ORIGINAL RESEARCH

A Longitudinal Effectiveness Study of a Child Obesity Electronic Health Record Tool

Amy Braddock, MD, MSPH, Richelle J. Koopman, MD, MS, Jamie Smith, MA, Andy S. Lee, Samuel Holt McNair, Sarah Hampl, MD, Nuha Wareg, MPH, MBBS, Megan Clary, MD, Natalie Miller, MD, and Christy B. Turer, MD, MHS

Background: **Primary-care providers, clinic staff, and nurses play an important role in reducing child obesity; yet time restraints and clinical demands compete with effective pediatric weight management and prevention.**

Methods: **To investigate the potential impact of an electronic health record (EHR) enabled tool to assist primary care teams in addressing child obesity, we conducted a controlled effectiveness study of FitTastic compared with usual care on the BMI pattern of 291 children (2 to 17 years) up to 4 years later.**

Results: **Per χ^2 analysis, a greater proportion of children with baseline overweight/obesity in the EHR tool group than the control group had a favorable BMI pattern (32% vs 13%, *P* = .03). In logistic regression, FitTastic children were more likely than control children to have a favorable BMI pattern at follow-up (OR 3.8, 95% CI 1.1 to 13.2), adjusted for age, gender, race, and parental education.**

Conclusion: **Study findings suggest that EHR-enabled tools to assist primary care teams in managing child obesity may be useful for helping to address the weight in children with overweight/obesity, especially in younger children (2 to 5 years). Digital and EHR-enabled technologies may prove useful for partnering health care teams and families in the important tasks of setting positive, family-centered healthy lifestyle behavioral goals and managing child overweight and obesity. (J Am Board Fam Med 2022;35:742–750.)**

Keywords: **Body Mass Index, Control Groups, Counseling, Electronic Health Records, Exercise, Healthy Lifestyle, Logistic Models, Patient Care Team, Pediatric Obesity, Primary Health Care, Technology**

Introduction

The rate of child overweight and obesity in the United States remains high. Among children ages 2 to 19 years, 18.5% meet body mass index (BMI) criteria for obesity, including 5.6% with severe obesity; an additional 16.6% of 2 to 19-year-olds meet criteria for overweight.[1] Data suggest that health care providers play an important role in reversing these trends[2] using counseling, promotion of healthy lifestyle behaviors,[3] and referral to clinical and community resources.[4] The US Preventive Services Task Force (USPSTF) recommends that primary care providers screen children aged 6 years and older for obesity and refer those who qualify for intensive counseling and behavioral interventions (Grade B recommendation).[5] Unfortunately, other clinical demands compete with the time and focus

This article was externally peer reviewed.

Submitted 21 September 2021; revised 12 January 2022; accepted 14 February 2022.

From University of Missouri, Columbia, MO (AB, RJK, JS, NW, MC); University of Missouri School of Medicine, Columbia, MO (ASL, SHM); General Pediatrics and Weight Management, Children's Mercy Hospital Center for Children's Healthy Lifestyles & Nutrition, Kansas City, MO, University of MO-Kansas City School of Medicine (SH); Cahaba Family Medicine, Pelham, AL (NM); Internal Medicine-Pediatrics, University of Texas Southwestern, Dallas, Texas (CBT).

Funding: This work was supported by the American Academy of Family Physicians Foundation Joint Grant Award Program (G1603JG). The findings and conclusions in this article are those of the authors and do not necessarily represent the official positions of the American Academy of Family Physicians.

Conflict of interest: None.

Corresponding author: Amy Braddock, MD, MSPH, Family and Community Medicine, University of Missouri, 306 Medical Sciences Building, 1 Hospital Drive, Columbia, MO 65212 (E-mail: williamsamy@health.missouri.edu).

providers have available to screen for and counsel families about overweight/obesity.[6,7] Previous studies support the use of electronic health record (EHR) tools to assist in the diagnosis and management of cardiovascular risk factors,[8] diagnosis of child overweight/obesity,[9,10] comorbidity evaluation[11] and management.[12] Previous literature has focused on provider adoption of EHR child obesity tools including concerns about disruption to work flow and insufficient time.[13] Providers prefer technology that increases their efficiency[13] and help provide tailored educational materials.[14] They also respond more favorably to Health Information Technology when it facilitates counseling for behavior-based health problems.[13] Fewer data have been published regarding EHR tool's role in sustained pediatric weight management for greater than 1 to 2 years.[15]

