Title of Project	Epidemiology, Exploration, and Evaluation: Addressing potentially dangerous medications in children on Medicaid with a mental health diagnosis
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2. STRUCTURED ABSTRACT (250 word maximum)

Purpose: 1) Describe the epidemiology of potentially dangerous (PD) behavioral health medications (BMHRx) use in children; 2) analyze the impact of specified policies on PD BMHRx practices; and 3) survey clinical practices regarding Med Rec practices. **Scope:** Children and young adults (to age 21) enrolled in NY State Medicaid in 2008-2014, and practices serving them. **Methods:** Cross-sectional and time-series analyses of Medicaid encounter and pharmacy data, incorporating accepted schemas for identifying BMHRx and Behavioral Health diagnoses (BMHDx); SurveyMonkey of clinical practices using survey-derived AHRQ-funded Collaboration for Advancing Pediatric Quality Measures Medication Reconciliation measures. **Results:** Fifteen percent of 0-21 years olds received BMHRx, varying by age (5% <age 6, 17% age 6-11, 23.4% age 12-17, and 21% age 18-20 years), and BMHDx. BMHDx and BMHRx were associated with increased Emergency Department (ED) use and hospitalization, not explained fully by visits primarily for BMHDx. Of those filling BMHRx, 38% filled two or more medications concurrently for 30 or more days; 15/1000 in 2008 filled BMHRx for contraindicated pairs of medications, down to 7/1000 in 2014, with >90% involving ziprasidone use. Likely off-label BMHRx use (LOLU) was common, in 36% (2008) of children, down to 24% in 2014, when LOLU was most common in young adults age 18-20 years (33%) and least common in children age 6-11 years (20%). A patient-centered medical home was not protective for DDI or LOLU. Moving to prescription carve-out was associated with reduction of PD BMHRx use. Despite nearly universal e-prescribing, Med Rec practices varied greatly and were not highly sophisticated. **Key Words:** Medicaid, Behavioral Health, Pharmacoepidemiology, Polypharmacy, Inappropriate Care, Medication Reconciliation (Words = 248)

3. PURPOSE (Objectives of the Study)

Our work was guided by the following three purposes:

Purpose 1: Describe in detail the epidemiology of patient safety in ambulatory care settings, focusing on medication safety in children with mental health diagnoses who are enrolled in New York State Medicaid

Purpose 2: Describe differences in potentially dangerous medication practices associated with two structural characteristics

(a) Receipt of primary care in a National Committee for Quality Assurance (NCQA)-recognized patient-centered medical home (PCMH)
(b) A new state policy ("carve-in") that assigns responsibility to manage the prescription pharmaceutical insurance benefit to managed care plans rather than to the state Medicaid program and

Purpose 3: Describe medication reconciliation practices of physician practices in NY State that serve children in NY Medicaid with behavioral and mental health diagnoses (BMHDx)

4. SCOPE (Background, Context, Settings, Participants, Incidence, Prevalence)

Public health insurance programs, Medicaid and CHIP, insure nearly half of children in New York State and may exceed 40% nationally.[1,2] With the passage of the Affordable Care Act in March 2010 and the resulting expansion of Medicaid in New York State, the number children insured by Medicaid in NY has rapidly increased. We compared December 2014 Medicaid enrollment data to 2014 NY State census estimates and found that the majority (53%) of children ages 0-5 years are insured by Medicaid; 47% of all children 0-18 years in NY State are insured by Medicaid. Mental health diagnoses are common in children. In 2013, preliminary data identified more than 183,000 children in NYS Medicaid (of whom more than 132,000, or 72%, were in Medicaid Managed Care [MMC]) who had at least one ambulatory encounter with at least one mental health diagnosis in 2013.

Medication safety is an ongoing concern for children, with an evident interest in the safety of mental health medications, particularly of second-generation ("atypical") antipsychotics (SGA), for children.[6,8] A CMS pamphlet[9,10,11] encourages judicious use; the Institute for Safe Medication Practices (ISMP) published concerns about their use[12]; and an Investigator General (IG) Report scrutinized the potentially dangerous off-label use of SGA in five states, including New York.[3]

This project undertakes a deep dive into the epidemiology of potentially dangerous medication practices (PDMP) to explore and evaluate interventions that may improve patient protections and to assess the epidemiology of medication safety and the nature of medication reconciliation (med rec) practices. Concerns about psychotropics in children and in Medicaid are well documented in the literature.[3,8,13-26] Despite preferences of child and adolescent psychiatrists[27] to limit care to the recommended (labeled) use of

psychotropic medications, large pluralities of off-label use are found in practice, with adverse consequences and without obvious satisfactory solutions.[3,22,28-33] Enhanced medication reconciliation has been recommended.[34-42] The patient-centered medical home (PCMH) has been suggested as an approach to enhance coordination of care, and a PCMH provides care to half or more children in NYS Medicaid. In October 2011, NYS MMC moved from a state-run pharmacy benefit to instead 'carve it in' to the Managed Care vendor contracts.

In a search for more nuanced and child-focused measures of med rec, AHRQ and CMS assigned the CAPQuaM consortium (Collaboration for Advancing Pediatric Quality Measures) to develop measures of medication reconciliation, including measures optimized for MH. CAPQuaM convened two multidisciplinary panels of national experts to develop guidelines regarding med rec to serve as the basis for the measures. The recommendations of the two panels converged to define a guideline offering a comprehensive vision for an enhanced med rec process that was used to develop the project's survey instrument. The current project focuses on a vulnerable AHRQ priority population: children in the NY Medicaid program with a mental health diagnosis receiving ambulatory care during the study period.

5. METHODS (Study Design, Data Sources/Collection, Interventions, Measures, Limitations)

All work was considered exempt from the perspective of the Case Western Reserve IRB; the NY State Department of Health IRB reviewed and approved all activities that involved clinical or practice-related data.

Overall Design: Cross-sectional epidemiological study using data from New York State Medicaid, each year from 2008-2014. Though we have conducted analyses up to 2016, we choose to present data from this range of years, all of which used ICD-9, as available and complete. In consultation with our partners at the NY State Department of Health (NYSDOH), we concluded that the change in 2015 to ICD-10 would result in sufficient alterations in findings that we did not have the resources to study and overcome. The Aim 1 analyses are interrelated to and created variables for the Aim 2 analyses; therefore, they are presented in an integrated manner. Space limitations require us to prioritize our presentation of methods and results. We also conducted an emailed survey of clinical practices serving NYS Medicaid children and young adults with Behavioral or Mental Health Diagnoses (BMHDx) using SurveyMonkey.

AIMS 1 and 2 Methodology

Aim 1 Intention: Describe in detail the epidemiology of patient safety in ambulatory care settings, focusing on medication safety in children with mental health diagnoses who are enrolled in New York State Medicaid

Aim 2 Intention: Assess the relationship of two key structural characteristics, one system (NYS Medicaid move from managing the policy benefit as a *Carve In* to a *Carve Out*) and one practice level (attainment of certification as an NCQA-accredited patient-centered medical home [PCMH]), to potentially dangerous medication practices.

Study Population We identified serial cohorts for each calendar year from 2008 through 2014 using NYS Medicaid data and identified those with behavioral or mental health diagnoses (BMHDx) or BMHRx, as described below. We excluded those over 21 years of age as of their last enrollment month of the year and those who were dually enrolled in Medicare. Other member demographics, including language spoken, race, 3M clinical risk group, and gender, were pulled from member enrollment data for the first month of enrollment during the calendar year. When a diagnosis code on those members' claims or encounters matched a code on a list of HEDIS or CAPQuaM "Med Rec" mental health ICD-9 codes, the member was flagged as having a behavioral or mental health diagnosis (BMHDx). When an NDC code on those members' claims or encounters matched a code from a list of behavioral health prescriptions defined by HEDIS and RxNorm, the member was flagged as having a behavioral or mental health prescription (BMHRx). The study population grew from 1,916,588 in 2008 to 2,430,826 in 2014. The number of children with BMHDx grew from 261,895 in 2008 (14% of 2008 study population) to 422,486 in 2014 (17% of 2014 study population). The number of children with BMHRx grew from 91,745 in 2008 (5%) to 141,363 in 2014 (6%).

