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SUPPLEMENT ARTICLE

Impact of a Primary Care Intervention on Physician Practice and Patient and Family Behavior: Keep ME Healthy—The Maine Youth Overweight Collaborative

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ABSTRACT

OBJECTIVE. To evaluate the effect of a pediatric primary care–based intervention, on improved clinical decision support and family management of risk behaviors for childhood overweight.

METHODS. An experimental field trial was conducted with 12 intervention sites in urban and rural areas of Maine and nonrandomized control sites. Change was assessed by using clinical and parent measures from 9 intervention and 10 control sites before and during the Maine Youth Overweight Collaborative intervention. Longitudinal information was collected from chart audits of patients aged 5–18 years (n = 600), systematic samples of parents collected before (n = 346) and during (n = 386) the intervention in 12 sites, and systematic samples of parents in 9 intervention (n = 235) and 10 control (n = 304) sites collected during the intervention. Surveys of health care providers (n = 14 and 17) before and during the intervention were also collected. Teams worked over 18 months to implement improvements in clinical decision support, including tracking BMI percentiles, identification of overweight patients, appropriate laboratory tests, counseling of families and patients use of a behavioral screening tool, and other improvements following the chronic-care model targeting patients aged 5 to 18 and their families.

RESULTS. Large changes occurred in clinical practice from before to during the Maine Youth Overweight Collaborative: increases in assessment of BMI (38%–94%), BMI percentile for age and gender (25%–89%), use of the 5-2-1-0 behavioral screening tool (0%–82%), and weight classification (19%–75%). Parent surveys indicated improvements in providers' behavior and rates of counseling. Intervention providers reported improvements in knowledge, attitudes, self-efficacy, and practice.

CONCLUSIONS. The Maine Youth Overweight Collaborative intervention improved clinical decision support and family management of risk behaviors, indicating a promising primary care–based approach to address overweight risk among children and youth. *Pediatrics* 2009;123:S258–S266

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Key Words
obesity, overweight, child, primary care, chronic-care model

Abbreviations
MYOC—Maine Youth Overweight Collaborative
NICHQ—National Initiative for Children's Healthcare Quality
CDC—Centers for Disease Control and Prevention
TV—television
OR— odds ratio
CI— confidence interval

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THE PREVALENCE OF childhood overweight* is increasing rapidly in the United States and now affects at least 16% of children and adolescents,[1] with even higher rates among subpopulations of minority, economically disadvantaged[2,3] and rural children.[4] Overweight is associated with significant health problems in this age group and is an important early risk factor for much of adult morbidity and mortality. The rapid increase in the prevalence of childhood and adolescent overweight portends an increase in associated chronic disease. An estimated 60% of overweight 5- to 10-year-olds already have 1 associated cardiovascular disease risk factor, or hyperinsulinemia, and more than 20% have 2 or more associated cardiovascular disease risk factors.[5] The incidence of type 2 diabetes, until recently thought to have an almost exclusively adult onset, has increased dramatically among youth.[6] Overweight and sedentary children and adolescents are also more likely than their peers to have adverse lipid levels, hypertension, orthopedic problems, and social stigmatization.[7]

These increases in overweight among children and adolescents call for intervention strategies that are broad-

*We define overweight following the Centers for Disease Control and Prevention (CDC) definition during the Maine Youth Overweight Collaborative (MYOC): children with BMI values at ≥95th percentile of the gender-specific BMI growth charts. These children are now categorized as obese (see www.cdc.gov/nccdphp/dnpa/bmi/childrens_BMI/about_childrens_BMI.htm).

based, including multiple sectors of society.[8–10] One important focus for intervention is the primary health care setting, where providers already see most children and youth in the United States. This setting may be opportune for creating awareness and motivating change to reduce overweight risk. Current gaps in both care and provider attitudes highlight the opportunities that exist in this area.[11] Providers are not widely measuring BMI percentiles for children, delivering preventive behavioral messages, or providing appropriate medical evaluation for overweight. There is also a documented lack of provider confidence (or self-efficacy) for addressing overweight in children and addressing lifestyle issues with children and their families.[12–16] Unfortunately, there is very limited evidence for effective clinical interventions to prevent or treat overweight in primary care settings or to routinely deliver preventive messages related to healthy nutrition and physical activity.[17–19]

