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Morbid Obesity and Use of Second Generation Antipsychotics among Adolescents in Foster Care: Evidence from Medicaid

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Abstract

Background—Many adolescents enter foster care with high body mass index (BMI), and patterns of treatment further exacerbate the risk of morbid obesity. A principal risk factor for such exacerbation is the use of second generation antipsychotics (SGAs). We examine the association between receiving a morbid obesity diagnosis and SGA prescriptions among adolescents in foster care.

Methods—We analyzed claims from 36 states' Medicaid Analytic Extract (MAX) files for 2000 through 2003. Obesity diagnoses were ascertained through a primary or secondary diagnosis claim of morbid obesity. Covariates included gender, race/ethnicity, age, insurance status, state obesity rate, and state fixed effects. We calculated relative risks of a diagnosis based upon four SGAs (clozapine, olanzapine, quetiapine, and risperidone) associated with obesity and a polypharmacy indicator.

Results—Of the 1,261,806 foster care adolescent-years in the MAX files, 6,517 were diagnosed with morbid obesity, an annual prevalence of 0.5%. The risk of a morbid obesity diagnosis is much higher for female and non-white adolescents. The risk increases with age. Quetiapine and clozapine increased the risk of a morbid obesity diagnosis more than 2.5 times, and two or more psychotropic drugs (polypharmacy) increased the risk fivefold.

Conclusions—Adolescents in foster care are much more likely to be on SGA medications, and therefore may be more susceptible to weight gain and obesity. Given that SGA prescribing for

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younger populations has only expanded since these data were released, our study may actually understate the magnitude of the problem. Care is needed when prescribing SGAs for foster care adolescents.

Keywords

obesity; foster care; psychotropics

1. INTRODUCTION

For the more than 166,000 adolescents in foster care, morbid obesity (a body mass index [BMI] of 120% of the 95th percentile for the age group) represents a public health concern (U.S. Department of Health Human Services, 2013), yet scant evidence exists on the prevalence of morbid obesity in this group. Nearly 21% of adolescents enter foster care obese (Steele & Buchi, 2008), and this percentage is even higher among certain groups; for example, 47% of Hispanic adolescents entering foster care are overweight or obese (Schneiderman et al., 2013b). After placement, adolescents continue to have difficulty losing weight, leading to additional weight gain and morbid obesity risk. (Schneiderman, Smith, Arnold-Clark, Fuentes, & Duan, 2013a).

In adolescence, the health risks associated with morbid obesity are substantially worse than those for moderate overweight and obesity; musculoskeletal disorders, sleep apnea, and non-alcoholic fatty liver disease are all significantly associated with morbid obesity (Kelly et al., 2013). Multiple cardiometabolic risk factors plague severely obese adolescents, such as low HDL cholesterol level, high systolic blood pressure, high diastolic blood pressure, high triglyceride level, and high glycated hemoglobin levels (Skinner, Perrin, Moss, & Skelton, 2015). Morbidly obese youth are likely to carry cardiac and metabolic risk factors into adulthood (Kelly et al., 2013).

Having entered foster care with high BMIs, patterns of treatment further exacerbate the risk of morbid obesity. In particular, adolescents' use of second generation antipsychotics (SGAs) is a contributing factor to weight gain. The exact physiological pathways are not precisely understood, but increased appetite or hyperphagia as a result of SGA initiation has been observed (Rojo et al., 2015). Weight gain for children and adolescents on SGAs may be as high as 8.5 kg (Correll et al., 2009). These facts suggest that, in addition to mental health concerns, clinicians should consider weight gain when prescribing SGAs.

SGA use has surged among children and adolescents overall, and rates are even higher among those in foster care (Olson, Blanco, Liu, Wang, & Correll, 2012; Raghavan et al., 2005; Zito et al., 2008). Clinicians have increasingly prescribed psychotropics to children and adolescents for non-psychotic disorders (Tran, Zito, Safer, & Hundley, 2012). For children in the child welfare system, psychotropic rates may be 2 to 3 times greater than for children in the community (Raghavan et al., 2005). For example, among children in foster care who had been dispensed psychotropic medication, 41.3% were prescribed three or more different classes of psychotropics during a single year (Zito et al., 2008).