To define behavioral/mental health diagnoses, a list of diagnoses was compiled based on the AHRQ CCS software and several Healthcare Effectiveness Data and Information Set (HEDIS) behavioral health measures that required identifying people with mental and behavioral health diagnoses through the HEDIS® value sets.[11,12] These HEDIS® measures included (1) Follow-up Care for Children Prescribed ADHD Medication, (2) Antidepressant Medication Management, (3) Utilization of the PHQ-9 to Monitor Depression Symptoms for Adolescents and Adults, (4) Diabetes Screening for People with Schizophrenia or Bipolar Disorder Who Are

Using Antipsychotic Medications, (5) Follow-up After Hospitalization for a Mental Illness, (6) Initiation and Engagement of Alcohol and Other Drug Dependence Treatment, (7) Adherence to Antipsychotic Medications for Individuals With Schizophrenia, and (8) Ambulatory Care. The list of diagnoses was then reviewed, and diagnoses were grouped into diagnostic classes by topic experts on the team, including Pincus, Shemesh, and Kleinman. Diagnostic classes included ADHD, anxiety, chronic and acute stress reactions, conduct disorder, depression, dementia, eating disorders, gender identity codes, learning, mood disorder, oppositional, peripartum mental disorders, personality disorder, pervasive, psychosis, sexual disorder, sleep disorder, somatoform, substance/alcohol use, suicide/self-injury, tic disorders, and other.[2] Behavioral/mental health diagnoses were considered present if the ICD-9-CM codes for the above-noted diagnostic classes appeared in any position on any Medicaid claim or encounter in the analysis year.

Medications were classified as BMHRx using NDC codes, the National Library of Medicine RxNorm ontology, and HEDIS®. Drug classes included alpha-2 receptor agonists, central nervous system (CNS) stimulants, first-generation antipsychotic medications, miscellaneous ADHD medications, miscellaneous antidepressants, monoamine oxidase inhibitors, phenothiazine antipsychotics, phenylpiperazine antidepressants, psychotherapeutic combinations, serotonin and norepinephrine reuptake inhibitor (SNRI) antidepressants, selective serotonin reuptake inhibitor (SSRI) antidepressants, second-generation antipsychotic medications, tetracyclic antidepressants, tricyclic antidepressants, anti-anxiety agents, bipolar disorder agents, anticonvulsants, and benzodiazepine/anticholinergics/antispasmodics.

Data Sources The primary sources of data were from NYS Medicaid pharmacy and FFS claim and MMC encounter data. No continuous enrollment criteria were applied; therefore, patients enrolled at any point in the year and for any amount of time were included in the study. Those eligible for both Medicare and Medicaid (i.e., “dual eligible”) were excluded, because Medicare is the primary payer for pharmacy and claims data were inaccessible.

Demographic information included gender, race/ethnicity, county of residence, age (calculated from date of birth), receipt of cash assistance (public assistance), insurance type (MMC vs FFS), and Medicaid eligibility category (disabled or not); information was obtained from linked Medicaid enrollment data. The patient’s county of residence was designated as urban if it mapped to USDA’s 2013 urban influence codes 1 or 2 (i.e., metropolitan areas with more than or fewer than 1 million residents); otherwise, the area was considered nonurban. Children receiving foster care services were identified using enrollment data provided by the NYS Office of Children and Families.

Medication information extracted from Medicaid pharmacy claims included NDC code, generic name/active ingredient, days’ supply, and date medication was filled at the pharmacy. Medications were grouped by active ingredient for this study. Medication start date was the first date the drug was filled for the patient, and the end date was calculated as start date plus days’ supply minus one. Concurrent use of contraindicated drug interactions was defined as overlapping fills of two or more contraindicated behavioral and mental health medications for at least 30 days, allowing for a possible 32-day gap between consecutive start and end dates of the same medication. This concurrency time frame was selected after review of the literature and is consistent with current thinking about concurrency; it included a clinical rationale to allow for medications to be titrated up or down when used concurrently in therapy transitions. Combination medications with two or more drug entities were excluded, because they could not be categorized as multiple medications.

IBM Micromedex was used to identify which DDIs were contraindicated.[13] The Micromedex severity index indicates whether potential DDIs are considered minor, moderate, major, or contraindicated. A minor interaction is an interaction that would have limited clinical effects. This may include an increase in the frequency or severity of the side effects but generally would not require a major alteration in therapy. An example of a minor interaction would be diazepam and fluoxetine, for which the risk is higher serum concentrations of diazepam. A moderate interaction may result in an exacerbation of the patient's condition and/or require an alteration in therapy. An interaction between alprazolam and sertraline with a potential for increased risk of psychomotor impairment and sedation is an example of a moderate interaction. A major interaction may be life threatening and/or require medical intervention to minimize or prevent serious adverse effects. A major interaction would be desipramine and escitalopram, with the potential for more serious impacts,

such as increased desipramine exposure and increased risk of QT-interval prolongation. We focused our study on those DDIs that were considered contraindicated for concurrent use. This included combinations such as amitriptyline and ziprasidone, for which there is an increased risk of QT-interval prolongation (with its concomitant risk of sudden cardiac death) and serotonin syndrome (hypertension, hyperthermia, myoclonus, mental status changes). Concurrent use of paroxetine and pimozide, for which there is an increased risk of pimozide toxicity, including cardiotoxicity (QT prolongation, torsades de pointes, cardiac arrest), would also be considered a contraindicated interaction. According to IBM Micromedex, all contraindicated DDIs included in this analysis had "fair," "good," or "excellent" documentation.

All BMHRx prescribed to any given patient were considered for the primary analysis of assessing the characteristics of medication prescribing and the potential for prescribing DDIs. Secondary analyses included a more in-depth evaluation of medication(s) that had the potential for significant clinical implications and providers that prescribed contraindicated DDIs. Prescribers of BMHRx, and specifically of contraindicated drug interactions, were identified from pharmacy claims, and provider specialty was extracted from the Medicaid database of NYS Medicaid providers. We focused findings on interactions between pairs of BMHRx.

Concurrent Drug Use Study: A study of concurrent 30-day use of behavioral health prescriptions was conducted for each year to identify the risk of Drug-Drug Interactions (DDIs) within the BMHRx members. BMH NDC codes were rolled up to the generic drug name. Consistent with existing literature, a 32-day gap was built into the concurrency analysis. Drug start and end dates were calculated using the prescription fill date and days' supply (plus 32 gap days). In each year studied, 38-40% of members who had BMHRx were taking two or more behavioral health drugs concurrently. Contraindicated drug pairs were defined using Micromedex. Any concurrent BMHRx pair that matched the contraindicated drug pair list was flagged as a potential DDI pair. The number of members with a potential DDI pair decreased from 514 in 2008 to 393 in 2014. For each year, a logistic regression analysis was used to model the likelihood of a member having a DDI using race as the independent variable, with White members used as the reference group. Approximately 25% of the study population was White in each year studied. We coded four additional race categories: Black, Hispanic, Asian, and other (included Native American, unknown, and "other"). A separate analysis was run for each age stratification (category 1: age 0-5; category 2: age 6-11; category 3: 12-18; category 4: 19-20). Similar models were built for DDI, limiting the population to just those with BMHRx or just those with concurrent BMHRx use. We also examined off-label use as a predictor of DDI.

