Relationship Between Attention-Deficit/Hyperactivity Disorder Care and Medication Continuity

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Objective: To describe the relationships between attention-deficit/hyperactivity disorder (ADHD) care practices and subsequent medication use.

Method: A retrospective cohort from a random sample of medical records in 50 pediatric practices with 188 providers, including 1,352 children who started ADHD medication, was studied. Independent variables included physician behaviors related to medication titration and monitoring of treatment response. Primary outcomes were number of days covered with ADHD medication during the first year of treatment and time from starting medicine to the first 30-day gap in medication supply. Multilevel modeling and Cox proportional hazards regression models were conducted.

Results: Children had an average medication supply of 217 days in the first year. Half experienced a 30-day gap in medication supply in the first 3 months. Nearly three-fourths had a medication adjustment in the first year with the first adjustment usually being a dosage change. The average time to the first medication adjustment was over 3 months. Physician's first contact with parents occurred in the first month of treatment for less than half, with the average time being over 2 months. Little variation related to ADHD care quality was accounted for at the physician level. Early titration and early contact were related to greater medication supply and continuity of treatment.

Conclusion: Earlier physician-delivered ADHD care (e.g., contact with parent after starting medication and medication adjustment) is related to greater medication supply and continuity. It remains to be determined whether interventions that improve the quality of titration and monitoring practices for children with ADHD would also improve medication continuity.

Key words: attention-deficit/hyperactivity disorder, adherence, clinical practice guidelines, quality of care, pharmacotherapy

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Medication is the most common[1] and efficacious[2] treatment for attention-deficit/hyperactivity disorder (ADHD) symptoms. Unfortunately, continuity of medication treatment is poor, as children often discontinue or periodically stop and re-start medicine,[3-7] which leads to the re-emergence of ADHD symptoms.[8,9] The most commonly cited reason for medication discontinuity is side effects.[10] Because many side effects can be mitigated through dose adjustments or medication switching, close follow-up of patients to address side effects should promote medication continuity. Indeed, ADHD clinical practice guidelines encourage physicians to titrate ADHD medication and to closely monitor treatment response to maximize benefit and minimize side effects.[11-13] Although the frequency of titration[4] and of monitoring[14-17] has been described in community-based settings, it is unknown whether either is associated with medication continuity.

Our objective was to describe the relationships between ADHD care practices and medication supply and continuity during the first year of treatment among children newly treated for ADHD. We hypothesized that after prescribing medication, the less time that elapsed until the physician had contact with the family, titrated medication, or assessed treatment response by collecting a behavioral rating scale would be associated with better continuity of medication treatment.

METHOD

Participants and Setting

We recruited practices from August 2010 through December 2012 to participate in a study focusing on improving the quality of community-based ADHD care. The data presented here reflect ADHD care at baseline (i.e., before intervention). A recruitment mailing was sent out to 128 practices in central and northern Ohio that served primarily children, had at least 2 pediatricians, and did not have access to an on-site mental health professional. We selected the first 50 practices that responded and met our inclusion criteria to participate. The remaining practices either did not respond, responded late, chose not to participate because they refer out all patients for ADHD care, or declined because they were already involved in other research or quality improvement initiatives. We recently published data from these practices on variation in physician ADHD assessment practices and monitoring behaviors (e.g., collection of rating scales).[17] This article takes the next step by describing variation in titration practices, medication supply and continuity, and the relationship between titration/monitoring practices and child medication supply/continuity.

Chart Reviews

We reviewed charts to assess pediatricians' ADHD care practices and their patients' medication supply and continuity. To select patient charts, we retrieved billing records with an ADHD diagnosis code during the past year. Coders randomly selected 10 patients per practitioner by selecting every nth patient from the list where n = (number of patients on the billing query) / 10. Since these chart reviews required a review of retrospective patient charts, a waiver of consent was granted from the Nationwide Children's and Cincinnati Children's Medical Centers' institutional review boards on the condition that no identifying or demographic information from the patient charts would be recorded.

Using a standardized chart audit form, we extracted the following information from each patient chart for any ADHD care between 2002 (the year after the initial American Academy of Pediatrics ADHD treatment guideline[12] was released) and the date of the chart review (August 2010 through December 2012): information on prescriptions written (i.e., date, medication, dosage, amount dispensed); dates of all ADHD-related treatment visits and phone or e-mail correspondence; and dates of collection for all parent- and teacher-completed ADHD rating scales after medication initiation. A random 10% sample of charts was audited by 2 research assistants each blinded to the other's audit. Interrater reliability was high for the number of days covered with medicine (intraclass correlation coefficient [ICC] = 0.96), presence of a medication change ($\kappa = 0.89$), and time to contact (ICC = 0.86).