Colleagues at a collaborating children's hospital (Children's Mercy Hospital in Kansas City, Missouri) developed the EHR-based tool 12345-FitTastic (www.fittastic.org, hereafter referred to as FitTastic) to assist primary care providers managing child obesity. The EHR-based tool was designed to support clinicians and health care teams in communicating with families about 5 lifestyle behaviors: (1) aim for at least 1 hour/day of physical activity, (2) limit screen time to 2 hours/day or less, (3) consume 3 servings/day of low-fat milk or calcium, (4) drink at least 4 servings/day of water instead of sugary drinks, and (5) consume at least 5 servings/day of fruits and vegetables. The lifestyle behaviors were based on Expert Committee recommendations[16] and created and refined through community focus groups and clinician input[17] to address positive goals. The FitTastic Healthy Lifestyle Initiative messaging was developed as part of a broader community-wide initiative to promote child and family healthy eating and active living supported by the National Initiative for Children's Health care Quality's Collaborate for Healthy Weight.[18,19] Two prior publications on FitTastic indicate that (1) providers evaluate the FitTastic EHR tool as useful, easy to use, and feasible for adoption in primary care,[20] and (2) child adherence to a greater number of FitTastic behaviors is inversely associated with BMI in a dose-dependent manner in a cross-sectional study of 24,255 patients.[21] Youth who met 0 or 1 lifestyle recommendation were 1.45 to 1.71 times more likely to have obesity than those meeting all 5 recommendations.[21] These studies suggest that there is potential for EHR tools like FitTastic to provide meaningful benefit to providers addressing child obesity. To understand the EHR tool's impact on child BMI in clinical practice long-term, however, requires a control comparison[22] and longitudinal outcomes data.[23–26] We conducted a controlled longitudinal study to determine if children with overweight/obesity at baseline seen at primary care clinics that used the EHR tool FitTastic, compared with children seen at clinics without the FitTastic tool, exhibited a more favorable BMI trajectory ("BMI pattern") (management of obesity, primary outcome), and if children with a healthy weight at baseline, maintained that healthy weight (prevention of obesity, secondary outcome), up to 4 years later.

Methods

Study Design and Setting

This nonrandomized, quasi-experimental, controlled study was conducted at university-affiliated suburban ambulatory practices. Following the programming and testing of FitTastic software, the FitTastic intervention was piloted with 4 pediatric providers in August 2015 and expanded to additional pediatric providers in January of 2016 and family medicine providers in June 2017. We used prepared scripts and documentation guides to train staff, nurses, and providers at 4 consecutive monthly clinic meetings, then quarterly, and then annually, regarding the use of the FitTastic EHR tool. Resident physicians were trained at orientation and didactic lectures. The FitTastic intervention included (1) a FitTastic-behavior assessment (assessment of the 5 FitTastic behaviors that families/children completed at each well-child visit and nurses entered into the EHR), (2) an EHR interface that supported providers with the behavior and BMI assessment for use in goal-setting with the family, (3) discussion of the FitTastic goals by provider, and (4) a goal-matched educational print-out and participation incentive (for example, a child who selected a goal of increasing physical activity might have received a frisbee, whereas a child/family who selected increased water consumption might have received a water bottle). As families returned for additional well-child visits (which typically occur annually after age 3 years), the provider had the ability to use the child's past behaviors, goals, and BMI to guide subsequent goal-setting and behavioral recommendations, as these were provided in the FitTastic EHR tool.

Eligibility and Recruitment

FitTastic intervention sites included 1 pediatric and 1 family-medicine clinic. Control clinics came from the same clinical network and included 5 family-medicine clinics. Collectively, clinics that agreed to participate were staffed by 60 providers - 28 pediatricians (10 attendings, 18 residents) and 32 family-medicine providers (22 attendings, 10 residents). Children were eligible to participate if they were age 2 to 17 years old, presenting for a well-child visit at a participating clinic, and not underweight (BMI > 5th percentile).[27] We included children with healthy weights and those with overweight/obesity because (1) Expert Committee recommendations include screening all children for high BMI and high-risk lifestyle behaviors, (2) to reduce any stigma associated with completing the FitTastic assessment, and (3) to evaluate use of FitTastic for improving the BMI pattern of children with overweight/obesity (primary outcome) and for prevention of weight gain among healthy weight children (secondary outcome).

