



Getting with the Guideline: Managing Pediatric ADHD in Your Primary Care Practice

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Inclusive Dates of Project

4/26/2014-11/8/2014	Getting with the Guideline: Managing ADHD in Your Pediatric Practice Live Workshops
6/18/2014-12/31/2015	Getting with the Guideline: Managing ADHD in Your Pediatric Practice Enduring Webcasts
3/31/2014-12/31/2015	meHealth™ Web Portal

1. Structured Abstract

The goal of this continuing medical education project was to provide training to learners (primary care providers and pediatricians) about the 2011 American Academy of Pediatrics Clinical Practice Guideline for the Diagnosis, Evaluation, and Treatment of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents (“guideline”), encourage learners to implement the guideline in practice and to use specific practice performance measures and patient outcome measures as they provide care for patients with ADHD. Methods used to train learners included: (1) live workshops held in eight cities around the United States, (2) enduring on-demand webcasts of workshop presentations, (3) a web portal performance improvement CME activity and, (4) non-accredited practice tools and patient education materials. 916 learners participated in the live regional workshops or the enduring webcasts. Learners demonstrated substantial improvements in knowledge, competence and confidence as related to management of pediatric ADHD and the guideline. 20 pediatric practices completed the web portal activity. Web portal data showed a good deal of variability in outcomes across sites and between raters on various outcome measures of provider and patient performance. The differences among sites suggests that future work should examine site specific features that promote improved learning which might account for the observed variability.

Key Words: attention-deficit/hyperactivity disorder, children, adolescents, preschool, behavioral therapy, medication

2. Purpose

The primary purpose of this set of CME activities was to deliver ACCME and ABP MOC accredited training that will improve care for children and youth with ADHD by increasing provider adherence to the 2011 AAP Clinical Practice Guideline for ADHD. Programs were designed to focus on four areas:

Areas of Training	Key Objectives
1. 2011 AAP Clinical Practice Guideline for ADHD	Learners will increase their knowledge of pediatric ADHD diagnosis and management, the 2011 guideline, and their confidence in applying principles of the guideline in practice
2. Self-Assessment of Practice Performance and Patient Outcomes	Learners will evaluate their adherence to the guideline with respect to practice performance and patient outcome measures
3. ADHD Assessment and Treatment	Learners will increase the use of guideline-based practice performance measures to assess and treat children and youth with ADHD which will lead to better patient outcomes
4. Office Work Flow	Practices will improve office work flow systems to enable the ADHD care team to provide guideline-based care.

Programs focused on teaching learners the importance of using the following *practice performance measures* and *patient outcome measures* when treating ADHD.

Practice Performance Measures
Use parent rating scales to initially assess symptoms of ADHD
Use teacher rating scales to initially assess symptoms of ADHD
Use the DSM criteria to determine whether patients meet criteria for a diagnosis of ADHD
Use parent rating scales for follow up after starting treatment
Use teacher rating scales for follow up after starting treatment

Have office contact (i.e., visit, phone call) within 14 days after initiating medication
Have office contact (i.e., visit, phone call) within six weeks after initiating medication
Patient Outcome Measures
Determine the amount of ADHD symptom reduction by tracking symptoms before and after treatment on rating scales completed by parents and/or teachers
Determine the amount of ADHD impairment reduction by tracking impairment before and after treatment on rating scales completed by parents and/or teachers

3. Scope

ADHD is the most frequent mental health condition that physicians who treat children and youth must address. Parents report that approximately 9.5 percent of all school age children ages 4 to 17 years have been diagnosed with ADHD sometime in their lives (CDC, 2012). These children show impairments in academic, social, and family functioning, and, when older, in occupational performance and often have coexisting psychiatric and/or learning disorders.

The guideline contains a set of Action Statements that clinicians should follow when providing care for children and adolescents with ADHD: (1) The clinician should initiate an evaluation for ADHD for any child 4 through 18 years of age who presents with symptoms of inattention, hyperactivity or impulsivity and has academic or behavior problems. (2) The clinician should use DSM criteria in making a diagnosis. (3) The clinician should assess for other conditions that might coexist with ADHD. (4) The clinician should recognize ADHD as a chronic condition and apply a chronic care model in treatment. (5) First line treatments (behavior therapy and/or medication) may vary with the age of the child. (6) The clinician should titrate doses of medication for ADHD to achieve maximum benefit with minimum adverse effects.

The methods used to assess, diagnose and treat children and adolescents who present with ADHD symptoms have significant impact on patient outcomes. This was clearly demonstrated in the multisite Multimodal Treatment Study for Children with ADHD (MTA Cooperative Group, 1999). Frequently monitored and carefully titrated medication treatment (informed by parent and teacher feedback) for children with ADHD, especially when combined with behavioral treatment, yielded the best outcomes.

Epstein et al., (2008) found that pediatricians who utilized consultation services to guide their assessment and treatment of ADHD following the evidence-based AAP guideline had better outcomes in their patients. To guide ADHD care, in 2011 the AAP revised and updated their 2001 guideline (AAP, 2011; AAP, 2001). The newer guideline offers physicians evidence-based recommendations for diagnosing and treating their patients with ADHD. New features include: extending the age range appropriate for a diagnose of ADHD from ages 6-12 years to 4-18 years; encouraging screening for coexisting emotional, behavioral, neurodevelopmental and physical disorders; and emphasizing a “Process of Care” consistent with a chronic care model.

Recommendations found in older versions of the guideline have not been reliably implemented in practice settings. Chan et al. (2005) found that only 57% of pediatricians reported using formal criteria to diagnose ADHD and only 27% indicated that they adhered to DSM-IV-TR criteria. Turbyville (2005) observed low rates of follow-up for 6-12 year-old children with a new ADHD medication. In 2013, NACE surveyed a national sample of 209 PCPs who reported on their familiarity with and adherence to the 2011 guideline. 71% reported that they had low familiarity with 2011 guideline, 34% used DSM criteria in diagnosing ADHD; 35% screened for coexisting conditions; less than half suggested medication and/or behavior therapy and titrated medication for maximum benefit and control of adverse effects.

Implementing the guideline in community practice is a complex process that requires specific, multi-faceted training (Langberg, J., 2009). Leslie et al. (2004) initiated the successful San Diego Attention-Deficit/Hyperactivity Disorder Project (SANDAP) which provided guideline training, assessment

materials, and assistance with collection and scoring of rating scales to pediatric practices in San Diego, CA. The Partnerships for Quality Project (Lannon et al., 2007) helped to close the gap between knowledge and care for children with ADHD by fostering a partnership between stakeholders. Cincinnati Children's Hospital Medical Center (CCHMC) began an ADHD Collaborative in 2004 to train community-based physicians and their office staff to implement the AAP guideline (Epstein et al., 2008). Epstein, et al. (2011) developed a web portal (myadhdportal.com) to standardize guideline training. Results demonstrated that pediatricians using the portal in the intervention group significantly improved rates of many AAP-recommended ADHD care practice behaviors as compared to the control group.

4. Methods

Three training opportunities were developed to educate learners about ADHD in children and adolescents, explain the AAP guideline and encourage implementation of measures to optimize diagnosis and treatment that would optimize care and reduce practice gaps. The training included: accredited live regional workshops, enduring webcasts and a web portal to guide providers' ADHD care. Non-accredited online practice tools and patient education materials were made available to learners.