To understand the increase in morbid obesity risk among foster care populations associated with SGAs, we present an analysis of the 2000–2003 Medicaid Analytic eXtract (MAX) administrative claims files. Medicaid claims data have been examined before for psychotropic polypharmacy (Constantine, Boaz, & Tandon, 2010) and psychotropic impacts on health outcomes (Jerrell & McIntyre, 2008). To our knowledge, however, no studies have used Medicaid claims data to examine obesity among adolescents in foster care, where SGA usage rates are substantially higher than those in the community. As noted by others (Reekie et al., 2015), the clinical trial evidence associating weight gain and psychotropic use among adolescents is sparse, with studies focused on smaller, specialized populations for a short followup period. Our data allow for much longer observation. We investigate whether SGA use is associated with increases in morbid obesity diagnoses among adolescents in foster care aged 10 through 18.

2. METHODS

2.1 Data source and analytic data set

We used Medicaid Analytic Extract (MAX) claims files from 36 states for 2000 through 2003. We used the Medicaid person summary file for enrollment and demographic information and the MAX prescription drug (RX) files for prescription fill date and national drug codes, which were grouped following the Medicaid MRX or Redbook classifications. ICD-9-CM diagnosis codes for adolescents were obtained from the physician/outpatient (“other therapy”) and inpatient MAX files.

We limited our analysis to adolescents in foster care between the ages of 10 and 18. Foster care status was ascertained from Medicaid eligibility variables; each was required to be eligible for Medicaid for at least 10 months of the year. From the RX files, we identified SGA prescriptions for all adolescents in foster care on Medicaid based on their generic names.

2.2 Morbid obesity Indicator

We searched all outpatient and inpatient files for a primary or secondary diagnosis claim of morbid obesity (ICD-9-CM code 278) and created a yearly indicator variable for the presence of a morbid obesity diagnosis. Analysis was conducted at the adolescent-year level with the obesity indicator as the dependent variable.

2.3 Covariates

Covariates included demographic information available in Medicaid files, which is limited to gender, race/ethnicity, age, insurance, and state of residence. Recent work has noted that race/ethnicity, gender, and age can be confounders for obesity in maltreated adolescents (Helton & Liechty, 2014). Race/ethnicity was collapsed into white (non-Hispanic), black (non-Hispanic), Hispanic ethnicity of any race, unknown and other race/ethnicity combinations.

Adolescents were classified into one of five insurance categories: primary care case management (PCCM only), fee-for-service (FFS only), a mix of PCCM and FFS coverage,

other insurance, and ineligible. If an adolescent spent more than 10 months of the year in Medicaid and 80% of their eligibility in PCCM, FFS, or a combination of both, they were grouped into the first three insurance categories, respectively. If they had at least 10 months of non-PCCM/non-FFS coverage, they were classified as other. Otherwise, they were labeled as ineligible.

We also included an indicator for any child maltreatment in the regression. Although ascertainment of child maltreatment via administrative claims is challenging, it has been noted as a major confounder for obesity at this age (Raghavan et al., 2015; Shin & Miller, 2012). We selected child maltreatment ICD-9 codes from a recent child maltreatment study (Raghavan et al., 2015). The indicator variable included ICD-9 diagnostic codes for the following conditions: child maltreatment (995.5), effects of hunger or thirst (994.2 or 994.3), personal history of psychological trauma presenting hazards to health (V15.4), counseling for victim of child abuse (V61.21), observation and evaluation for suspected abuse and neglect (V71.81), rape or alleged rape/sexual abuse (E906.1 or V71.5), criminal neglect (E968.4), assault (E961-E966, E968), or no food/no water (E904.1 or E904.2).

2.4 SGAs associated with weight gain

At this point, we limited our analyses to the four SGAs most associated with weight gain that were available for prescribing at the time: clozapine, olanzapine, quetiapine, and risperidone. These were culled from three reviews of psychotropic effects on child and adolescent weight (Correll et al., 2009; De Hert, Dobbelaere, Sheridan, Cohen, & Correll, 2011; Reekie et al., 2015). These prescriptions have been shown to increase weight between 0.79 kgs and 8.54 kgs relative to placebo.

