Title of Project. Educating and Supporting Primary Care Providers in the Implementation of Evidence-Based Practices for ADHD

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Structured Abstract

Purpose: To evaluate a distance-learning, quality improvement intervention to improve pediatric primary care provider use of ADHD rating scales.

Scope: The study was conducted in 19 primary care practices across urban and suburban settings with 105 participating clinicians

Methods: Clinicians at primary care practices were cluster-randomized to a 3-part distance-learning, quality improvement intervention (web-based education, collaborative consultation with ADHD experts, and performance feedback reports/calls), qualifying for Maintenance of Certification (MOC) Part IV credit, or wait-list control. We compared changes relative to a baseline period in rating scale use by study arm using logistic regression clustered by practice (primary analysis) and examined effect modification by level of clinician participation. An electronic health record-linked system for gathering ADHD rating scales from parents and teachers was implemented prior to the intervention period at all sites. Rating scale use was ascertained by manual chart review.

Results: Differences between arms were not significant. From the baseline to intervention period and following implementation of the electronic system, clinicians in both study arms were significantly more likely to administer and receive parent and teacher rating scales. Among intervention clinicians, those who participated in at least one feedback call or qualified for MOC credit were more likely to give parents rating scales with differences of 14.2 (95% confidence interval: 0.6, 27.7) and 18.8 (95% confidence interval: 1.9, 35.7) percentage points, respectively.

Key Words: ADHD, Primary Care, Quality Improvement

Purpose

To evaluate a distance-learning, quality improvement intervention to improve pediatric primary care provider use of ADHD rating scales, explore the impact of systems-level electronic supports for clinicians, and examine whether level of clinician participation in quality improvement moderated the effect of the intervention on study outcomes.

Scope

Attention-deficit/hyperactivity disorder (ADHD) is the most common neurodevelopmental disorder, affecting approximately 7% of children and adolescents.[1] ADHD often results in impairments in multiple domains, including academics, interpersonal relationships, classroom behavior, and self-esteem.[2] ADHD is associated with higher rates of other psychiatric disorders,[3, 4] substance abuse,[5-7] and suicide.[3] These negative effects underscore the importance of accurately diagnosing children and adolescents with ADHD and monitoring treatment effects over time. Best practices for assessing ADHD include the use of parent and teacher ratings scales to examine symptoms, impairments, and comorbid conditions.[8] Rating scales provide clinicians with needed information to both diagnose children and tailor treatments to improve outcomes.

Although the American Academy of Pediatrics (AAP) has affirmed the central role of pediatric primary care providers (PCPs) in assessing and treating ADHD and has published practice guidelines and toolkits to bolster evidence-based care,[8, 9] the implementation of evidence-based practices (EBP) in primary care is highly variable and often poor.[10-12] Three broad classes of intervention have been developed to improve the implementation of EBPs for assessing ADHD in primary care: 1) providing education to PCPs about EBPs for assessing ADHD; 2) applying systems interventions (e.g., electronic and office work flow systems); and 3) using quality improvement strategies (e.g., performance feedback followed by group data review and development of improvement strategies). Virtually all approaches to improving the implementation of EBPs for assessing ADHD have incorporated a provider education component.[13-17] In addition, many projects have incorporated strategies to improve implementation of EBPs, including using electronic systems for administering, scoring, and interpreting rating scales,[13] enlisting care coordinators to follow up with parents and teachers,[15] and collaborating with practice staff to improve workflow.[13, 14, 16] Recently, interventions have incorporated quality improvement (QI) strategies to improve provider implementation of EBPs.[13, 14, 18, 19] However, only two of these QI studies used a randomized controlled design.[13, 19] In both of these studies, the intervention combined a QI and systems component, so it was not possible to distinguish the contribution of each component. The current study is unique in its focus on evaluating the QI component of intervention.

