Improving Cardiometabolic Monitoring of Children on Antipsychotics

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Abstract

Objectives: This study evaluated changes in cardiometabolic monitoring for children and adolescents who were prescribed an antipsychotic medication in a state mental health system before and after a quality improvement intervention.

Methods: The intervention included education for prescribers, auditing on metabolic monitoring, and feedback to mental health center leaders regarding their monitoring. Research staff extracted yearly data on cardiometabolic monitoring from randomly selected community mental health center records before and after the intervention. Pre- and postintervention changes in monitoring were assessed with chi-squared tests.

Results: Evidence of past year monitoring increased: for glucose 18.9%–42.1% ($\chi^2=6.75$, $p<0.001$), for triglycerides 13.5%–31.0% ($\chi^2=4.54$, $p=0.033$), for cholesterol 13.5%–33.1% ($\chi^2=5.48$, $p=0.019$), and for weight 67.6%–84.1% ($\chi^2=5.21$, $p=0.022$). Rates of monitoring for blood pressure and waist circumference increased but not significantly. In both years studied, weight was obtained most frequently and waist circumference was obtained least frequently.

Conclusions: Monitoring rates significantly improved for four out of six parameters evaluated, but overall monitoring rates remained low at the end of the study period. Prescriber education with audit and feedback may improve cardiometabolic monitoring rates, but research is needed to evaluate barriers to monitoring in children.

Keywords: cardiometabolic, side effects, antipsychotic medications, quality improvement, metabolic monitoring

Introduction

THE USE OF atypical antipsychotic medication in children and adolescents is associated with considerable cardiometabolic side effects (Correll et al. 2009; Bobo et al. 2013), and these metabolic disturbances can have lasting consequences. Obesity in childhood has been linked to higher adult rates of cardiovascular disease, metabolic syndrome, and cancer (Kelsey et al. 2014). Although guidelines recommend routine monitoring of metabolic side effects to address them immediately (Table 1; American Diabetes Association et al. 2004; Findling et al. 2011), monitoring rates remain low in children (Edelsohn et al. 2015).

Interventions have been shown to improve rates of metabolic monitoring. For example, a metabolic monitoring training program to educate prescribers in a Canadian child psychiatry clinic resulted in significantly higher rates of monitoring at initial prescribing of an antipsychotic, as well as 3 and 6 months later. Because research has shown that audit and feedback is an additional effective strategy to change provider behavior (Ivers et al. 2014), we developed a

metabolic monitoring program that incorporated prescriber education with regular audit and feedback regarding provider monitoring. This naturalistic, pre-post study evaluated the impact of this program on metabolic monitoring rates among children and adolescents treated with antipsychotics in a state community mental health system.

Methods

Overview

The state mental health authority conducted education for prescribers, auditing on metabolic monitoring, and feedback to mental health center leaders regarding their center's monitoring. Data on the presence of cardiometabolic monitoring were collected from randomly selected community mental health center records before and after the intervention. Pre- and postintervention changes in monitoring were assessed with chi-squared tests.

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TABLE 1. RECOMMENDED SCREENING GUIDELINES FOR INDIVIDUALS TAKING SECOND-GENERATION ANTIPSYCHOTICS

	<i>ADA and APA consensus development conference on antipsychotic drugs and obesity and diabetes (American Diabetes Association et al. 2004)^a</i>	<i>AACAP, 2011 practice parameter for the use of atypical antipsychotic medications in children and adolescents (Findling et al. 2011)^b</i>
Personal and family history	B, annually	B, regularly
Weight (BMI)	B, 4 w, 8 w, 12 w, quarterly	B, regularly
Blood pressure	B, 12 w, annually	B, regularly
Waist circumference	B, annually	—
Eye examination	—	If quetiapine: B, periodic
Fasting glucose	B, 12 w, annually	B, regularly
Fasting lipid profile (HDL, LDL, TG, total cholesterol)	B, 12 w, every 5 years	If weight change or family history: B, regularly
Electrocardiogram	—	If family or personal history: B, regularly. If ziprasidone: given risk of QTc changes: B, stable dose
Prolactin	—	Only if symptoms
Hemoglobin A1c	—	As needed
Electroencephalography	—	If clozapine, B, stable dose, behavioral changes

^aRecommends more frequent assessments may be warranted based on clinical status.