To recruit participants for this study, we emailed the parent or guardian of all children ages 2 to 17 years who had been seen for a well-child visit at the participating family medicine and pediatric clinics and already received the FitTastic intervention, from April-June 2017. The e-mail included a consent form, a FitTastic behavior assessment, and a survey about the utility of FitTastic to promote healthy behaviors, as well as demographic information including parental race and education. All survey data were collected using RedCap. To maximize participation, we sent up to 4 subsequent e-mails at 2 to 3-week intervals and offered those who agreed to participate a choice of either a $5 fruit/vegetable voucher to a local grocery store or a youth recreation center pass (worth $6).

We emailed parents/guardians of children in the control clinics from a list of children ages 2 to 17 years who had been seen for at a well child visit during the same period as the intervention arm (April–June 2017). We only included participants who had at least 2 heights and weights documented in the EHR– 1 during the intervention period and at least 1 additional height and weight in the same post-intervention follow-up period as for the intervention group from any clinic visit (July 2017–December 2019). As with the intervention group, if parents did not respond to the initial e-mail, we sent up to 4 follow-up e-mails at 2- to 3-week intervals. At control clinics, staff, nurses, and providers delivered usual care using the same EHR and well child structured visit templates as intervention clinics. Control clinic providers were not provided training or educational materials for FitTastic.

In the intervention arm, we included only those children whose parent/guardian completed the emailed survey and at least 2 FitTastic behavior assessments – 1 in clinic and 1 via e-mail. Children also needed at least 2 heights and weights documented in the EHR. FitTastic exposure was assessed using nurse completion/documentation of a FitTastic behavioral assessment in the child's EHR. The choice to identify intervention delivery using the FitTastic behavioral assessment (typically documented by a nurse) rather than goal documentation (typically documented by a provider) was due to the greater reliability of documentation by nurses and the central role of nurses in counseling families on healthy lifestyle behaviors.[28,29] The intervention was continued for the children in the intervention arm at least until their last recorded FitTastic behavior and BMI percentile through December 2019. The project was approved by the University of Missouri Health Science Internal Review Board (IRB # 2002856).

To obtain BMI for children whose parent/guardians agreed to participate, data extracted from the EHR included child gender, date of birth, visit date, visit heights, and visit weights from clinic visits between January 2016 and December 2019. The first visit used in the analysis of child BMI in the FitTastic arm was the date of the child's first FitTastic behavior assessment, and for the control group, the first available well-child visit with data for height and weight in the trial period (earliest date was January 2016). The last visit for both arms was the last visit with both weight and height data at the time of data extraction (December 2019). We calculated BMI by dividing weight in kilograms by height in meters squared (BMI = weight [kg]/height [m^2]), then used the child's gender and visit age to compute BMI percentile using standardized CDC algorithms. We used BMI percentile rather than Z-scores because clinicians communicate with families about child growth using percentiles. To address data-entry errors, we removed biologically implausible BMI-percentile values (defined as those varying by >10% in 1 month). To categorize each child's BMI pattern, we defined favorable versus unfavorable BMI pattern by comparing the BMI-percentile category at the first visit to the last visit. For example, BMI maintenance from a BMI ≤ 85th percentile at baseline to last measurement, regardless of BMI increase within that category or reduction from ≥85th percentile to ≤85th percentile would be a favorable pattern. We included ≥85th percentile as the cutoff for a favorable weight pattern because this is threshold between healthy and overweight BMI percentiles for children.

Analysis

We used χ^2 analysis to evaluate if the intervention, compared with controls, was associated with a favorable BMI pattern. Two χ^2 analyses were conducted: 1 for children with overweight/obesity alone, and for all children (those with a healthy weight and those with overweight/obesity, at the first visit). Multivariable logistic regression was used to examine the association of intervention (FitTastic vs control) and having a favorable BMI pattern after adjustment for child age, gender, race, and parental education. Only the child's first and last BMIs were used for assessment.

We calculated odds ratios and 95% CIs. We assessed model discrimination with the c-statistic, where 1.0 indicates perfect fit and 0.5 is no better than a coin toss. We assessed model calibration with the Hosmer-Lemeshow goodness-of-fit test, using a $P > .05$ to indicate adequate fit (over the range of predicted readmission). All analyses were performed using SAS for Windows, version 9.4 (SAS Institute, Cary, NC).