The Maine Youth Overweight Collaborative (MYOC) is a primary care–based intervention implemented over 18 months that targets youth aged 5 to 18 years and their families. The intervention took place at 12 sites in both urban and rural areas of Maine. Intervention materials were designed to follow the conceptual framework of the chronic-care model following the Institute for Healthcare Improvement's Breakthrough Series Collaborative model.[20–23]

This report focuses on evidence for improvement in 2 important aspects of this model of clinical practice: improved clinical decision support and family management of risk behaviors. Improvements in clinical decision support included tracking BMI percentiles, identification of overweight patients, and use of a behavioral screening tool. Family management of risk included counseling of families and patients on 5-2-1-0 behavioral goals: encouraging ≥5 servings of fruits and vegetables daily; limiting screen time to ≤2 hours daily; ≥1 hour of physical activity daily, and; avoiding (0) sugar-sweetened beverages. Other goals included overall practice and provider improvements following the chronic-care model.

MYOC Intervention

Theoretical Framework

The MYOC intervention was designed to implement improvements in clinical decision support among children and youth aged 5 to 18 years, counseling of families and patients on 5-2-1-0 behavioral goals, and overall practice and provider improvements following the chronic-care model.[20–22] Successful learning collaborative models have been developed for asthma, diabetes, and other chronic diseases.[24–29] In partnership with the Maine Harvard Prevention Research Center, the Maine Center for Public Health established the MYOC in collaboration with the Maine Chapter of the American Academy of Pediatrics. We used the American Academy of Pediatrics policy statement for prevention of pediatric overweight and obesity[30] as a guide for the MYOC. Although evidence from randomized trials is lacking to support any particular primary care strategy to prevent or treat the development of overweight among children and youth,[31,32] we used expertise gained from research conducted by the Harvard Prevention Research Center, the National Initiative for Children's Healthcare Quality (NICHQ), the Centers for Disease Control and Prevention (CDC), and others who have documented effective strategies for reducing overweight in developing the MYOC key-change package focused on the 5-2-1-0 behavioral targets.[31,33,34] We followed the approach of Rollnick et al[35,36] in adapting elements of motivational interviewing for brief interventions to promote health behavior change that considers the time constraints of busy primary care settings. Materials were developed or adopted to enhance maintenance of behavior change.[37]

Intervention Components and Tools

Each intervention site participating in the MYOC received packages of tools for clinical decision support and counseling and self-management support for families and patients. All tools and the key-change package and evaluation logic model are available online.[38]

Clinical Decision Support

Tools for clinicians included the Pediatric Obesity Clinical Decision Support Chart[38] with an algorithm and guidelines for the prevention and management of overweight; guidelines for medical evaluation of overweight patients and hypertension management; reference laboratory values and blood pressure and BMI percentile charts; a discussion of limitations of the BMI; and guidelines for effective communication with families, including tips for brief, focused advice and brief negotiation around the 5-2-1-0 behavioral targets. Practices worked to assess BMI percentiles on all children aged 5 to 18 years annually and to follow the expert panel recommendations for medical assessment of overweight patients, which included checking fasting lipid profiles and a liver function panel (alanine aminotransferase/aspartate aminotransferase) if the patient was overweight and aged ≥10 years and fasting blood glucose if the clinician identified more than 1 risk factor for diabetes.

Practice teams were encouraged to develop clinical information systems to track outcomes and improve care; they were provided an Excel- or Access- (Microsoft, Redmond, WA) based overweight population registry developed by the MYOC and NICHQ. If practices had an electronic medical record system, they were provided technical support and encouraged to develop a registry; track key clinical metrics for overweight patients (eg, BMI, blood pressure, goal setting, follow-up); and identify patients who would benefit from proactive care (eg, patients who had not been seen in >6 months or needed referral to a specialist).