2.5 Statistical analysis

We first calculated descriptive statistics for the control variables on the group with diagnosed morbid and the non-diagnosed sample. We ran bivariate tests of significance between the two populations: a proportion test for indicator variables and Chi-squared tests for mutually exclusive categorical variables. We also calculated the prevalence of several SGAs among the group diagnosed with morbid obesity.

The primary independent variables were adolescent gender, race/ethnicity, and SGA prescriptions with indicator variables included for state and age. In addition, we examined the association between a morbid obesity diagnosis and a polypharmacy indicator. We defined the polypharmacy indicator as having a prescription overlap of more than 30 days of two different SGAs.

To determine whether any of the covariates or prescriptions were significantly associated with a diagnosis of morbid obesity, we also estimated the relative risk of a morbid obesity diagnosis as the outcome at the adolescent-year level. Using a morbid obesity diagnosis as a dependent variable, we followed Cummings (2009) and Greenland (2004) and fit a binomial generalized linear model with a log link to estimate our relative risks (Greenland, 2004; Cummings, 2009). We used clustering corrections for variance estimates at the adolescent-year level.

Both the Washington University Human Research Protection Office and the Institutional Review Board of RTI International approved these analyses. Analyses were conducted in Stata 13.1 (Stata Corp., College Station, TX).

3. RESULTS

Of the 1,261,806 foster care adolescent-years in the MAX files, only 6,517 were diagnosed with morbid obesity, an annual prevalence of 0.5%. Table 2 presents the demographic characteristics of the two populations. The group that received a diagnosis of morbid obesity is predominantly female (62.5% compared with 48.1% of the non-diagnosed group). However, the racial makeup of the two groups is qualitatively similar. Both the diagnosed and the non-diagnosed groups contain roughly the same proportion of white and black youth. Adolescents in foster care with a morbid obesity diagnosis tended to be older than the non-diagnosed group. The non-diagnosed group contained a more uniform distribution of ages than the diagnosed group. Diagnosed child maltreatment in both groups was less than 1%, but it was significantly higher in the diagnosed group (0.87%) than in the non-diagnosed group (0.35%) ($p < 0.01$).

Selected prescriptions for adolescents diagnosed with morbid obesity are presented at the bottom of Table 2. Among those with a morbid obesity diagnosis, clinicians prescribed quetiapine (8.0%) and risperidone (13.5%) most frequently, followed closely by olanzapine (6.1%). Clozapine (0.4%) was prescribed much less frequently. The prevalence for risperidone was more than twice as high for those with a morbid obesity diagnosis (13.5% versus 6.7%). A single SGA was prescribed to approximately 20% of the population, whereas 1.4% was prescribed two or more.

Relative risks for these prescription drugs and other covariates are presented in Table 3. Being diagnosed with morbid obesity is substantially more likely for female adolescents in foster care. Furthermore, the risk of being diagnosed with morbid obesity is between 1.14 to 1.31 times higher for non-white than for white adolescents in foster care. Morbid obesity risk increases with age, with the risk being highest at age 17 (2.43 relative risk). All relative risks for the SGAs were greater than one, indicating a positive and statistically significant ($p < 0.05$) association with a morbid obesity diagnosis. Adolescents in foster care taking quetiapine and clozapine had 2.7 and 2.8 times the risk of having a morbid obesity diagnosis.

Adolescents who took any of the four SGAs had three times the risk for being diagnosed with morbid obesity. Two or more SGAs resulted in more than a fivefold increase in the relative risk of a morbid obesity diagnosis. These results are presented in Table 3.

4. DISCUSSION

This paper explores the associations between a morbid obesity diagnosis and SGA prescriptions. Certain SGAs were associated with a much higher risk of morbid obesity diagnoses: taking quetiapine or clozapine was associated with more than 2.5 times the risk, and taking two or more SGAs concomitantly substantially increased the relative risk of a morbid obesity diagnosis.

All of the SGAs we investigated had increased risks of morbid obesity, with those taking multiple SGAs at the highest risk for obesity. Unfortunately, very little scientific evidence exists revealing the underlying causes for the detrimental metabolic effects of SGAs. Current research suggests that the activation of certain transcription factors may be associated with increased levels of metabolic disorders, such as obesity (Rojo et al., 2015). Alternative treatments that prevent the onset of obesity while also treating the underlying mental health concerns. For example, prescribing a SGA along with topiramate or metformin, which both have been used in weight management, may mitigate their weight gaining side effects (Klein, Cottingham, Sorter, Barton, & Morrison, 2006; Reekie et al., 2015; Wozniak et al., 2009). This evidence indicates clinicians may need to consider weight gain when choosing which SGA to prescribe.

