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The long-term sustainability of a quality improvement project was examined. The ADHD Collaborative was designed to assist community-based pediatricians in adhering to the American Academy of Pediatrics evidence-based assessment and treatment guidelines for attention deficit hyperactivity disorder (ADHD). Patient chart reviews were completed out to 2 years post training for 14 practices ($N = 38$ pediatricians), who received the ADHD Collaborative intervention to assess whether improvements made immediately post training were sustained.

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Pediatricians maintained significant improvements in their use of evidence-based assessment and treatment practices for a period of 2 years. The majority of the improvements occurred quickly, within 6 months of training. Pediatricians focused most of their continuous quality improvement (CQI) efforts on improving follow-up care for their patients with ADHD. Systematic monitoring and follow up of ADHD patients who were prescribed medication improved considerably from pre-training (10%) to 6 months (49%), and pediatricians continued to make gradual improvements in follow-up care (62% at the 2-year follow up). Systematic intervention efforts with a focus on CQI are effective at improving and sustaining quality of ADHD care. More work is needed to determine how to disseminate, support, and deliver this and similar intervention models to the many physicians who may benefit.

Attention deficit hyperactivity disorder (ADHD) is one of the most common neurobehavioral disorders in children, with a prevalence rate of 8.7% (Froehlich et al., 2007). The high prevalence rate of the disorder, in combination with a shortage of specialty mental health providers (i.e., child psychologists and psychiatrists), has necessitated that primary care physicians take an active role in caring for children with ADHD (Goodfriend, Bryant, Livingood, & Goldhagen, 2006; Kim, 2003). Primary care physicians currently provide the majority of evaluation and treatment services for children with ADHD (Bussing, Zima, & Belin, 1998; Rappley, Gardiner, Tetton, & Houang, 1995).

In 2000 through 2001, the American Academy of Pediatrics (AAP) issued consensus guidelines that provide primary care physicians with evidence-based recommendations for the assessment and treatment of children with ADHD (AAP, 2000, 2001). The AAP assessment guidelines emphasize the importance of collecting parent and teacher standardized rating scales and using the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev. [*DSM–IV–TR*]; American Psychiatric Association, 2000) criteria as the basis for making an ADHD diagnosis. Treatment guidelines focus on providing systematic follow up, including the collection of follow-up parent and teacher ratings scales to quantitatively assess response to treatment.

The AAP guidelines have been widely disseminated and their adoption actively promoted. Despite the AAP's efforts to promote physician awareness, it is evident that the AAP recommendations are not being reliably implemented in the community. Chan, Hopkins, Perrin, Herrerias, and Homer (2005) completed a large, nationally representative survey of pediatricians' ADHD-related practice behaviors as compared to the recommendations provided in the AAP guidelines. Only 57% of pediatricians reported using formal criteria to diagnose ADHD. Further, only 27% of physicians who reported using formal criteria indicated that they adhered to *DSM–IV–TR* criteria. Standardization of diagnostic procedures is important to address problems with under- and over-diagnosis of children with

ADHD in the community. For example, in a large national sample of children aged 8 to 15, only 47% of children who met *DSM–IV–TR* criteria for ADHD based on administration of a diagnostic interview had prior diagnoses of ADHD (Froehlich et al., 2007). This suggests that there are significant problems with under-identification of ADHD in the community.

Problems have also been identified in terms of adherence to the AAP recommendations for ADHD treatment (Gardner, Kelleher, Pajer, & Camp, 2004; Rushton, Fant, & Clark, 2004). For example, Rushton et al. found that only 53% of physicians who prescribed stimulant medications for patients with ADHD completed routine follow-up visits as recommended by the AAP. Standardization of treatment is also critical, as systematic and ongoing monitoring of medication effectiveness yields results that are superior to less systematic efforts (Jensen et al., 2001; MTA Cooperative Group, 1999).