Many of the interventions used to date have involved in-person training of the practice on ADHD management and fostering collaboration among all members of the practice. Although these approaches have been found to improve use of EBPs,[14-16] these may be challenging to scale for large numbers of clinicians from geographically dispersed practices. To address this issue, our study was designed to test the SHARE (Supporting Healthcare for ADHD through Relationships and Education) intervention, providing education with QI strategies to providers across primary care practices in a time-efficient manner using distance-learning technologies

(i.e., webinars, online discussion boards, and performance feedback delivered via email and discussed at phone meetings).

We planned the current study to fill gaps in the literature. First, it evaluates a distance-learning educational intervention incorporating QI methods using a cluster-randomized design. Second, although systems-level supports (i.e., electronic portal for administering rating scales) were used in the study, the systems component was available to all study providers and not experimentally manipulated. Finally, the study examined whether level of clinician participation in QI moderated the effect of this readily scalable intervention on outcomes.

Setting and Study Population

This study was conducted within a hospital-owned primary care practice-based research network.[20] At the time of the study, the network included 26 practices caring for approximately 240,000 children in 2 states. Practices used a common electronic health record (EHR), Epic (EpicCare, Verona, WI). Practice leaders were approached and 19 practices confirmed interest in participating (73%). All 3 urban, primarily Medicaid-insured practices in the network participated. Practices that chose not to participate did so due to competing clinical priorities or involvement in other research projects. All 166 non-trainee clinicians at the 19 participating practices were invited to participate in November 2014. 105 clinicians consented to participate in this study and were the primary subjects. Secondary subjects included patients aged 5-12 years with an ADHD diagnosis in the EHR who received care from study clinicians. Children with autism spectrum disorder were excluded.

Methods

Study Design and Randomization

In this cluster-randomized trial, randomization to the intervention or waitlist control was done at the primary care practice level. All participating clinicians within a practice who chose to participate received the assigned intervention. The randomization sequence was generated by the study statistician and was stratified by practice Medicaid percent (≥20% versus <20%) and size. Randomization resulted in 9 intervention and 10 control practices. Neither participants nor the study team were blinded to group assignment following randomization.

Outcomes were recorded during an 8-month baseline period (December 1, 2013-July 31, 2014), during which neither group received the intervention, and an 8-month intervention period (December 1, 2014-July 31, 2015), during which both groups were provided access to an electronic system to complete rating scales, but only clinicians in practices randomized to the intervention received the 3-component SHARE intervention.

Intervention

The SHARE intervention was a 3-component, distance-learning/quality improvement program satisfying criteria for Part IV Maintenance of Certification (MOC) credit from the American Board of Pediatrics (ABP). First, clinicians received education through three, 15-minute web-based presentations created by the study team that focused on evidence-based practices for managing ADHD in primary care and communication strategies for effectively collaborating with families. Second, clinicians could collaboratively consult ADHD experts via a health system online networking site or private email/telephone conversation. Third, clinicians received performance feedback reports every 2 months that informed them of their rates of

sending and receiving ADHD rating scales from parents and teachers, and allowed them to compare their results to those of the entire group, an approach that has previously proved effective.[21-25] Feedback reports were discussed during four, 1-hour conference calls in which participants reviewed their data and discussed strategies to improve use of EBPs. There was no effort to foster communication among control sites. Clinicians who participated in all aspects of the intervention could obtain ABP MOC Part IV credit. We did not provide clinic-level onsite coaching and support. The intervention was targeted for clinicians and did not engage the full office staff including nurses, medical assistants, care coordinators/managers or clerical staff.

The ADHD Care Assistant

To facilitate collection of parent and teacher rating scales by primary care providers, we developed an electronic system called the ADHD Care Assistant. The Care Assistant sent electronic surveys via email to parents and teachers and presented results seamlessly in the EHR.[26] The Care Assistant was made available to all clinicians in the network, including those in the study and those who were not, prior to the intervention period. All providers were offered web-based training on how to use the Care Assistant and nearly all (100/105) completed training. The cost of building the Care Assistant was approximately $115,000 in support of user interface design, programming and faculty input.