Results

In the control group a total of 683 parents were emailed, 117 completed the entire survey and 14 completed some but not all the survey for a 19% response rate. In the intervention group, we emailed 626 parents with 182 completing the entire survey and 35 completing some but not all the survey for a 34.6% response rate. Of 303 children who enrolled in the study (190 intervention and 113 control), 4% were underweight at baseline (BMI percentile <5%) and were excluded from the analysis. Of the remaining 291 children (179 intervention and 112 control), 69% had a healthy BMI percentile (BMI% 5-84th) and 31% had a BMI percentile consistent with overweight or obesity (BMI % ≥85th percentile) at baseline. BMI patterns were examined over an average follow-up length of 2.9 years (range: 6 months to 4 years). The average number of recorded FitTastic behavior assessments per participant was 2.2 (S.D., 1.1; range, 2 to 6).

Baseline characteristics of intervention and control children were similar for child age, gender, race, and BMI category; however, a higher percentage of intervention than control children had a parent with a college degree ($P = .002$) (Table 2). In comparing sample characteristics among children by BMI category (healthy vs overweight/obesity), higher parental educational attainment was correlated with a lower proportion of child overweight/obesity at baseline ($P = .01$).

FitTastic versus Control BMI Patterns

Using χ^2 analysis, in the subset of children with baseline overweight/obesity (n = 89), a greater proportion of children at FitTastic sites than control sites had a favorable BMI pattern (32% versus 13%, $P = .03$, (Table 3). No demographic factor (including child age, gender, race, or parental education) was associated with BMI pattern. In the overall sample of children (with both healthy weight and overweight/obesity), the proportion of children with a favorable BMI pattern was 68% in the FitTastic arm, versus 58% in the control arm (this 10% difference was not statistically significant). (Table 3) Practice type (family medicine vs pediatric) was not associated with BMI pattern ($P > .05$).

In multivariable adjusted analyses limited to the subsample with overweight/obesity, compared with control children, children in the FitTastic arm had 3.8 times the adjusted odds of having a favorable

Table 1. Definition of Favorable versus unfavorable BMI Pattern per First and Last BMI Percentile (BMI%)

	Last BMI%	
First BMI%	Favorable BMI pattern	Unfavorable BMI pattern
Healthy weight, BMI% <85th	Healthy weight, BMI% <85th	Overweight/obesity, BMI% ≥85th
Overweight/obesity, BMI% ≥85th	Healthy weight, BMI% <85th	Overweight/obesity, BMI% ≥85th

Abbreviation: BMI, Body Mass Index.

Table 2. Sample Demographics Overall, by Intervention Arm, and by Baseline BMI Category

	Overall		Intervention versus Control					BMI Category at Baseline				
			FitTastic		Control			Healthy		Overweight/ Obesity		
	N	%	N	%	N	%	p-Value	N	%	N	%	p-Value
Overall	291	100	179	61.5	112	38.5	–	202	69.4	89	30.6	–
Child gender							0.63					0.06
Male	156	53.6	94	52.5	62	55.4		101	50.0	55	61.8	
Female	135	46.4	85	47.5	50	44.6		101	50.0	34	38.2	
Child age							0.23					0.07
2 to 5 years	159	54.6	103	57.5	56	50.0		119	58.9	40	44.9	
6 to 12 years	92	31.6	50	27.9	42	37.5		59	29.2	33	37.1	
13 to 17 years	40	13.8	26	14.5	14	12.5		24	11.9	16	18.0	
Child's race							0.37					0.75
Caucasian	236	81.1	144	80.4	92	82.1		166	821	70	78.6	
African American	30	10.3	16	8.9	14	12.5		19	9.4	11	12.3	
Other Race	12	4.1	9	5.0	3	2.6		9	4.4	3	3.3	
Unknown/Missing	13	4.4	10	5.5	3	2.6		8	3.9	5	5.6	
BMI at baseline							0.21					–
Healthy	202	69.4	129	36.1	73	43.8		–		–		
Overweight/obesity	89	30.6	50	63.9	39	56.2		–		–		
Parent education							0.002					0.01
No college degree	107	36.8	51	28.5	56	50.0		64	31.7	43	48.3	
College degree	183	62.9	127	70.9	56	50.0		138	68.3	45	50.6	
(not reported)	(1)	–			(1)					(1)		
Study arm							–					0.21
Control	112	38.5	–		–			73	36.1	39	43.8	
Intervention	179	61.5	–		–			129	63.9	50	56.2	

Abbreviation: BMI, Body Mass Index.