1. Live Regional Workshops in Eight Cities

Getting with the Guideline: Managing Pediatric ADHD in Your Primary Care Practice included a series of one-hour accredited presentations in eight cities from April through November 2014. The topics and associated learning objectives are listed below:

New Findings in Our Understanding of ADHD in Children and Youth

- Explain current research findings in pediatric ADHD
- Discuss new data about the genetics of ADHD and associated disorders
- Explain the role of diet as a potential therapy for ADHD
- Identify how long-term stimulant medications affect neurological development and ADHD

Review of AAP ADHD Assessment and Treatment Guideline and Measurement-Based Care

- Discuss new features of the guideline and compare to earlier guidelines
- Identify the special circumstances for care of preschoolers and adolescents with ADHD
- Explain how to use rating scales for initial assessment and follow-up care
- Discuss practice performance measures and patient outcome measures for ADHD

Pharmacologic Treatments for ADHD and Shared Decision Making within a Chronic Care Model

- Discuss the guideline and Process of Care algorithm in decision-making for care
- Explain the safety and efficacy of different pharmacologic options
- Explain the importance of shared decision making and the use of a chronic care model
- Discuss methods to evaluate treatment effects by systematically measuring outcomes
- Explain strategies to manage adverse effects of medication treatments

Non-Medical Treatments for ADHD and Shared Decision Making

- Discuss the clinician's respect for parental goals and treatment preferences
- Explain the importance of educating parents and patients about ADHD
- Explain the importance of parent behavior management training
- Discuss promising and inadvisable alternative treatments

Managing Office Work Flow for ADHD Care in Your Practice by Using a Web Portal

- Explain how a web-based tool can improve the quality of ADHD care in practice
- Deliver and track assessment rating scales to parents and teachers using web-based tools
- Implement systematic follow-up to monitor response to treatment using web-based tools
- Customize and improve work flow for ADHD care in practice

Target Audience and Locations: The target audience for this training was pediatricians and other primary care providers who treat pediatric patients with ADHD. Invitations to participate were sent to

pediatricians and PCPs practicing in and around Fort Lauderdale, Tampa, Baltimore, St. Louis, Indianapolis, Wilmington, Nashville, and Raleigh. These cities were selected as training sites because

they have a higher than average prevalence of ADHD. 811 clinicians registered for the conferences and 532 attended - 75% were physicians, 22% nurse practitioners or physician assistants, 1% registered nurses, and 2% other. By specialty, 53% were pediatricians, 38% PCPs, and 9% were unclassified. Based upon self-report of the number of ADHD patients treated weekly, the estimated number of patients with ADHD that could be impacted per month is approximately 7,851.

Outcome Evaluation Methodology for Live Workshops: Various methodologies were used to collect outcome data from the live workshops. (1) Prior to attending the workshop and 90 days after, all registered attendees were asked to complete a survey to determine how often they utilized specific measures in their care of pediatric patients with ADHD. (2) Immediately following the live workshop attendees were surveyed as to what degree the learning objectives were addressed, whether the content was evidence-based and unbiased, the effectiveness of the faculty, and the likelihood that they would make changes in practice. (3) Using ARS keypads workshop attendees were asked pre and post-test questions during each presentation to assess changes in knowledge, competence, and confidence. (4) Similar questions were asked four weeks after the workshop to assess retention and change in practice..

2. Enduring On-Demand Webcasts

New Findings in Our Understanding of ADHD in Children and Youth, Review of AAP ADHD Assessment and Treatment Guideline and Measurement-Based Care, Pharmacologic Treatments for ADHD and Shared Decision Making within a Chronic Care Model, and Non-Medical Treatments for ADHD and Shared Decision Making were recorded and posted online at www.naceonline.com for on-demand viewing as accredited webcasts from June 2014 to December 2015.

Target Audience: Invitations describing the webcasts were sent to pediatricians and primary care providers practicing in the United States. 787 clinicians registered for the four enduring webcasts and 384 completed them. Within this group 41% were physicians, 48% nurse practitioners or physician assistants, and 15% other. Pediatricians made up 38%, PCPs 34%, psychiatrists 7% and 20% were unclassified. The estimated number of patients with ADHD impacted per month is approximately 5,652.

Outcome Evaluation Methodology for Enduring Webcasts: Learners were required to complete pre- and post-test questions to assess changes in knowledge, competence, and confidence with respect to caring for ADHD and their intention to change practice behavior.

3. ADHD Web Portal

The meHealth.com portal, licensed by Optimal Medicine, was originally developed (as myADHDportal.com) by researchers and clinicians at Cincinnati Children's Hospital Medical Center to help pediatricians improve their assessment and treatment of children and adolescents with ADHD. The platform was approved as a quality improvement education activity by the American Board of Pediatrics (ABP) for Maintenance of Certification Part IV and for this project the platform was certified for 20 *AMA PRA Category 1 Credits*[™] by Albert Einstein College of Medicine. The platform addresses the needs of providers to implement many of the procedures described in the guideline and records the utilization of specific practice performance and patient outcome measures: use of DSM for diagnosis, use of Vanderbilt Rating Scales delivered electronically to parents and teacher with automatic reporting and interpretation of results, recommendations for treatment planning including medical and non-medical treatments, monitoring of treatment using follow-up Vanderbilt Rating Scales, and tests of change to improve office work flow. In addition, the platform contains online webcasts to address gaps in knowledge and competency of learners needing to learn about the guideline and how to implement it in their practice.

Target Audience: Invitations describing the portal were sent to pediatricians practicing in the US. 83 pediatricians signed up to use the portal and 23 completed the activity recording 1,268 patient records.

Outcome Evaluation Methodology for Web Portal: Data related to the utilization of practice performance and patient outcome measures was collected.

4. Online Assessment Tools, Resources, and Patient Education Materials

Online assessment and tracking tools and patient education materials were posted online (naceonline.com/MyADHDCareTeam.com/) and made available to all workshop participants.

5. Results and Discussion

Outcome Data: Live Workshop Presentations

Satisfaction with the Live Workshops: Learners who attended in eight cities and who viewed remotely via live streaming were surveyed about the overall program: 100% responded that the presentations met the stated learning objectives; 100% indicated that the presentations improved their competence in managing pediatric ADHD; 85% learners stated that they planned to implement ideas they learned about ADHD care in their practice; and 95% stated that the presentations were free of commercial bias.

Survey of Utilization of ADHD Practice Measures: Prior to attending the live workshop all registered attendees were asked to complete a survey to determine how often they utilized specific practice measures in their care for pediatric patients with ADHD. 337 participants in the workshop who indicated that they currently provide care to children and adolescents with ADHD completed the survey before they attended the workshop and 75 of these learners completed the survey ninety days following their workshop.

Table 1 shows that clinician reported fairly regular use of parent and teacher rating scales to initially assess ADHD symptoms. The use of parent scales was slightly improved following the workshop. Use of DSM criteria in determining diagnosis of ADHD was used less than two-thirds of the time and reported use of these criteria did not change significantly after the workshop. There was significant room for improvement in the use of rating scales. Office contact within 14 days of starting medication was below 50% with improvement to about 85% within six weeks of starting medication. Calculation of changes in ADHD symptoms or impairment before and after treatment was below 50% and only increased slightly.

Before Workshop N=337	90 Days After Workshop N=75	Uses the Practice Measure >70% of the Time
77%	84%	use parent rating scales to initially assess symptoms of ADHD
79%	70%	use teacher rating scales to initially assess symptoms of ADHD
59%	61%	use DSM criteria to determine a diagnosis of ADHD
53%	59%	use parent rating scales for follow up after starting treatment
46%	56%	use teacher rating scales for follow up after starting treatment
47%	47%	have office contact (i.e., visit, phone call) within 14 days after initiating medication
85%	86%	have office contact (i.e., visit, phone call) within six weeks after initiating medication
47%	48%	determine amount of ADHD symptom reduction by tracking symptoms before and after treatment on rating scales completed by parents and/or teachers
41%	49%	determine the amount of ADHD impairment reduction by tracking impairment before and after treatment on rating scales completed by parents and/or teachers

We also attempted to compare surveys from providers who had registered for the live workshops but who did not attend. These providers would have made up a control group. However, only 10 providers completed the post-workshop survey and, therefore, did not provide sufficient data for analysis.

