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Patterns of Psychotropic Medication at Admission for Youth in Residential Care

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Abstract

High levels of psychotropic medication use and polypharmacy are common for emotionally and behaviorally troubled youth entering residential care. Polypharmacy has often been characterized as an especially serious problem in this vulnerable population. Latent Class Analysis was used to identify medication subgroups for 636 youth in an intensive residential program. Additionally, auxiliary analyses (e.g., diagnoses, demographics, expressed problem behaviors) were used to identify the personal and behavioral attributes associated with individuals in each of the latent classes. Three distinct medication patterns emerged: low/no psychotropic medication, the combination of antidepressant and antipsychotic medications, and multiple psychotropic medications. The latent classes were significantly different from one another on 12 of the 14 variables, helping explicate how patient and clinical characteristics underlie patterns of psychotropic medication use. Findings of this study, combined with additional research, hold promise for leading to improved, youth-centered prescribing practices. Our findings also highlight the need for careful monitoring of the types and range of medications that some youth are prescribed, and research on how youth with certain background characteristics are more likely to get prescribed multiple psychotropic medications. For youth experiencing higher levels of psychotropic polypharmacy, medication regimens need thoughtful reassessment using the principle of sufficiency as the foundation for medication management.

Keywords: Psychotropic medication, Polypharmacy, Residential care, Children and adolescents, Latent Class Analysis

Introduction

For youth in need of emotional and behavioral intervention, oftentimes there are high levels of psychotropic medication use (Comer et al. 2010). For example, the use of off-label (i.e., prescribing a drug for a condition other than that for which it has been officially approved) atypical antipsychotic medications has increased over the last 10 years (Harrison et al. 2012; Olfson et al. 2010; Rubin et al. 2012). A review of relevant literature found that polypharmacy (i.e., treatment using two or more psychotropic medications) increased 5.1 fold, from 4.8% to 24.7% for youth on a stimulant between 1996 and 2002 (Safer et al. 2003). An examination of Medicaid claims found a 6.2 fold increase in polypharmacy from 6.7% to 41.6% for depressed adolescents between 1996 and 2005 (McIntyre and Jerrell 2009). Similarly, between 1996 and 2007, the polypharmacy rate increased from 14% to 20% for youth prescribed psychotropic medication by an office-based physician (Comer et al. 2010), and has been reported to be as high as 60% for youth seeing an office-based psychiatrist (Mojtabai and Olfson 2010). An additional challenge in this area is that youth experiencing polypharmacy tend to be on medications from multiple psychotropic medication categories (e.g., mood

stabilizers and antipsychotics) and even prescribed multiple medications within any given category (Comer et al. 2010; Spellman et al. 2010). The growing trend for youth to be on two or more medications far outpaces our capacity to evaluate and assess efficacy and safety (Saldaña et al. 2014; Tishler and Reiss 2012; Vitiello 2007). There is particular concern in relation to the adverse effects of psychotropic medications to the developing brain and body of children and adolescents (Correll and Carlson 2006; Singh and Chang 2012).

Youth in out-of-home care settings are at much higher risk for polypharmacy, and it is especially prevalent in residential care settings where it is more the rule than the exception (Brüggemann et al. 2008). Indeed, research examining youth in intensive, restrictive residential programs has found that between 78% and 88% of youth were on a psychotropic medication at admission, with 57–67% being on two or more psychotropic medications (Huefner et al. 2014; Lyons et al. 2004). Although elevated rates of polypharmacy use might be due to higher mental health needs, this practice nonetheless poses a much higher chance of potential health risks (Huefner et al. 2014; GAO 2011). Most psychotropic medication research has focused on monopharmacy (i.e., treatment using a single medication), whereas relatively little has examined polypharmacy (Taylor 2010; Vitiello 2005). While some polypharmacy combinations are supported by effectiveness trials, most are of unproven efficacy and may put patients at increased risk of drug interactions with uncertain gains in terms of quality of care or improved clinical outcomes (Mojtabai and Olfson 2010). For example, although it has been observed that the use of combined medications for youth with comorbid disorders or complex symptom presentation may be clinically justified and effective in certain instances (Gadow et al. 2016; Linton et al. 2013; Pappadopulos et al. 2003; Wilens 2009), these studies are almost exclusively based on case reports and small-scale, non-blind assessments (Safer et al. 2003).

More often than not, however, the psychotropic polypharmacy pattern for youth does not match a research-supported combination. For example, Pruitt and Kiser (2004) found the most frequently occurring multi-psychotropic combinations for children with serious emotional disturbance receiving treatment at a university school of medicine clinic were 1) mood stabilizer with an antidepressant or antipsychotic (9.4%), 2) antidepressant with a stimulant (9.4%), 3) stimulant with an alpha agonist (7%), and 4) mood stabilizer, antidepressant, antipsychotic, and alpha agonist (5%). The complexity of polypharmacy patterns following current practice for troubled youth presents a tremendous challenge to practitioners and researchers. Beyond the work of Pruitt and Kiser (2004), we do not yet know the common patterns, especially for those youth most likely to be on psychotropic medications (e.g., highly troubled emotionally and behaviorally disordered youth like those found in residential care settings). Additionally, because of exclusionary criteria utilized in randomized clinical trials, there is limited empirical data on the treatment of youths with complex and comorbid conditions (Martin et al. 2003).