Outcome Metrics

We assessed several implementation outcomes including: the number of intervention providers viewing each educational presentation; the content of posts in the online networking site and approximate number of consultations per month occurring by email, phone or in person; and number of providers participating in any of the feedback report calls and completing MOC attestation. In addition, we assessed the number of clinicians in both study arms using the ADHD Care Assistant at least once during the study period. Finally, we calculated the cost of the intervention for a fully engaged clinician by estimating the number of hours spent participating (1 hour for the educational presentation, 4 hours for the feedback report calls, and 4 hours for other activities, e.g. posting and viewing content in the online networking site) and multiplying the total by the median hourly wage of U.S. primary care physicians ($82/hr).[27]

Primary study outcomes, determined by manual chart review that reflected completion of either electronic or paper surveys, included sending out and receiving back parent and teacher ADHD rating scales. For each clinician, we drew a random sample of 4 patients in the baseline period and 4 patients in the intervention period with ADHD who had either a preventive care or ADHD follow-up visit with that clinician (8 patients per clinician total) using random number generation in Stata (StataCorp, College Station, TX). We chose to review 4 charts per period as this was a number nearly all clinicians would be able to meet, and would result in a large number of charts (790 total) reviewed in detail. One study team member reviewed EHRs for each patient and recorded whether a parent or teacher survey had been sent or returned during the period in question. The chart review coding protocol was developed through an iterative process that included group review of more complex charts to establish coding rules based on consensus. A random sample of 15% of charts in the baseline and intervention periods (118 total) were reviewed by a second coder and inter-rater reliability was calculated using kappa statistics (moderate-to-high reliability for all outcome metrics [28, 29]).

Covariates

We recorded clinician gender and provider type (pediatrician or nurse practitioner). We

assessed clinician baseline beliefs of acceptability and effectiveness of managing ADHD in primary care using the previously validated ADHD Questionnaire for Primary Care Providers,[30] and change in these beliefs from the baseline to the post-intervention period. Patient-level covariates were ascertained from the EHR and included age in years, gender, race (categorized as White, Black, and Other Race), ethnicity (Hispanic versus non-Hispanic), and insurance payer (Medicaid, Private, or missing). Insurance was missing for 4 children (<1%). In statistical models, we included those covariates that were associated with at least one outcome (sending out and receiving back parent and teacher surveys) at the $p<0.1$ level; these included patient age, race, and insurance status, as well as provider type.

Statistical Analysis

The study population was described using means and standard deviations (SD) for continuous variables and frequencies with proportions for categorical variables. To evaluate the effect of the intervention on EBPs for ADHD, we calculated the proportion of patients in both study arms with parent and teacher rating scales sent and received during the baseline and intervention periods. We then calculated the percentage point change between periods within each arm, and the difference-in-difference between arms. Results were also described by practice.

To control for differences in patient and clinician covariates between study arms, we used separate logistic regression models for each outcome, with independent variables including study arm, time period (baseline versus intervention), and an interaction between study arm and time period. Models were adjusted for covariates associated with at least one outcome at the $p<0.1$ level, and included provider type as well as patient age, race, and insurance status. Variances accounted for the cluster-randomized design. We used marginal standardization to calculate: 1) the predicted proportion of patients seen by clinicians in each group who had each outcome in each period, 2) within-group change over time and 3) the between-group difference in the change in outcomes over time, standardized for covariates. Finally, we evaluated outcomes at the practice-level and compared the change in outcomes over time for each primary care practice. In a sensitivity analysis, generalized estimating equations (GEE) clustered by provider were applied to determine whether results could be confirmed. Analysis was by intention-to-treat.

In a secondary analysis that applied the methods described above, we examined whether level of participation in the performance feedback component of the intervention (a measure of intervention engagement) was associated with increases to rating scale use among clinicians randomized to the intervention arm. Specifically, we assessed any participation (defined as participating in at least one feedback conference call) and full participation (clinician attestation of completing the ABP MOC program). We also compared outcomes between intervention clinicians with full participation and control clinicians. In an additional analysis, we examined whether associations of the intervention with rating scale outcomes differed by patient insurance status (public versus private).