Several interventions have been developed and tested to promote the implementation of the AAP-recommended ADHD practice behaviors among primary care physicians (for a review, see Langberg, Brinkman, Lichtenstein, & Epstein, 2009). Although many of these interventions are effective at promoting short-term adherence to guideline recommendations, most did not study (Olson, Rosenbaum, Dosa, & Roizen, 2005), or were unable to document (Epstein et al., 2007; Leslie, Stallone, Weckerly, McDaniel, & Monn, 2006), sustainability of practice improvements. Designing evidence-based interventions that not only change practice behavior, but result in sustained changes after training, is crucial to improving care for patients (Feldstein & Glasgow, 2008; Glasgow & Emmons, 2007). Using quality improvement (QI) methodology appears to be a promising model for achieving short-term and long-term change, as QI focuses on changing the system in which health care is delivered, rather than the individual provider's behavior alone.

Only two studies have utilized a QI model to improve dissemination of evidence-based care for ADHD. Polaha, Cooper, Meadows, and Kratochvil (2005) demonstrated change and sustainability in practice improvements in ADHD care for as long as 3 years post training. However, this study was limited both in its focus (i.e., improving assessment, but not treatment practices) and its small sample size (i.e., 8 physicians). More recently, Epstein et al. (2010; see also Epstein et al., 2008) reported efficacy data from a QI intervention, the ADHD Collaborative, which targeted both ADHD assessment and treatment practices and was implemented across an entire community of physicians. The cornerstone of this intervention was its emphasis on using QI methodology to engage primary care physicians in restructuring their office systems to promote and support changes in ADHD management. Primary care physicians who participated in this intervention made significant improvements in their use of the evidence-based ADHD assessment and treatment practices (Epstein et al., 2008). Further, children treated by these community physicians made ADHD

symptom improvements comparable to those achieved in randomized clinical trials (Epstein et al., 2010).

To promote sustainability of these gains, primary care physicians were taught to incorporate QI methods of continuous performance feedback and plan–do–study–act (PDSA) cycles. PDSA cycles allow physicians to continuously examine and solve barriers to implementation of the ADHD guidelines within their practices. This study presents sustainability outcomes from the ADHD Collaborative physicians at 24 months post training, and focuses on the contribution that QI training played in achieving these outcomes. We hypothesized that ongoing use of QI methodology beyond the first 12 months would result in sustained improvement for all practice behaviors continuing until 24 months post training.

METHOD

Participants

All primary care offices listed in telephone directories and within a 30-min radius of Cincinnati Children's Hospital Medical Center (CCHMC; $N = 209$ practices; 569 primary care physicians) were mailed a brochure and letter describing the ADHD Collaborative. The intervention model was described, and the requirements for participation were delineated. Two weeks after the mailing was sent out, practices were called by an ADHD Collaborative staff member to discuss interest in participation in the project. If requested, a local opinion leader traveled to the practice to answer questions about the project and solicit participation. Fifty-five practices employing 202 physicians (158 pediatricians and 44 family physicians) voluntarily enrolled in the ADHD Collaborative. Thirty-eight practices declined participation, whereas the remaining 155 practices were not responsive or had scheduling conflicts.

Training for the 55 practices was divided into 11 phases, each phase consisting of between 3 to 10 practices, based on when during the 3-year recruitment period they expressed interest in joining the Collaborative. The first four phases ($N = 20$ practices) piloted the intervention model. Post-pilot modifications were based on feedback from pilot practices and focused on (a) improving physician adherence with implementing guideline recommendations and (b) condensing the model so that larger numbers of physicians could be trained with enhanced effectiveness. The intervention model used to train the fifth phase of physicians was deemed the final model after it was determined by the research team that it was the most parsimonious, yet effective, intervention version. This model was used without modification for training all subsequent phases.

