, suggesting that diverse populations could similarly benefit. Although studies have shown that brief interventions similar to ours in pediatric providers' offices have demonstrated feasibility[30,33] and improved parental confidence, and others show chart evidence of provider improvements in counseling rates, documentation of overweight,[29,33,34] or confidence,[23,24] there are few reports that assess parent perception or child behavior outcomes.

Two important studies that did assess behavior outcomes showed that a primary care intervention did not produce any significant differences in child behavior.[22,35] One possible reason we were able to demonstrate improvements in behaviors was our focus on recognition of weight status by parents. We do not know specifically if improved parental accuracy of weight status translates into greater understanding of the need to follow behavioral prescriptions with respect to nutrition and physical activity or weight trajectories, and our sample was too small to assess this association. However, this area deserves further research as a possible mechanism for improving the effectiveness of clinic-based obesity interventions.

Our study had several limitations. The changes reported are only short term, and our sample size was relatively small, derived from the willing English-speaking families at just one clinic, so generalizability is limited. However, our clinic is diverse, and this was reflected in the demographics of our sample. Small sample size also limited the ability to fully assess the relationship between improved weight status understanding and behavior change. This small sample size is mostly attributed to the relatively infrequent occurrence of parents scheduling and bringing their 4- to 12-year-olds to clinic for well-child visits in this population. Attrition (particularly from 1-month to 3-month follow-up) also limits our interpretability. However, the limitation of attrition is mitigated by the fact that demographics were similar between groups that did and did not complete the study, and the only

differences in behaviors were at the 1-month follow-up. Interestingly, these differences reflected the fact that busier families likely followed up less often, as they were more likely to report fewer than 2 days of family activity per week and more likely to report eating out more than once per week. Another limitation is that our STC instrument has not been previously validated, although the questions are based on previous research. Importantly, the changes seen in reported behaviors could easily be the result of social desirability or reporting bias, and we do not have objective measures of diet or physical activity before and after implementation of the tool. Also, parent report of discussions with the physician of weight or BMI may not accurately reflect whether or not they occurred. Our results were only assessed at 1 and 3 months following the intervention, so we cannot attest to sustainability. Longer follow-up periods would also allow for greater tracking of changes in children's weight status and how behavior changes affect weight trajectories long term. Finally, the lack of a control group definitely limits the ability to assess whether changes seen were related to the intervention, and thus causality cannot be determined. This should be remedied in future research.

Treatment plans cannot address unidentified problems. Whether BMI screening and communication to parents of young children and changed understanding of children's weight status helps parents adopt recommended behavior changes, or whether it changes pediatricians' management, has not been adequately investigated and is an area ripe for future research. For families who do not change behaviors with such a simple intervention, more intensive counseling may be necessary, such as a motivational interviewing approach that has shown promise.[21] Also, more research might be needed to find out which parent and practitioner characteristics are associated with lack of change, to improve dynamic communication.

Still, ours is one of the first studies to report short-term healthy weight behavior adoption following brief provider counseling. Given the evidence that television reduction is associated with BMI reduction[36,37] and the importance of sugary beverages toward total daily energy intake,[38] it is encouraging that parents in our study reported improvement in these areas. Our finding of improved reports of discussion of BMI following use of color-coded BMI charts adds to the growing body of research on this potentially important tool. Future research is needed to determine whether tools like this and our STC assessment and counseling instrument might impact sustainable and important behavior change and weight status for children in our increasingly "obesogenic" world.

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