Counseling and Self-management Support for Families and Patients

Strategies focused on 5-2-1-0 behavioral goals. Tools developed for the office visit include the 5-2-1-0 behavioral screening tool and Keep ME Healthy poster for waiting rooms and offices featuring the 5-2-1-0 behav-

ioral goals. Additional tools have been added since the MYOC, including goal-setting worksheets and goal trackers for families to chart 5-2-1-0 behaviors and parent/child flipcharts with healthy lifestyle tips, all of which are also available on the Web site.[38]

The 5-2-1-0 behavioral screening tool is a 1-page survey for parents or youth to complete in the waiting room. The screen was designed to be simple to complete (all questions are answered with "yes" or "no"; eg, "I watch TV [television], videos, or play computer games less than 2 hours per day.") Questions cover fruit and vegetable intake, family meals and daily breakfast, TV and other screen time, whether a TV is in the bedroom, physical activity, and sugar-sweetened beverage, milk, and fast-food consumption. The screening tool and poster were designed to focus parent/provider discussion around 5-2-1-0 evidence-based risks.

Practice teams were encouraged and supported (through learning sessions, bimonthly calls, site visits, other communications and tools) to routinely deliver 5-2-1-0 healthy lifestyle messages to all patients during annual preventive care visits; to assess patient readiness to change by asking questions related to the importance of and confidence in making change; to promote self-management skills with patients; and to assist patients with setting self-management goals for behavior change.

Other supports provided, but not evaluated in this analysis, included health care system support and the promotion of leadership on youth overweight among health care system leaders, including public and private payers. Participating practice teams were asked to include senior leaders at learning sessions and at the final celebration. They were also asked to keep senior leaders within their respective organizations informed about their MYOC activities and progress toward MYOC goals. In addition, the MYOC also worked to assist in health care system redesign or identifying the care team in the practice and clarifying roles for each team member.

Teams consisted of at least 3 persons from each practice and were required to include a physician, a second clinician (eg, nurse), and an administrative staff leader. The concept of the team approach is central to the chronic-care model and an important premise underlying the ability of the practice to implement MYOC system changes. Team members were asked to make joint decisions about patient tracking, assessment, education, and follow-up, with decisions tailored to the needs, context, and skills of each team. Before the first learning session, teams were asked to identify and clarify roles and expectations for each team member. Teams were asked to set up regular meetings to assess team functioning and plan improvements. Teams were asked to provide care for overweight patients by using planned care follow-up visits and to use alternative models of care to support overweight patients (eg, telephone follow-up or group visits).

The MYOC also encouraged sites to partner with communities and with 1 or more community organizations with the potential to affect healthy lifestyles for children. As part of this community outreach, practices were encouraged to form alliances and partnerships with state programs, Healthy Maine Partnership sites, local agencies, schools, faith organizations, businesses, and others to inform and support individuals and their treatment plans.

MYOC Implementation

The MYOC was implemented by using the Breakthrough Series Collaborative model developed by the Institute for Healthcare Improvement.[23] MYOC work was guided by a steering committee that met 7 times (once before the MYOC started and quarterly thereafter). Steering-committee members represented providers; provider organizations; specialists and other clinical experts; community organizations; payers; academic partners; the Maine Center for Disease Control; and the NICHQ. The steering committee convened an expert panel to review existing literature and protocols and develop the key-change package.

Twelve practices participated in the MYOC for 18 months (November 2004 through April 2006). The practices provide significant levels of care for the underserved and represent ~25% of pediatric groups statewide. Practices were self-selected and included geographic locations throughout the state, including 1 pediatric and 1 family practice residency program, 9 primary care pediatric practices, and 1 family practice. Approximately 58% of Maine children are eligible for MaineCare (Medicaid), and ~10% are underinsured or uninsured.[39] The estimated numbers of pediatric patients in MYOC practices averaged 7200 (range: 3000–18 000), and the number of providers averaged 7 (range: 3–23).