Thirty-one pediatric practices ($N = 123$ pediatricians) were evaluated using the final training model. The three phases trained the earliest with the final

model (Phases 5–7; $N = 14$ practices; $N = 38$ pediatricians) had patient chart reviews completed out to 2 years post training and are included in this report. Of these pediatricians, 63% were women, and 84% were Caucasian. Twenty-nine percent of practices served primarily (> 50% of patients) Medicaid populations, 36% served primarily rural populations, and 64% served primarily urban and suburban populations.

Although the intervention model was also implemented with a small number of family practices ($N = 3$ in Phases 5–7), we found that the intervention model was not conducive to family practice settings due to the low rate of ADHD referrals. A decision was made to exclude any data collected from family practitioners from this report.

Intervention

The finalized intervention model included four training sessions, totaling 5 hr. Two 1 1/2-hr didactic sessions were given by a practicing community-based primary care physician. The didactics focused on the evidence base for the AAP ADHD guideline recommendations. The didactics emphasized the importance of obtaining Vanderbilt ADHD Rating Scales from both parents and teachers at the time of the initial assessment for ADHD and during follow up after initiating medication treatment. Physicians were instructed to collect rating scales weekly during medication titration and then every 3 to 6 months during medication maintenance. Evidence for the efficacy of both medication and behavioral treatments for children with ADHD was presented with emphasis on the findings from the Multimodal Treatment Study of Children with ADHD (MTA; MTA Cooperative Group, 1999). The didactics highlighted the importance of a combined approach (i.e., both medication and behavior therapy) for treating children with ADHD. All didactic trainings occurred at a central location and were attended by physicians and one or more physician-identified office champions (including nurse practitioners, nurses, medical assistants, front office personnel, and office managers).

Each didactic session was followed 1 week later by a 1-hr office-based training session, attended by physicians and office staff, which focused on modifying office flow as a means to facilitate the incorporation of the AAP evidence-based guideline practices. These training sessions began with charting office flow as it pertained to how ADHD patients were managed prior to intervention. Offices were then introduced to an idealized office flow diagram, which represented a more parsimonious system for imbedding all AAP guideline recommendations into office operations. Practices were taught to approach the ideal flow with the understanding that each practice faces unique challenges that are defined by differences in patient populations, physicians' experiences, and support staff compositions. A variety of tools (e.g., Vanderbilt ADHD Rating

Scales, written care management plans, and telephone follow-up protocols) were provided to practices to support the implementation effort. Offices were given written instructions on how to score and interpret the Vanderbilt forms and a tracking grid for following sequential Vanderbilt scores as a function of medication dose over time.

Sustainability Components of Intervention

The intervention employed several strategies to promote and sustain practice improvements. First, practices were taught to use a patient log to track the progress of patients with ADHD through the assessment and treatment process. Every 3 to 6 months, the ADHD Collaborative staff conducted chart reviews (see the following Chart Reviews section for more detail). Offices were then provided with practice-specific data in a report-card format, which identified the extent to which guideline-based process and patient outcome measures were improving (see Table 1).

Second, at the time a practice received its quarterly report card, the practices were taught to identify areas that needed further improvement and to devise a plan for targeting those areas using small tests of process change (i.e., PDSA cycles). The development of PDSA cycles by each office was facilitated by a trained pediatrician affiliated with the ADHD Collaborative. This pediatrician contacted each office after the practice had received their quarterly report card and reviewed the report cards with the office's lead physician. The ADHD Collaborative pediatricians systematically and collaboratively worked with the lead physician to identify target behaviors, derive a plan for improving those target behaviors, set goals, and institute a timeline for implementing the changes.

Third, group meetings with representatives from all practices were held every 3 months. Group meetings focused on providing physicians with updates and information on ADHD-related issues but primarily focused on facilitating cross-practice communication about strategies for overcoming obstacles to implementing the AAP guideline recommendations. All of the aforementioned activities (i.e., chart reviews, PDSA cycles, and quarterly meetings) occurred for 2 years post training.