Assessment of Knowledge, Competence, and Confidence in Treating Pediatric ADHD: For each presentation we asked pre and post-test questions. Each set of questions consisted of four to five multiple choice questions assessing content knowledge and one question assessing confidence. An example of the latter is “On a scale of 1 to 5, please rate how confident you are in your knowledge of current research findings in pediatric ADHD diagnosis and treatment.”

Results for Content Knowledge

Figure 1 shows substantial changes in the total percent correct score for each program. The change from pre- to post-test was highly significant for each program by the McNemar chi-square test (all p-values < 0.0001). As the Figure suggests, the programs were not equally effective as indicated by significant differences in the magnitude of change ($X^2[16] = 103, p < 0.001$). The pre- to post-test improvements in percent correct seen in Figure 1 were greatest for the New Findings (34%) program, less for the AAP Guideline (20%) Pharmacologic Treatments (19%) and Non-Medical Treatment (26%) programs and nil for the Office Work Flow program (3%).

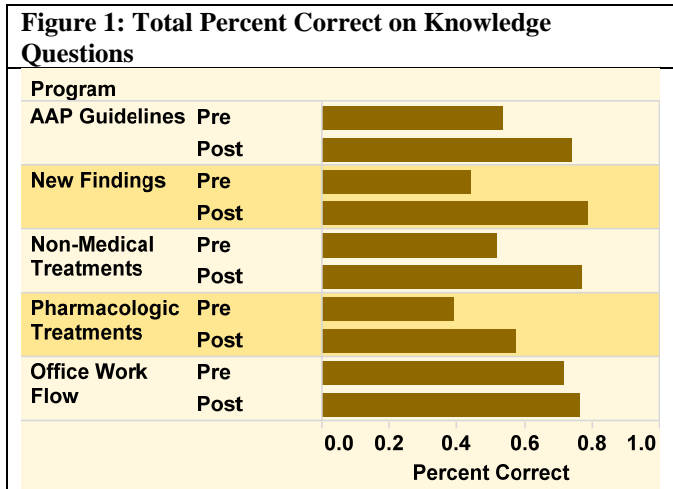
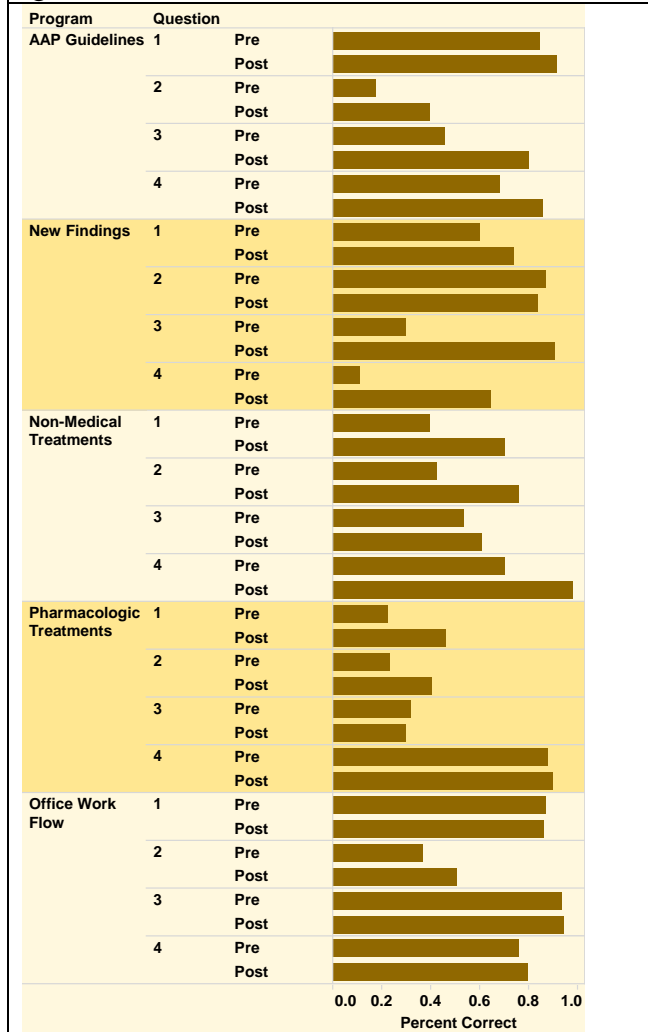


Figure 2: % Correct for Each Knowledge Question



We also used the McNemar test to determine if, for each content knowledge question, the change from pre- to post-test was statistically significant. For the AAP Guideline program, all questions except for question one were significantly improved (all p-values < 0.0001). For the New Findings program, all questions were significantly improved (all p-values < 0.0001). For the Non-Medical program, all questions except for question three were significantly improved (all p-values < 0.001). For the Pharmacologic Treatments program, all questions except for questions three and four were significantly improved (all p-values < 0.005). For the Office Work Flow program, only question two was significantly improved (p = 0.03). These results can be seen in Figure 2.

Results for Confidence Ratings

McNemar tests showed improved confidence ratings for each program from pre-test to post-test (Figure 3; all p-values < 0.001). The changes in confidence scores differed among programs. On the six-point confidence scale, the increase in confidence was greatest for the Non-Medical Treatments (1.5) and Office Work Flow (1.4) programs and less for the New Findings (0.9), Pharmacologic Treatments (1.1) and AAP Guideline (1.0) programs. These differences among programs were statistically significant ($X^2[28] = 72, p < 0.001$). For each program, the correlations between the improvements in confidence (Figure 3) and the improvements in knowledge (Figure 1) were small (all $r < 0.1$) and not significant (all p-values > 0.5).

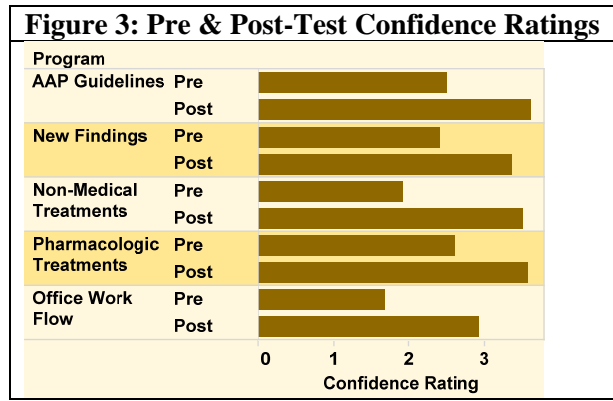
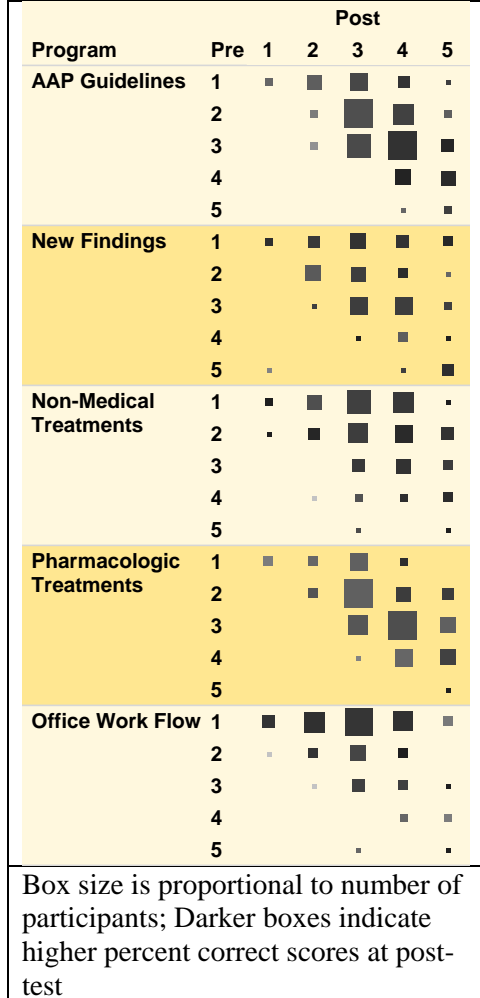