Off-Label Drug Use Study: Off-label drug use was studied each year within members with BMHRx. A list of appropriate diagnoses, based on FDA and Compendia indications, was compiled for each generic drug name. Those diagnoses were translated into ICD-9 codes. For each member-drug combination, we searched for appropriate ICD-9 codes within the study year and the previous calendar year. If a member did not have an appropriate diagnosis code (according to FDA guidelines) for the prescription they filled during the study year, they were considered "potentially off label" per FDA guidelines. If a member did not have an appropriate diagnosis code (according to Compendia guidelines) for the prescription they filled during the study year, they were considered "potentially off label" per Compendia guidelines. Members who were "off label" according to both FDA and Compendia guidelines were considered "overall potentially off label." NYS Medicaid's Drug Utilization Review board uses both FDA and Compendia indications to determine on-label use. The number of children with "overall potentially off-label" drug use changed from 33,056 in 2008 (36% of the BMHRx study population in 2008) to 34,530 in 2014 (24% of the BMHRx study population in 2014).

Patient-Centered Medical Home Study (Aim 2): For each year, each member of the study population that utilized primary care services during the year was attributed to a primary care provider (PCP). Primary care service utilization was based on the presence of a claim or encounter with a preventive or evaluation and management (E&M) procedure code. Only claims and encounters with a service rendering or billing provider specializing in internal medicine, pediatrics, adolescent medicine, internal medicine-pediatrics, family practice, general preventive medicine, or general practice were considered. Each member was attributed to the PCP that they visited the most during the year. In the event that a member visited two PCPs an equal number of times, the member was assigned to the provider with the most E&M codes. If a single PCP could not be determined, the member was attributed to the PCP that they visited last during the year. Using Patient-Centered Medical Home (PCMH) recognition data from the National Committee on Quality

Assurance (NCQA), we grouped providers into PCMH or non-PCMH groups. If the PCP was recognized as a PCMH provider at any time during the study year, they were flagged as a PCMH. In each year studied (2010-2014), 35-40% of the study population could not be attributed to a provider because of a lack of qualifying procedure codes or lack of visits with PCPs in the specialties included in our definition. We began studying PCMH using 2010 data, which is when the NYS Medicaid PCMH Incentive Program began. With the number of PCMH-recognized providers growing since 2010, the proportion of children attributed to PCMH PCPs has also grown. In 2010, 14% of attributed members were attributed to PCMH providers. In 2014, this grew to 41%.

In 2014, a logistic regression was used to create a propensity score for each member's PCMH grouping based on demographic characteristics (gender, age category, region, BMHDx presence, BMHRx use, race category, eligibility for supplemental security income (SSI), presence of a healthy/acute 3M clinical risk group, foster care status, receipt of cash assistance, and Medicaid managed care enrollment). An iterative 1:1 matching process created two groups of similarly matched individuals based on demographic characteristics. The PCMH group and non-PCMH group each contained 562,554 individuals. The number of members with an Emergency Department (ED) visit during the year, an inpatient stay during the year, a DDI, and any overall off-label drug use was counted for each group. ED visits and inpatient stays were determined using HEDIS specifications. The proportion of members with an ED visit in the PCMH versus non-PCMH group was 29.8% versus 28.3%. The proportion of members with an inpatient stay was 8.2% versus 7.8%. The DDI rate per 10,000 individuals was 1.9 in both groups, and the off-label rate per 10,000 individuals was 142.9 versus 159.1. When stratified by age group, proportions remain similar between the PCMH and non-PCMH groups, with the largest deviation between groups apparent for off-label use in each age group. Older age groups were more likely to have off-label use, as was the non-PCMH group for the 6-11, 12-18, and 19-20 age stratifications. Similar findings were seen when stratifying propensity scores by quintile to examine PCMH vs non-PCMH rates (rather than using a 1:1 match).

Time-Series Analysis (Aim 2): To analyze the impact of a carve-in of behavioral health services into the Medicaid benefit package, a summary dataset was created. The summary data included counts by year of study population members, members with ED visits, members with inpatient stays, members with DDI, and members with off-label drug use. Additional summary datasets were created to limit the study pool to members with BMHDx or BMHRx. When studying ED and inpatient utilization as the primary outcomes, we also created a summary dataset with quarterly time intervals, resulting in four time points per year. The analyses used interrupted time-series models to determine the impact of the behavioral health carve-in that occurred in 2011; 2011 was treated as the intervention year, so 2011 data were excluded from the analysis. For ED visits, the time-series analysis that included the full study population showed a downward trend after the intervention compared with the forecasted trend.

The following outcomes were studied: 1) proportion of members with an ED visit during the year, 2) proportion of members with an inpatient visit during the year, 3) proportion of members with an ED visit during the quarter, 4) proportion of members with an inpatient visit during the quarter, 5) proportion of BMHRx members with any overall off-label use during the year, 6) proportion of BMHDx members with an ED visit during the year, 7) proportion of BMHDx members with an inpatient visit during the year, 8) proportion of members with a BH ED visit during the year, and 9) proportion of members with a BH inpatient visit during the year. We present an illustrative selection of these analyses in the finding.

Data Sources/Collection: To create the code for the yearly cohorts used in the time-series analysis, there was a 10-step process: 1) identify nondual Medicaid enrollees under 21, 2) search for any BMHRx, 3) search all diagnoses and flags for BMHDx, 4) assign BMHDx classes to members, 5) pull and code demographics for all members, 6) identify and flag ED and inpatient use by year and also by quarter, 7) identify and flag concurrent BMHRx drug use, 8) assess for DDI, 9) assess indications and flag off-label use, and 10) compile all member demographics, utilization, DDI, and off-label use in a table with one row per member.

The analyses described here in detail were preceded by dozens of analyses to elucidate aspects of the relevant epidemiology, and these are summarized in the not-comprehensive table (ANALYSES) at the end of the methods section. As the reported analyses occurred over a 4-year period, small differences in numbers for various studies will be found. These typically relate to small alterations in the criteria for data extractions, exclusion criteria, data completeness, or assumptions. They are not material to our findings.

Kleinman postdoctoral mentees and in-kind contributors to the project, Bakaki and Ronis, conducted scoping reviews that were coordinated with this project. Each was supported in part as a KL2 Scholar by the Clinical and Translational Science Award (NIH) to CWRU. Bakaki's work included the elucidation of pediatric polypharmacy practices and definitions in the literature. Ronis studied factors related to doctor-patient decision making, relationships, and the quality of care. Details of their literature review methodologies are not included herein but are available from publication projects listed below.