The Institutional Review Board (IRB) at the study institution approved this study. All participating clinicians provided informed consent. The IRB waived the requirement of patient assent and parent consent.

Limitations

Our study had several limitations. First, we enrolled clinicians from within one health system who were interested in participating in the project and worked in practices that agreed to

participate. Although this is among the largest published trials to address ADHD care, these factors may limit the generalizability of results. Second, although we obtained rating scale outcomes through a detailed chart review process, this methodology enabled us to review a limited number of charts per provider, reducing power to detect modest differences in rating scale outcomes. Third, we did not distinguish between initial and follow-up ADHD rating scales in chart review. Fourth, the implementation of the Care Assistant and the Hawthorne effect[31] may have led to improvements in control practices, biasing results toward the null. Fifth, examining changes in symptom scores for patients was outside the scope of this project as symptom scores were not routinely recorded in the medical record, even when there was a record of rating scale receipt. Sixth, we cannot exclude the possibility that there was communication between intervention and control sites, but we expect the effect, if any, was minimal given the usual lack of communication across sites regarding the management of specific conditions. Also, all three urban practices (2 control, 1 intervention) had embedded mental health professionals. Given our study design, the impact of these professionals is unclear and warrants further investigation. Finally, although all children in the study were receiving care from participating clinicians, we did not distinguish whether clinicians were prescribing medication for each child. However, monitoring of ADHD symptoms is relevant to the primary care role regardless of whether medication is currently prescribed**.**

Results

Characteristics of Study Population

A total of 105 clinicians participated in the study out of 166 invited. A majority of clinicians were female (84%) and pediatricians (89%). Participation rates by practice ranged from 14-100% and did not differ by study arm. The intervention group had a slightly higher proportion of nurse practitioners than the control group. Baseline provider perceptions of acceptability and effectiveness at managing ADHD in primary care were similar between study arms ($p>0.1$ for all factors), and there was minimal change in provider perceptions of acceptability and effectiveness from baseline to post-intervention. Charts were randomly selected for 790 patients. In the intervention group, 62% of patients were white compared to 37% in the control group ($p<0.001$), and 42% had Medicaid insurance compared to 58% in the control group ($p<0.001$).

Implementation Outcomes

Implementation outcomes included clinician engagement in the intervention program and use of the ADHD Care Assistant by both groups. Of the 53 clinicians in the intervention group, 42 (79%) completed all 3 educational presentations. Five clinicians posted in the online networking site. Content discussed in 11 total posts included use of alpha-2 agonists for ADHD management, interpreting behavior rating scales, and finding a behavior therapist in the community. There were on average two phone, email, or in-person consultations with ADHD experts per month. 30 clinicians participated in at least one performance feedback call (57%), while 19 (36%) participated in all components of the intervention and attested to fulfilling MOC requirements. A majority of clinicians in both the intervention and control groups used the Care Assistant (39/53 (74%) and 38/52 (73%) used the system at least once, respectively). Nineteen clinicians in the intervention group used the system at least 5 times (36%) and 10 used it at least 10 times (19%), compared to 16 clinicians (31%) and 8 clinicians (15%) in the control group. No clinicians reported lack of parent email as a barrier to use. The cost of the intervention for the most engaged providers based on time invested was approximately $738 per provider.

ADHD Rating Scale Administration and Completion

The proportion of patients with documentation of a parent rating scale sent out in the baseline period was slightly higher in the control than the intervention group (19.4% compared to 16.5%). Both groups significantly increased from the baseline to the intervention period (by 25.6 percentage points (95% confidence interval (CI): 15.0, 36.2) in the intervention group, and 13.6 percentage points (4.4, 22.9) in the control group), accompanying implementation of the Care Assistant at all sites. Although the increase was greater in the intervention than the control group, the relative difference failed to reach statistical significance (12.0 percentage point increase relative to the control group, 95% CI: -2.1, 26.0). Upon standardizing for patient and clinician covariates, the relative difference was slightly attenuated but the confidence interval narrowed (10.8 percentage points, 95% CI: -0.2, 21.9). Similar patterns, none reaching statistical significance, were observed for other outcomes (parent scales received, teacher scales sent out and received), but the relative differences between study arms were smaller. Although minor differences were noted, results overall were similar in sensitivity analyses using generalized estimating equations (GEE). In addition, patterns were consistent across patients with private and public insurance.