Measurement of Physician and Practice Characteristics

Pediatricians reported their demographic characteristics and the percentage of their patients whose primary payer was Medicaid. They also reported whether their practice was affiliated with an academic medical center, had an electronic medical record (EMR), and was located in an urban, suburban, or rural setting.

Healthcare Provider Sample

The 50 participating practices included 188 healthcare providers (184 pediatricians and 4 nurse practitioners). The mean age of the health care providers was 43.5 years (SD = 9.5 years). The average number of years since health care providers had finished their residency training program was 12.9 years (SD = 9.1 years). The majority of health care providers were white (n = 158, 86%) and female (n = 117, 64%). Pediatricians varied in the reported proportions of Medicaid patients in their panels (range = 0%–99%; mean = 45%, SD = 31%). Approximately 25% of pediatricians (n = 39) reported an affiliation with an academic medical center. In all, 69% of practices (37/50) had an EMR at the time of the chart audit. Of the pediatricians, 53 pediatricians (28%) reported being located in urban settings, 103 as suburban (55%), and 17 as rural (9%).

Patient Sample

Across the 188 providers, 1,514 patient charts were reviewed. Of those, we identified 1,352 children who were newly treated for ADHD with prescriptions written that were sufficient to cover at least 30 days with medication. Of those, 699 had at least 1 year elapse from the date of the first prescription to the date of the chart review.

Quality of Care Measures

We calculated "times to events"—the number of days from when the patient was initially prescribed medication until the relevant event—as indices of recommended ADHD care behaviors. Titration events of interest included medication adjustments (i.e., dosage change, medication switch, addition/removal of a medicine). Monitoring events of interest included parent–physician contact (i.e., visit, phone call, or e-mail to discuss the child's response to ADHD treatment, excluding parent contacts with office staff solely to request a refill) and the collection of a behavior rating scale from a parent or teacher. We also tallied the number of events that each child experienced in the first year of treatment. For parent–physician contacts, we also examined whether children had the event of interest in the first month after starting medicine, because having a visit in the first month of treatment is an established quality metric that is routinely tracked and reported by the National Committee for Quality Assurance.[18]

For children prescribed stimulant medication, the daily dosage for the final prescription written was calculated in methylphenidate dosage-equivalent units by converting daily dosages of all nonmethylphenidate stimulant medications using the following conversions (mixed salt amphetamines dose or dexmethylphenidate dose × 2; lisdexamfetamine × 0.8).

Outcome Measures

Based on prescriptions written, we calculated medication supply, as defined by the number of days covered with ADHD medication during the first year of treatment, and medication continuity, as defined by the time from starting medicine to the first 30-day gap in medication supply.

Statistical Analyses

Patients were nested within pediatricians, and pediatricians were nested within practices. Our description of the ADHD care quality and medication supply in the first year of treatment focuses on the 699 participants who had a full year elapse from starting medicine to the date of the chart review. This was necessary to ensure that all participants had an equal opportunity to experience the event of interest. We computed all descriptive estimates by modeling the multilevel nature of the data. For the medication titration events and outcome measures, we used multilevel models to estimate the percentage of variation attributable to patients, pediatricians, and practices, and statistically tested whether these estimates differed from 0.

For children who had at least 1 year elapse from starting medication to the date of the chart audit, we used multilevel modeling to test whether predictor variables (i.e., time to first medication adjustment, number of medication adjustments, presence of a contact in the first month, time to first contact, and number of contacts) were associated with number of days covered with medicine. We used SAS Proc Mixed to model the continuous variables (e.g., time to contact) using Kenward-Roger degrees of freedom for fixed effect parameter estimate tests.[19] We used Mplus version 7.11 (Muthen and Muthen, Los Angeles, CA) to model the binary variables (i.e., presence or absence of medication adjustment).

We included the full 1,352 patients who started medication in analyses that involved the outcome of time to first 30-day gap in medication. Cox proportional hazards regression models with clustering of patients under pediatricians and of pediatricians under practices and using robust standard errors were estimated to assess the association between presence of follow-up in the first month of treatment and the days to the first 30-day gap (function coxme in R version 3.01). To examine the influence of summer vacation on these relationships, we conducted sensitivity analyses with and without participants with a first 30-day gap occurring during the summer. For some patients who started medication, less than 1 year elapsed before the chart review (n = 653). If these patients did not