Finally, physicians were provided with an algorithm for making fast-track referrals to mental health specialists at CCHMC for patients who failed to respond to medication or appeared to have significant comorbid conditions.

Measure

Vanderbilt ADHD rating scales. The Vanderbilt ADHD rating scales are *DSM–IV–TR* based, with a Teacher-Report Scale and a Parent-Report Scale

TABLE 1
Baseline 6-, 12-, 18-, and 24-Month Follow-Up Outcomes From the ADHD Collaborative Intervention

	Proportion (No. of Patients; No. of Physicians)								
Practice	*Baseline*	*6-Month Outcome*	*Baseline vs. 6-Month Outcome (χ^2)*	*12-Month Outcome*	*Baseline vs. 12-Month Outcome (χ^2)*	*18-Month Outcome*	*Baseline vs. 18-Month Outcome (χ^2)*	*24-Month Outcome*	*Baseline vs. 24-Month Outcome (χ^2)*
Proportion of patients evaluated with parent rating scales	61% (156; 37)	99% (202; 33)	12.552*	97% (93; 27)	10.135*	97% (105; 27)	10.135*	93% (42; 17)	5.929**
Proportion of patients evaluated with teacher rating scales	61% (155; 37)	98% (202; 33)	12.552*	95% (93; 27)	10.135*	95% (105; 27)	10.135*	86% (42; 17)	3.798**
Proportion of patients meeting *DSM–IV–TR* criteria for ADHD	41% (152; 37)	76% (192; 33)	8.834*	80% (86; 26)	10.090*	79% (94; 27)	9.156*	68% (40; 17)	4.207**
Proportion of patients with a written care management plan	2% (200; 38)	80% (194; 33)	43.466*	76% (88; 26)	38.648*	76% (94; 27)	36.839*	79% (38; 18)	35.171*
Proportion of patients with office contact within 14 days of initiating medication	32% (193; 38)	73% (166; 34)	12.642*	74% (90; 30)	11.691*	81% (85; 24)	13.325*	71% (38; 17)	7.267*
Proportion of patients with an office follow up within 6 weeks of medication initiation	52% (186; 37)	77% (165; 34)	4.817**	76% (86; 29)	4.151**	75% (83; 24)	3.411	78% (37; 16)	2.573
Proportion of patients with *follow-up* rating scales completed by parent	8% (185; 37)	48% (165; 34)	17.098*	49% (86; 29)	15.593*	58% (84; 24)	9.776*	59% (34; 16)	9.269*
Proportion of patients with *follow-up* rating scales completed by teacher	11% (184; 36)	49% (165; 34)	6.508**	37% (86; 29)	6.508**	52% (83; 24)	13.146*	64% (33; 15)	16.409*

Note. ADHD = attention deficit hyperactivity disorder; *DSM–IV–TR* = *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; American Psychiatric Association, 2000).

*$p < .01$. **$p < .05$.

form (Wolraich et al., 2003). The Vanderbilt ADHD Rating Scales were included as part of the ADHD Toolkit developed by the AAP to facilitate ADHD guideline adherence. Post intervention, all physicians in the study used the Vanderbilt to assess for ADHD and to monitor treatment progress. The Vanderbilt Rating Scales include the 18 *DSM–IV–TR* ADHD symptoms, which are rated on a 4-point Likert scale, with 0 indicating whether each ADHD symptoms occurs 0 (*never*), 1 (*occasionally*), 2 (*often*), or 3 (*very often*). A total symptom score can be derived by summing the responses on the 18 *DSM–IV–TR* ADHD symptom items. In addition to assessing ADHD symptoms, the Vanderbilt Rating Scales also include items regarding functional impairment. Parents and teachers rate eight functional impairment items on a 5-point Likert scale indicating whether the child is 1 (*excellent*), 2 (*above average*), 3 (*average*), 4 (*somewhat of a problem*), or 5 (*problematic*) in each domain of functional impairment. Internal consistency for the Vanderbilt parent and teacher versions is excellent, with Cronbach's alpha ranging from 0.90 to 0.95 as assessed in both community and clinic samples. Concurrent validity of the 18 Vanderbilt ADHD items with the ADHD section of the Computerized Diagnostic Interview Schedule for Children is high ($r = .79$; Wolraich et al., 2003).