TABLE: ANALYSES	Description
Prevalence of BMHD in Children in NYS Medicaid	Prevalence of BHD by demographics, prevalence of Dx class
Hosp and ED visits in Children with BHD_2014	# of ED visits/Hosp by Dx Class; Risk of ED visits and Hosp in Child with BHD vs without BHD
Rates/rates ratio of hosp and ED visits in children with BHD vs without BHD	Higher risk of ED visit and hosp in children with BHD regardless of whether the service was for a BH condition glm (log-linked Poisson Model)
Patient-Centered Medical Home (PCMH) effect on health differences in children with behavioral health diagnoses (BHD)	Determine impact of PCMH on racial & economic differences in ED visits and hospitalizations among children with BHD
PCMH Effect ED in BHD No Rx_2014	Determine impact of PCMH on risk of children getting BMHDx but no rx, by BHD Class
Demographics distribution among kids in Medicaid 2008-2016	Distribution of Demographics Among Medicaid Children (2008-2016): Cohort; Distribution of Demographics Among Medicaid Children (2008-2016): No BHD or BH Rx
Demographics distribution among kids in Medicaid 2008-2016, pre vs. post carve-in reform: with average change over time	Pre- vs. Post-Carve In Reform, Change in Distribution of Demographics of Medicaid Children (2008-2016) among 1) total Medicaid kids, 2) cohort, 3) no BHD or BH Rx
Distribution of BMHD Classes Among Children in Cohort (2008-2016)	Quantify percent of Kids in cohort with BHD Class, by year
Distribution of BMHD Classes (2008-2016): with average change over time	Distribution of BMHD Classes Among Children in Cohort (2008-2014); Change in distribution of BMHD Classes Among Children in Cohort (2008-2014)
Prevalence of having a BHD or BMHRx among Medicaid children, by demographics (2008-2016)	Trends in Prevalence of BMHD/Rx Among Different Demographics of Medicaid Children (2008-2016)
Prevalence of having a BHD or BMHRx among Medicaid children, by demographics, Pre- vs. Post-Carve In Reform (2008-2016): with average change over time	Pre- vs. Post-Carve In Reform, Change in Prevalence of BMHD/Rx Among Different Demographics of Medicaid Children (2008-2016)
Most common BH medications filled by children with BHD who have an Rx filled	Quantify BH Meds/Total number of kids with BHD who have an Rx filled
Most common non-BH medications filled by children with BHD who have an Rx filled	Quantify non-BH Meds/Total number of kids with BHD who have an Rx filled
Number of children with BMH Drug Labels filled in 2008-2016	Quanity children with BH drug labels filled (2008-2016)
Top 25 Meds among cohort members with BHD, by BH Drug Class in 2014	Quantify percent of children taking the top 25 BH meds among cohort members with BHD who are taking BH Rx, stratify by BH Class
	Quantify percent of children taking the top 25 meds among cohort members with BHD who are taking any Rx, stratify by BH Class
Top 10 Meds among cohort members with BHD, by Age and BH Class in 2014	Quantify percent of children taking the top 10 meds among cohort members with BHD who are taking any Rx, stratify by age group (overall vs 12-18) and BH Class
Top 10 Meds among cohort members with BHD, by Age Group in 2014	Quantify percent of children taking the top 10 meds among cohort members with BHD who are taking any Rx, stratify by age group
PMPY Rate of BH Rx and Non-BH Rx Filled in 2014 Among Cohort, stratified by Age Group	Epidemiology: Quantify per member per year rates of BH Rx Filled in 2014; Quantify per member per year rates of Non-BH Rx Filled in 2014
Top 20 Meds Filled Among Children in Cohort with Anxiety but No ADHD in 2014, by Age Group	Top 20 BH Meds Filled Among Children in Cohort with Anxiety but No ADHD in 2014, by Age Group
	Top 20 Meds Filled Among Children in Cohort with Anxiety but No ADHD in 2014, by Age Group
Total Number of Non-MH Meds Filled_by class_2014	Determine number of NonBH Meds Filled in 2014 Among Children in Cohort with BHD, by BH Dx Class and age group
Percent of Kids Taking BH Drugs Filled in 2014, Cohort vs BH Rx Only: By Drug Class	Percent of Kids Taking BH Drugs Filled in 2014, Cohort vs BH Rx Only: by Drug Class
Children with concurrent use of BH medications in 2014	Using HEDIS and specifications of experts on the team, generate dataset of children using BH medication concurrently in 2014; quanitfy number of days of concurrent drug use
	Sensitivity analysis: Quantify children using at least 1 of the top 10 BH medications concurrently with another BH med for ≥1, ≥15, or ≥30 days
Geographic spread of kids with concurrent use of contraindicated DDI among 10 most common BH medications in 2014	Epidemiology: Quantify PMPY (per member per year) rates of concurrent use of contraindicated DDI in kids on BH Rx, by Region (for ≥1, ≥15, or ≥30 days)

Prevalence of concurrent use of contraindicated DDI in children in Medicaid taking the 10 most common BH medications in 2014	Epidemiology: Quantify rates of concurrent use of contraindicated DDI in kids on BH Rx, stratified by specific DDI and by BH status (presence or absence of BHD)
Characteristics of children in Medicaid with concurrent use of contraindicated DDI in 2014	Demographic distribution of characteristics, stratified by presence or absence of BHD
BH Dx classes among children in Medicaid with concurrent use of contraindicated DDI in 2014	Distribution of BH classes and comorbidities
Distribution of Prescribers/DDI/Prescriber Specialty of Prescribers of contraindicated DDI in 2014	Identify and describe prescribers of contraindicated DDIs; determine number of DDIs per prescriber and number of children per prescriber
	Analysis stratified by BHD status: Identify and describe prescribers of contraindicated DDIs; determine number of DDIs per prescriber and number of children per prescriber
Ziprasidone analysis: Prevalence of concurrent use of contraindicated DDI where ziprasidone is a medication in 2014	Epidemiology: Quantify rates of concurrent use of contraindicated DDI in kids on BH Rx
	Epidemiology: Quantify rates of concurrent use of contraindicated DDI in kids on BH Rx, stratified by specific DDI and by BH status
Ziprasidone analysis: Characteristics of children with concurrent use of contraindicated DDI where ziprasidone is a medication in 2014	Distribution of characteristics, stratified by presence or absence of BHD
Ziprasidone analysis: BH Dx classes among children with concurrent use of contraindicated DDI where ziprasidone is a medication in 2014	Distribution of BH classes and comorbidities
Ziprasidone analysis: Distribution of Prescribers /DDI/ Prescriber Specialty of Prescribers of contraindicated DDI in 2014	Epidemiology: quantify prescribers of contraindicated ziprasidone DDIs; determine number of DDIs per prescriber and number of children per prescriber
Off-Label Analysis among Top 10 BH Rx (2014)	Epidemiology: Using specifications of team and FDA indications, develop and implement nine-step procedure to quantify rates of concurrent use of kids taking one of the top 10 BH drugs who 1) do not have FDA-approved Dx, 2) do not have FDA-approved Dx but have another BHD, 3) do not have FDA-approved Dx or any BHD
	Determine number of visits to providers, by provider specialty (psychiatrist/child psych vs other) among kids in the three categories mentioned above
	Identify and classify Dx of kids with off-label use
Outcomes analysis: Prevalence of potential harmful outcomes in children on behavioral health medications in 2014	Quantify frequency of various harmful outcomes (poisoning, death, cardiac arrest, serotonin syndrome, hypertensive crisis, seizures, long QT syndrome, shock, coma, delirium, nystagmus, diplopia, neutropenia, and priapism) in children with behavioral health prescription fills and in children with concurrent use of contraindicated DDI
Outcomes analysis: Risk of poisoning in children on behavioral health medications and in children with contraindicated DDI in 2014	Determined relative risk of poisoning and CNS poisoning in children with behavioral health Rx filled compared to those without BH Rx filled. Quantified risk of poisoning on children with concomitant use of contraindicated DDI
Outcomes analysis (2014): Temporal specifications to determine which medications in the contraindicated DDI could likely have led to poisoning	Identified BH medications in contraindicated DDI that were taken in children subsequently diagnosed with poisoning

BHD Classes and Diagnoses Included in Study

Diagnostic Class	**ICD-9 CM**
ADHD/hyperkinetic	314, 3141, 3142, 3148, 3149, 31400, 31401, 31407
Anxiety	30922, 30923, 3000, 3001, 3002, 3003, 3007, 3094, 3099, 3130, 3132, 30000, 30001, 30002, 30009, 30010, 30011, 30012, 30013, 30014, 30015, 30016, 30019, 30020, 30021, 30022, 30023, 30029, 30921, 30924, 30928, 30982, 30983, 30989, 31321, 31322, 31323
Chronic and Acute Stress Reactions	3083, 3084, 3089, 30981
Depression	311, 2962, 2963, 3004, 29620, 29621, 29622, 29623, 29624, 29625, 29626, 29630, 29631, 29632, 29633, 29634, 29635, 29636
Eating Disorders	3071, 3075, 30750, 30751, 30752, 30753, 30754, 30759
Gender Identity Codes	3023, 3026, 30250, 30251, 30252, 30253, 30285
Learning	3151, 3152, 3154, 3155, 3158, 31500, 31501, 31502, 31509, 31531, 31532, 31534, 31535, 31539, 31590
Mood Disorder	308, 2964, 3080, 296, 2967, 2969, 3011, 3090, 3091, 3131, 29383, 29600, 29601, 29602, 29603, 29604, 29605, 29606, 29610, 29611, 29612, 29613, 29614, 29615, 29616, 29640, 29641, 29642, 29643, 29644, 29645, 29646, 29650, 29651, 29652, 29653, 29654, 29655, 29656, 29660, 29661, 29662, 29663, 29664, 29665, 29666, 2968, 29680, 29681, 29682, 29689, 29690, 29699, 30110, 30111, 30112, 30113
Oppositional	3093, 31381

