Use of an Electronic Medical Record System to Support Primary Care Recommendations to Prevent, Identify, and Manage Childhood Obesity

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ABSTRACT

Many primary care physicians are not providing care that is consistent with recommendations to prevent, to identify, and to manage childhood obesity. This report presents modifications made to the electronic medical record system of a large pediatric health care system, using a quality improvement approach, to support these recommendations and office system changes. Although it is possible to make practice changes secondary to electronic medical record system enhancements, challenges to development and implementation exist. Pediatrics 2009;123:S100–S107

Over the past 3 decades, the national prevalence of overweight has tripled for children and adolescents. Approximately 37% of Delaware children have a BMI of ≥85th percentile, making them overweight or obese. Important psychological and medical consequences of excess weight and antecedents of adult disease occur in obese children and adolescents. In addition, obese children and adolescents are more likely to become overweight or obese adults; this concern is greatest among adolescents.

Childhood obesity is a complex problem that must be addressed in the multiple settings in which children spend their time. Although primary care interventions alone will not resolve the obesity epidemic, addressing this issue in the primary care setting is an important component of the overall approach to resolving this crisis. Expert recommendations for addressing childhood overweight in this setting have been in existence for a decade, and new expert recommendations were released recently. These recommendations include guidance for assessment of overweight, obesity, and comorbid conditions, as well as assessment and counseling on associated dietary, physical activity, and sedentary behaviors.

Multiple studies have revealed that many primary care practitioners are not providing care that is consistent with these recommendations. An example of an overused test is thyroid function testing. Although such testing is not recommended by the American Academy of Pediatrics, O’Brien et al found that the majority of physicians who requested laboratory studies for the initial treatment of overweight children included thyroid function studies. Kologatla and Adams found that knowledge of guidelines was not associated with adherence; although 19% of physicians were aware of the national recommendations, only 3% reported adhering to all of them.

For primary care clinicians, barriers to providing the recommended care to address childhood obesity include lack of self-efficacy, inadequate tools or resources, insufficient knowledge and skills, lack of time, competing priorities, insufficient reimbursement, and lack of awareness of community resources. Cabana et al found that self-efficacy was associated with guideline implementation. Perrin et al demonstrated an association between pediatrician self-efficacy regarding obesity counseling and access to tools, especially electronic tools. In another study, physician self-reported lack of knowledge about behavior change strategies was found to be a leading barrier to counseling on obesity. The authors described low self-perceived proficiency in the use of behavioral management strategies to change dietary and physical activity habits.

When counseling is performed, it is unclear whether clinicians focus on the behaviors that are most strongly supported by science as being associated with childhood obesity. Observational research and clinical trials in childhood point to several risk and protective factors as key focus areas for behavioral interventions, primarily fruit and vegetable consumption, television viewing behaviors, physical activity, and sugar-sweetened beverage intake. Consistent with expert recommendations, in Delaware we have adapted the Massachusetts Jump Up and Go campaign and are using 5-2-1-Almost None as our framework, based on the numerical recommendations for these respective behaviors. Focusing on these target behaviors, we developed an intervention that complies with expert recommendations to apply motivational interviewing techniques for weight-control counseling in pediatric practice.

Recognizing the multiple barriers and challenges facing primary care providers, a statewide quality improvement initiative was launched in Delaware in May 2007, to assist clinicians and their office teams in preventing, identifying,
and managing childhood obesity. We are using the Breakthrough Series approach for quality improvement to support office system changes.\(^{29}\) Dorsey et al\(^7\) suggested that the most important implications of their findings are that efforts to address childhood obesity in the pediatric primary care setting would likely be enhanced by aggressive system changes that encourage physicians to adopt standardized approaches. One strategy for improvement involves addressing the identified barrier of lack of practical office-based tools to implement screening tests and best practice checklists.\(^{14}\) Within the Delaware Nemours primary care offices, we have modified our existing electronic medical record (EMR) to imbed clinical guidelines and best practice approaches that help providers work with families to make behavior changes.

The 2001 publication * Crossing the Quality Chasm: A New Health System for the 21st Century* noted that computer systems lead to an improvement in patient outcomes.\(^{30}\) Cited reasons for the use of EMRs include improved quality of care,\(^{31,32}\) documentation, and workflow.\(^{32}\)
EMRs have been found to improve clinician implementation of clinical guidelines.33–35 Bordowitz et al33 found EMR automatic BMI calculations to improve documentation and treatment of adult obese patients. EMRs also have been used to educate providers regarding their own performance, to guide pediatric care and to facilitate quality improvement efforts.31,36 Because of these benefits, improvements may be more sustainable and more widely disseminated.