Chart Reviews

All of the practices were asked at the onset of training to begin keeping a registry of all patients for whom an ADHD assessment was initiated. The charts of all patients on the registry were subsequently reviewed every 3 to 6 months by ADHD Collaborative research staff to monitor whether specific elements of guideline-recommended care were being employed. Charts were reviewed for evidence of documentation of seven specific AAP guideline-related measures. Each patient's chart was examined for evidence of the following practices: (a) Was a standardized parent or teacher rating scale that included *DSM–IV–TR* ADHD items utilized during the evaluation process?; (b) Did the child meet *DSM–IV–TR* criteria for ADHD based on rating scale symptom criteria?; (c) Was a written care management plan utilized?; (d) If prescribed medication, was there any contact with the family within 14 days of initiating medication?; (e) If prescribed medication, was there an office visit within 6 weeks?; and (f) Was a parent or teacher rating scale used during the first 6 weeks of medication treatment to assess medication response?

Analyses

Baseline performance was established for each physician by reviewing the charts of up to 10 patients per physician who had been diagnosed with ADHD during

the preceding 2 years. For some physicians, fewer than 10 patient charts were reviewed because some had fewer than 10 new elementary school-aged patients who had been diagnosed with ADHD within the past 2 years.

To statistically test for sustained improvement, baseline levels of practice behaviors were compared to post-intervention levels of practice behaviors for each quarterly data review time point out to 24 months. Chi-square tests were used to compare proportions. The institutional review board at CCHMC approved this study.

RESULTS

Pre-intervention, the charts of 214 elementary school-aged children with ADHD were reviewed across the 14 practices and 38 pediatricians. Pre-intervention, physicians reported collecting rating scales during the ADHD assessment process with 61% of their patients. Primary care physicians followed up prescribing medication with an office visit within 6 weeks of medication initiation for 52% of their patients. Primary care physicians rarely used standardized ADHD rating scales to assess treatment response (10%; see Table 1).

Physicians demonstrated substantial post-training gains in their demonstration of evidence-based ADHD practice behaviors. Use of the Vanderbilt ADHD Rating Scales to assess for ADHD neared 100%. Primary care physicians showed significant increases in the use of written-care management plans with their patients, contacting patients within 14 days of medication initiation, conducting follow-up visits within 6 weeks of medication initiation, and collecting parent and teacher ratings of the Vanderbilt ADHD Rating Scales to assess treatment response. These gains were seen as early as 3 months post intervention.

Fifty-four PDSAs were completed during the project ($M = 4.15$ PDSAs completed per practice). One practice did not complete any PDSAs because they rapidly reached targeted goals on all measures, and no PDSAs were needed. As noted earlier, the targets of the PDSA were determined by examining each practice's report card and selecting the areas with the worst performance. The vast majority of PDSAs focused on improving follow-up care. Table 2 presents the frequency with which each ADHD practice behavior was targeted, and provides examples of the most commonly utilized strategies to improve performance.

Regarding sustainability, chart reviews demonstrate that the short-term practice improvements were maintained out to 2 years. As shown in Table 1, all of the ADHD practice behaviors continued to be significantly improved from those reported pre-intervention. Of note, there were also some significant improvements that occurred for some of the treatment practice behaviors between the 12- and 24-month time points. For example, collection of Vanderbilt Rating Scales from teachers to assess medication response during medication maintenance averaged

TABLE 2
Physician Continuous Quality Improvement Efforts:
Frequency and Description of Systematic Change Efforts