Each site was requested to send the 3-member multidisciplinary team (provider leader/champion, another medical staff, and administrator) to three 1½-day learning sessions. During November and December 2004, participating practices began collecting baseline chart data to identify performance gaps (the difference between current and desired performance) in their practice. During the first learning session in November 2004, teams were taught the chronic-care model and concepts of quality improvement, including the model for improvement (a specific approach to quality improvement that emphasizes the use of small, incremental tests of change).[23] They were provided materials and information on the basis of guidelines developed by the expert panel (convened June 2004), including the key-change package. Coaching and support was provided through the 2 additional learning sessions; bimonthly conference calls used to bolster best practice around medical evaluation and follow-up and to engage practice teams in discussion; site visits; periodic e-mails that provided the latest news and literature on relevant topics to practice teams; and periodic performance feedback based on expert faculty review of bimonthly project team reports. The first 2 learning sessions focused extensively on brief, focused negotiation, patient goal setting, evidence-based guidelines, and the basis to quantify improvements, whereas the third session provided extensive information on shared medical appointments and group visits.

METHODS

Design

The design of this evaluation was quasi-experimental,[40] meaning that we lacked randomized control sites. Data were collected before the intervention began in intervention sites in November 2004 (pre-MYOC) and then after 16 to 17 months of implementation in spring 2006 (during MYOC). The primary study contrast is between measures collected before and during implementation of the MYOC. We contrast, for example, the percentage of charts of youth aged 5 to 18 years with no BMI percentile assessed and hypothesized that there would be improvements in the intervention sites from pre-MYOC to during the MYOC. From parent/caretaker (parent) surveys collected before and during the MYOC, we likewise expected improvements in the percentage reporting counseling on 5-2-1-0 behavioral targets.

We also used a quasi-experimental design, with during-MYOC intervention data (fall 2006) from parent surveys in 9 intervention and 10 control sites with measures of provider counseling on 5-2-1-0 topics. We hypothesized that parent reports from intervention sites would show more evidence of clinician counseling on 5-2-1-0 topics compared with controls. Our evaluation was designed to collect data by using relatively low-intensity, low-cost collection methods over the first 18 months of the MYOC; a larger outcome evaluation is now ongoing by using follow-up BMI data.

Data

Data were collected via chart reviews, surveys of parents, and surveys of providers participating in the MYOC. The study received institutional review board approval by the Harvard School of Public Health Committee on Human Subjects.

Chart Reviews

In March 2006, staff in the MYOC sites reviewed charts for the last 70 well-child visits in each site for patients aged 5 to 18, including at least 10 charts per provider (or <10 per provider spread equally among a number of providers equaling <7). Data were gathered for the most recent well-child visit and for the last well-child visit before 2005. We created a longitudinal data set to examine change over time for the same subjects from pre-MYOC (before November 2004) to during the MYOC (January 2005 to March 2006). Data included assessment of weight and height, BMI, BMI percentile, overweight weight classification, and blood pressure and diagnosis of overweight.

Chart review data were abstracted by site personnel onto data forms. Age was calculated by using birth date and date of examination; gender was noted from the chart. We defined overweight following CDC guidelines at the time and used CDC SAS software (www.cdc.gov/NCCDPHP/dnpa/growthcharts/resources/sas.htm).

Charts for 896 patients were reviewed in spring 2006; of these, 600 were the appropriate age (5–18) with gender assessed, a visit during the MYOC, and a documented pre-MYOC visit (before November 2004). These data comprise a longitudinal sample with data before and after initiation of the MYOC (see Table 1).