^bRecommends following ADA/APA guidelines.

AACAP, American Academy of Child and Adolescent Psychiatry; ADA, American Diabetes Association; APA, American Psychiatric Association; B, baseline; BMI, body mass index; HDL, high-density lipoprotein; LDL, low-density lipoprotein; TG, triglycerides; w, weeks.

Setting

The state mental health system included 10 community mental health centers that provided comprehensive care to children with serious emotional disturbances. Each center's medical director oversaw prescribing at his or her center. These nonprofit centers operated independently and did not share medical records, some of which were paper, some electronic. Services were guided by state rules. The Medicaid pharmacy program conducted some quality monitoring and prior authorization procedures, but no limits were set on prescribing antipsychotics to children during the study period.

Participants

In fiscal year (FY) 2009, 171 child records were randomly selected from eight of the 10 centers and reviewed. Thirty-seven children were prescribed antipsychotics. In FY 2013, the state mental health authority focused on children taking antipsychotics, randomly selecting 150 records of children on antipsychotics, including 15 at each of the 10 centers.

Measures

Medical records were reviewed for the presence of past 12-month antipsychotic prescriptions, weight, height, waist circumference, and laboratory results of glucose, triglycerides, and cholesterol. Documentation of monitoring during the past year was recorded as present or absent. We did not collect demographics or identifying information.

Intervention

The intervention has been described previously (Cotes et al. 2015). Briefly, the state's mental health authority initiated a quality improvement program for antipsychotic prescribing and cardiometabolic side effect monitoring, with a goal of improving physical health in adults and children treated with atypical antipsychotics.

The quality improvement team educated state leaders, mental health center leaders, and consumer and family groups. They provided community mental health center leaders access to lectures by experts and recent data summaries of antipsychotic prescribing and monitoring practices (from the previous year's audit and Medicaid claims) that allowed each leader to compare his or her own center with others. All community mental health adult and child prescribers received a quarterly letter describing the quality initiative's goals and recommendations, as well as articles on antipsychotic prescribing and side effect monitoring. A psychiatrist conducted three 50-minute educational outreach sessions over a year for prescribers at each of the community mental health centers. Sessions focused on antipsychotic efficacy, cardiometabolic side effects, risk factor monitoring, and data feedback regarding center-level rates of prescribing and monitoring. The educational sessions were conducted during usual administrative meeting times with the prescriber group at each mental health center between the two audits, FY 2009 and FY 2013.

Procedures

Each year, the state mental health authority reviewed randomly sampled clinical records of children treated at community mental health centers in the state. We utilized mental health center record data over claims data because this method enables assessment of whether results of laboratory examination, vital signs, and weight were obtained and available for prescribers to utilize in the clinic visit. In 2009, records from all children were sampled. After 2009, the sampling strategy was modified because less than 10% of children were prescribed antipsychotics. In FY 2013, only records of children treated with an antipsychotic in the past year were sampled to obtain more data on the quality of side effect monitoring.

Trained mental health authority staff with assistance from mental health center quality improvement staff extracted data from clinic records, entered it into databases, and double-checked for

errors. Researchers analyzed the deidentified data. The state and academic medical center institutional review boards approved the study plan that did not obtain consent from participants, as only deidentified data were analyzed by researchers. The researchers followed the principles outlined in the Declaration of Helsinki.

Statistical analyses

Descriptive statistics were used (SAS 9.2) to report rates of documented cardiometabolic monitoring. Chi-squared tests were used to assess changes in the rate of monitoring from FY 2009 to FY 2013.

Results

Between FY 2009 and FY 2013, monitoring rates for weight, cholesterol, triglycerides, and glucose increased significantly (Table 2). The largest change was seen in glucose monitoring, which increased from 18.9% to 49.1%. Changes in cholesterol and triglyceride monitoring were similar, with cholesterol monitoring increasing from 13.5% to 33.1% and triglyceride monitoring increasing from 13.5% to 31.0%. Weight monitoring increased from 67.6% to 84.1%. There was no significant change in rates of blood pressure and waist circumference monitoring. In both FY 2009 and FY 2013, patient weight was the most frequently monitored parameter and was the only parameter that was measured in more than 50% of patients during either measurement period. The least frequently monitored parameter, waist circumference, was not checked in any of the patients on antipsychotics reviewed in FY 2009, and in only 4 of 141 patients (2.8%) in FY 2013.