Modifications were made to the EMR system used by 9 primary care offices throughout the state of Delaware, imbedding recommendations to prevent, to identify, and to manage childhood obesity. In 2000, Nemours began implementation and use of the Epic EMR system (Epic System, Madison, WI) throughout the enterprise. The introduction of this system in the Delaware Nemours primary care practices began in 2001 and was completed in 2003. In 2004, we began working with national experts to design EMR supports for best practices for childhood overweight. This close collaboration was key in ensuring that the resulting EMR enhancements were consistent with the new recommendations, now considered the standard of care. EMR modifications included a prompt to alert users of a BMI above the healthy weight range, an electronic clinical protocol to assess and to counsel regarding targeted lifestyle behaviors, and reminders to screen for comorbidities of overweight as necessary.

CASE REPORT

In this example, the patient is a 10-year-old Hispanic girl accompanied by her mother for a well-child visit at a participating clinic. The front desk receptionist hands the mother a 5-2-1-Almost None behavior assessment survey and asks the mother to complete it in the waiting room (Fig 1). The nurse checks the patient’s weight, height, and vital signs; her weight is 42.1 kg, her height is 1.40 m, and her blood pressure is 98/50 mm Hg. The patient’s BMI is automatically calculated by the EMR and, at 21.6 kg/m², it is at the 91st percentile for age and gender. A best practice alert is triggered to prompt the provider to access the Smart Set for children 2 to 18 years of age with a BMI of ≥85th percentile for age and gender (Fig 2). On reviewing the BMI growth curve, the provider notes that the patient’s BMI has been increasing percentiles in the past 2 years. The provider reviews the patient’s family history, which is noncontributory, and assesses the patient’s lifestyle habits on the basis of the 5-2-1-Almost None survey responses. The patient consumes soda on a regular basis and drinks 2% milk. The patient and her mother report being motivated to make a change; their readiness-to-change score is 7. Together, the provider and the family set the goal of reducing the patient’s soda consumption and buying 1% milk for the family’s use.

The physical examination does not otherwise reveal any pathological conditions. To describe the patient’s growth, the provider selects “overweight, BMI 85th–94th percentile” from the drop-down list on the EMR. Other options include healthy weight, underweight, obesity, and morbid obesity. The provider needs to choose a weight category option to close the visit record. The provider accesses the best practice alert Smart Set for BMI of ≥85th percentile. Because the patient’s family history and risk factor assessment are noncontributory, the provider chooses to check the lipid panel only. The patient and her mother are asked to return in 1 month for a weight check and review of progress made toward the healthy lifestyle goal set in this visit.
EMR TOOLS FOR USE DURING WELL-CHILD VISITS

The following EMR-linked tools are designed for use with children 2 to 18 years of age, to facilitate the promotion of healthy lifestyle behaviors and the diagnosis and management of overweight children. First, automatic BMI assessment is performed with the input of height and weight, as measured at the visit. The provider sees the BMI and the BMI percentile, along with height and weight percentiles, blood pressure, heart rate, and temperature, on the initial EMR screen for the visit. The provider sees the BMI and the BMI percentile, along with height and weight percentiles, blood pressure, heart rate, and temperature, on the initial EMR screen for the visit.

Second, the growth assessment field must be completed in the assessment section of the well-visit progress note. The field includes a drop-down list of responses, including morbid obesity, obesity, overweight, healthy weight, and underweight. The visit record cannot be closed without completion of the growth assessment, a feature designed to encourage providers to review the BMI growth plot for every patient.

Third, every family seen for a well-child visit is to be given the 5-2-1-Almost None survey for patients/families that asks 11 true/false questions about eating habits, screen time, physical activity, and sugar-sweetened beverage consumption. The parent or patient fills out the survey in the waiting room, and the nurse enters the responses in the questionnaire section of the EMR. The true/false responses expedite data entry. If the parent did not receive the survey or did not complete it because of language or literacy barriers, then the nurse helps the family complete the survey. The nurse hands the hard copy of the survey back to the family to discuss with the provider.