We found that the annual prevalence of morbid obesity diagnoses was only 0.5% among adolescents in foster care. Although it has been well-documented that physician diagnoses of pediatric obesity are suboptimal during outpatient preventive care visits (Patel et al, 2010), this estimate still contrasts sharply with a national morbid obesity prevalence of 3.8% in children and adolescents (Skelton, Cook, Auinger, Klein, & Barlow, 2009), even though evidence indicates that the rates of overweight and obesity in foster care are generally similar to national estimates (Steele & Buchi, 2008). The low levels of diagnoses are particularly concerning given the influence of physician acknowledgement on patients' perceptions of their own weight. (Post et al, 2011) The reasons behind these diverging estimates remain unclear.

Although rarely diagnosed, we determined that child maltreatment was a significant co-occurring diagnosis with morbid obesity. Children who experience sexual, physical, or emotional abuse may attempt to cope via overeating, leading to weight gain (Gustafson & Sarwer, 2004; Mason et al., 2015). Sexual and physical abuse in childhood has been linked to morbid obesity in adulthood (Richardson, Dietz, & Gordon-Larsen, 2014). Childhood neglect may also play a role in increasing BMI, as children may engage in unhealthy eating behaviors without proper supervision (Shin & Miller, 2012). Recent estimates suggest that more than one-quarter of children under investigation for child maltreatment were obese (Helton & Liechty, 2014). However, those estimates do not distinguish between obesity and severe obesity.

We found that females, blacks, and Hispanics all have increased risk of a morbid obesity diagnosis and that morbid obesity risk increased with age during adolescence. All of these results confirm previous findings. As noted in the introduction, Hispanic children entering foster care have high rates of obesity upon entry (Schneiderman et al., 2013b). Other research has shown that adolescent females, blacks, and Hispanics are all much more likely to be on a poor BMI and mental health trajectory (Mumford, Liu, Hair, & Yu, 2013). Age has also been positively associated with BMI growth in children who experienced neglect. (Shin and Miller, 2012)

This study has several limitations. First, our use of ICD-9 codes to identify diagnoses of morbid obesity likely underestimates the problem (Benson, Baer, & Kaelber, 2009). Second, we also present associations only. Third, we are also unable to control for preexisting

obesity. Finally, our data are from the early 2000s. Our understanding of the obesity problem has changed substantially since then. As such, physicians may be more aware of the health effects of morbid obesity in adolescents and may be more likely to intervene on their behalf. SGA prescribing behavior has also changed substantially in the current medical environment.

5. CONCLUSIONS

Because adolescents in foster care are much more likely to be on SGA medications, weight gain and obesity should be an area of concern. Given that SGA prescribing for younger populations has expanded since these data were released, our study may actually understate the magnitude of the problem. We emphasize that additional caution should be heeded when considering prescribing SGAs for foster care adolescents. Clinicians need to understand the extent to which SGAs may be associated with higher likelihood of morbid obesity for this population.

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Abbreviations

BMI	body mass index
FFS	fee-for-service
MAX	Medicaid Analytic Abstract
PCCM	primary care case management
SGA	second generation antipsychotic

References

- Benson L, Baer HJ, Kaelber DC. Trends in the diagnosis of overweight and obesity in children and adolescents: 1999–2007. *Pediatrics*. 2009; 123(1):e153–158. DOI: 10.1542/peds.2008-1408 [PubMed: 19117837]
- Bleich SN, Bennett WL, Gudzone KA, Cooper LA. Impact of physician BMI on obesity care and beliefs. *Obesity*. 2012; 20(5):999–1005. [PubMed: 22262162]
- Constantine RJ, Boaz T, Tandon R. Antipsychotic polypharmacy in the treatment of children and adolescents in the fee-for-service component of a large state Medicaid program. *Clinical Therapeutics*. 2010; 32(5):949–959. DOI: 10.1016/j.clinthera.2010.04.021 [PubMed: 20685503]
- Correll CU, Manu P, Olshanskiy V, Napolitano B, Kane JM, Malhotra AK. Cardiometabolic risk of second-generation antipsychotic medications during first-time use in children and adolescents. *Journal of the American Medical Association*. 2009; 302(16):1765–1773. DOI: 10.1001/jama.2009.1549 [PubMed: 19861668]