Most psychotropic medication research has examined individual medications, or even psychotropic medication subtypes (e.g., stimulants, antipsychotics, antidepressants) in isolation, whereas research has shown that in practice they frequently are used in a complex array of combinations. To tap into these complex combinations, Latent Class Analysis (LCA) can be utilized. LCA is a person-centered analytic technique designed to identify subgroups of individuals with distinctive profiles/patterns (Jobe-Shields et al. 2015; Lanza et al. 2003). A key feature of LCA is that subgroup membership is not known and must be inferred from the data (Berlin et al. 2014). LCA has been used to identify underlying patterns of illegal drug and alcohol use, as well as levels of disturbance within individuals with posttraumatic stress disorder (e.g., Green et al. 2010; Hedden et al. 2010; Patra et al. 2009; Ramo et al. 2010). LCA has not, insofar as we can determine, been used to examine patterns of psychotropic polypharmacy. The promise of this research is to produce findings with practical and empirical significance for understanding and classifying psychotropic medication use in children and adolescents.

Prior research examining psychotropic polypharmacy has used a wide range of variables in order to better understand and explain what increases the likelihood of polypharmacy in child and adolescent populations. For instance, research has shown that psychotropic polypharmacy has been related to sex, race, age, maltreatment, and out-of-home placement history. Specifically, polypharmacy has been shown to be related to being male (Dean et al. 2006) and Caucasian (Raghavan and McMillen 2008), however the literature is inconsistent (e.g., Griffith et al. 2010; Logan et al. 2015). Polypharmacy is also related to being older at the time of admission (Dean et al. 2006), being younger at first out-of-home admission (Fite et al. 2008; Li et al. 2015), to having a history of maltreatment (Fontanella et al. 2009; Schilling and Christian 2014), and having experienced a greater number of out-of-home placements (Saldaña et al. 2014; Stambaugh et al. 2012). Additionally, researchers have also found that polypharmacy is related to clinical factors, such as diagnosis and current behavior problems (Logan et al. 2015; Raghavan and McMillen 2008). However, no research to date has examined these variables in relation to distinct patterns of polypharmacy reflecting specific combinations of medication use found among youth in a residential care setting. To address this gap, these variables will be used as predictors of medication classes identified via LCA.

This study represents an initial and unique attempt at identifying and describing naturally occurring groups of psychotropic medication usage among youth entering residential care, and if youth characteristics such as age, out-of-home placement history, diagnosis, and level of disruptive behavior are related to those patterns.

Method

Participants

The sample for this study included all youth who were admitted for the first time to an intensive residential program in the Midwest (US) between January 2008 and October 2014 (n = 636). The treatment model for this psychiatric residential treatment facility (PRTF) is based on a modified teaching-family model (Daly and Davis 2003; Daly et al. 1998). Requirements for admission into this program include having failed at other less restrictive placement settings, having at least one Axis I diagnosis, and having an IQ above 80. Comorbidity rates are fairly high in this population, with 68% of the youth having two or more classes of diagnosis (e.g., a behavioral disorder and a mood disorder). Of these youth, 340 (53.5%) were wards of the state and 271 (42.6%) had their stay funded by Medicaid. The overall sample means or percentages for the predictor variables used in the analysis are shown in Table 1.

Table 1. Sample means (SD) or percentages for the 14 predictor measures

	M or %
Age at first placement	10.2 (4.7)
Age at admission	14.3 (2.5)
Prior placement number	3.6 (4.4)
Male	54.2%
Caucasian	63.1%
Initial problem behavior	
Aggression	14.7
(29.9)	
Oppositional	37.9
(30.4)	
Hyperactivity	16.5 (16.9)
Covert	4.8 (6.5)
Internalizing	9.1 (8.6)
Victim	28.3%
Admission diagnosis	
Behavior disorder	84.0%
Mood disorder	57.7%
Other disorders	49.4%

Procedure

All data used in the study came from the organization's administrative database. Admission data were collected by admission counselors prior to entry to the program, medication data were collected by nursing staff at the time of admission, and initial problem behavior was collected by direct-care staff during the first two weeks in the program. The research protocols were reviewed and approved by the organization's internal review board (IRB) according to federal guidelines.

Measures

Demographics

Demographic variables extracted from the administrative database include: (a) gender, (b) age at admission, (c) number of prior placements, (d) age at first placement, (e) race (recoded to Caucasian/minority), and (f) whether youth had been sexually and/or physically abused (based upon history provided by the referral source).