BMI pattern (95% CI, 1.1 to 13.2, Table 4). Model discrimination was moderate (c-statistic = 0.77) and calibration ($P = .41$), was adequate. Younger child age (age 2 to 5 years, vs 13 to 17 years; OR, 15.4; 95% CI, 1.6 to 148.4) also was associated with an increased adjusted odd of having a favorable BMI pattern.

In the overall sample (of children with healthy weight and overweight/obesity), only younger children and male gender were significantly associated with having a favorable BMI pattern (Table 4). The FitTastic intervention was not associated with a favorable BMI pattern when data from healthy weight children were included in the analysis.

Discussion

Children with overweight/obesity seen at clinics using the FitTastic intervention were more likely to have a favorable BMI pattern up to 4 years later than children seen at control clinics. The difference was significant in both the bivariate and

Table 3. BMI Pattern FitTastic versus Control

	Full Sample (n = 291)				Overweight/Obese Only (n = 89)			
	% Favorable	% Unfavorable	χ^2	p-Value	% Favorable	% Unfavorable	χ^2	p-Value
FitTastic	68.7	31.3	3.43	0.06	32.0	68.0	4.47	0.03
Control	58.0	42.0			12.8	87.2		

Abbreviation: BMI, Body Mass Index.

Table 4. Multivariable Analysis of Factors Associated with Favorable BMI Pattern, Overall and in Sub-Sample with Overweight/Obesity

	Overall Sample (n = 291)				Overweight/Obese Subsample (n = 89)			
		95% CI				95% CI		
	OR	Low	High	p-Value	OR	Low	High	p-Value
Intervention versus control	1.42	0.84	2.39	0.19	3.8	1.1	13.2	0.04
Child age								
2 to 5 years	2.21	1.05	4.63	0.04	15.4	1.6	148.4	0.02
6 to 12 years	1.38	0.63	3.00	0.41	6.6	0.6	67.1	0.11
13 to 17 years (referent)								
Male gender (vs female)	2.04	1.22	3.40	0.01	2.7	0.9	8.2	0.09
African American (vs other race)	0.52	0.23	1.17	0.11	0.2	0.1	1.4	0.10
Parental education:								
College degree versus no degree	1.11	0.95	1.29	0.17	1.0	0.7	1.32	0.80

Abbreviations: BMI, Body Mass Index; OR, odds ratio; CI, confidence interval.

multivariable adjusted analyses. By contrast, in the overall sample that included healthy weight children, 10% more of the FitTastic intervention children had favorable BMI pattern compared with the control children in the bivariate analysis (a nonsignificant difference) with no difference after adjustment for age, sex, race, and parental education.

Study data suggest that younger children (aged 2 to 5 years) may be more likely than older children to have a favorable BMI pattern after exposure to FitTastic. Prior literature is mixed regarding the influence of child age on the effectiveness of primary care weight-management interventions. For example, a 2014 meta-analysis of 20 family-based behavioral interventions (n = 1671 children ages 2 to 19 years) reports that weight outcome differed by child age ($R^2 = 0.305$, $\beta = 0.169$, $P = .014$),[34] whereas a 2016 meta-analysis of 18 primary care-based intervention studies (n = 3358 children ages 2 to 18 years) concludes that child age had no influence on weight outcomes.[30] In our study, the association of younger child age and favorable BMI pattern may be due to the FitTastic emphasis on family-oriented goal setting for lifestyle behaviors.

In addition, the increased effectiveness of FitTastic among younger children could result from the stages of development in younger children who make decisions less independently than adolescents,[35] may be more susceptible to suggestions of authority figures such as their parents or providers, and who are more likely to adopt health behaviors of their families.[36,37] It is also easier for younger children to develop and sustain new healthy behaviors compared with adolescents and adults.[37] The early adoption of healthy lifestyle behaviors, even without improvement in BMI, can prevent or delay the onset of cardiometabolic diseases associated with obesity such as diabetes and hypertension.[38] Thus, in designing EHR weight-management tools that target younger children, it may prove useful to consider how the tool engages families in conversations around setting goals for sustainable healthy behaviors.