- Cummings P. Methods for estimating adjusted risk ratios. *Stata Journal*. 2009; 9(2):175.
- De Hert M, Dobbelaere M, Sheridan EM, Cohen D, Correll CU. Metabolic and endocrine adverse effects of second-generation antipsychotics in children and adolescents: A systematic review of randomized, placebo controlled trials and guidelines for clinical practice. *European Psychiatry*. 2011; 26(3):144–158. DOI: 10.1016/j.eurpsy.2010.09.011 [PubMed: 21295450]
- Greenland S. Model-based estimation of relative risks and other epidemiologic measures in studies of common outcomes and in case-control studies. *American Journal of Epidemiology*. 2004; 160(4): 301–305. [PubMed: 15286014]
- Gustafson T, Sarwer D. Childhood sexual abuse and obesity. *Obesity Reviews*. 2004; 5(3):129–135. [PubMed: 15245381]
- Helton JJ, Liechty JM. Obesity prevalence among youth investigated for maltreatment in the United States. *Child Abuse and Neglect*. 2014; 38(4):768–775. DOI: 10.1016/j.chiabu.2013.08.011 [PubMed: 24035366]
- Jerrell JM, McIntyre RS. Adverse events in children and adolescents treated with antipsychotic medications. *Human Psychopharmacology*. 2008; 23(4):283–290. DOI: 10.1002/hup.932 [PubMed: 18302312]
- Jones E, Eyler AA, Nguyen L, Kong J, Brownson RC, Bailey JH. It's all in the lens: differences in views on obesity prevention between advocates and policy makers. *Childhood Obesity (Formerly Obesity and Weight Management)*. 2012; 8(3):243–250.
- Kelly AS, Barlow SE, Rao G, Inge TH, Hayman LL, Steinberger J, Daniels SR. Severe obesity in children and adolescents: identification, associated health risks, and treatment approaches a scientific statement from the American Heart Association. *Circulation*. 2013; 128(15):1689–1712. [PubMed: 24016455]
- Klein DJ, Cottingham EM, Sorter M, Barton BA, Morrison JA. A randomized, double-blind, placebo-controlled trial of metformin treatment of weight gain associated with initiation of atypical antipsychotic therapy in children and adolescents. *American Journal of Psychiatry*. 2006; 163(12): 2072–2079. DOI: 10.1176/ajp.2006.163.12.2072 [PubMed: 17151157]
- Mason SM, Maclehorse RF, Katz-Wise SL, Austin SB, Neumark-Sztainer D, Harlow BL, Rich-Edwards JW. Childhood abuse victimization, stress-related eating, and weight status in young women. *Annals of Epidemiology*. 2015; 25(10):760–766. e762. [PubMed: 26272779]
- Mumford EA, Liu W, Hair EC, Yu TC. Concurrent trajectories of BMI and mental health patterns in emerging adulthood. *Social Science and Medicine*. 2013; 98:1–7. [PubMed: 24331875]
- Olfson M, Blanco C, Liu SM, Wang S, Correll CU. National trends in the office-based treatment of children, adolescents, and adults with antipsychotics. *Archives of General Psychiatry*. 2012; 69(12):1247–1256. DOI: 10.1001/archgenpsychiatry.2012.647 [PubMed: 22868273]
- Post R, Mainous A, Gergorie S, Knoll M, Diaz V, Sexena S. The Influence of Physician Acknowledgement of Patients' Weight Status on Patient Perceptions of Overweight and Obesity in the United States. *Archives of Internal Medicine*. 2011; 171(4):316–321. [PubMed: 21357807]
- Patel A, Madsen K, Maselli J, Caban M, Stafford R, Hersch A. Underdiagnosis of pediatric obesity during outpatient preventive care visits. *Academic Pediatrics*. 2010; 10(6):405–409. [PubMed: 21075322]
- Raghavan R, Brown DS, Allaire BT, Garfield LD, Ross RE, Hedeker D. Challenges in using Medicaid claims to ascertain child maltreatment. *Child Maltreatment*. 2015; 20(2):83–91. [PubMed: 25159585]
- Raghavan R, Zima BT, Andersen RM, Leibowitz AA, Schuster MA, Landsverk J. Psychotropic medication use in a national probability sample of children in the child welfare system. *Journal of Child and Adolescent Psychopharmacology*. 2005; 15(1):97–106. DOI: 10.1089/cap.2005.15.97 [PubMed: 15741791]
- Reekie J, Hosking SP, Prakash C, Kao KT, Juonala M, Sabin MA. The effect of antidepressants and antipsychotics on weight gain in children and adolescents. *Obesity Reviews*. 2015; 16(7):566–580. DOI: 10.1111/obr.12284 [PubMed: 26016407]
- Richardson AS, Dietz W, Gordon-Larsen P. The association between childhood sexual and physical abuse with incident adult severe obesity across 13 years of the National Longitudinal Study of Adolescent Health. *Pediatric Obesity*. 2014; 9(5):351–361. [PubMed: 24115589]