Figure 4: Confidence and Knowledge

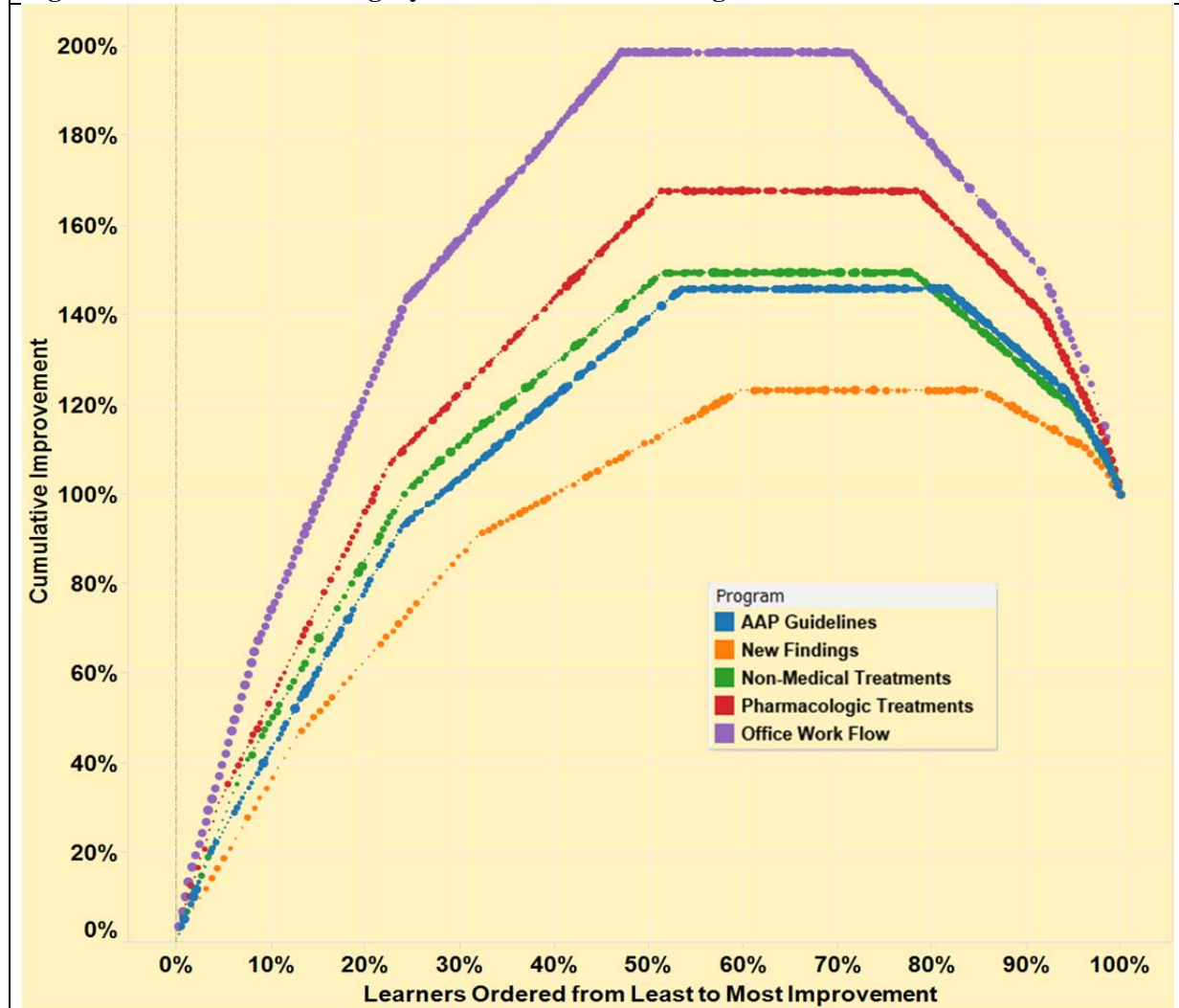


A more fine grained view of the confidence ratings is shown in Figure 4. For each program, the pretest confidence is given on the vertical axis and the post-test confidence on the horizontal axis. The size of the box is proportional to the number of learners in each cell. Darker boxes correspond to higher percent correct scores on the post-test. Boxes below on the diagonal contain participants who did not change in confidence; those above and below the diagonal indicate those who increased and decreased confidence, respectively. The Figure shows that most of the data are above the diagonal, indicating pre- to post-tests improvements in confidence for most learners. Yet, across all programs, the association between confidence at post-test and percent correct at post-test is only modest ($r = 0.14, p = 0.001$).

Individual Learning Dynamics

In Figure 5, learners are ordered along the horizontal axis from most to least improvement. The vertical axis gives the cumulative improvement contributed by all learners up to and including each learner’s position. Each point corresponds to one learner ordered from most to least improvement on the horizontal axis. The vertical distance from point to point is the amount of improvement contributed by each learner. Larger points correspond to better pre-test scores. These data show no clear association between pre-test score and amount of change for each individual. That is somewhat counterintuitive because those with the lowest pre-test scores have the greatest room to change. This finding may be due to the relatively high scores at pre-test for most subjects (Figure 1).

Figure 5: Individual Learning Dynamics for the Four Programs



Each point corresponds to one learner ordered from most to least improvement on the horizontal axis. The vertical distance from point to point is the amount of improvement contributed by each learner. Larger points correspond to better pre-test scores.

In an ideal program, all learners would improve by the same amount. For such a hypothetical program, all the points would fall on the diagonal line connecting the [0%,0%] point at the lower left with the [100%,100%] point. All of the programs deviate greatly from the diagonal. The rising parts of each curve indicate learners that show improvement, the flat part to no change and the descending part to worsening. The Office Work Flow program is the most deviant. About 50% of the learners show some improvement and they account for 200% of the total improvement (i.e., their combined total improvement score is twice the total score for the entire program). That occurs because the remaining 50% of learners do not change or worsen. The poor performance of learners in the Office Work Flow program may be due to their very high pretest scores, as can be seen in Figures 1 and 2.

Summary of Live Workshop Results: These data show statistically significant and substantial improvement across all programs and all questions evaluated. The pre- to post-test improvements in percent correct were greatest for the New Findings program, less for the AAP Guideline, Pharmacologic Treatments (19%) and Non-Medical Treatment (26%) programs and not at all for the Office Work Flow program. The lack of effect of the Office Work Flow program is likely due to the high pre-test scores for

that program. The lack of association between confidence and knowledge suggests that more work needs to be done to give learners feedback about their level of knowledge. We also found that the programs were not equally effective in improving knowledge and increasing confidence. The data do not allow us to determine if this was due to differences in content, learners or speakers.

Outcome Data: Enduring Webcast Presentations

This section of the report evaluates the results of four CME webcasts hosted at www.naceonline.com. For each program we conducted pre and post-tests. Each test consisted of four multiple choice questions assessing content knowledge (five for the pharmacologic program) and one question assessing confidence. An example of the latter is “On a scale of 1 to 5, please rate how confident you are in your knowledge of current research findings in pediatric ADHD diagnosis and treatment.”