In addition, although parental education (college vs no college) was a risk factor for child overweight/obesity at baseline (Table 2), we found no influence of parental education on the BMI pattern of FitTastic versus control participants (Table 4), suggesting the FitTastic can be equally effective in children with parents of different educational levels.

The association of FitTastic with a favorable BMI pattern among children with elevated BMIs but not both normal and elevated BMIs suggests that similar EHR tools such as FitTastic may be most effective for weight management rather than prevention. FitTastic's healthy lifestyle messaging may resonate with families with a child with a high BMI, increasing the likelihood that families make physical activity and nutrition changes that improve BMI. On the other hand, 1 benefit of FitTastic that providers identified previously was that use of FitTastic with all families (not just children with obesity) may reduce the stigma associated with completing FitTastic behavioral assessments.[20] Providers at the intervention clinics chose to continue FitTastic after the completion of the study, currently up to 5-years after initiation, speaking to those providers' favorable views of FitTastic.

Although meta-analysis suggests that clinic-based interventions can be effective in reducing child obesity,[30] providers are competing with obesogenic environments of both parents and children, which can feel insurmountable, contributing to provider feelings of futility when addressing child obesity.[31] This study suggests that EHR tools have the potential to assist providers who are working to improve the weight status of children with obesity. This reduction in BMI likely represents the use of the FitTastic EHR tool rather than clinic-based child obesity culture change as all trainings and scripts focused only on use of the EHR tool and did not include any child obesity education or training. Additional studies are required to understand the true utility of other EHR tools beyond FitTastic to reduce child obesity.

In addition to the benefits of EHR tools being adopted by providers, and showing promise to reduce the BMI of children with obesity, EHR-based clinical support tools, once programmed into the EHR, can be widely disseminated,[32] especially if they are free and open sourced.[33] EHR-based child obesity tools can also be evaluated using data in the EHR, including BMI and other health metrics, as they were for this study. These data are recorded by trained nurses and staff in a standardized method at regular intervals in the clinic or hospital, over a long period of time, and in a large number of pediatric patients. This marriage of clinic-based interventions and EHR data assessment offers the opportunity for significant innovation. In addition, deidentified EHR data can responsibly be used to evaluate interventions such as FitTastic, and evaluate natural phenomena, such as COVID-19.

Study limitations include the recruitment and surveying of participants after they had been seen for care, the incongruent use of family medicine and pediatric clinics in the intervention arm versus sole use of family medicine clinics in the control arm, the presence of the trial in a single geographic location in the same system, and with a primarily white suburban population, and the lack of randomization. All pediatric clinics at the academic institution had implemented FitTastic, so the study could not be randomized, and no pediatric clinics were available to serve as controls. There was also a higher response rate to the emailed surveys from the intervention than the control group. We addressed these limitations by examining differences in BMI pattern by clinic type and group. There were no differences in BMI pattern between family medicine and pediatric clinics or between baseline BMIs in the control and intervention sites. There was also no difference in final BMI pattern based on race or parental education. However, we were not able to evaluate ethnicity differences due to the sample size and lack of ethnic diversity in our sample. We were also not able to evaluate differences in socioeconomic status of families or propensity of nurses to use FitTastic in different families. Additional studies in a more diverse populations would be beneficial.

A key study strength is the implementation and examination of an EHR-enabled decision support tool that was developed with community input and had undergone extensive provider testing for usability and feasibility. EHR-enabled tools require extensive stakeholder input, expertise, and time to design and build, and often get used without being tested for effectiveness or potential for dissemination. Additional strengths include the use of a control arm to compare effectiveness, the length of follow-up after intervention delivery (up to 4 years), and the pragmatic approach to intervention implementation and evaluation.[39]

Conclusion

Data from this study suggest that EHR-enabled tools to assist with child overweight/obesity management in primary care clinics hold promise for assisting providers in improving the BMI pattern of children with overweight and obesity up to 4 years later. Data do not support the effectiveness of FitTastic for maintaining a healthy weight or preventing unhealthy weight gain in children without overweight or obesity. Digital and EHR-enabled technologies may prove useful for partnering health care teams and families in the important tasks of setting positive, family-centered healthy lifestyle behavioral goals and managing child overweight and obesity. EHR tools offer substantial promise to help relieve the burden that primary care providers experience addressing difficult problems such as child obesity.