- Rojo LE, Gaspar PA, Silva H, Risco L, Arena P, Cubillos-Robles K, Jara B. Metabolic syndrome and obesity among users of second generation antipsychotics: A global challenge for modern psychopharmacology. *Pharmacological Research*. 2015; doi: 10.1016/j.phrs.2015.07.022
- Schneiderman JU, Smith C, Arnold-Clark JS, Fuentes J, Duan L. Weight changes in children in foster care for 1 year. *Child Abuse and Neglect*. 2013a; 37(10):832–840. DOI: 10.1016/j.chiabu.2013.02.005 [PubMed: 23499524]
- Schneiderman JU, Smith C, Arnold-Clark JS, Fuentes J, Duan L, Palinkas LA. Overweight and obesity among Hispanic children entering foster care: a preliminary examination of polyvictimization. *Child Maltreatment*. 2013b; 18(4):264–273. DOI: 10.1177/1077559513508236 [PubMed: 24137014]
- Shin SH, Miller DP. A longitudinal examination of childhood maltreatment and adolescent obesity: results from the National Longitudinal Study of Adolescent Health (AddHealth) Study. *Child Abuse and Neglect*. 2012; 36(2):84–94. [PubMed: 22398304]
- Skelton JA, Cook SR, Auinger P, Klein JD, Barlow SE. Prevalence and trends of severe obesity among US children and adolescents. *Academic Pediatrics*. 2009; 9(5):322–329. DOI: 10.1016/j.acap.2009.04.005 [PubMed: 19560993]
- Skinner AC, Perrin EM, Moss LA, Skelton JA. Cardiometabolic risks and severity of obesity in children and young adults. *New England Journal of Medicine*. 2015; 373(14):1307–1317. [PubMed: 26422721]
- Steele JS, Buchi KF. Medical and mental health of children entering the Utah foster care system. *Pediatrics*. 2008; 122(3):e703–709. DOI: 10.1542/peds.2008-0360 [PubMed: 18762506]
- Tran AR, Zito JM, Safer DJ, Hundley SD. National trends in pediatric use of anticonvulsants. *Psychiatric Services*. 2012; 63(11):1095–1101. DOI: 10.1176/appi.ps.201100547 [PubMed: 22983637]
- U.S. Department of Health Human Services. The adoption and foster care analysis and reporting system (AFCARS) report. Washington, DC: U.S. Department of Health and Human Services; 2013.
- Wozniak J, Mick E, Waxmonsky J, Kotarski M, Hantsoo L, Biederman J. Comparison of open-label, 8-week trials of olanzapine monotherapy and topiramate augmentation of olanzapine for the treatment of pediatric bipolar disorder. *Journal of Child and Adolescent Psychopharmacology*. 2009; 19(5):539–545. DOI: 10.1089/cap.2009.0042 [PubMed: 19877978]
- Zito JM, Safer DJ, Sai D, Gardner JF, Thomas D, Coombes P, Mendez-Lewis M. Psychotropic medication patterns among youth in foster care. *Pediatrics*. 2008; 121(1):e157–163. DOI: 10.1542/peds.2007-0212 [PubMed: 18166534]

HIGHLIGHTS

- Foster care adolescents are at an increased risk of morbid obesity and for second generation antipsychotic (SGA) use
- Medicaid claims files were examined
- Risk of morbid obesity diagnosis higher for female, non-white, older adolescents
- Quetiapine and clozapine associated with a morbid obesity risk increase of more than 2.5 times.
- Two or more SGAs raised the risk for a morbid obesity diagnosis fivefold.