Discussion

Metabolic monitoring rates improved significantly for four key parameters (glucose, cholesterol, triglycerides, and weight) after education with audit and feedback. Despite these promising results, waist circumference assessment was universally not adopted by the pediatric prescribers. Clinicians may have avoided waist circumference assessment because it is more difficult to interpret than body mass index in children (Huang et al. 2011), and body mass index and waist circumference equally predict cardiometabolic risk in this group (Sardinha et al. 2016). Nevertheless, the overall improvements in monitoring consistent with previous research (Ronsley et al. 2012) suggest that education with audit and feedback is a promising method to improve cardiometabolic monitoring of children on antipsychotic medications.

Despite the improvement in monitoring, prescribers still did not monitor the majority of children for cardiometabolic side effects after the intervention. The low rate of monitoring, despite pre-

scribers having received education and feedback and having knowledge that they were being monitored, raises concerns and suggests that barriers interfere with this practice. Previous research demonstrated that children and parents may be unwilling to be monitored (Rodday et al. 2015). Other barriers may include workflow challenges, such as the absence of reminders indicating when the child is due for monitoring, and the lack of an easily accessible recording mechanism for the monitored parameters (McLaren et al. 2017), as well as cost in the form of copays for patients and reimbursements for insurance companies. Overall, barriers to monitoring children treated with atypical antipsychotics have not been robustly evaluated.

The results of this study must be interpreted with caution due to the absence of a control condition and randomized design, and the differing methodologies in sampling between 2009 and 2013. The changes in monitoring observed over this 4-year period could be due to a secular trend rather than due to the intervention. That said, findings from other studies support the interpretation that the intervention did have an impact. First, our findings are consistent with a previous intervention study (Ronsley et al. 2012). Second, the postintervention monitoring rates we found are higher than the rates of monitoring reported by child psychiatrists in a national survey from 2012 to 2013. In that survey, only about 20% reported that they had adopted monitoring into their practice despite a very high level of self-reported knowledge of the monitoring guidelines (over 95% were aware of all the guidelines; McLaren et al. 2017). In addition, in this study, postintervention monitoring was higher than rates shown in survey studies in 2008–2012 (Edelsohn et al. 2015; Crystal et al. 2016).

Our study assessed the ability of education with audit and feedback to improve cardiometabolic monitoring of children treated with atypical antipsychotics. Other interventions have been shown to be effective in changing physician behavior, including academic detailing, economic incentives, and multifaceted interventions (Mostofian et al. 2015), but laboratory tests in children may be particularly difficult to implement. Future research could explore reminder systems, more intensive active education, workflow changes, and nurse-led monitoring. In addition, future studies should seek to understand barriers, including parents' and children's attitudes and beliefs about monitoring. Parents and children may need education, support, or other facilitators to improve compliance with monitoring.

Conclusion

This research suggests that prescriber education with audit and feedback increased prescriber monitoring of children on antipsychotic medications. Despite the intervention, however, most children remained unmonitored. Further research should

TABLE 2. PROPORTION OF CHILDREN ON ANTIPSYCHOTIC MEDICATION WITH PRESENT METABOLIC PARAMETERS IN THE RECORD OVER THE PAST 12 MONTHS

Parameter	2009 (n = 37)	2012 (n = 145)	Test statistic
Glucose	0.189	0.421	$\chi^2 = 6.75$, df = 1, $p = 0.009$
TG	0.135	0.310	$\chi^2 = 4.54$, df = 1, $p = 0.033$
Cholesterol	0.135	0.331	$\chi^2 = 5.48$, df = 1, $p = 0.019$
Weight	0.676	0.841	$\chi^2 = 5.21$, df = 1, $p = 0.022$
Blood pressure	0.351	0.490	$\chi^2 = 2.27$, df = 1, $p = 0.132$
Waist circumference	0	0.028	$\chi^2 = 1.04$, df = 1, $p = 0.307$

TG, triglycerides.

evaluate barriers to monitoring as well as strategies to overcome such barriers.