The authors acknowledge Weighing Ina program of Children's Mercy, Kansas City and its community and public health partners for the creation of the Healthy Lifestyles Initiative and the 12345Fit-tastic! messaging. Further support was provided by Boone County Public Health and Human Services in Columbia, Missouri, who provided funding for incentive prizes and handouts. We would also like to acknowledge, Dr. Anuradha Rajagopalan for her contributions implementing and facilitating FitTastic, and Gwen Wilson for her assistance with literature searches and reference management.

To see this article online, please go to: http://jabfm.org/content/35/4/742.full.

References

1. Fryar CD, Carroll MD, Ogden CL. Prevalence of overweight, obesity, and severe obesity among children and adolescents aged 2–19 years: United States, 1963–1965 through 2015–2016. Centers for Disease Control and Prevention, National Center for Health Statistics. https://www.cdc.gov/nchs/data/hestat/obesity_child_15_16/obesity_child_15_16.pdf. Published 2018. Accessed August 15, 2020.
2. Seburg EM, Olson-Bullis BA, Bredeson DM, Hayes MG, Sherwood NE. A review of primary care-based childhood obesity prevention and treatment interventions. Curr Obes Rep 2015;4:157–73.
3. Turer CB, Barlow SE, Sarwer DB, et al. Association of clinician behaviors and weight change in school-aged children. Am J Prev Med 2019;57:384–93.].
4. Vine M, Hargreaves MB, Briefel RR, Orfield C. Expanding the role of primary care in the prevention and treatment of childhood obesity: a review of clinic- and community-based recommendations and interventions. J Obes 2013;2013:172035.
5. US Preventive Services Task Force. Screening for Obesity in Children and Adolescents: US Preventive Services Task Force Recommendation Statement. Pediatrics 2010;125:361–7.
6. Hill SG, Phan TT, Datto GA, Hossain J, Werk LN, Abatemarco D. Integrating childhood obesity resources into the patient-centered medical home: Provider perspectives in the United States. J Child Health Care 2019;23:63–78.
7. Beasley JW, Wetterneck TB, Temte J, et al. Information chaos in primary care: implications for physician performance and patient safety. J Am Board Fam Med 2011;24:745–51.
8. Naureckas SM, Zweigoron R, Haverkamp KS, Kaleba EOB, Pohl SJ, Ariza AJ. Developing an electronic clinical decision support system to promote guideline adherence for healthy weight management and cardiovascular risk reduction in children: a progress update. Transl Behav Med 2011;1:103–7.
9. Saviñon C, Taylor JS, Canty-Mitchell J, Blood-Siegfried J. Childhood obesity: Can electronic medical records customized with clinical practice guidelines improve screening and diagnosis? J Am Acad Nurse Pract 2012;24:463–71.
10. Morais A, Kelly J, Bost JE, Vaidya SS. Characteristics of correctly identified pediatric obesity and overweight status and management in an academic general pediatric clinic. Clin Pediatr (Phila) 2018;57:1168–75.
11. Shaikh U, Berrong J, Nettiksimmons J, Byrd RS. Impact of electronic health record clinical decision support on the management of pediatric obesity. Am J Med Qual 2015;30:72–80.
12. Young EL. Increasing diagnosis and treatment of overweight and obese pediatric patients. Clin Pediatr (Phila) 2015;54:1359–65.
13. Dryden EM, Hardin J, McDonald J, Taveras EM, Hacker K. Provider perspectives on electronic decision supports for obesity prevention. Clin Pediatr (Phila) 2012;51:490–7.
14. McDonald J, Goldman RE, O'Brien A, et al. Health information technology to guide pediatric obesity management. Clin Pediatr (Phila) 2011;50:543–9.
15. Gentile N, Cristiani V, Lynch BA, et al. The effect of an automated point of care tool on diagnosis and management of childhood obesity in primary care. J Eval Clin Pract 2016;22:962–8.
16. Barlow SE, Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. Pediatrics 2007;120:S164–S192.
17. Children's Mercy. Dairy intake and body composition. Office of Evidence Based Practice (EBP)-Critically Appraised Topic. https://www.childrensmercy.org/contentassets/752849f69a344ba48856b523af8c70c1/dairy.pdf. Published 2018. Accessed August 20 2020.
18. Ragsdale KJ, Hampl S, Wade K, Summar D SM. Implementation of 12345 Fit-Tastic! in Pediatric Primary Care. Paper presented at: American Academy of Pediatrics National Conference and Exhibition; October 10, 2014; San Diego, CA.
19. Wade K, Russell LP, Hampl S. Healthy Weight Plans in Pediatric Primary Care Clinic. Paper presented at: American Academy of Pediatrics National Conference and Exhibition; October 23, 2015, 2015; Washington, DC.
20. Williams A, Turer C, Smith J, et al. Adoption of an electronic medical record tool for childhood obesity by primary care providers. Appl Clin Inform 2020;11:210–7.
21. Shook RP, Halpin K, Carlson JA, et al. Adherence with multiple national healthy lifestyle recommendations in a large pediatric center electronic health