Table 1

Demographic characteristics of diagnosed morbidly obese adolescents in foster care and on Medicaid, 2000–2003

Category Variable	Received Morbid Obesity Diagnosis (N=6,517)	Did Not Receive Morbid Obesity Diagnosis (N=1,255,289)	P-value
Gender			
Male	37.5%	51.9%	<0.01
Race/Ethnicity			
White	38.5%	41.8%	
Black	36.2%	38.3%	
Hispanic	7.9%	7.2%	
Unknown race	14.8%	10.7%	
Other race	2.6%	2.0%	<0.01
Age			
10	6.4%	11.2%	
11	7.2%	11.5%	
12	8.9%	11.7%	
13	10.9%	11.7%	
14	13.2%	11.7%	
15	14.2%	11.9%	
16	15.3%	11.8%	
17	15.1%	11.2%	
18	8.7%	7.3%	<0.01
Insurance			
FFS only	50.7%	50.5%	
PCCM only	1.3%	3.0%	
Mix of FFS/PCCM	0.6%	0.6%	
Other	26.9%	16.3%	
Ineligible	20.6%	29.6%	<0.01
Child Maltreatment Diagnosis			
Any code for child maltreatment	0.87%	0.35%	<0.01
State Obesity Rate			
Above average	43.6%	43.7%	0.84
Psychotropic Prescription			
Olanzapine	6.1%	2.6%	<0.01
Clozapine	0.4%	0.1%	<0.01
Risperidone	13.5%	6.7%	<0.01
Quetiapine	8.0%	2.5%	<0.01
SGA Polypharmacy			
None	79.1%	90.5%	
One of the above	19.5%	9.2%	
Two or more of the above	1.4%	0.3%	<0.01

Note: FFS = fee for service; PCCM = primary care case management

Table 2

Association of demographics and SGAs with morbid obesity diagnosis among adolescents in foster care enrolled Medicaid programs, 2000–2003

Covariate	Relative Risk (95% Confidence Interval)
Male	0.54 (0.51–0.57) **
White	1.00
Black	1.27 (1.18–1.35) **
Hispanic	1.17 (1.05–1.31) **
Unknown race	1.13 (1.01–1.27) **
Other race	1.31 (1.10–1.57) **
Age 10	1.00
Age 11	1.09 (0.97–1.24)
Age 12	1.30 (1.15–1.48) **
Age 13	1.59 (1.41–1.79) **
Age 14	1.92 (1.71–2.16) **
Age 15	2.05 (1.82–2.30) **
Age 16	2.27 (2.02–2.54) **
Age 17	2.43 (2.17–2.73) **
Age 18	2.19 (1.92–2.49) **
Insurance	
FFS only	1.00
PCCM only	1.36 (1.05–1.77) **
Mix of FFS/PCCM	1.51 (1.07–2.14) **
Other	1.28 (1.09–1.49) **
Ineligible	0.92 (0.82–1.04)
Child maltreatment diagnosis	1.71 (1.30–2.25) **
Olanzapine	1.96 (1.75–2.20) **
Clozapine	2.80 (1.70–4.61) **
Risperidone	2.28 (2.09–2.48) **
Quetiapine	2.73 (2.46–3.04) **

** Significant at the $p < 0.05$ level.

Notes: FFS = fee for service; PCCM = primary care case management; SGA = second generation antipsychotic. 95% confidence interval presented in parentheses. State fixed effects (not shown) were included in the regression.

Table 3

Association of multiple SGAs with morbid obesity diagnosis among adolescents in foster care enrolled in Medicaid programs, 2000–2003

Polypharmacy	Relative Risk (95% Confidence Interval)
No SGAs	1.00
One SGAs	3.05 (2.86–3.27) **
Two or more SGAs	5.21 (4.21–6.44) **

** Significant at the $p < 0.05$ level.

Notes: SGA = second generation antipsychotic. 95% confidence interval presented in parentheses. State fixed effects, sex, race, insurance, state obesity levels, and age (all not shown) were included in the regression.