Fourth, the provider reviews the responses to the 5-2-1-Almost None survey. To help document the healthy lifestyle counseling, the provider pulls up the BMI readiness-to-change Smart Phrase in the EMR by typing “.bmi readiness” into the progress note field (Fig 3). This pulls up a few lines of prepared text to help document counseling to set a healthy lifestyle goal based on the family’s readiness to change. The Smart Phrase reads, “Is (the patient) ready to make a healthy lifestyle change today?” If applicable, the provider inputs the readiness-to-change score as a number from 1 to 10 (Fig 3) and selects the priority health goals the family would like to work on from a drop-down list of some common options (Fig 4). The provider also may input the lifestyle goal as free text. If the family does not want to make a healthy lifestyle change, then the provider can enter free text describing the family’s reason or barrier to change. The BMI readiness-to-change Smart Phrase may be accessed in any progress note, regardless of the nature of the visit (well-child or sick). By presenting some preset text, the Smart Phrase makes it quicker for the provider to document counseling and goal-setting, while prompting the provider to determine the family’s readiness-to-change score and to use techniques consistent with a focused, brief, motivational interview.

Fifth, the best practice alert Smart Set for BMI of ≥85th percentile for children 2 to 18 years of age is designed to facilitate orders and referrals for evaluation and management of comorbidities associated with overweight (Fig 2). The Smart Set includes a diagnosis section that links overweight-related diagnoses with their corresponding International Classification of Diseases, Ninth Revision codes. In the “Routine Labs” section, the lipid panel, fasting glucose, serum glutamic-oxaloacetic transaminase, and serum glutamic-pyruvic transaminase measurements are checked as defaults. The final section
of the Smart Set is supplemental orders. This includes checklists of common orders and referrals for evaluation of the following comorbidities of overweight: type 2 diabetes mellitus, hypertension, nonalcoholic steatohepatitis, hypothyroidism, Cushing syndrome, polycystic ovary syndrome, asthma, slipped capital femoral epiphysis, Blount disease, Prader-Willi syndrome, and chromosomal abnormalities. Below each comorbidity is a list of laboratory tests and other diagnostic tests and/or referrals that may facilitate diagnosis or treatment of the patient.

Sixth, patient instructions for all well-child visits include a 5-2-1-Almost None tips sheet. The tips sheet is available in Spanish and English and in a short or long format. The latter can be selected in the BMI of ≥85th percentile Smart Set. Finally, the provider may use the EMR to access the Internet-based community resource database for Delaware to refer families to local resources that can support them in achieving their healthy lifestyle goals.

DISCUSSION

EMR Support for System-Level Changes Using the Chronic Care Model

In Delaware, Nemours primary care is working with other partners, including the Delaware Chapter of the American Academy of Pediatrics, the Delaware Division of Public Health, and the National Initiative on Children’s Healthcare Quality, using the Breakthrough Series approach to quality improvement to support system changes. These improvement efforts include 3 tightly linked and highly successful frameworks, that is, the model for improvement, the collaborative learning model, and the chronic care model for child health. The chronic care model offers a new structure for addressing chronic problems in the health care sector and includes decision support, clinical information systems, community resources, family management support, delivery system design, and health care system support. This model has been demonstrated to support system changes and is an approach recommended by childhood obesity experts. It is our goal to support sustainable practice system changes by addressing all of these components through improvements to the EMR (Table 1).

Expert committees and advisory groups recommend BMI percentile for age and gender as the accepted measure for assessing overweight status among children and adolescents. The published literature has consistently shown rates of BMI assessment by pediatricians to be low. Several studies reported that BMI assessment was associated with improved counseling about healthy eating and physical activity behaviors and improved comorbidity screening. Also, communication of weight trajectories may help parents to adopt behavioral prescriptions. Flower et al reported that clinicians revealed frustrations regarding the complexity of BMI, which suggests the importance of incorporating the use of BMI into EMRs to foster routine use. Our experience demonstrates that this is feasible and relatively simple to accomplish. Although it is early in our intervention, participating practitioners are recording patient BMI category at 100% of well-child visits. The change to the EMR system that prohibits closing a critical EMR page unless a child’s growth category has been input occurred without complaints from the users.