At the practice level, we found that the change in the proportion of patients for whom clinicians sent out parent ADHD rating scales varied widely by practice, from 6.3% to 50.0% in the intervention group and -5.0% to 50.0% in the control group. Of note, all intervention practices improved, while in the control group one had a decline and one had no change.

Association of Intervention Engagement with ADHD Rating Scale Outcomes

Intervention clinicians who participated in at least one performance feedback call were more likely to send out parent rating scales than intervention clinicians who did not participate (relative difference of 14.2 percentage points, 95% CI: 0.6, 27.7). There were no significant differences for other outcomes. Similarly, clinicians who completed all aspects of the intervention (meeting requirement for MOC) had a significant relative increase only in the proportion of patients with a parent rating scale sent out (relative difference of 18.8 percentage points, 95% CI: 1.9, 35.7) compared to other intervention clinicians. When clinicians who met requirements for MOC were compared to control clinicians, significant differences were found in the sending of parent rating scales (relative difference of 23.1 percentage points, 95% CI: 5.1, 41.1). In practices with the highest rates of clinician participation in the study ($\geq$ 80%), outcomes were not superior to practices with lower rates of involvement (< 80%) across all study outcomes.

In one of few practice-based ADHD studies to use a rigorous trial methodology, we report the results of a 19-practice cluster randomized trial testing the effect of targeting primary care providers using a distance-learning intervention with QI methods on use of evidence-based practices for ADHD. We found that between-arm differences were not statistically significant, indicating that education with QI using distance-learning methods did not result in significant change. In addition, the findings demonstrated that providers in both study arms sent out and received significantly more parent and teacher rating scales following implementation of the electronic Care Assistant, suggesting that this systems-level support may have been useful for both groups. Further, in an as-treated analysis, intervention clinicians who participated in at least one feedback call and, to an even greater extent, those who fulfilled requirements to receive MOC credit had higher rates of sending parent rating scales, indicating that level of provider engagement in intervention contributed to outcomes.

Overall, engagement in the QI intervention by participating providers was modest, with few clinicians utilizing the collaborative consultation component and only 36% fulfilling MOC requirements. The findings suggest that distance-learning QI interventions that provide clinicians with education and resources but do not have specific requirements for active participation may be inadequate to improve the quality of ADHD care. The SHARE intervention had modest clinician engagement, and did not significantly improve rating scale completion beyond the increase observed in the control group.

Our results differ from two prior studies that tested comprehensive educational interventions, one that used QI methods with providers and the other that did not; this latter study involved in-person training and engagement of the entire office staff in workflow redesign.[14, 16] These studies, both non-randomized, found larger improvements in ADHD rating scale use than were seen in our study. [14,16] Comprehensive, whole-office-focused interventions are more time-intensive to implement on a large scale, and may involve contributions from non-revenue generating staff (e.g., administrative staff, ADHD care coordinators). In contrast, we enrolled a large number of geographically dispersed practices and implemented an entirely distance-learning-based intervention targeted toward clinicians. The approach we used was efficient and relatively inexpensive; however, the lack of overall improvement raises questions regarding the value of a QI intervention that is entirely clinician-focused. Even in practices with the highest rates of clinician participation in the study ($\geq$ 80%), outcomes were not superior to practices with lower rates of involvement (< 80%). More broadly, our results suggest the importance of balancing efficiency and costs with comprehensiveness; had we extended this intervention to involve the entire practice staff and included in-person collaborations, we may have found larger improvements, albeit at greater cost. As fully engaged clinicians were more likely to improve, a more comprehensive intervention that better engaged the whole office may have been more effective. More fully integrating supports into clinician workflows may also have improved outcomes. For example, clinicians may have consulted experts more often if consultation did not require logging into a separate system to post a message to the group discussion or for sending an email. A direct link to the group from the EHR may have been more effective.