Outcome Measure Targeted for Improvement	*Frequency*	*Most Common Plan–Do–Study–Act Cycles*
Percentage of patients with office contact within 14 days of medication initiation	10	1. Office staff will begin making telephone follow-up calls at 7 days rather than 14 days to allow time for repeated follow-up attempts if family is not reached on first attempt. 2. Schedule all patients for 2-week office follow-up visit (i.e., in place of phone contact) at the time of the medication initiation visit. 3. Families are instructed by the physician to call the office with a progress report within 7 days of medication initiation. If office has not heard from family within 10 days, office staff calls family.
Percentage of patients with an office follow-up visit within 6 weeks of medication initiation	5	1. Office policy created and reviewed with families stating that medication refills will not be written until the patient comes into the office for a follow-up appointment. 2. Parents are reminded during the 14-day telephone call that an office follow-up visit needs to be scheduled. 3. Office staff schedules follow-up appointment at the time of the initial medication initiation visit.
Percentage of patients with follow-up Vanderbilt Rating Scales completed by parent	16	1. Parents are provided Vanderbilt forms to complete in the office waiting room at time of office follow-up visit. 2. Parents are asked to fill out follow-up forms when they come to the office to pick up the refill script at 2 weeks. 3. Families are provided copies of the follow-up Vanderbilt forms at the time of initial treatment conference and told to mail or fax them back prior to the office follow-up visit.
Percentage of patients with follow-up Vanderbilt Rating Scales completed by teacher	15	1. Office staff takes responsibility for faxing teachers follow-up Vanderbilt forms 1 week prior to the patient's first follow-up appointment. 2. Families are provided with follow-up teacher forms at the time of the initial medication initiation conference and told to have teachers' complete forms in time for the office follow up. 3. Follow-up Vanderbilt forms are mailed or e-mailed to parents 1 week after medication initiation. Parents are reminded during the 14-day telephone contact to provide teachers with Vanderbilt forms and that teachers must complete forms before follow-up visit.
Other	8	1. Examples of other areas targeted for improvement include written care management plan and completion of parent and teacher Vanderbilt Rating Scales at assessment.

43% during the first year post training and increased to 58% during the second year post training. Similar increases were seen for collection of the Vanderbilt ADHD Parent-Report Scale during medication maintenance.

DISCUSSION

Pediatricians in the ADHD Collaborative made significant improvements in their use of evidence-based ADHD assessment and medication treatment practices, and sustained these gains for a period of 2 years. Examination of practice behaviors over the course of the 2-year study indicates that most of the improvement occurred immediately post training (i.e., within 6 months); thereafter, practice behavior improvements were sustained for up to 2 years. Physicians demonstrated almost universal adoption of recommended ADHD assessment behaviors. Specifically, by 6 months post training, nearly 100% of children assessed by physicians for ADHD had parent- and teacher-completed Vanderbilt ADHD Rating Scales. Physicians also made marked improvements in ADHD medication treatment behaviors. For example, collection of the Vanderbilt ADHD Rating Scales to assess medication treatment response increased nearly sevenfold, from 8% pre-intervention to a post-training average of 54%. Collection of teacher follow-up ratings increased fivefold to an average of 51% post training.

This study's demonstration of sustainability of intervention gains is unique, especially in light of the fact that it was accomplished in a community setting where experimental control is difficult. A key feature of this intervention's success in producing initial change and then sustaining those changes was the significant emphasis placed on continuous organizational systems modification. As part of the initial training, all practices modified their office flow to facilitate evidence-based ADHD care. The goal was to customize flow for each practice so that the office system allowed all physicians within a practice to engage in similar ADHD assessment and treatment practices in accordance with the AAP consensus guideline recommendations. However, the initially identified office system was rarely ideal and typically did not lead to improvement across all measures. Hence, practices were taught to continue the office system modification process through the use of data-driven systematic revisions, referred to as PDSA cycles (Langley, Nolan, Nolan, Norman, & Provost, 1996). If AAP recommended practices were not being achieved, practices implemented small tests of change to address these identified shortcomings. It was through this process of continuous quality improvement (CQI) that additional office system changes were made, further improvements generated, and gains sustained. This continuous system change concept is a core tenant of the CQI intervention framework (Bailie et al., 2008). CQI is based on the hypothesis that "one size fits all" interventions delivered from outside agencies are un-

likely to be internalized into office systems and are, therefore, inherently nonsustainable.