Figure 6: Total Percent Correct on Knowledge Questions

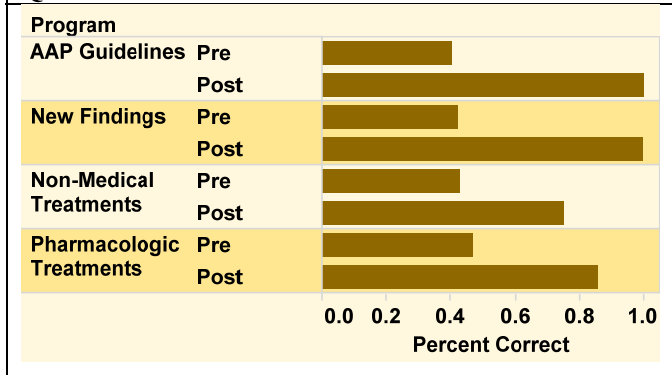
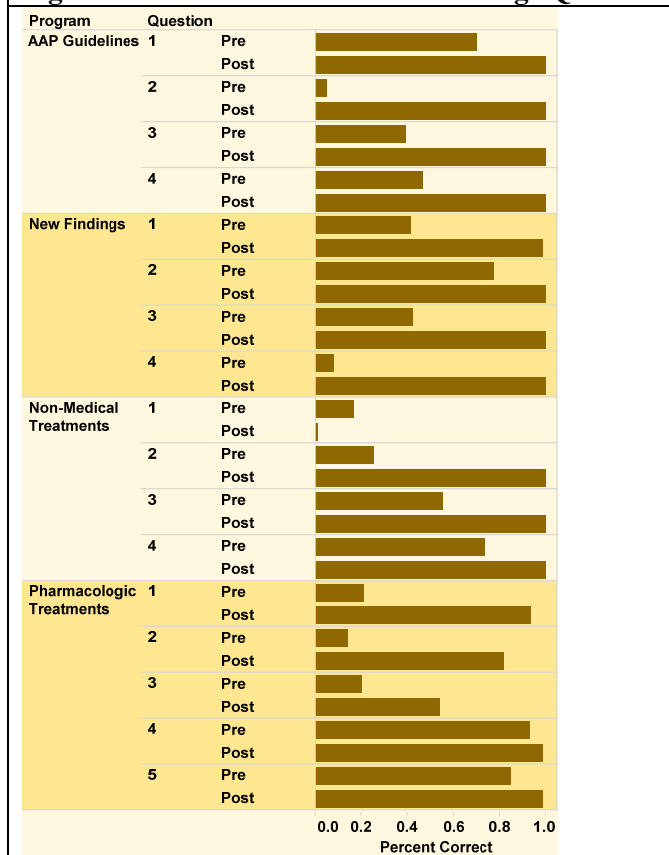


Figure 7: % Correct for Each Knowledge Question



Results for Content Knowledge

Figure 6 shows substantial changes in the total percent correct score for each program. The change from pre- to post-test was highly significant for each program by the McNemar chi-square test (all p-values < 0.0001). As the Figure suggests, the programs were not equally effective as indicated by significant differences in the magnitude of change ($X^2[15] = 76, p < 0.001$). The Pre- to Post-test improvements in percent correct seen in Figure 6 were greatest for the AAP Guideline (60%) and New Findings (58%) programs and less for the Pharmacologic Treatments (39%) and Non-Medical Treatment (33%) programs.

We also used the McNemar test (see Figure 7) to determine if, for each content knowledge question, the change from pre- to post-test was statistically significant. For the AAP Guideline program, all questions were significantly improved (all p-values < 0.0001). For the New Findings program, all questions were significantly improved (all p-values < 0.0001). For the Non Medical program, all questions were significantly improved (all p-values < 0.001). For the Pharmacologic Treatments

program, all questions were significantly improved (all p-values < 0.005).

Results for Confidence Ratings

McNemar tests showed improved confidence ratings for each program from pre-test to post-test (all p-values < 0.001). The changes in confidence scores differed among programs as seen in Figure 8. On the six point confidence scale, the increase in confidence was greatest for the Non-Medical Treatments program (1.3), intermediate for the New Findings program (0.9) and less for the Pharmacologic (0.8) and AAP Guideline (0.8) programs. These differences among programs were statistically significant ($X^2[15] = 33, p = 0.005$). For each program, the correlations between the improvements in confidence (Figure 8) and the improvements in knowledge (Figure 6) were small (all $r < 0.1$) and not significant (all p-values > 0.5).

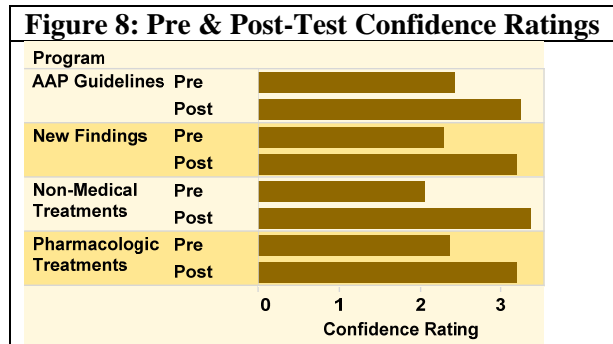
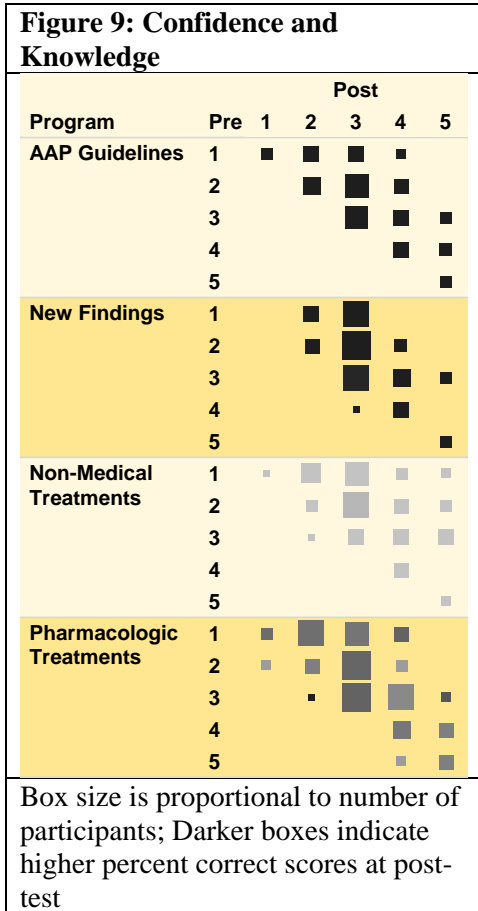