Clinical Diagnosis

A comprehensive psychological assessment prior to admission was available for most youth. This assessment was conducted by licensed clinicians in the community who are not affiliated with the residential treatment facility. The order in which the diagnoses are listed in the administrative data base does not indicate primary vs. secondary diagnosis. The diagnoses listed for the youth were collapsed into three non-exclusive categories (i.e., youth could have one or more diagnoses): (1) behavior disorders, (2) mood disorders, and (3) other diagnoses (e.g., reactive attachment disorder).

Behavioral Incidents

Daily observations of significant youth behaviors come from direct observation of behaviors gathered in a clinical management tool called the Treatment Progress Checklist (TPC). The TPC is a modified version of Chamberlain's Parent Daily Report (Chamberlain et al. 2006; Chamberlain and Reid 1987). The TPC report logs all significant events (e.g., property damage, self-destructive behavior, physical assault) that occur at the setting during each of the three shifts each day. Each recorded incident includes a descriptive narrative of the behavior or event, and staff categorize each incident using at least one of 46 behavior codes. Each code has been operationalized so answers are consistent across staff entries. Some incidents may include more than one code. Direct-care staff record these events in a TPC (paper form) at the end of each shift for each child (one form per day, divided into three

sections, one section for each shift). All staff working that shift (between 9 and 14 individuals) collaboratively complete the TPC form for each youth. For this study, behavioral incidents were grouped into 5 general areas: oppositional, hyperactive, aggressive, internalizing, and covert. Oppositional behavior is an aggregate of arguing, complaining, defiance, irritable mood, not participating in program, and swearing and/or obscenities. Hyperactive behavior is an aggregate of fidgeting, homework incomplete, interrupting often, off-task behavior, and talking excessively. Aggressive behavior is an aggregate of physical aggression, physical assault, physical assault attempt, property damage, and threatening. Internalizing behavior is an aggregate of crying, negative self-statements, pouting, somatic complaints, and withdrawal. Covert behavior is an aggregate of inappropriate boundaries, lying/cheating, secretive/suspicious behavior, stealing, and teasing/provoking.

Staff are extensively trained to use the TPC and the reliability of the daily observation of initial problem behavior in this population has been established previously. Research using this behavioral coding process has found an 83.5% interjudge agreement in regards to the "reportability" of youth behavior between direct-care staff responding to 43 scenarios (Wright 2001). Additionally, research examining the reliability of the coding process within the population for this program found kappa coefficients between 0.66 and 0.97 for codes assigned for the same incident narratives (Larzelere 1996). Taken together, both at the level of reporting and coding, the behavioral coding process possesses adequate reliability.

The expression of problem behavior in youth often changes during the first few days in the PRTF. It frequently starts low and then escalates as youth become more familiar with and test the boundaries of their new environment. Moreover, the behavioral intervention itself is designed to reduce youth's problem behaviors, and significant reductions in the behaviors measured by the TPC occur over the first couple of months (Huefner and Vollmer 2014). We used the first two weeks of behavioral data in order to obtain stable data indicative behavioral problems at the time of admission that was relatively less impacted by suppression of the behavioral intervention.

Victimization

Victimization status was obtained from a form called the Presenting Problems Checklist (PPC), which is collected separately from all the other data used in this research. The PPC is used primarily by a separate division the organization, and is not systematically used by the PRTF for either clinical or administrative purposes (hence its use is sporadic). It is unlikely that completion of this form is based on any attribute of the youth entering the PRTF. The PPC is completed by admission staff based on information gleaned from the psychosocial history and other information collected in the admissions process, and contains a list of 50 problems (e.g., out of control of parental instruction, physically assaultive toward peers, school behavior problems, etc.). Three of the items (victim of neglect, victim of physical abuse, victim of sexual abuse) were used to create a dummy variable—having one or more of these items checked was scored as a "yes" for victimization. The program does not use a formal measure of victimization, so there is no way to determine victimization status for youth for whom a PPC was not completed.

Psychotropic Medications

All medications that the youth brought with them at the time of admission were recorded in the organization's database by a psychiatric nurse as part of the admission process. Youth are sent to this residential program primarily because they have behavioral issues (whether or not they have a formal behavioral disorder diagnosis). Many of their psychotropic medications at the time of admission are presumably aimed at helping them with their behavioral issues. From the information available to us, however, we cannot determine why youth were put on these medications, what other mediations have been tried, or even the extent to which the medications have impacted their behavior prior to entering the program. Complicating the matter, the psychotropic prescriptions for each youth were often made independently by a variety of prescribers (psychiatrists, pediatricians, general practitioners). Taken together, youth's complex treatment histories and multiple prescribers often result in medication patterns that are confusing to our psychiatrists and clinicians, as well as others (see Kingsbury et al. 2001; Rosenheck 2005).