Other*	290, 293, 294, 302, 306, 310, 312, 2900, 2901, 2902, 2903, 2904, 2908, 2930, 2931, 2938, 2939, 2940, 2941, 2948, 2949, 3006, 3009, 3010, 3012, 3013, 3014, 3015, 3016, 3017, 3018, 3019, 3020, 3021, 3022, 3024, 3029, 3060, 3061, 3062, 3063, 3064, 3065, 3066, 3067, 3068, 3069, 3070, 3073, 3074, 3076, 3077, 3079, 3081, 3100, 3101, 3102, 3108, 3109, 3120, 3121, 3124, 3128, 3129, 3133, 3139, 29010, 29011, 29012, 29013, 29020, 29021, 29040, 29041, 29042, 29043, 29381, 29382, 29384, 29389, 29410, 29411, 29421, 30120, 30121, 30122, 30150, 30151, 30159, 30181, 30182, 30183, 30184, 30189, 30270, 30271, 30272, 30273, 30274, 30275, 30276, 30279, 30281, 30282, 30283, 30284, 30289, 30650, 30651, 30652, 30653, 30654, 30659, 30740, 30741, 30742, 30743, 30744, 30745, 30746, 30747, 30748, 30749, 30929, 31081, 31089, 31200, 31201, 31202, 31203, 31210, 31211, 31212, 31213, 31220, 31221, 31222, 31223, 31230, 31231, 31232, 31233, 31234, 31235, 31239, 31281, 31282, 31289, 31382, 31383, 31389, 29420
Peripartum mental disorders	6484, 64840, 64841, 64842, 64843, 64844
Pervasive	299, 2990, 2991, 2998, 2999, 29900, 29901, 29910, 29911, 2998C, 29980, 29981, 29990, 29991
Psychosis	2909, 295, 297, 298, 2950, 2951, 2952, 2953, 2954, 2955, 2956, 2957, 2958, 2959, 2970, 2971, 2972, 2973, 2978, 2979, 2980, 2981, 2982, 2983, 2984, 2988, 2989, 29500, 29501, 29502, 29503, 29504, 29505, 29510, 29511, 29512, 29513, 29514, 29515, 29520, 29521, 29522, 29523, 29524, 29525, 29530, 29531, 29532, 29533, 29534, 29535, 29540, 29541, 29542, 29543, 29544, 29545, 29550, 29551, 29552, 29553, 29554, 29555, 29560, 29561, 29562, 29563, 29564, 29565, 29570, 29571, 29572, 29573, 29574, 29575, 29580, 29581, 29582, 29583, 29584, 29585, 29590, 29591, 29592, 29593, 29594, 29595
Somatoform	316, 347, 3005, 3082, 3159, 34700, 34701, 34710, 34711, 3008, 3078, 30081, 30082, 30089, 30780, 30781, 30789
Substance/alcohol use	305, 2910, 2911, 2912, 2913, 2914, 2915, 2918, 2919, 2920, 2922, 2929, 3039, 3042, 3050, 3051, 30510, 3575, 4255, 5710, 5711, 5712, 5713, 7795, 9800, 29181, 29182, 29189, 29211, 29212, 29281, 29282, 29283, 29284, 29285, 29289, 30300, 30301, 30302, 30303, 30390, 30391, 30392, 30393, 30400, 30401, 30402, 30403, 30410, 30411, 30412, 30413, 30420, 30421, 30422, 30423, 30430, 30431, 30432, 30433, 30440, 30441, 30442, 30443, 30450, 30451, 30452, 30453, 30460, 30461, 30462, 30463, 30470, 30471, 30472, 30473, 30480, 30481, 30482, 30483, 30490, 30491, 30492, 30493, 30500, 30501, 30502, 30503, 30520, 30521, 30522, 30523, 30530, 30531, 30532, 30533, 30540, 30541, 30542, 30543, 30550, 30551, 30552, 30553, 30560, 30561, 30562, 30563, 30570, 30571, 30572, 30573, 30580, 30581, 30582, 30583, 30590, 30591, 30592, 30593, 53530, 53531, 64830, 64831, 64832, 64833, 64834, 65550, 65551, 65553, 76071, 76072, 76073, 76075, 96500, 96501, 96502, 96509, V6542
Suicide/self-injury	E9500, E9501, E9502, E9503, E9504, E9505, E9506, E9507, E9508, E9509, E9510, E9511, E9518, E9520, E9521, E9528, E9529, E9530, E9531, E9538, E9539, E954, E9550, E9551, E9552, E9553, E9554, E9555, E9556, E9557, E9559, E956, E9570, E9571, E9572, E9579, E9580, E9581, E9582, E9583, E9584, E9585, E9586, E9587, E9588, E9589, E959, V6284
Tic disorders	3072, 3333, 30720, 30721, 30722, 30723

*Other diagnostic class includes sleep disorders, conduct disorders, sexual disorders, personality disorders, dementia, and other uncategorized mental health diagnoses.

Survey Methodology: For this Aim, we began with the CAPQuaM Mental Health Medication Reconciliation Survey developed for practices that care for children with BMHDx. The lead developers of that survey were on this research team and served as internal consultants as the team adapted the survey for this purpose and for implementation via SurveyMonkey. We collaboratively developed a one-page educational intervention that, in conjunction with completion of the survey, was certified for granting of 1 hour of CME credit as incentive by CWRU with the following learning objectives:

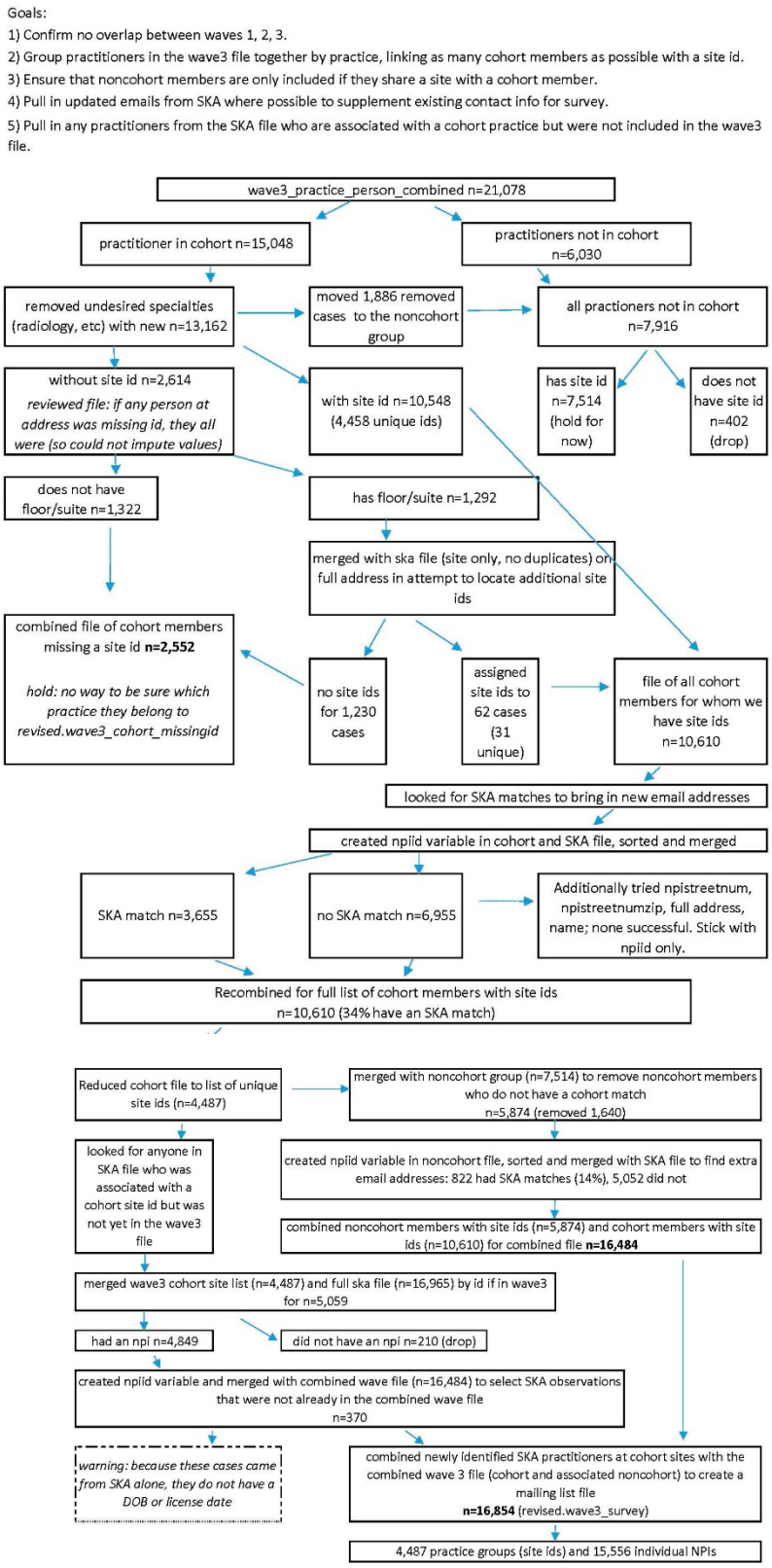
After participating in this activity participants will be able to:

- *Introduce a new and emerging evidence-based perspective regarding Medication Reconciliation*
- *Incorporate an understanding of this evidence-informed approach to Medication Reconciliation into the design and performance of their practice operations related to one or more of the following specific attributes:*
    - *Medication Reconciliation IT Infrastructure*
    - *Medication Reconciliation Policy Infrastructure*
    - *Medication-related Communications with Families*
    - *Medication-related Communications among Clinicians*
    - *Medication Reconciliation Procedures*
    - *Frequency of Medication Reconciliation*
    - *Content and Comprehensiveness of Medication Reconciliation*
    - *Involvement of Pharmacists*
- *Re-frame perceptions of what Medication Reconciliation policy and practices can be and do to enhance patients' health and/or avoid adverse outcomes*
- *Foster positive attitudes toward Medication Reconciliation opportunities*

The evaluation completed by those who optionally requested CME (via hypertext link in the survey) included eight questions comprised of 20 items, and these data are reported as one of the findings of this study.

The survey proved far more challenging to conduct and complete than had been anticipated. We had planned to conduct the combined educational intervention and survey under the auspices of operational quality improvement and without informed consent.

Figure: Survey Sample Assembly



The NYSDOH IRB did not permit this formulation and required our invitation letter to term this work research and optional, which we believe severely challenged our ability to recruit respondents. The methodological and logistical challenges were substantial, and we have described many previously. Example of various challenges are that the purchased (SK&A) database only allowed us to link 40% of clinicians both to a practice and to an email address, links made were found to be faulty, email addresses were wrong, and there were barriers to establishing CME credit as an incentive for survey completion. The challenges delayed and limited some of our work, but the team succeeded in completing the survey, even with the challenges.

The protocols derived were themselves necessarily complex. Our general approach is outlined in the table below. Key data resources include Medicaid data mart; the purchased SK&A data; PNDS, an internal data resource available to Medicaid and the NYSDOH; and NY State Educational Department data.

Practitioners in the Medicaid database could have up to four specialty codes. We sought to survey those whose clinical practice might prescribe any of the medications of interest and who had seen at least one child with a BMHDx during the eligibility period. As an example of the care and processes used along the way, we describe here the steps used to determine which individuals were in eligible specialties when identifying the finder file for our sample. The initial one third cohort sample contained 15,048 practitioners.

Process for Generating Clinician Sample for Med Rec Survey	Data Source
1. Created a list of clinicians (MD, NPs, DOs) that saw or were assigned kids in our cohort. Excluded clinicians who have these specialties ONLY: Injury medicine, genetics, physical medicine/chiropractic, anesthesiology, ophthalmology, chronic disease educator, preventative medicine, optometrist, radiology, pathology, nuclear medicine Included: internal medicine; pediatrics; family medicine; psychiatry; obstetrics and gynecology; emergency medicine; surgery; neurology; pediatrics subspecialty; orthopedics; otolaryngology; urology; dermatology; immunology; neurology and psychiatry; dentist; substance use	Medicaid Datamart
2. Clinicians matched to SKA extensive file using NPI only to pull addresses and SKA ID from SKA extensive	SKA extensive
3. Remaining clinicians matched to SKA mailing file using NPI only to pull addresses from SKA mailing	SKA mailing
4. Clinician list with addresses created by combining clinicians and addresses from steps 2 and 3	
5. This clinician list was submitted to PNDS vendor to standardize all the addresses. This includes: standardizing street names (e.g., LANE vs LN), using upper case, generating latitude and longitude	
6. SKA ID assigned to sites from SKA mailing that had an exact site address (address, city, zip, suite) match to an SKA Extensive Site	
7. Each row assigned an identifier—the identifier is the SKA ID when available. Otherwise, it's the address||city||zip||suite	
8. Created a dataset FINAL with two groups of addresses: a. Those that had an SKA extensive ID (each ID corresponds to a unique site) b. Those that didn't match to any SKA extensive site based on address||city||zip||suite. Some of these sites have a potential SKA extensive match when we drop suite and just match on address||city||zip. These sites have a potential_ska_ext_match indicator. (The dataset called SKA_MAIL2 lists all of the SKA extensive potential matches for these sites.)	
9. Those addresses that matched to more than one SKA extensive site based on address||city||zip||suite. We decided to drop this group entirely based on an analysis that showed the associated clinicians not being particularly different from the clinicians we retain.	
10. Two datasets created using the FINAL data: a. FINAL_PRACTICELIST is a unique list of identifiers (one row per site) b. FINAL_ALLPROV_EMAIL_List is a list of the clinicians at the sites identified in FINAL_PRACTICELIST—including clinicians at the sites even if they didn't see kids in our cohort. Those that saw kids in our cohort have a cohort_ind=1. This dataset includes clinician attributes that CWRU can use to choose who to email first: clinician DOB, licensure date, email addresses, specialty. Specialty pulled from PNDS. Email addresses were taken from the SKA email data we purchased, and also from PNDS Q3 2017. Some clinicians have multiple emails. The emails reported more often are toward the left of the dataset.	• Email addresses pulled from SKA email and PNDS Q3 2017 • DOB, licensure date, specialty pulled from SED (State Education Department)
11. Practices randomized into three waves: wave1, wave2, wave3	
12. Clinician list created for each wave: wave1_npi_pracname, wave2_npi_pracname, wave3_npi_pracname	

Step 1 After removing 6030 practitioners with only those ineligible specialties listed in Step 1 above, we reviewed the list of remaining specialties and identified keywords and phrases to remove ineligible specialties, such as blood bank, anesthesiology, anesthesiologist, pathologist, etc. We removed practitioners with the following strings in the specialty 1-4 fields: AERO; ALLIED; BLOOD; ANES ; CHRONIC; PATHOL; LABORATORY; MUSCULOSKELETAL; NUCLEAR M; OPHT; OPTH; PHYSICIAN ASSISTANT; RAD; OPTOM; INTERVENTIONAL RAD. This reduced the cohort to 13,072, with 1976 observations moved into a '*probable noncohort*' file. **Step 2** We removed all anesthesiologists from the cohort group but want to bring them back in if "pain management" is included in any of their specialty fields; 1976 observations were examined; 24 included "pain" and were returned to the cohort group, bringing the total to 13,096. **Step 3** We reviewed the table of all specialties listed for individuals remaining in the '*probable noncohort*' file and identified keywords and phrases to retain individuals who had eligible specialties in addition to ineligible specialties. We searched for individuals with the following strings in the specialty 1-4 fields: ALLERG; EMERGENCY ENDOCRIN; FAMILY; GASTROENT; INTERNAL; NEUROLOGIST; PSYCH; PEDIATRICIAN. Sixty-four included one of the above strings and were returned to the cohort group, now totalling 13,162. **Step 4** We finalized *true cohort* (n=13,162) and *true noncohort* (n=7,916) lists and add a variable called real_cohort (true noncohort = 1886 observations remaining in probable noncohort + 6030 observations in noncohort).