Methodological differences between our study and earlier studies also may have contributed to differences in results. Prior studies of educational and quality improvement interventions aimed at improving EBPs have often lacked a control group[14-16, 18, 32] or used non-randomized controls,[33] limiting the ability to determine whether similar patterns would have been observed without the intervention. In our study, substantial improvements were seen in the control group that, like the intervention group, had access to the Care Assistant to facilitate the sending and receipt of rating scales. In addition, our study used a rigorous chart review process that included random selection of charts and a coding system with demonstrated inter-rater reliability. As noted by Epstein et al,[13] prior studies in which clinicians selected their own charts to review found much higher rates of rating scale use than when a more objective chart review process was used.[14, 33, 13]

Since all practices implemented an electronic system, our randomized design did not allow us to formally test the benefit of this intervention. However, improvements in sending and receiving parent and teacher rating scales across both study arms following Care Assistant implementation suggest a benefit to the electronic system. Our findings regarding the electronic system are consistent with a prior 8-site cluster-randomized trial with 49 clinicians that found that the use of an ADHD portal combined with performance feedback significantly improved use

of parent and teacher rating scales in the assessment process and follow-up.[13] In a follow-up study, use of that ADHD portal was associated with improvements in parent-reported ADHD impairment scores.[19] Overall, these results along with our own suggest that the combination of electronic supports and QI with performance feedback and opportunities to receive MOC credit may be needed to meaningfully and significantly improve ADHD care. Should distance learning, QI approaches be implemented in practice, the addition of an electronic system to distribute and obtain rating scales, now available through commercial vendors, is likely to maximize impact. In addition, because clinicians who were more actively engaged in the performance feedback component were more likely to administer parent rating scales, our results indicate that the effectiveness of distance learning, QI interventions for ADHD may be improved by using strategies to more fully engage clinicians, such as involving "champions" from within the practice, which have proven helpful in other contexts.[34-36]

Given that rating scale results are needed to tailor care and improve outcomes, our findings also suggest that additional strategies, especially at the system-level, are needed to improve rating scale completion and not simply administration. For example, changes in practice workflow that lead to better monitoring of rating scale use and prompting of parents and teachers when needed might be useful.[14, 16] In addition, texting parents, proven to improve adherence in other settings,[37-40] might improve rates of rating scale return. Further, care coordination that promotes communication between primary care, mental health care, and school systems might enhance use of evidence-based practices and improve outcomes, including rating scale return.[41, 42] The large variability in results by practice underscores the importance of systems at the practice level for intervention impact.

Conclusion

A distance-learning, clinician-focused, ADHD QI intervention tested with a rigorous randomized design across 19 sites proved inadequate alone to improve rating scale use in primary care. However, improvements in rating scale completion from baseline were seen across intervention and control practices following implementation of an electronic system and among clinicians most engaged in the intervention. Findings suggest that pairing distance learning, QI strategies with systems-level interventions to support clinicians (electronic systems to support workflows, office-based champions to bolster engagement), office staff as well as parents and teachers (e.g., care coordination, texting) may be needed to best improve rating scale use and, ultimately, ADHD outcomes.

List of Publications and Products

Power TJ, Michel J, Mayne S, et al. Coordinating systems of care using health information technology: development of the ADHD Care Assistant. Adv Sch Ment Health Promot. 2016;9: 201-218. DOI: 10.1080/1754730X.2016.1199283

Fiks AG, Mayne SL, Michel JJ, et al. Distance-learning, ADHD quality improvement in primary care: a cluster-randomized trial. J Dev Behav Pediatr. 2017;3:, 573-583.

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Power T J, Mautone JA, Guevara J P, et al. Improving mental health care: linking schools and primary care. In: the National Association of School Psychologists; 2017 Feb; San Antonio, TX.

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