For analysis, psychotropic medications were categorized into one of six categories: (1) antianxiety, (2) antidepressant, (3) antipsychotic, (4) mood stabilizer, (5) stimulant/NRI (norepinephrine reuptake inhibitor), or (6) alpha agonist. These categories are well established and widely used in psychotropic medication research (e.g., Jann et al. 2016; Olfson et al. 2009).

Data Analyses

LCA was used to identify subgroups of youth with unique profile of psychotropic medication use (Lanza et al. 2003). The LCA was conducted with Mplus version 7.3 (Muthén and Muthén 2012). In this study, the six medication categories were modeled as dichotomous indicators of a categorical latent variable representing subgroup membership. A series of LCAs were conducted with increasing numbers of classes, with fit statistics and the substantive meaning of the solutions being used

to determine the number of classes. Fit indices included the Bayesian Information Criteria (BIC), the Vuong-Lo-Mendell-Rubin Likelihood Ratio Test (VLMR-LRT), and the Bootstrapped Likelihood Ratio Test (BLRT). These indices, along with the substantive meaning, were used to determine the best fitting solution (Berlin et al. 2014). The result with the smallest BIC is considered to be the best fitting. The VLMR-LRT and the BLRT compare a solution with a specific number of classes to an answer with one less class. The null hypothesis for the VLMR-LRT and BLRT is that a model with k classes and one with k−1 classes are not different from each other. A decision to reject the null hypothesis means that a solution with k classes provides a better fit to the data.

The 3-step approach advanced by Asparouhov and Muthén (2014a,b) was used to examine the relation between subgroup membership and several variables. The 3-step approach was carried out in Mplus using the Auxiliary command (Muthén and Muthén 2012). The BCH (Block, Croon, & Hagenaars, 2004) option is used with the Auxiliary command to estimate mean-level differences between subgroup membership and continuous outcome variables (i.e., age at admission to the current program, prior number of out-of-home placements, and five classes of problem behavior [aggressive, oppositional, hyperactive, covert, and internalizing] expressed during the first two weeks of the current episode of care). Similarly, the DCAT (distal categorical outcome) command is used with the Auxiliary command to examine the relation between subgroup membership and categorical outcomes (i.e., biological sex, race, and history of victimization [yes/no], and three classes of admission diagnosis [behavior disorder, mood disorder, and other disorder]). The BCH and DCAT are the preferred options for examining class membership differences across continuous and categorical outcomes, respectively, and have been shown to perform well (Asparouhov and Muthén (2014a,b).

Each of the auxiliary analyses for the 14 predictors is an independent statistical analysis, creating the need to control for alpha. We chose to use Holm's step-down Bonferroni method to control for family-wise error rates (Holm 1979), with the family-wise error rate set at .05.

Complete data were available for 362 (56.9%) youth; 12 of the 14 variables used in the present study had missing data. Three variables did not have any missing data (psychotropic medications, age at admission, and gender), 11 variables had less than 2% of the sample missing (age at first placement, prior placement number, race, all 5 behavioral indicators, and the three diagnostic categories). Only one variable, victimization status, had substantial proportion of missing data at 43.1% missing. Missing data for this variable was due to administrative failure in inputting the data. The LCAs were based on complete data (psychotropic medications), while the auxiliary analyses implemented list-wise deletion (the N for each analysis is shown in Table 3).

Results

Table 2 shows the fit statistics for three LCA models (2, 3, and 4 class models) that were estimated. Examination of the fit statistics indicated that the 3-class model was the best fit for the data. The BIC, VLMR-LRT, and BLRT all indicated that the 3-class solution provided the best fit to the data. We also examined the substantive meaning of the 2, 3, and 4 class models. The 3-class solution seemed to provide the most conceptually meaningful solution. Entropy for the 3-class solution was acceptable (.70). The pattern for the three class solution across the medication categories is shown in Fig. 1. The three medication classes are (1) low/no psychotropic medications, (2) antidepressant and antipsychotic medications, and (3) multiple psychotropic medications. Table 3 shows that there were significant differences between the 3 latent classes for 12 of the 14 predictor variables and lists the raw-score averages. These differences are discussed below.

Table 2. Fit statistics for one, two, three, and four class models

Number of classes	Log likelihood	Number of free parameters	BIC	VLMR-LRT	BLRT	Entropy
1	−2037	6	4112.8	n/a	n/a	n/a
2	−1887	13	3857.9	293.6*	300.1*	0.87
3	−1852.7	20	3834.5	67.09*	68.6*	0.70
4	−1849.8	27	3873.8	5.71	5.8	0.76

The null hypothesis for the Vuong-Lo-Mendell-Rubin Likelihood Ratio Test (VLMR-LRT) and the Bootstrapped Likelihood Ratio Test (BLRT) is that models with k classes and one with k−1 classes are not different from each other. A decision to reject the null hypothesis means that a solution with k classes provides a better fit to the data. Underline indicates best fitting solution for a particular fit statistic.