TABLE 1 Cohort Chart Review Data: Keep ME Healthy Before and During MYOC Intervention Change in Clinical Practice Indicators ($N = 600$)

	Before the MYOC (00/1997–10/2004), %	During the MYOC (01/2005–03/2006), %	*P*
Cohort patient characteristic			
Age, y			
5–11	—	56	
12–17	—	44	
Female	—	47	
At risk of overweight ($n = 568$) (BMI ≥ 85th percentile)	36.8	38.9	
Overweight prevalence (BMI ≥ 95th percentile)	19.75	20.3	
Underweight (BMI < 10th percentile)	4	2	
Clinical practice indicator: change from before to during the MYOC[a]			
Recorded height	99	99	—
Recorded weight	99	99	—
Assessment of BMI	38	94	.0001
BMI percentile for age and gender	25	89	.0001
Weight classification made	19	79	.0001
Used 5-2-1-0 behavioral screening tool	0	82	.0001
Blood pressure recorded	92	95	.18

[a] Change models take into account clustering of observations within site.

Parent/Caretaker Surveys Before and During the MYOC

A brief baseline parent/caretaker survey (parent survey) was developed consisting of 4 items to assess parents' awareness of ever having heard lifestyle messages around the 5-2-1-0 theme from their child's provider or nurse in the office. Both pre-MYOC and during-MYOC surveys included the same 4 questions: (1) "Has a doctor, nurse, or anyone else in this office ever talked to you about nutrition?" (yes/no); (2) "Has a doctor, nurse, or anyone else in this office ever talked to you about physical activity or exercise?" (yes/no) (3) "Has a doctor, nurse, or anyone else in this office ever talked to you about TV viewing or other screen time?" (yes/no) and (4) "Has a doctor, nurse, or anyone else in this office ever talked to you about sugar-sweetened drinks?" (yes/no). In October 2004, staff mailed parent surveys to participating MYOC practices that distributed the surveys in waiting rooms to parents of children at the onset of well-child visits. Practices were asked to collect surveys from the first 50 parents of patients presenting for well-child visits.

For the during-MYOC parent survey, items were added to include questions about the last well-child visit, goal setting and attainment, and perceived quality of the advice received concerning 5-2-1-0 messages. Questions included: "Did a doctor, nurse, or anyone talk with you about sugar-sweetened drinks at your child's last visit?" Follow-up questions included: "Did you and your child set a goal of no sugar-sweetened drinks for your child?

"Did you and your child make any sugar-sweetened drink-related changes?" and "How would you rate the quality of the advice you received about sugar-sweetened drinks at that visit? (poor, fair, good, very good, excellent)?" Similar questions asked about nutrition, physical activity, and TV and other screen time. We have no data documenting reliability of these questions. These items were developed to be simple to use in clinical settings. There were no reports from practices to indicate that parents had difficulty answering. Practices were mailed the surveys in mid-February 2006 and asked to return completed surveys by March 2006. Practices were asked to distribute surveys to the first 70 parents of patients presenting for well-child and other acute visits. We excluded acute visits.

A total of 346 surveys were available for analysis before the MYOC (October/November 2004), and 386 were available during the MYOC (February/March 2006). Data to estimate response rates to these surveys were not collected.

During-MYOC Parent Survey: Intervention and Control Sites

A during-MYOC parent survey was administered to parents of patients aged 0 to 18 years visiting an MYOC or control site during November 15, 2006, to December 31, 2006, for a well-child or acute visit. Up to 100 surveys were handed out at each site (average: 73). We estimated an overall 97% response rate; 96% for intervention and 98% for control sites. We dropped from analysis surveys with unclear age, children with no previous visit to the practice, those outside of ages 5 to 18 during the MYOC, and those without complete data for the variables studied, for a final sample of 539. Survey questions asked about 5-2-1-0 behaviors replicated from the during-MYOC survey already described.

Provider Surveys Before and During the MYOC

A paper-and-pencil provider survey, consisting of 40 items, was developed to measure provider knowledge, attitudes, self-efficacy and practices around key MYOC objectives including measurement and tracking of height and weight, BMI percentile calculation, overweight classification, behavioral goal setting around 5-2-1-0 behaviors, brief motivational interviewing, and working with local community organizations to support patients. Survey respondents were asked how strongly they agreed or disagreed with statements on a Likert-type (1–5) scale. All MYOC providers were asked to complete the survey before the first MYOC learning session in November 2004 and a follow-up in March 2006. The during-MYOC survey included all the pre-MYOC questions as well as additional questions exploring providers' experiences with specific aspects of the MYOC, such as trainings, administering the 5-2-1-0 screening form, keeping a registry, ordering appropriate laboratory tests, positive effects of the collaborative, and challenges.