Clinical Significance

Multiple studies have shown that the cardiometabolic side effect monitoring for children taking antipsychotic medications is generally inadequate, and interventions such as prescriber education with audit and feedback may increase clinician's implementation of monitoring.

Disclosures

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References

- American Diabetes Association, American Psychiatric Association, American Association of Clinical Endocrinologists, North American Association for the Study of Obesity: Consensus development conference on antipsychotic drugs and obesity and diabetes. *Diabetes Care* 27:596–601, 2004.
- Bobo W, Cooper W, Stein M, Olfson M, Graham D, Daugherty J, Fuchs C, Ray W: Antipsychotics and the risk of type 2 diabetes mellitus in children and youth. *JAMA Psychiatry* 70:1067–1075, 2013.
- Correll C, Manu P, Olshansky V, Napolitano B, Kane J, Malhotra A: Cardiometabolic risk of second-generation antipsychotic medications during first-time use in children and adolescents. *JAMA* 302:1765–1773, 2009.
- Cotes RO, de Nesnera A, Kelly M, Orsini K, Xie H, McHugo G, Bartels S, Brunette MF: Antipsychotic cardiometabolic side effect monitoring in a state community mental health system. *Community Ment Health J* 51:685–694, 2015.
- Crystal S, Mackie T, Fenton MC, Amin S, Neese-Todd S, Olfson M, Bilder S: Rapid growth of antipsychotic prescriptions for children who are publicly insured has ceased, but concerns remain. *Health Aff (Millwood)* 35:974–982, 2016.
- Edelsohn GA, Parthasarathy M, Terhorst L, Karpov IO, Schuster J: Measurement of metabolic monitoring in youth and adult Medicaid recipients prescribed antipsychotics. *J Manag Care Spec Pharm* 21:769–777, 777a–777cc, 2015.
- Findling R, Drury S, Jensen P, Rapoport J, Bukstein O, Walter H, Benson S, Chrisman A, Farchione T, Hamilton J, Keable H, Kinlan J, Schoettle U, Siegel M, Stock S: Practice parameter for the use of atypical antipsychotics in children and adolescents, 2011. Available at www.aacap.org/App_Themes/AACAP/docs/practice_parameters/Atypical_Antipsychotic_Medications_Web.pdf (last accessed on February 20, 2017)
- Huang TT, Borowski LA, Liu B, Galuska DA, Ballard-Barbash R, Yanovski SZ, Olster DH, Atienza AA, Smith AW: Pediatricians' and family physicians' weight-related care of children in the U.S. *Am J Prev Med* 41:24–32, 2011.
- Ivers NM, Grimshaw JM, Jamtvedt G, Flottorp S, O'Brien MA, French SD, Young J, Odgaard-Jensen J: Growing literature, stagnant science? Systematic review, meta-regression and cumulative analysis of audit and feedback interventions in health care. *J Gen Intern Med* 29:1534–1541, 2014.
- Kelsey M, Zaepfel A, Bjornstad P, Nadeau K: Age-related consequences of childhood obesity. *Gerontol* 60:222–228, 2014.
- McLaren JL, McHugo GJ, Drake R, Brunette MF: Monitoring of second-generation antipsychotics: A national survey of child psychiatrists. *Psychiatr Serv* 2017 [Epub ahead of print]; DOI: 10.1176/appi.ps.201500553.
- Mostofian F, Ruban C, Simunovic N, Bhandari M: Changing physician behavior: What works? *Am J Manag Care* 21:75–84, 2015.
- Rodday AM, Parsons SK, Mankiw C, Correll CU, Robb AS, Zima BT, Saunders TS, Leslie LK: Child and adolescent psychiatrists' reported monitoring behaviors for second-generation antipsychotics. *J Child Adolesc Psychopharmacol* 25:351–361, 2015.
- Ronsley R, Rayter M, Smith D, Davidson J, Panagiotopoulos C: Metabolic monitoring training program implementation in the community setting was associated with improved monitoring in second-generation antipsychotic-treated children. *Can J Psychiatry* 57:292–299, 2012.
- Sardinha LB, Santos DA, Silva AM, Grontved A, Andersen LB, Ekelund U: A comparison between BMI, waist circumference, and waist-to-height ratio for identifying cardio-metabolic risk in children and adolescents. *PLoS One* 11:e0149351, 2016.

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