* $p < .001$

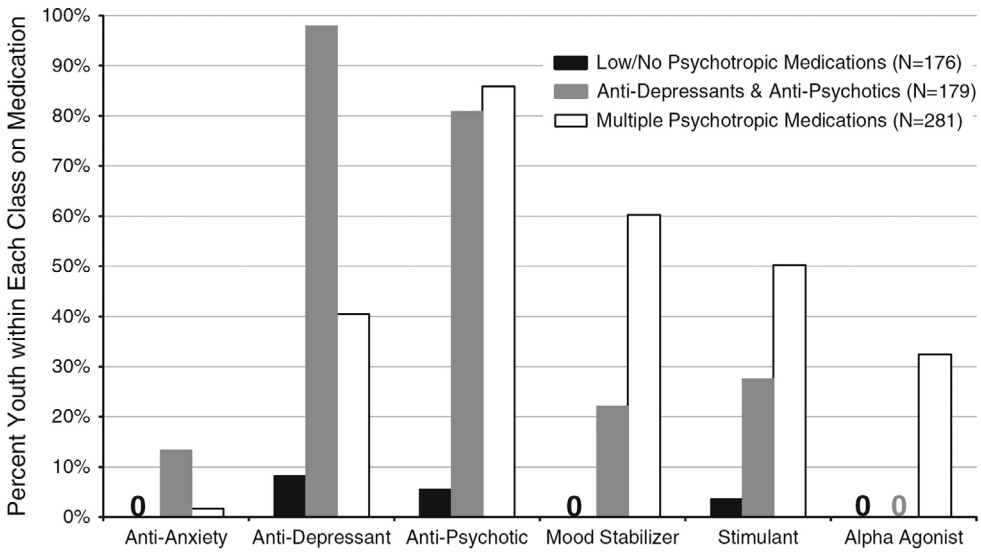

Fig. 1. Psychotropic medication patterns for the three class solution (class labels and percentage of sample shown) across the medication categories

Table 3. Univariate Chi-square scores testing for significant differences for the LCA classes across the 14 predictor measures

			Low/no psychotropic medications (n = 176)		Anti-depressants/ anti-psychotics (n = 179)		Multiple psychotropic medications (n = 281)	
	Overall χ^2	N	Mean	S.E.	Mean	S.E.	Mean	S.E.
Age at first placement	35.20*	633	10.84^{a}	0.39	12.05^{b}	0.45	8.58^{a}	0.32
Age at admission	73.34*	636	15.05^{a}	0.17	15.59^{a}	0.22	12.95^{b}	0.21
Prior placement number	6.15	634	4.53	0.48	3.11	0.29	3.40	0.32
Male	27.24*	636	$61.2\%^{a}$	4.3	$31.0\%^{b}$	5.2	$71.8\%^{a}$	4.8
Caucasian	7.26*	624	$55.1\%^{a}$	4.0	$71.0\%^{b}$	5.5	$65.4\%^{ab}$	3.6
Initial problem behavior†								
Aggression	35.81*	636	7.26^{a}	1.32	2.39^{b}	2.10	27.06^{c}	3.00
Oppositional	28.17*	636	36.55^{a}	2.57	25.23^{b}	2.63	46.85^{c}	2.37
Hyperactivity	47.75*	636	14.34^{a}	1.07	7.28^{b}	1.45	23.75^{c}	1.47
Covert	15.08*	636	4.70^{a}	0.49	2.72^{b}	0.50	6.15^{a}	0.58
Internalizing	66.84*	636	5.22^{a}	0.50	7.45^{b}	0.80	12.43^{c}	0.70
Victim‡	12.16*	362	$34.8\%^{a}$	5.7	$64.5\%^{b}$	5.8	$47.6\%^{ab}$	4.4
Admission diagnosis								
Behavior disorder	21.09*	635	$88.4\%^{a}$	.028	$63.6\%^{b}$	.069	$96.5\%^{c}$	.019
Mood disorder	66.02*	635	$34.6\%^{a}$	.040	$84.1\%^{b}$	.046	$54.2\%^{c}$	.039
Other disorders	0.40	635	48.1%	.041	47.9%	.048	51.3%	.035

† Problem behavior during the first 2 weeks of episode of care.

‡ Victim status only available for a random subset of youth; see Method section for specific details.

* Significant $p < .05$ correcting for family-wise error using Holm's Bonferroni (Holm 1979).

The lettered superscripts following the class means indicate which means are statistically different; means that share a superscript letter are not significantly different.

Medication Latent Classes

Low/No Psychotropic Medication Class

More than a quarter of the youth are represented by the low/ no psychotropic medications latent class ($n = 176$, 28%). Most youth in this class were not on any psychotropic medication at the time of admission, with limited numbers on an antidepressant, antipsychotic, or a stimulant/NRI.