Data Collection at the Primary Care Sites

Pre-MYOC and during-MYOC data were collected in the original 12 MYOC sites. In the fall of 2006, 10 additional new sites were selected to participate in a second MYOC; these sites were also self-selected and can be considered similar to the original MYOC sites in demonstrating an interest in improving systems of care related to youth overweight. Nine of the original 12 MYOC sites participated in this new phase. During-MYOC parent-survey data were gathered in sites, with the 10 new sites serving as controls. The 9 MYOC sites and the 10 control sites appear to be similar on a number of characteristics. The MYOC sites reported an average of 4600 children as having a medical home at that site, and control sites reported an average of 4400; the average percentage of patients with MaineCare was 45% in the 9 MYOC sites and 34% in the control sites. To check for potential differences, we also compared the 9 MYOC sites with the 3 MYOC sites not participating in the new collaborative by using parent-survey data from spring 2006. We examined questions about each of the 5-2-1-0 behaviors at the child's last visit. There were no significant differences between groups.

Statistical Methods

The primary hypothesis was of substantial change in MYOC sites over time in the outcomes selected under the counterfactual assumption that, in the absence of the MYOC, there would have been no or minimal change. For analysis of change in rates, we tested for a change in proportions over time, taking into account clustering of observations within site by using SAS SURVEYMEANS.[41] This approach takes into account the intraclass correlation of responses within sites. For analyses of change in parental/caretaker reports within sites, we tested for differences in proportions from before and during the MYOC, taking into account the clustered observations within sites by using the LOGISTIC procedure in SUDAAN.[42] We used SAS SURVEYLOGISTIC for analysis of differences in rates among intervention and control sites, controlling for age of child and also taking into account the clustered design. Provider surveys were given to a census of participants in the MYOC and, as such, were not subject to sampling variability, so descriptive results are reported without statistical tests for differences.

RESULTS

Change in Chart Review Data From Before to During Implementation of the MYOC

Chart review data (Table 1) indicate that during the MYOC visit, 20.3% of this sample was classified as overweight on the basis of weight, height, age, and gender documented in the chart. There were no significant increases noted in assessment of blood pressure (from 92% to 95%) or height or weight (from 99% to 99% for both) from before to during the MYOC. There were large shifts in assessment of BMI (38%–94%; $P < .0001$), BMI percentile for age and gender (25%–89%; $P < .0001$), and weight classification by provider (19%–75%; $P < .0001$). Use of the 5-2-1-0 behavioral screening tool increased from 0% (it was not available before the MYOC) to 82% ($P < .0001$).

TABLE 2 Parent Recalls of Behavioral Issues Discussed During Clinical Visits: Keep ME Healthy Intervention Sites Before and During the Intervention

Question: Has a Doctor, Nurse, or Anyone in This Office Ever Talked to You About. . .	Before Intervention (October 2004) ($N = 341$), % Yes	During Intervention (February-March 2006) ($N = 378$), % Yes	P[a]	Odds Ratio (95% CI)[a]
Nutrition?	74	92	.0002	4.0 (2.1–7.7)
Physical activity or exercise?	78	88	.02	2.1 (1.2–3.7)
Television viewing or other screen time?	58	79	.005	2.7 (1.4–5.3)
Sugar-sweetened drinks?	54	82	.0004	3.7 (1.9–7.1)

[a] The statistics take into account clustering of observations within sites. Odds ratios are from logistic regressions comparing preintervention and during-intervention results.