Although the office system modification was a critical component of the ADHD Collaborative intervention, this was only one of many intervention components. The ADHD Collaborative intervention was designed to address all components of the National Initiative for Children's Healthcare Quality Chronic Care Model (CCM; Bodenheimer, Wagner, & Grumbach, 2002; Wagner, Austin, & Von Korff, 1996). According to this model, there are six essential elements that must be addressed by the primary care delivery system to effectively treat chronic care conditions, such as ADHD: (a) community resources and policies (i.e., linkages to and relations with hospitals), (b) health care organization (i.e., leaders must recognize chronic care as a priority and support QI efforts), (c) self-management (i.e., involve patients in treatment so that they learn strategies for managing illness), (d) delivery system design (i.e., the organizational system must be altered and clear division of labor and roles established), (e) decision support (i.e., importance of evidence-based guidelines consistently reinforced and access to consultation is available), and (f) clinical information systems (i.e., registry of patients that allows physicians to receive feedback on patient care).

The ADHD Collaborative model is the only community-based ADHD intervention model, to our knowledge, that specifically addresses all six components of the CCM (see Table 3). In fact, across diseases, few intervention models address multiple components of the CCM. For example, in a review of 39 studies of interventions using the CCM across a variety of illnesses (asthma, diabetes, and congestive heart failure), none of the interventions addressed more than four of the six components, and the majority addressed only two or three (Tsai, Morton, Mangione, & Keller, 2005). There is compelling evidence that each of the CCM components is associated with better outcomes and that the synergistic integration of the elements is what drives improvement (Bodenheimer et al., 2002; Glasgow & Emmons, 2007; Tsai et al., 2005).

Although our intervention was effective at improving performance, no practice behavior was implemented with 100% reliability. Perfect reliability is probably unrealistic because the practice behaviors tracked in this study are, in many cases, beyond the physicians' ability to control. For example, there is only so much a physician can do to collect teacher rating scales, even with innovative problem solving. Options our primary care physicians used included having parents prompt teachers, faxing rating scales directly to teachers, and refusing to refill stimulant prescriptions until teachers completed the Vanderbilt ADHD Rating Scales (see Table 2). Ultimately, improvement for this measure likely requires training with teachers and policy development by schools that is outside the traditional scope of physician activity. Additional guidance may be needed from the AAP in terms of realistic targets for treatment behaviors and suggestions for how far to go to ensure that guidelines are followed.

TABLE 3
Chronic Care Model Components and Corresponding Intervention Components of the ADHD Collaborative

Chronic Care Model Components	*ADHD Collaborative Components*
Community resources	Linked to CCHMC through fast-track referral service; can receive appointment and expert consultation for patients who do not respond to medication or with complex comorbidities; access to behavioral parent training groups.
Health care organization	Collaborative didactics emphasize importance of AAP guidelines and focus on importance of practice physician leader buy-in.
Self-management support	Written care management plan gives family opportunity to be involved in goal setting and treatment planning.
Delivery system design	Office systems modifications curriculum forces practices to map out all staff members' roles and specific tasks in getting AAP guidelines implemented.
Decision support	Office systems modified so guideline adherence is part of everyday practice; specialist completes quarterly PDSAs with practice to make additional office systems and personnel role changes.
Clinical information systems	Data for all patients entered on the patient log track, and physicians receive quarterly report cards detailing their adherence to the evidence-based ADHD practice behaviors.