The low/no psychotropic medications youth had the highest number of prior placements ($M = 4.5$), but this was not significantly higher than the antidepressant

and antipsychotic medications youth. The initial levels of problem behavior for the low/no psychotropic medications class was significantly lower than the multiple psychotropic medications youth and significantly higher than the antidepressant and antipsychotic medications youth for all three of these behavioral categories. Additionally, the low/no psychotropic medications youth were significantly higher than the antidepressant and antipsychotic medications class for covert behaviors, and were significantly lower than the other classes for internalizing behavior ($M = 5.2$) problems. Low/no psychotropic medications youth also had the lowest levels of victimization, but this was only significantly lower than the antidepressant and antipsychotic medications youth. Conversely, the low/no psychotropic medications class had the highest percentage of minority youth (45%), but again this was only significantly different from the antidepressant and antipsychotic medications class. The level of aggression for the low/no psychotropic medications youth was significantly higher than the antidepressant and antipsychotic medications youth, but only about 25% of the level of aggression of the multiple psychotropic medications youth. While the levels for all types of problem behavior for this group were significantly lower than the multiple psychotropic medications class, they were equally likely to have a behavioral disorder diagnosis (94%) at the time of admission as the multiple psychotropic medications youth. Conversely, low/no psychotropic medications youth were the least likely to have a mood disorder diagnosis (24%) at admission. Low/no psychotropic medications youth had a significantly higher percentage of males than the antidepressant and antipsychotic medications class.

Antidepressant/Antipsychotic Class

More than a quarter of the youth fell into the antidepressant and antipsychotic medications latent class ($n = 179$; 28%). Almost every youth in this class was on an antidepressant at the time of admission (98%), with 81% also being on an antipsychotic. Lower numbers of these youth were on a stimulant (28%), mood stabilizer (22%), and/or antianxiety (13%) medication. Youth in this class were on an average of 2.9 psychotropic medications ($SD = 1.1$).

The antidepressant and antipsychotic medications youth had the oldest age at first out-of-home placement, which was significantly older than the low/no psychotropic medications and multiple psychotropic medications youth. They also had the oldest average age of admission to the current program, which was significantly older than the multiple psychotropic medications class. The antidepressant and antipsychotic medications youth had the lowest number of prior placements, but this was not significantly lower than the other groups. These youth had the highest rate of victimization (65%), which was significantly higher than only the low/no psychotropic medications youth. Antidepressant and antipsychotic medications youth were significantly more likely than the other groups to be female (69%), and significantly more likely than the low/no psychotropic medications class to be Caucasian (71%). The antidepressant and antipsychotic medications youth had significantly lower levels of aggression, oppositional, hyperactive, and covert problem behaviors during the first 2 weeks of program stay than either the low/no psychotropic medications or multiple psychotropic medications youth. This group's level of internalizing problem behavior was significantly higher than the low/no psychotropic medications youth and significantly lower than the multiple psychotropic medications youth. Antidepressant and antipsychotic medications youth were significantly less likely to have a behavioral disorder diagnosis and significantly more likely to have a mood disorder diagnosis than the other groups.

Multiple Psychotropic Medications Class

Just under half of the youth fit the multiple psychotropic medications class ($n = 281$; 44%). This group is characterized by the highest percentages of youth on antipsychotic (86%), mood stabilizer (60%), stimulant (50%), and alpha agonist (32%) medications. There were also multiple psychotropic medications youth on antidepressant (40%) and antianxiety (2%) medications. Youth in this class were on an average of 3.2 psychotropic medications ($SD = 1.6$).

The multiple psychotropic medications youth had the youngest average age at first out-of-home placement, but were only significantly younger than the antidepressant and antipsychotic medications youth. Multiple psychotropic medications youth were also younger at the time of admission to the current program, significantly younger than the other two groups. The multiple psychotropic medications class had the highest percentage of males (72%), but this was only significantly higher than the antidepressant and antipsychotic medications class. This group had significantly higher averages for aggression, oppositional, hyperactive, and internalizing problem behaviors than either of the other groups. They were significantly higher than the antidepressant and antipsychotic medications class for covert behaviors. The multiple psychotropic medications youth had the highest percentage of behavioral disorder diagnoses (98%), but this was only significantly higher than the antidepressant and antipsychotic medications class. Multiple psychotropic medications youths' level of mood disorder diagnosis was significantly lower than that for the antidepressant and antipsychotic medications youth, but significantly higher than that for the low/no psychotropic medications youth.

Discussion

We found that there are meaningful patterns in the prescribed psychotropic medications of youth who were admitted to an intensive psychiatric residential care program. Three distinct medication patterns emerged: the low/ no medication latent class (most youth in this group were on no psychotropic medication at all with a few on antidepressants, antipsychotics, or stimulant/NRIs), the antidepressants/antipsychotic medication latent class (youth typified by almost all being on an antidepressant, with significant numbers also being on an antipsychotic, stimulant/NRI, mood stabilizer, and/or antianxiety), and the multiple psychotropic medication latent class (had the highest average number medication class prescriptions, with most youth on an antipsychotic, with the highest numbers on a mood stabilizer, stimulant/NRI, or alpha agonist). Additionally, the use of auxiliary variables allowed a better understanding of the attributes and characteristics of the individuals in each of the latent groups.