Changes in Parent/Caretaker Surveys From Before to During the MYOC

The parent-survey results indicate improvements in the rate at which providers talked about 5-2-1-0 messages after initiation of the MYOC. Before the MYOC, between 54% and 74% of parents reported ever having someone in the pediatric office talk to them about nutrition, physical activity or exercise, TV or screen time, and sugar-sweetened drinks. During the intervention, as indicated by the logistic regression results, the rates improved for talking about nutrition (odds ratio [OR]: 4.0 [95% confidence interval (CI): 2.1–7.7]; $P < .0002$), physical activity or exercise (OR: 2.1 [95% CI: 1.2–3.7]; $P = .02$), TV or screen time (OR: 2.7 [95% CI: 1.4–5.3]; $P < .005$), and sugar-sweetened drinks (OR: 3.7 [95% CI: 1.9–7.1]; $P < .0004$) (see Table 2).

Additional questions in the during-MYOC survey asked parents about their last well-child visit, whether a doctor or a nurse talked with them about the 5-2-1-0 topics, whether they set goals to change these behaviors, and whether behavior changes were made. Most parents reported a doctor or a nurse discussing these topics with them at the last visit. Forty-nine percent of the parents reported setting a goal of ≥5 fruits and vegetables per day; 26% reported making nutrition changes; 40% reported setting a goal of at least 1 hour of physical activity per day; 15% reported making physical activity changes; 38% reported setting a goal of ≤2 hours of screen time per day; 12% reported making TV/screen changes; 32% reported setting a goal of drinking no sugar-sweetened beverages; and 17% reported making changes in these drinks (see Table 3). These results, thus, provide some evidence that the intervention may be affecting change in these risk behaviors. In addition, when asked to rate the quality of the advice they received, more than half of the parents rated the quality of advice in each of these areas as good, very good, or excellent.

During-MYOC Parent Survey: Intervention Versus Control Sites

During-MYOC surveys of parents were conducted in the late fall (November/December) of 2006 in 9 MYOC and 10 control sites. Similar age distributions were observed in the intervention and control sites. Adjusted logistic regression results indicate that parents at the intervention sites compared with controls reported higher rates of counseling at the last well-child visit concerning fruits and vegetables (OR: 2.12; $P < .0001$), physical activity (OR: 1.90; $P < .005$), TV (OR: 2.80; $P < .001$), and sugar-sweetened drinks (OR: 2.63; $P < .001$).

Provider-Survey Results

Fourteen providers (representing 88% of MYOC team providers at baseline) completed the pre-MYOC provider survey, whereas 17 providers (representing 100% of MYOC team providers) completed the survey at the

TABLE 3 Parent Recalls of Behavioral Issues Discussed at Last Visit of Child (Aged 6–18 at Time of Survey) for Keep ME Healthy Intervention and Control Sites

	Intervention Sites (9) ($N = 235$), %	Control Sites (10) ($N = 304$), %	P[a]	Adjusted OR (95% CI)[a]
Age group, y				
5–11	51.6	57.1		
12–18	48.4	42.9		
Counseling questions: Did a doctor, nurse, or anyone talk with you about. . .at your child's last visit?				
Fruits and vegetables? (yes)	74.0	58.5	.0001	2.12 (1.45–3.11)
Physical activity or exercise? (yes)	81.3	69.4	.005	1.90 (1.32–2.72)
TV viewing or screen time? (yes)	71.5	48.7	.001	2.80 (1.49–5.24)
Sugar-sweetened drinks (eg, soda, sports drinks, juice drinks, or fruit punch)? (yes)	63.8	41.1	.0001	2.63 (1.76–3.92)

Surveys were completed in 2006.

[a] Adjusted for age composition by using multivariable logistic regression and taking into account the clustering of observations within sites.

final MYOC learning session in May 2006 (during the MYOC). All providers were aware of the American Academy of Pediatrics recommendation to track BMI percentile for age and gender annually for all children and adolescents. Increases were observed in indicators from pre to post: 64% and 94% knew the correct BMI percentile range for at risk for overweight, and 93% and 100% knew the correct BMI percentile range for overweight at baseline and after the test, respectively. Although this was a small sample of providers, results indicate increases in provider-perceived self-efficacy in addressing weight with all patients, as well as nutrition, physical activity, screen time, sugar-sweetened beverages, behavioral goal setting, and brief, focused negotiation. More providers reported behavioral goal-setting with overweight patients, and more reported using motivational interviewing.