Note. See Wagner (1998) for further details related to the Chronic Care Model components. ADHD = attention deficit hyperactivity disorder; CCHMC = Cincinnati Children's Hospital Medical Center; AAP = American Academy of Pediatrics; PDSA = plan–do–study–act.

Limitations

Our ability to draw conclusions about sustainability of physician improvements is limited by the relatively small sample size and lack of a control group. ADHD Collaborative practices were trained in phases. We were only able to examine sustainability out to 2 years for those practices who had been involved in the project for a period of 2 years when the project ended. It is possible that these practices are unique in some way (e.g., motivation), and the sustainable gains witnessed with this sample would not generalize to the overall sample. However, at 1 year post intervention, the entire group of participating pediatricians made similar improvements across these same measures (Epstein et al., 2010; Epstein et al., 2008). The design of the study and interpretation of the results would have been strengthened by the addition of a control group of untrained physicians. Without a control group, it is not possible to state for certain whether improvement was caused by the ADHD Collaborative intervention. However, it is important to note that practices were trained in phases, and each phase demonstrated a

nearly identical pattern of pre- to post-intervention improvement (Epstein et al., 2010; Epstein et al., 2008). This time-series design supports the assertion that the ADHD Collaborative intervention produced physician improvements.

Physicians in the study kept a patient log where they recorded the names of all patients who had an ADHD evaluation initiated. ADHD Collaborative research staff used these logs to determine which patient charts needed to be reviewed. Therefore, it is not possible to determine from the available data how accurate physicians were in recognizing symptoms of ADHD and initiating evaluations. Further, the chart review process specifically focused on documenting physician's assessment and medication treatment practices. It is unclear if physicians in the study made referrals for behavior therapy in addition to initiating ADHD medication treatment.

Implications for Practice

The dissemination of a proven intervention such as this poses several challenges. First and foremost, the engagement in CQI activities requires time, resources, and adequate reimbursement (Cabana et al., 1999; Epstein et al., 2007; Leslie, Weckerly, Plemmons, Landsverk, & Eastman, 2004). It is reasonable to assume that if the cost of adopting evidence-based ADHD practices is greater than the incentives, dissemination of the ADHD Collaborative model will be unsuccessful. Accordingly, it will be important for future research efforts to formally assess the cost of adopting ADHD guidelines in terms of materials costs, staff time, and insurance reimbursement.

One recent incentive for primary care physicians comes from the American Board of Pediatrics (ABP) "Performance in Practice" re-credentialing requirement. Beginning in 2010, the ABP will require documentation of engagement in a structured QI activity as part of the maintenance of certification process. This certification criterion provides an opportunity for the AAP, in conjunction with the ABP, to begin to systematically train pediatricians on how to employ QI science as a means for successfully implementing guidelines.

The fast-growing, pay-for-performance movement is another means of providing incentives for physicians who engage in evidence-based care. However, there are a number of unanswered questions about how pay-for-performance programs can be applied to the care of children with ADHD (Mandel & Kotogal, 2007). For example, existing pay-for-performance programs are increasingly focusing on health outcomes and cost-efficiency, rather than solely on clinical process (Rosenthal, Landon, Howitt, Song, & Epstein, 2007). Although it is assumed that adherence to AAP recommendations leads to improved health outcomes for children with ADHD, this has yet to be demonstrated in a community care context. Indeed, it is possible that ADHD guideline adherence will actually increase the short-term cost of caring for children with ADHD. For pay-for-performance

to work in the treatment of ADHD, insurance companies may need to employ an evaluation system that combines short-term cost considerations with measures of impairment reduction, decreased accidental injury, improved comorbidity ascertainment, parental satisfaction, and long-term outcomes tracked into adulthood.

In summary, we have documented the successful implementation of the AAP ADHD guidelines by a cohort of primary care physicians using a combination of academic detailing and comprehensive training in CQI techniques. Primary care physicians demonstrated significant improvement with all assessment and treatment process measures relative to baseline, and were able to sustain their levels of improved practice for 24 months following intervention.

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