The low/no psychotropic medications class accounted for about 28% of the youth. These were youth who tended to be older than the program average. This group also had the highest level of racial minority status (45%), which might indicate that these youth had less access to psychotropic medications. Previous research has found that even controlling for clinical acuity, African-American and Latino children were less likely to report past-year psychotropic medication use compared to Caucasian children (Leslie et al. 2003). There is a long history of research indicating that racial minorities appear to have unequal access to healthcare resources (Fossett et al. 1992; Raghavan et al. 2014), but this finding does not account for appropriateness of the medication (i.e., whether minorities might be under-medicated and/or Caucasians might be over-medicated). Previous research on the population examined in this study has found that there are overall reductions in the medication rates for youth (Huefner et al. 2014) and that there are not racial differences in outcomes (Ringle et al. 2012).

Conversely, low/no psychotropic medications youth had significantly lower levels of victimization (35%) than the antidepressant and antipsychotic medications class. However, this is just the percentage of youth with a record of physical or sexual abuse at some point, and does not indicate anything about the severity of that abuse. Perhaps a better approach would be to account for the extent (or count) of maltreatment (Felitti et al. 1998; Ippen et al. 2011). Research has found that higher levels of trauma are associated with higher levels of psychotropic medication (Anda et al. 2007; Brack et al. 2012). This may be another indication that youth in this class are not under-medicated. The antidepressant and antipsychotic medications class also accounted for about 28% of the youth. These youth were older in age at first-out-of-home placement, more likely to be female, and had the highest rate of victimization. These youth were also significantly more likely to have a mood disorder diagnosis, and almost all (98%) were admitted on an antidepressant. This group was least likely to have a behavioral disorder diagnosis (58%), which may be associated with the lower than average levels of aggressive, oppositional, hyperactive, and covert behavior during the first two weeks of program stay. Interestingly, this group was not the highest for internalizing behavior problems during the first two weeks of stay in the program. Histories of victimization and mood disorder are consistent with the use of antidepressants and antipsychotics (Brack et al. 2012; Burcu et al. 2014).

It is also notable that 81% in this group were also on an antipsychotic. The association of a mood disorder diagnosis with high levels of antipsychotics and antidepressants is suggestive of anxious depression or severe mood dysregulation (Carlson et al. 2009; Leibenluft 2011). This pattern has also been associated with a bipolar diagnosis (Carlson et al. 2009; Findling et al. 2011), and self-harm/suicidality (Brunner et al. 2014; Smith 2005). The antidepressant/antipsychotic combination aligns with an emerging effectiveness literature, and is suggestive of adjunct pharmacotherapy for treatment-resistive depression (e.g., anxious depression; Chena et al. 2011; Marcus et al. 2008; Papakostas 2010).

The multiple psychotropic medications class accounted for about 44% of the youth. Youth in this group had the highest average number of psychotropic medications (3.2) at the time of admission. Multiple psychotropic medications youth had the youngest average age at first out-of-home placement and the youngest average age at the time of admission to a psychiatric residential program. It is interesting that individuals in the multiple psychotropic medications latent class tended to be placed into out-of-home services at younger ages, which may indicate being more troubled and/or simply having had a longer period of time to accumulate more than one prescription for psychiatric medication.

Almost all of these youth had a behavior disorder diagnosis, and half of them had a mood disorder diagnosis at the time of admission. This group differs from the antidepressant and antipsychotic group in terms of behaviorally acting out. The degree of disturbance in these youth is reflected in their high levels of behavioral acting out during the first two weeks of their program stay. Multiple psychotropic medications youth expressed these higher rates of initial problem behavior in spite of entering the program on the highest average number of psychotropic medications. Previous research has indicated that much initial problem behavior for youth in the program studied here is aggressive in nature (Huefner et al. 2014). Aggressive behavior itself has been associated

with polypharmacy (Safer et al. 2003) and with dysregulated mood (Leibenluft 2011).

The pattern found in the multiple psychotropic medications latent class was similar to research which suggests that polypharmacy rates are highest for youth receiving antipsychotics (Dean et al. 2006). The high percentages of youth in this class concurrently on mood stabilizers, antipsychotics, and alpha agonists potentially is troubling as these all carry the potential for serious health-related side effects (Fontanella et al. 2009). The high rates of polypharmacy for this class may indicate a pattern where a high number of agents have been combined in an attempt to find a medication or combination of medications that effectively improves a youth's symptoms and behavior (Steiner and Karnik 2009). Some researchers have postulated that high pediatric polypharmacy rates result from insufficient trials of monopharmacy (e.g., inadequate dose, sufficient time frame, etc.), symptom-based prescribing, clinical encounter time constraints, managed care restrictions, and insufficient attention to psychosocial issues (Kingsbury et al. 2001; Rosenheck 2005).