We further illustrate our methods with two pieces of our protocol The figure, *Assembling the Cohort*, uses the numbers from one third of our sample to illustrate how we assembled the sample by linking clinicians to practices, first using the site ID from the purchased SK&A database and subsequently looking for a sufficient address or practice name to be confident for inclusion in the practice. To develop a full list of those in a given practice, we needed to use the cohort identification file as a sort of a finder file to bring in others from the same practice. This was because our unit of analysis for the survey was the practice and not the individual clinician.

Following the identification of practices and the associated practitioners, we prioritized whom we would contact in the following order of prioritization: Our target was to identify a clinical or other leader, such as a medical director, and our invitation-email invited recipients to redirect us within the practice in the event we had reached someone not in leadership. Many practices initiated additional email contact with us.

Our approach to emailing the practices was to prioritize in order five potential respondents, each of whom might receive up to three emails, as summarized below:

Step 1: For each eligible and qualified practice, establish a contact order for survey participants.

ORDER	
For participants with a title:	
First	CEO/Acting CEO, President, Chair
Second	Chief
Third	Owner
Fourth	Vice President, Associate Chair
Fifth	Medical Director
Sixth	Administrator, Associate Medical Director, Assistant Medical Director
For participants without a title but with a birthdate:	
Seventh	Participants younger than 66 years of age, in descending order
Eighth	Participants older than 66 years of age, in ascending order
For participants without a title or birthdate:	
Ninth	Participants without a title or birthdate, sort alphabetically from A to Z

Step 2: Send the survey invitation and link to one person at a time in order determined above, sending up to a maximum of five participants in a practice. The general schedule is as follows:

General SCHEDULE *Approximately 8 weeks (2 months) per wave*			
Person 1		If no response by Thursday, send to Person 4	
Monday	Survey invitation and link (initial)	Thursday	Survey invitation and link (initial)
Thursday	Reminder (first reminder)	Monday	Reminder (first reminder)
Monday	Reminder (final reminder)	Thursday	Reminder (final reminder)
If no response by Thursday, send to Person 2		If no response by Monday, send to Person 5	
Thursday	Survey invitation and link (initial)	Monday	Survey invitation and link (initial)
Monday	Reminder (first reminder)	Thursday	Reminder (first reminder)
Thursday	Reminder (final reminder)	Monday	Reminder (final reminder)
If no response by Monday, send to Person 3		NB: When we identified that email address or contact person was incorrect, our team moved on immediately to the next appropriate option, to continue the Monday/Thursday time frame for invitations and reminders. Once a survey was completed for a practice, we stopped sending invitations and reminders.	
Monday	Survey invitation and link (initial)		
Thursday	Reminder (first reminder)		
Monday	Reminder (final reminder)		

6. RESULTS (Principal Findings, Outcomes, Discussion, Conclusions, Significance, Implications)

Aim 1: DDI and off-label analyses AND Aim 2: Time-series and PCMH analyses

Study Population Characteristics and BHD Prevalence: In 2014, there were 2,259,209 children under age 21 who received Medicaid services. Of these, 19.3% (n=435,953) had behavioral health diagnoses (Table 1). Among those with BHD, 29.2% (n=127,236) also had a behavioral health prescription filled in 2014. Most enrollees with BHD were between the ages of 12 and 17 (30.8%), had male gender (58%), and were non-Hispanic White (34.2%). Most without BHD were ages 0-5 (36.6%), female gender (51.8%), and non-Hispanic White (25.4%). When comparing BHD with non-BHD, there were also significant differences in the distribution of those who received foster care (3.1% vs 0.9%, $P < .001$) and cash assistance (57.9% vs 39.2%, $P < .001$), and in enrollees living in rural areas (9.0% vs. 5.1%, $P < .001$). There was a similar distribution for those enrolled in MMC (78.4% and 77.5%, respectively, $P < .001$). Just over half of enrollees with BHD (51.7%) and 86.7% without BHD were healthy per their CRG or had acute or minor chronic conditions.

Prevalence rates of BHD per 1000 enrollees (Table 1) were high among those who were receiving foster care (458), residing in rural areas (297), residing in the Western region of NYS (284), receiving cash assistance (261), age 12-17 years (250), non-Hispanic White (244), and of male gender (224). Children and young adults using BH medications and classified with severe CRG had the highest rates of BHD (868 and 592 per 1000, respectively).

For the entire study population, the most common BHD classes (Table 2) were other learning disorders (55), ADHD/hyperkinetic (51), and anxiety (42). Variations in prevalence existed across the age groups. Young adults ages 18-20 had the highest rates per 1,000 of substance/ alcohol use (105) and depression (63). ADHD/ hyperkinetic was the leading class of BHD for

children ages 6-17. Children ages 12-17 had the highest rates of oppositional disorders (27 per 1000). Rates of suicide/self-injury (10 per 1000) and acute/chronic stress reactions (12 vs. 11 per 1000) were comparable among children ages 12-17 and young adults, respectively. Children ages 12-17 also had the highest rates of enrollees with >1 BHD class (54 per 1000); the mean number of BHD classes per patient aged 12-17 was 1.9.

Health Service Utilization: Analyses of service utilization were focused on enrollees ages 6-20 years, which we stratified into three groups. For the entire cohort (ages 6-20), rates per 100 person-years (PY) for both all-cause and non-behavioral health-related ED visits and hospitalizations combined (ED and IP) were 88.9 and 59.1, respectively, in those with BHD (Table 3). In enrollees without BHD, that rate was 39.7 per 100 PY. Young adults ages 18-20 years with BHD had the highest rates of non-BH-related and all-cause combined ED visits and hospitalizations (88.4 and 142.9 per 100 PY, respectively), whereas enrollees ages 12-17 without BHD had the lowest rates (33.3 per 100 PY).

Unadjusted rate ratios of combined IP and ED utilization among BHD compared with non-BHD (Table 4) showed that, for all ages, non-BH-related rates were nearly 50% higher and all-cause rates were 2.24 times higher in enrollees with BHD ($P < .05$). The multivariate model showed that, after adjusting for age group, gender, area of residence, receipt of cash assistance, race/ethnicity, receipt of foster services, and clinical risk group, differences decreased but remained statistically significant (RR, non-BH-related=1.21; RR, all-cause=1.71, $P < .05$). The only outcome with lower rates in all ages with BHD compared against without BHD after adjusting for patient characteristics was non-BH-related hospitalizations (RR=0.81, $P < .05$).

Adjusted rate ratios also varied by age group. Young adults ages 18-20 years had the highest rate ratios of non-BH-related (1.46, $P < .05$) and all-cause (2.24, $P < .05$) combined ED and IP. Children ages 6-11 years had the lowest rates: there was no statistically significant difference in all-cause combined ED and IP utilization rates for BHD compared with non-BHD, but rates of non-BH-related combined ED and IP use were 28% lower in BHD (RR=0.72, $P < .05$).