Figure 9: Confidence and Knowledge

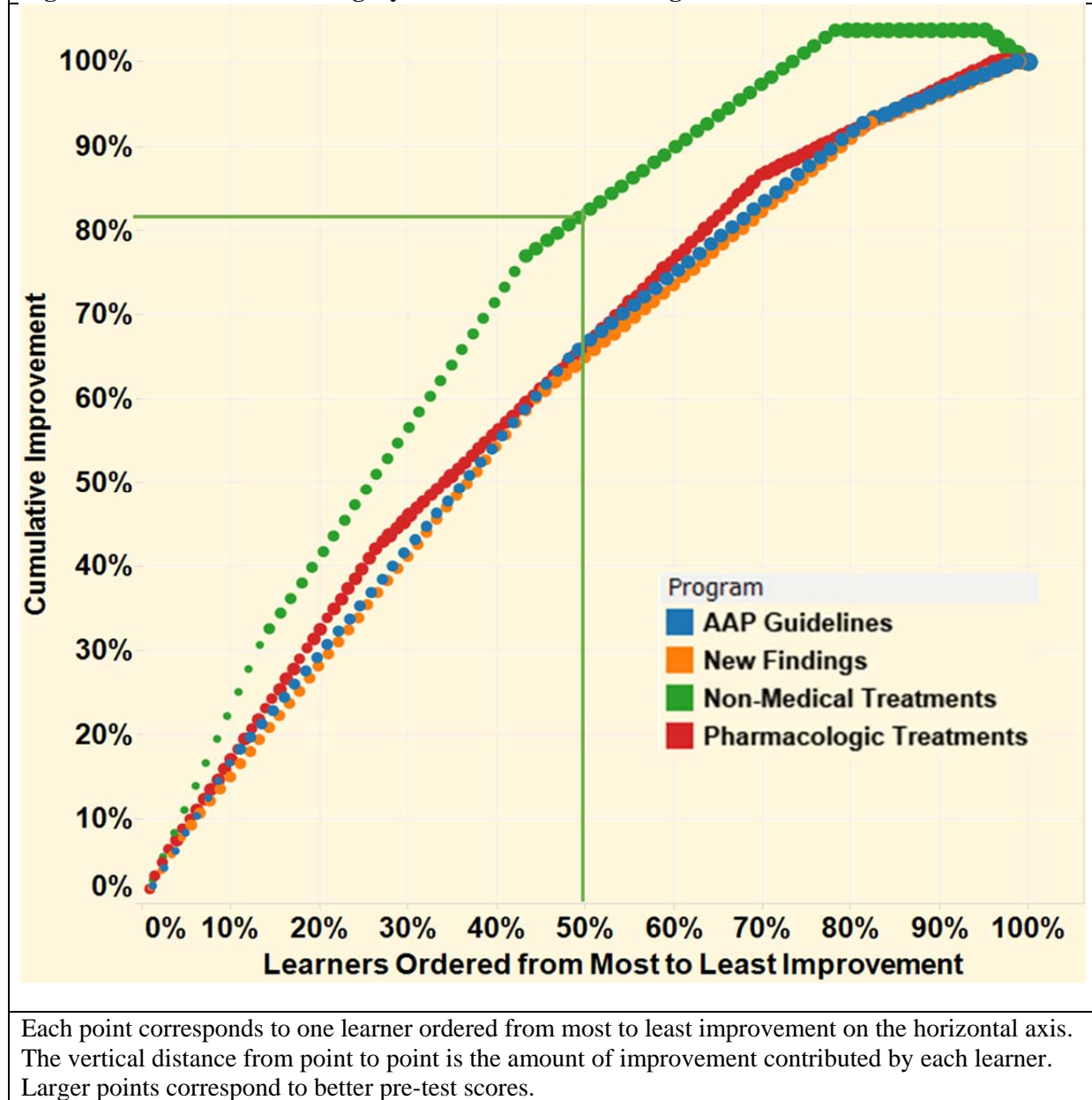


A more fine grained view of the confidence ratings is shown in Figure 9. For each program, the pre-test confidence is given on the vertical axis and the post-test confidence on the horizontal axis. The size of the box is proportional to the number of learners in each cell. Darker boxes correspond to higher percent correct scores on the post-test. Boxes below the diagonal contain participants who did not change in confidence; those above and below the diagonal indicate those who increased and decreased confidence, respectively. Paradoxically, the Non-Medical Treatment participants are, at post-test, showing the greatest changes in confidence (more boxes above the diagonal) but the lowest percent correct on the post-test (lighter shaded boxes). In fact, across all programs, the correlation between confidence and percent correct at post-test was -0.07, indicating no association between post-test knowledge and confidence. There was, however, a small but significant correlation between pretest knowledge and post-test confidence ($r = 0.13, p = 0.01$). The best predictor of post-test confidence was pre-test confidence ($r = 0.63, p < 0.0001$). This pattern of correlation was seen for each program when analyzed separately.

Individual Learning Dynamics

Summary statistics, by necessity, hide the results of individual learners, which are difficult to display graphically due to the number of learners involved. Figure 10 presents a method of presenting individual learning in a compact fashion. In the Figure, learners are ordered along the horizontal axis from most to least improvement. The vertical axis gives the cumulative improvement contributed by all learners up to and including each learner's position. For example, because the sum of change scores from pretest to post-test across all learners is 252 for the Pharmacologic program, the 50% point on the vertical axis correspond to 151 change points for that program. Each point corresponds to one learner ordered from most to least improvement on the horizontal axis. The vertical distance from point to point is the amount of improvement contributed by each learner. Larger points correspond to better pre-test scores. Thus, we can see that learners with the lowest pretest scores (small dots) changed the most (they are on the left side of the graph), which is what one would expect.

Figure 10: Individual Learning Dynamics for the Four Programs



We can see from the point highlighted by the green lines that 50% of the learners account for about 82% of the improvement in the Non-Medical Treatments program. In contrast, for the other programs, 50% of the learners account for only 65% of the improvement.

In an ideal program, all learners would improve by the same amount. For such a hypothetical program, all the points would fall on the diagonal line connecting the [0%,0%] point at the lower left with the [100%,100%] point at the upper right. Three of the programs do not deviate much from the diagonal line. The Non-Medical Treatments program shows the greatest deviation. The first section of its plot (green dots) shows large amounts of improvement per learner up to about 45% of learners. But most of the learners show very little improvement. That change is seen by the decrease in the slope of the line formed by the green dots. And, at the end of the green dotted line we see that the line flattens out

(indicating no change) and then decreases (indicating worse scores at post-test than pretest). In contrast, the other programs show very little flattening/decreasing.

One reason for flattening/decreasing seen for the Medical Treatments program could be the presence of ceiling effects as those with high pretest scores cannot be expected to improve much. This does not seem to be the case. As Figure 6 shows, there were no dramatic differences in pretest scores between the programs ($F[3,379] = 1.7, p = 0.17$). However, as indicated by the size of the points in Figure 10, poor learners tend to have higher pretest scores, which suggest some role for learning effects.

Summary of Enduring Webcast Results: These data show statistically significant and substantial improvement across all programs and all questions evaluated. The improvements in percent correct were greatest for the AAP Guideline and New Findings programs and less for the Pharmacologic Treatments and Non-Medical Treatment programs, although this was partly due to ceiling effect on the post-test. The lack of association between confidence and knowledge suggests that more work needs to be done to give learners feedback about their level of knowledge. We also found that the programs were not equally effective in improving knowledge and increasing confidence. The data do not allow us to determine if this was due to differences in content, learners or speakers.

Clinical Impact of Live Workshops and Enduring Webcasts: Data collected from the live workshops and enduring webcasts indicated improvement in knowledge about guideline-based care, competence, and confidence. Responses to specific pre- and post-test questions indicated the following information was learned:

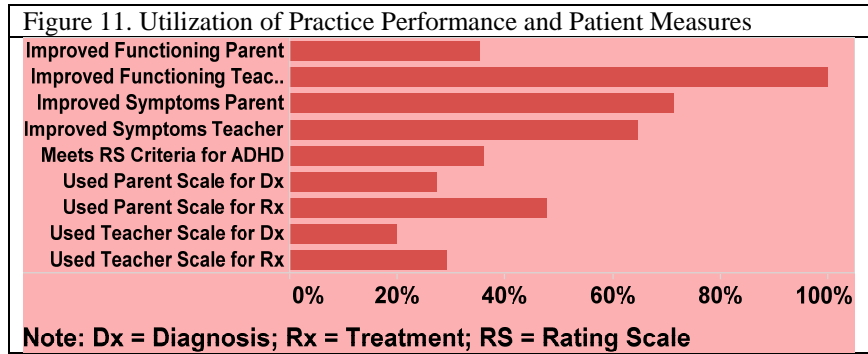
- the importance of collecting data at multiple points (initial assessment and follow up) via rating scales completed by both parents and teachers and that they should also apply a chronic care model in their treatment paradigm
- how to use the Vanderbilt Rating Scales to help make a DSM-based diagnosis, and the importance of using scales at initial assessment and for follow-up care
- pharmacologic treatment and not behavior therapy is the recommended initial approach when treating youth ages 12 to 18
- immediate and extended release methylphenidate is the class of medicines that should be used to treat children with ADHD below the age of 6 as recommended in the guideline
- stimulant medication was not contraindicated when certain conditions (i.e., anxiety disorders, tics, Tourette syndrome) were present, but it was contraindicated when patients were taking an MAO inhibitor
- the use of shared decision making can double the chances that a family will initiate treatment for ADHD.
- symptoms of ADHD often persist into adolescence about 75% of the time.
- parent behavior management training can have a significant impact on the behavior of children with ADHD
- alternative treatments for ADHD such as megavitamins, thyroxine, L-carnitine, and St. John's Wort were ineffective
- research on alternative therapies (i.e., diet, neurofeedback, megavitamins, etc.) to treat ADHD indicated they were not effective
- omega-3 fatty acids supplements added to the diet can reduce symptoms of ADHD.
- long-term use of stimulant medication in treating ADHD may have a normalizing effect on structural MRI findings.
- follow-up rating scale data should be gotten from parents and teachers four to six weeks after medication is initiated.
- a goal of at least 25% reduction in total symptom score should be reached on follow-up assessment.

Outcome Data Web Portal

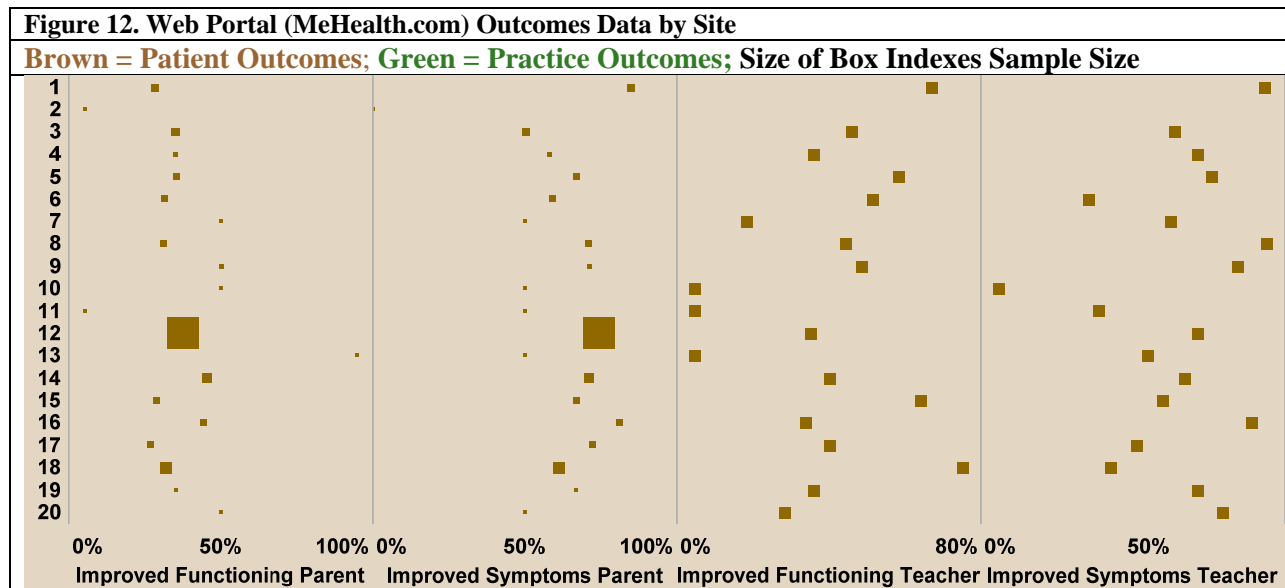
As of December 31, 2015, 83 pediatricians had registered on the web portal and 23 pediatricians had completed training on the mehealth.com web portal.

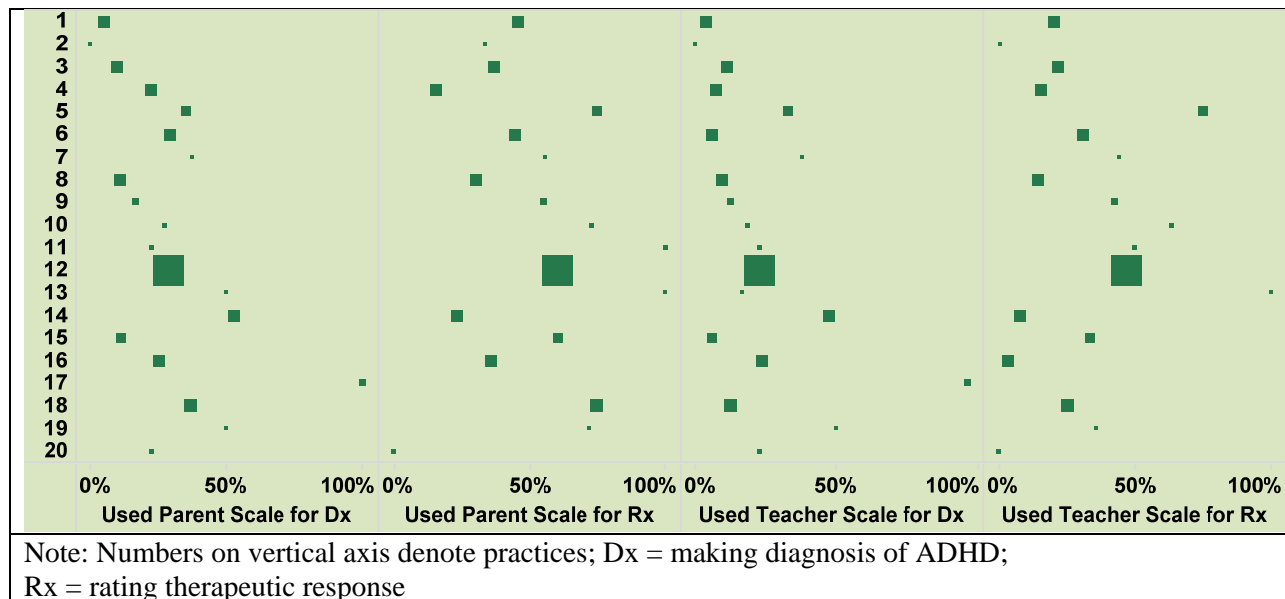
Summary of Outcome Data

An overall summary of the results is given in Figure 11 by the red graph to the right. It shows the total results across sites. The percent of respondents having and using either parent or teacher ratings was well less than 50%. Less than half the patients assessed met criteria for ADHD. Although data collection was incomplete, those with complete data showed good treatment outcomes as regards percent of patients improved or normalized. The only exception was for the relatively low rates of improved symptoms by parent assessment



The graphs below give detailed outcome results by site. The brown and green graphs give patient and practice outcomes, respectively. The box's location within each panel indexes the percent with the outcome. Higher percentages correspond to better outcomes. Larger boxes indicate larger samples.





For the patient outcomes (brown), it is clear that most of the data were provided by one site (#12). The patient outcome graphs show that the totals (red graph) hide a good deal of variability among sites. Sites with higher levels of parent reported symptom improvement also had higher levels of teacher reported symptom improvement ($r = 0.60$, $p = 0.006$). Parent and teacher ratings of functional improvement were not correlated with one another ($r = -0.33$, $p = 0.15$).