Our results found that the multiple psychotropic medications latent class, while having the highest rates of behavioral diagnoses, was not significantly higher than the behavioral diagnosis rate for the low/no psychotropic medications class. However, it is very interesting to note that the multiple psychotropic medication class had significantly higher rates of initial problem behavior than either of the other medication classes (the exception being not significantly higher than the low/no psychotropic medications class rate for covert behavior). The last factor, initial problem behavior, might be seen as providing clinical justification for the high medication rates, but conversely, one could argue that problem behavior rates should be suppressed by the elevated levels of concomitant/adjunctive medications (Griffith et al. 2010), although problem behavior rates prior to medication administration were unknown in this sample.

Our results do show that the latent groups found in the prescribed psychotropic medications at admission were related to interesting patterns of clinical need. Arguably, if severe mood dysregulation is accurate for the youth in the antidepressant and antipsychotic medications latent class, then the pattern of psychotropic medications makes sense and is supported by research as an appropriate treatment for these youth. Conversely, the medication patterns seen in the multiple psychotropic medications class do not conform to any supported clinical practice and is suspect by its apparent excess. On the other hand, given admission to an intensive residential program which serves youth with high levels of behavioral and emotional disturbance, there is the possibility that the low/no psychotropic medication latent class may be under-medicated. In fact, that all these youth have been admitted to an intensive residential treatment program suggests that their medication regimens need thoughtful reassessment using the principle of sufficiency as the foundation for medication management (i.e., using just enough medication as clinically indicated; Bellonci and Huefner 2014).

This study examined medication patterns at the time of admission to an intensive residential treatment center, which is a helpful initial step in understanding the differing needs and challenges of youth with emotional and behavioral problems. Future research needs to look at how patterns of psychotropic medication use change over time for this population of youth. For example, what psychotropic medications are these youth on at the time of discharge, and do changes in medication correspond to changes in their diagnostic formulation? Additionally, are there differences in how youth in the different latent classes respond to the program intervention? Are youth in the low/no psychotropic medications class more likely to have a psychotropic medication added, and the multiple psychotropic medications class to have psychotropic medications dropped? The adequacy of pharmacotherapy to meet the clinical needs of these youth was not addressed in this study, and also needs to be addressed in future research. There is a need for longitudinal research that focuses on the relationship between placement history and psychotropic medication trials. Finally, there is a strong need for future research to examine the issue of medication dosage data in children and adolescents. What is the relationship between dosage and issues like treatment effectiveness, practitioner conformity to practice guidelines, polypharmacy, and side effects?

One limitation of this study is the lack of standardized measures of psychopathology. Such measures were only available for a limited number of the youth in the study. With the caveat that we only looked at broad diagnostic categories and level of troubled behavior during the first two weeks in the program, the results reported here emphasize the need to reassess children's clinical and pharmacological therapeutic needs. A second limitation is that the Auxiliary command in Mplus does not allow for the examination of multiple outcome variables simultaneously. As such, we are not able to investigate the three diagnostic dimensions together, and this limits the conclusions that we can make about the specificity of the relation between class membership and diagnosis. However, our analyses take a significant first step toward characterizing psychotropic medication use patterns among high-risk youth using LCA and provide a foundation on which future studies can build. Another limitation is that we only looked at youth admitted to one facility located in the Midwest. As it has been noted that there can be regional patterns of psychotropic medication prescription (Aman et al. 2005; Radigan et al. 2005; Rawal et al. 2004), it is possible that our results

reflect such a regional pattern. It should be noted, however, that the overall levels of psychotropic medication use found in these programs are consistent with those found in similar programs in other parts of the country (Breland-Noble et al. 2004; Connor et al. 1998; Ryan et al. 2008). Last of all, the PRTF does not use a systematic measure of victimization and the victimization data used in this research comes from a form that is inconsistently completed by admissions staff. Both these issues create a very real limitation for the use of the victimization data available to us, but we deemed victimization status sufficiently important to include it in the analysis.

Our results are an initial effort towards grouping and describing different classes of psychotropic medication usage among youth entering an intensive residential care program. Our findings highlight that many youth in residential care are on multiple psychotropic medications, and that there is a critical need to evaluate this practice. Our results also help explicate the patient and clinical characteristics that underlie the latent psychotropic medication classes. These findings highlight the need for more careful monitoring of the types and range of medications that youth are prescribed. It is our belief that this information, and that of further research examining the patterns of pediatric psychotropic medication use, will ultimately lead to improved, youth-centered prescribing practices.

Compliance with Ethical Standards

Conflict of interest — No external funding supported any aspect of this study. None of the authors has any conflicting interest.

Research Involving Human Participants and/or Animals — The research protocols were reviewed and approved by the organization's internal review board (IRB) according to federal guidelines (as mentioned in the manuscript in the Procedure section).

Informed Consent — This research was based on archival data and so informed consent was not required by the IRB.

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