As Story et al reported, the most common areas of

FIGURE 4
BMI readiness-to-change Smart Phrase, prompting the provider to set and to record priority behavior change goals.
TABLE 1  EMR Support for System-Level Changes Based on the Chronic Care Care Model Component  EMR Changes
Decision support: promote clinical care that is based on the best available scientific evidence.  Incorporation of electronic decision supports, including the requirement to assess BMI and prompts notifying user of elevated BMI (Fig 2); this prompt is linked to decision support for performing an appropriate physical examination and screenings for comorbidities of overweight as necessary.
Clinical information systems: organize data to facilitate population-based care.  Development of a performance report to track user performance on quality improvement measures; in offices with EMR enhancements, the EMR captures the practice-specific information and generates the results of the key quality improvement initiative measures in a monthly report.
Community resources: partner with or create linkages to the community to meet the needs of families and children in a culturally competent manner.  Development of an Internet-based community resource database to be used by clinicians, staff members, and/or the children and families themselves; this database, which can be accessed through the EMR, provides information and links to existing community resources, including youth programs, afterschool activity programs, physical activity outlets (trails and recreation centers), and healthy affordable foods (food markets and farmers markets).
Family management support: support families to make changes to improve the health of their children.  Development of electronic motivational interviewing, or brief focused negotiation, tools that are embedded in the EMR; these tools include the 5-2-1-Almost None healthy lifestyle survey (Fig 1) and preset text (Smart Phrase) to document the use of a readiness-to-change scale (Fig 3), counseling, and goal setting options (Fig 4).
Delivery system design: ensure the delivery of effective, efficient, clinical care for children 0–18 y of age, to prevent, to identify, and to treat childhood overweight.  Development of enhancements to the EMR that fit into users’ workflow; multiple iterations of EMR enhancements have been tested with feedback from users, to support rather than to inhibit workflow.
Health care system support: promote the support and reimbursement of appropriate prevention, assessment, and management of childhood obesity among health care system leaders.  Development of EMR enhancements that support appropriate diagnoses; a key role for clinical practices is to diagnose correctly (with diagnosis codes) all children with overweight or obesity and associated comorbidities, to maximize reimbursement for clinical care and counseling.

clinician self-perceived low proficiency were in the use of behavioral management strategies. Experts recommend using a brief form of motivational interviewing to support and to reinforce behavior change.\textsuperscript{3} These approaches typically have not been incorporated into clinical practice. Embedding motivational interviewing supports into EMR is novel. These electronic supports remind clinicians to counsel using motivational interviewing techniques and improve documentation, providing the opportunity to assess impact and potentially to improve reimbursement. Improved documentation has been found to be a reason for EMR usage, both in the literature\textsuperscript{32,34} and as experienced in our initiative. Our data indicate excellent usage of EMR enhancements. Just 1 year into this initiative, participating providers are reporting through EMR documentation that they are counseling regarding 5-2-1-Almost None behaviors at \textasciitilde97\% of well-child visits.

A component of our work about which we are particularly excited involves the development of a monthly report to track practice performance on quality improvement measures. Quality improvement initiative participants who use the EMR enhancements (the Nemours primary care participating practices) can review their practice-specific measures in a monthly report.

Lessons Learned
Having leadership prioritization, a practice change agent, and clinician input facilitated our creation and implementation of EMR changes. It was clearly beneficial that the Nemours leadership recognized childhood obesity as a priority issue. Leadership support enabled the commitment of resources and personnel for the EMR modifications and participation of the majority of Nemours primary care sites in this initiative. Having a practicing primary care physician lead the design and testing of the EMR changes and serve as a liaison among all interested parties has been enormously helpful. Others also have shown that clinician input is essential for success.\textsuperscript{42} In addition, it was likely an advantage that changes were implemented within an EMR system that the Nemours primary care practices had been using for \textasciitilde6 years.

In building and implementing these EMR enhancements, we have encountered challenges. Creating the enhancements has required efforts from multiple individuals in various segments of our large organization. Developing the EMR changes has been ongoing for 3 years and, as supported by the literature,\textsuperscript{44} has required multiple feedback loops and iterations. Different clinicians have different methods for using the EMR and unique approaches to workflow. For example, we initially included documentation of readiness to change and priority health goals in the BMI Smart Set. We received feedback from our users that placement with the orders was not consistent with optimal workflow; therefore, documentation was not occurring. This led us to move these components to the BMI readiness-to-change Smart Phrase. Additional feedback recently led us to add these components to the growth assessment drop-down list, which has led to greater user satisfaction. Clinician and office staff member acceptance of both the guidelines and the EMR enhancements continues to be a challenge. We are currently working with a self-appointed team from our practices. These are likely the practice change agents from each office who are most concerned with or interested in addressing childhood obesity. With the many competing priorities in the office setting, keeping even these leaders of change ex-
cited about this work is a challenge. We understand that, ultimately, use of EMR enhancements will occur only if clinicians find the system to be useful, workflow-efficient, and an improvement for providing high-quality patient care.41,44