As the brown graphs suggest, symptoms were more likely to improve than functioning for both parent ($t[19] = 4.8$, $p = 0.0001$) and teacher ($t[19] = 3.2$, $p = 0.005$) ratings. Using a parent rating scale for either diagnosis or treatment was not associated with either parent rated symptoms or parent rated functional impairments (all p 's > 0.10). The same was true for teachers (all p 's > 0.07). Neither the symptom ratings nor the functional ratings differed between parents and teachers ($t[19] = 1.2$, $p = 0.26$ and $t[19] = 0.2$, $p = 0.85$, respectively).

Sites using parent reports for diagnosis were also likely to use teacher reports ($r = 0.83$, $p < 0.0001$). Sites using parent reports for therapeutic response were also likely to use teacher reports of response ($r = 0.91$, $p < 0.0001$). In contrast, use of either parent or teacher reports for diagnosis did not predict the use of rating scales for therapeutic response

These data show a good deal of variability in outcomes across sites and between raters. These rater effects are consistent with prior literature indicating low agreement between parents and teachers. The differences among sites suggests that future work examine site specific features that promote improved learning and account for the observed variability.

Learners using the meHealth™ portal were instructed to identify practice and/or patient outcome measures that were found by the practice to be in need of improvement, to identify potential reasons as to why the problem exists for the measure, and to decide upon a test of change or strategy that could be implemented by the practice to improve utilization of the measure. The figure below shows a sampling of problems practices encountered in implementing different measures, potential reasons for these problems as noted by the practice, and the proposed tests of change the practice thought of implementing to rectify the problem.

Table 2. Sample Problems and Tests of Change for Practices			
Measure	Problem	Reason(s)	Test(s) of Change
Average Percentage Reduction in Parent Total Symptom Score (TSS) for Patients Started on Treatment	Average percentage drop less than recommended 25 in TSS	Magnitude of individual patient's response to medication not being monitored	Create office flow process to systematically review all treatment summaries focusing on patients with less than 25 drop in TSS
Average Percentage Reduction in Teacher Total Symptom Score (TSS) for Patients Started on Treatment	Average percentage drop in TSS less than recommended 25	We suspect we are not capturing an adequate number of teachers. With the start of school, we will increase teacher enrollment by providing feedback to providers and improving our clinic processes to get teachers enrolled and solicit their feedback	During titration, collect follow-up ratings scales weekly. Change dose or medications weekly or bi-weekly until minimum 25 reduction in TSS is achieved.
Average Time to Obtaining First Set of Parent Follow-up Rating Scales Since Beginning Treatment	Average time greater than recommended maximum of 42 days	Parents either don't activate accts before follow up or forget to complete scales through the portal	Make reminder calls 1 week after initial appt to make sure parents have activated accts and call patients 1 week prior to 1 month follow up so forms are updated
Average Time to Obtaining First Set of Teacher Follow-up Rating Scales Since Beginning Treatment	Average time greater than recommended maximum of 42 days	Parents were not taking forms to teachers. forms are being faxed to teachers now	Create office process for contacting parent to remind teacher to complete forms.
Number of patients registered for assessment on web portal	Not entering enough initial emails at registration of patient	Found many non-compliant. Admin forgetting to ask	Require parent and one teacher to complete history and assessment prior to scheduling 1st ADHD evaluation appt.
Patients with No Impairment According to Parent Ratings	Large number of patients with continuing impairment	Medication treatment not addressing all areas of child's impairment	Determine whether patient requires change in medication/dose, office screening or referral for additional evaluation or treatment.
Percentage of Patients Meeting DSM Criteria	Low percentage of assessed patients meet DSM criteria	Rule out possibility that excessive number of patients not meeting strict DSM criteria are being started inappropriately on medication.	Perform chart review on last 10 patients not meeting DSM criteria. Determine what percentage had ADHD ruled out. Determine what percentage were diagnosed with ADHD-NOS.
Time Elapsed Between Two Most Recent Sets of Parent Follow-up Rating Scales	Average time greater than recommended 12 weeks	Not completing the follow up Vanderbilt forms prior to follow up visit. Parents not motivated to complete forms	Create process to remind parents to complete forms within 4 days of sending them
Time Elapsed Between Two Most Recent Sets of Teacher Follow-up Rating Scales	Average time greater than recommended maximum of 12 weeks	Teacher not responding	Create office policy to ensure that no medication refills will be provided until teacher ratings completed. Encourage parents to remind teachers to complete forms.

Conclusions

This project sought to improve adherence to guideline-based care for children and adolescents with ADHD. Studies have shown that despite the AAP guideline having been published first in 2000 and most recently in 2011, clinicians may not be aware of the details of the guideline and may provide less than optimal care.

This educational project offered three formats for training: live workshops in eight cities, on-demand enduring webcasts, and training through a web portal. Each format was designed to help clinicians have a better understanding of the 2011 guideline and to encourage them to follow action steps described in the guideline related to assessment, diagnosis, and treatment of pediatric ADHD.

The training encouraged clinicians to carefully consider employing specific measures in their practice related to diagnosis and treatment of ADHD such as: using parent and teacher rating scales for initial assessment, determining a diagnosis of ADHD based on DSM criteria, using parent and teacher rating scales for follow-up assessment, having timely office contact with patients after medication has been initiated, assessing ADHD symptom change following treatment, and assessing changes in functional impairment following treatment. Practice tools and patient education materials were made available to clinicians to enable them to implement changes in their practice.

Learners who participated in the live workshops and enduring webcasts showed significant gains in knowledge about the 2011 guideline. They improved in their competence to apply the knowledge in practice, in their confidence about treating ADHD related to the guideline. With respect to measures, surveys completed by learners as to how they actually use specific measures in their practice to evaluate, treat, and monitor ADHD symptoms and functional outcomes of patients, indicated continued need for improvement even after they attended the training. While clinicians reported fairly regular use of parent and teacher rating scales to initially assess ADHD symptoms there is a need to more regularly use DSM criteria in determining a diagnosis, more regularly schedule office contact with patients/families within 14 days of initiation of medication, and to improve in the frequency of using parent and teacher rating scales to re-assess symptoms and functional impairment after treatment is initiated.

Participating in a workshop about ADHD care, the AAP guideline, and the importance of using specific practice measures in providing this care may not produce substantial change in practice behavior, despite many learners stating that they intend to do so. We recognized this at the outset of the training and offered learners the opportunity to enhance their training by participating in conference calls that could include other members of the office-based ADHD care team. Despite the fact that ten to fifteen learners showed an interest in this coaching, only one site scheduled and participated in the coaching.

Recruitment of clinicians to participate in the meHealth.com web portal was also challenging. For some clinicians the barrier to registering was reluctance to use another platform to record patient information that was not integrated with their current EMR system. For some it was the amount of time they thought it would take to complete the requirements of the program to earn credit. Less than 30% of those who did register, completed. Engaged portal learners were provided with personalized support calls to help them understand how to use the portal to assess strengths and weaknesses in their practice related to ADHD care, sign up and activate patient/parent accounts, transmit rating scales to parents and teachers at initial assessment and for follow-up, schedule office contacts, and to assess changes in ADHD symptoms and impairment as a result of treatment. Review of some of the tests of change that clinicians considered revealed some of the barriers that clinicians faced in optimally using the portal. These included issues such as: patients with no Internet access, having to create office policies to ensure parents activated accounts set up for them on the portal, getting rating scales from teachers and parents in time to make treatment decisions for continued care, making sure office contacts were scheduled properly. The web portal is an excellent platform and practice tool to organize office procedures and workflow around ADHD care, automate data collection, maintain patient records to monitor the impact of ongoing treatment, etc. However, sites that were not as actively engaged in the portal probably, most likely, require better understanding of the benefits of the portal, comprehensive training on how to use it, and a strong commitment to using it by the office-based ADHD care team.

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