Awareness of specific community resources increased from 50% to 88%. At the latter survey, 87% of providers reported the 5-2-1-0 behavioral screen as useful or very useful with all patients, and 93% of providers considered the survey useful or very useful for use with overweight patients. Only 40% of providers considered keeping a registry or performing recommended laboratory tests on overweight patients to be useful or very useful.

DISCUSSION

This evaluation of the MYOC documents the success of clinicians in 12 sites located throughout Maine in effectively changing practices that can identify, prevent, and treat childhood overweight. Study results indicate large changes in clinical practice from before to during implementation of the MYOC: increases in assessment of BMI percentile for age and gender, use of the 5-2-1-0 behavioral screening tool, and weight classification. Independent parent surveys indicate improvements in providers discussing the 5-2-1-0 behavioral targets: nutrition, TV time, physical activity, and sugar-sweetened drinks from before to during the MYOC. Control sites were identified, and during-MYOC intervention data from parent surveys indicate higher rates of counseling at the last well-child visit for all the 5-2-1-0 targets in intervention versus control sites (fruits and vegetables, physical activity, TV, and sugar-sweetened drinks). Consistent with these data, providers at the intervention sites reported improvements in knowledge, attitudes, self-efficacy, and practice, including medical evaluation of overweight patients, counseling on 5-2-1-0 targets, use of goal setting, and motivational interviewing.

This quasi-experimental study has several limitations. It was not possible to randomly assign the intervention to sites; thus, there is always the potential for unmeasured differences between the intervention and control sites in explaining the observed differences. Although we have clear evidence for change in clinical measures from before during the MYOC, the study lacks a comparable control group for these analyses to ascertain the level of change that might have been expected in the absence of the MYOC. The very large changes observed over such a short period of time, however, argue for a clear intervention effect.

The pre-MYOC and during-MYOC parent surveys also indicate substantial increases in counseling around 5-2-1-0 behavioral targets by intervention-site providers. Again, however, we do not have a true randomly assigned control group; thus, some of the change could have happened in the absence of the MYOC. To minimize expense and respondent burden, we also did not collect detailed background data concerning the pediatric patients or their parents. We relied on a systematic sampling plan within sites (consecutive patients), large samples, and control sites to improve our estimates of impact. Thus, there is the potential for unmeasured confounding variables to bias results.

Our measures asked parents to recall counseling either at any point in the past or at the last well-child visit and were developed to be inexpensive and easy to administer. We do not have formal data indicating reliability or validity. Low reliability would tend to bias our results to the null. Follow-up data from the second parent survey indicated, however, that between 12% and 26% of children changed targeted 5-2-1-0 behavior, indicating that the counseling received may have been having an effect. Another methodologic concern is the potential for measurement error in assessment of weight, height, and, hence, calculation of overweight.

Although we did not successfully collect data in the first parent surveys that would allow estimation of response rates, our during-MYOC parent survey (conducted in the late fall of 2006) achieved a response rate of 98%. These data indicate little problem with response bias. Because the data were clustered within site, our analyses took the clustering into account in estimating changes over time and differences between the intervention and control sites.

Although this evaluation provides good evidence for improved process of care within MYOC sites, the question remains as to whether the MYOC can effectively reduce overweight in the population via improved prevention and treatment. We are in the midst of a long-term follow-up to document the effect on outcomes over the 3 years after MYOC implementation.

One final issue is that of generalizability of results. It may be that the initial MYOC sites are relatively unique "early adopters."[43] In follow-up evaluation work we will be able to document how the next collaborative sites fare in their implementation.

CONCLUSIONS

The MYOC intervention improved clinical decision support and family management of risk behaviors, indicating a promising primary care–based approach to improving diet, physical activity, reducing TV viewing, and overweight risk among children and youth.

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