CONCLUSIONS
Many obstacles impede the prevention, identification, and management of childhood obesity. More data are needed for a better understanding of whether embedding clinical guidelines into an existing EMR affects physician behaviors and child outcomes. The rich data being collected in the EMR as part of this initiative, such as physician documentation of BMI assessment and motivational interviewing approaches, as well as patient-level behavior changes and BMI, should permit us to gain a better understanding of these questions. We will continue to use an iterative process, assessing usability, clinician satisfaction, and workflow effects of the modifications, and will revise our intervention accordingly. This report demonstrates that using a quality improvement approach to modify an EMR system for implementation of expert recommendations is feasible. This promising approach is likely generalizable to other conditions; however, initial efforts in addressing new conditions also are likely to be time-intensive.

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REFERENCES
27. Nemours Health and Prevention Services. Planting the seeds
to help children Grow Up Healthy. Available at: www.

28. Resnicow K, Davis R, Rollnick S. Motivational interviewing for
pediatric obesity: conceptual issues and evidence review. J Am
Diet Assoc. 2006;106(12):2024–2033

29. Institute for Healthcare Improvement. The Breakthrough Series:
IHI’s Collaborative Model for Achieving Breakthrough Improvement.
Boston, MA: Institute for Healthcare Improvement; 2003

30. Institute of Medicine, Committee on Quality Health Care in
America. Crossing the Quality Chasm: A New Health System for the

for electronic medical records in US primary care. J Am Med Inform
Assoc. 2003;10(1):1–10

32. Kemper AR, Uren RL, Clark SJ. Adoption of electronic health
records in primary care pediatric practices. Pediatrics. 2006;
118(1). Available at: www.pediatrics.org/cgi/content/full/118/1/e20

medical record to improve documentation and treatment of

34. Garg AX, Adhikari NK, McDonald H, et al. Effects of comput-
erized clinical decision support systems on practitioner perfor-
mance and patient outcomes. JAMA. 2005;293(10):1223–1238

35. Goldberg HI, Neighbor WE, Cheadle AD, Ramsey SD, Diehr P,
Gore E. A controlled time-series trial of clinical reminders:
using computerized firm systems to make quality improvement
research a routine part of mainstream practice. Health
Serv Res. 2000;34(7):1519–1534

36. Fiks AR, Alessandrini EA, Luberti AA, Ostapenko S, Zhang X,
Silber JH. Identifying factors predicting immunization delay for
children followed in an urban primary care network using an
electronic health record. Pediatrics. 2006;118(6). Available at:
www.pediatrics.org/cgi/content/full/118/6/e1680

37. Pearson ML, Wu S, Schaefer J, et al. Assessing the implementa-
tion of the chronic care model in quality improvement collabora-
tives. Health Serv Res. 2005;40(4):978–996

38. Barlow SE, Bobra SR, Elliot MB, Brownson RC, Haire-Joshu D.
Recognition of childhood overweight during health supervisi-
225–232

39. Dilley KJ, Martin LA, Sullivan C, Seshadri R, Binns HJ; Pedi-
atric Practice Research Group. Identification of overweight status
is associated with higher rates of screening for comorbid-
2007;119(1). Available at: www.pediatrics.org/cgi/content/
full/119/1/e148

40. Flower KB, Perrin EM, Viadro CL, Ammerman AS. Using body
mass index to identify overweight children: barriers and facili-

41. Adams WG, Mann AM, Bauchner H. Use of an electronic
medical record improves the quality of urban pediatric primary

42. Gadd CS, Baskaran P, Lobach DF. Identification of design fea-
tures to enhance utilization and acceptance of systems for
Internet-based decision support at the point of care. Proc AMIA
Symp. 1998:91–95

43. Corb GJ, Liaw Y, Brandt CA, Shiffman RN. An object-oriented
framework for the development of computer-based guideline

44. Tierney WM, Overhage JM, McDonald CJ. Computerizing
guidelines: factors for success. Proc AMIA Annu Fall Symp. 1996:
459–462
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