record and reduced risk of obesity. Mayo Clin Proc 2018;93:1247–55.

22. Brown AW, Altman DG, Baranowski T, et al. Childhood obesity intervention studies: A narrative review and guide for investigators, authors, editors, reviewers, journalists, and readers to guard against exaggerated effectiveness claims. Obes Rev 2019; 20:1523–41.
23. Must A, Tybor DJ. Physical activity and sedentary behavior: a review of longitudinal studies of weight and adiposity in youth.Int J Obes 2005;29:S84–96.
24. Sigmund E, Sigmundová D. Longitudinal 2-year follow-up on the effect of a non-randomised school-based physical activity intervention on reducing overweight and obesity of Czech children aged 10-12 years. IJERPH 2013;10:3667–83
25. Taylor RW, McAuley KA, Barbezat W, APPLE project, et al. Two-year follow-up of an obesity prevention initiative in children: the APPLE project. Am J Clin Nutr 2008;88:1371–7.
26. Danielzik S, Pust S, Müller MJ. School-based interventions to prevent overweight and obesity in prepubertal children: process and 4-years outcome evaluation of the Kiel Obesity Prevention Study (KOPS). Acta Paediatr 2007;96:19–25.
27. American Academy of Pediatrics. Bright Futures/AAP Recommendations for Preventive Pediatric Health Care. 2020. http://www.aap.org/en-us/professional-resources/practice-support/Periodicity/Periodicity%20Schedule_FINAL.pdf. Accessed September 1, 2020.
28. Rabbitt A, Coyne I. Childhood obesity: nurses' role in addressing the epidemic. Br J Nurs 2012;21:731–5.
29. Rainey SK, Christophersen ER. Behavioral pediatrics: The role of the nurse clinician. Issues Compr Pediatr Nurs 1978;3:19–28.
30. Mitchell TB, Amaro CM, Steele RG. Pediatric weight management interventions in primary care settings: a meta-analysis. Health Psychol 2016;35:704–13.
31. Bradbury D, Chisholm A, Watson PM, Bundy C, Bradbury N, Birtwistle S. Barriers and facilitators to health care professionals discussing child weight with parents: A meta-synthesis of qualitative studies. Br J Health Psychol 2018;23:701–22.
32. Lyman JA, Cohn WF, Bloomrosen M, Detmer DE. Clinical decision support: progress and opportunities. J Am Med Inform Assoc 2010;17:487–92.
33. Leong TY, Kaiser K, Miksch S. Free and open source enabling technologies for patient-centric, guideline-based clinical decision support: a survey. Yearb Med Inform 2007;16:74–86.
34. Janicke DM, Steele RG, Gayes LA, et al. Systematic review and meta-analysis of comprehensive behavioral family lifestyle interventions addressing pediatric obesity. J Pediatr Psychol 2014;39:809–25.
35. Wray-Lake L, Crouter AC, McHale SM. Developmental patterns in decision-making autonomy across middle childhood and adolescence: European American parents' perspectives. Child Dev 2010;81: 636–51.
36. Case A, Paxson C. Parental behavior and child health. Health Aff (Millwood) 2002;21:164–78.
37. Perry CL. Preadolescent and adolescent influences on health. In: Smedley BD, Syme SL, eds. *Promoting health: Intervention strategies from social and behavioral research*. Washington, DC: National Academies Press; 2000:217–53.
38. Pandita A, Sharma D, Pandita D, Pawar S, Tariq M, Kaul A. Childhood obesity: prevention is better than cure. Diabetes Metab Syndr Obes 2016;9:83–9.
39. Loudon K, Treweek S, Sullivan F, Donnan P, Thorpe KE, Zwarenstein M. The PRECIS-2 tool: designing trials that are fit for purpose. BMJ 2015;350:h2147.