Results of the multivariate models testing demographic differences in rates of service utilization in enrollees ages 6-20 years with BHD are shown in Table 5. Rates of service utilization increased with age. Young adults had 74% higher rates of ED visits and 2.34 times higher rates of IP stays than children ages 6-11 years (all $P < .001$). Among all race/ethnicities, the greatest differences in rates of combined ED and IP were seen in Blacks (RR=1.37) and Native Americans (RR=1.41) compared with Whites (all $P < .001$). Females had 31% higher rates of combined ED and IP than males. Other at-risk groups were those receiving cash assistance (RR=1.29, $P < .001$) and in foster care (RR=1.32, $P < .001$). Rates of service utilization increased as the number of BHD classes increased and as CRG severity increased. Those with two BHD classes had 25% higher rates of hospitalizations than those with one BHD class, but those with three or more BHD classes had nearly three times greater rates of hospitalizations than those with one BHD class (RR=2.87, all $P < .001$). Living in rural areas put children and young adults at risk of ED visits (RR=1.19, $P < .001$) but not IP stays (RR=0.81, $P < .001$).

Table 1. Characteristics and 12-month prevalence of behavioral health diagnoses among children and young adults in NYS Medicaid, 2014 (N=2,259,209)

Characteristic	BHD	No BHD	Number of BHD per 1,000 Patients
Overall N	435,953	1,823,256	193
Age			
0-5 years	22.2%	36.6%	126
6-11 years	29.8%	27.9%	203
12-17 years	30.8%	22.1%	250
18-20 years	17.3%	13.4%	236
Gender			
Male	58.0%	48.0%	224
Female	42.0%	51.8%	162
Unknown	0.0%	0.2%	14
Race/Ethnicity			
White	34.2%	25.4%	244
Black	17.5%	17.8%	190
Hispanic	22.8%	20.9%	207
Native Am	0.3%	0.3%	189
Asian	4.1%	9.2%	97
Other	3.6%	3.6%	197
Unknown	17.4%	22.8%	154
Poverty Level			
No Cash Assistance	42.1%	60.8%	142
Cash Assistance	57.9%	39.2%	261
Receipt of Foster Care			
No Foster Care	96.9%	99.1%	189
Foster Care	3.1%	0.9%	458
Insurance Type			
Fee For Service (FFS)	21.6%	22.5%	187
Medicaid Managed Care (MMC)	78.4%	77.5%	195
Area of Residence			
Urban	91.0%	94.9%	187
Rural	9.0%	5.1%	297
Region of Residence			
Long Island	7.5%	8.6%	173
Central	10.1%	6.8%	262
Western	17.4%	10.5%	284
Hudson Valley	9.7%	9.4%	198
Northeast	8.0%	4.9%	282
NYC	47.2%	59.8%	159
3M Clinical Risk Group			
Healthy/Minor	51.7%	86.7%	125
Moderate	45.2%	11.5%	483
Severe	1.9%	0.3%	592
Unknown	1.3%	1.5%	178
BH Medication Use			
BH Rx Filled	29.2%	1.1%	868
No BH Rx Filled	70.8%	98.9%	146

Distribution via chi square contingency tables. $P < .001$ for all comparisons.

Table 2. Twelve-month prevalence of BHD classes per 1000 enrollees with BHD (N=435,953)

BHD Class	All Ages	0-5 years	6-11 years	12-17 years	18-20 years
Other learning disorders	55	84	64	29	11
ADHD/hyperkinetic	51	10	89	77	33
Anxiety	42	7	45	69	72
Other	32	14	42	45	31
Substance/alcohol use	32	5	6	57	105
Somatoform	24	38	24	14	10
Depression	24	0	9	51	63
Other mood disorders	21	1	15	44	42
Pervasive	16	13	21	17	13
Oppositional	14	2	20	27	6
Acute and Chronic Stress Reactions	6	1	6	12	11
Psychosis	5	0	3	10	15
Suicide/self-injury	4	0	1	10	10
Eating	2	3	2	2	2
Tic	2	1	4	2	1
Peripartum	1	0	0	1	6
Gender Identity Codes	0	0	0	0	1
Any BHD class	193	126	203	250	236
One BHD class	116	87	118	141	139
Two BHD classes	44	30	49	54	49
Three or more BHD classes	33	10	37	54	48
Mean number of BHD classes per patient	1.7	1.4	1.7	1.9	1.8

Table 3. Rates of ED visits and hospitalizations per 100 person-years among enrollees ages 6-20 years with BHD vs without BHD in NYS Medicaid, 2014 (N=1,494,502)

	All Ages		6-11 years		12-17 years		18-20 years	
Outcome	BHD	No BHD	BHD	No BHD	BHD	No BHD	BHD	No BHD
ED								
Non-BH Related	55.4	36.8	47.9	37.0	48.7	31.3	81.4	46.0
All Cause	76.1	36.8	57.1	37.0	71.0	31.3	119.6	46.0
IP								
Non-BH Related	3.7	2.9	2.6	1.8	3.0	2.0	7.0	6.6
All Cause	12.8	2.9	6.5	1.8	13.3	2.0	23.3	6.6
ED and IP								
Non-BH Related	59.1	39.7	50.5	38.9	51.6	33.3	88.4	52.6
All Cause	88.9	39.7	63.6	38.9	84.2	33.3	142.9	52.6

Table 5. Rate ratios for demographic correlates of all-cause ED visits and hospitalizations among enrollees with BHD, ages 6-20 years (N= 333,456)

Characteristic	Adjusted Rate Ratio (95% CI)		
	ED	IP	ED and IP
Age Group			
6-11 years	Ref	Ref	Ref
12-17 years	1.14 (1.12, 1.15)	1.66 (1.61, 1.70)	1.19 (1.18, 1.20)
18-20 years	1.74 (1.72, 1.76)	2.34 (2.27, 2.41)	1.80 (1.78, 1.82)
Female gender	1.32 (1.31, 1.34)	1.21 (1.18, 1.23)	1.31 (1.30, 1.32)
Race/Ethnicity			
White	Ref	Ref	Ref
Black	1.37 (1.35, 1.39)	1.37 (1.33, 1.41)	1.37 (1.35, 1.38)
Hispanic	1.31 (1.29, 1.32)	1.20 (1.17, 1.24)	1.29 (1.28, 1.31)
Asian	0.77 (0.75, 0.80)	1.27 (1.19, 1.35)	0.83 (0.81, 0.85)
Native American	1.45 (1.35, 1.55)	1.21 (1.00, 1.45)	1.41 (1.33, 1.51)
Other/Unknown	1.28 (1.26, 1.29)	1.33 (1.29, 1.37)	1.28 (1.27, 1.30)
Receipt of cash assistance	1.32 (1.31, 1.33)	1.09 (1.06, 1.12)	1.29 (1.28, 1.30)
Receipt of foster care services	1.23 (1.21, 1.26)	1.73 (1.66, 1.80)	1.32 (1.30, 1.34)
Rural area of residence	1.19 (1.17, 1.21)	0.81 (0.77, 0.84)	1.14 (1.12, 1.15)
Clinical Risk Group			
Healthy/minor	Ref	Ref	Ref
Moderate	1.42 (1.40, 1.43)	8.50 (8.08, 8.95)	1.63 (1.61, 1.64)
Severe	2.02 (1.98, 2.07)	45.09 (42.60, 47.71)	3.22 (3.15, 3.28)
BHD Classes			
One BHD class	Ref	Ref	Ref
Two BHD classes	1.22 (1.20, 1.25)	1.25 (1.19, 1.30)	1.23 (1.21, 1.25)
Three or more BHD classes	2.05 (2.01, 2.09)	2.87 (2.74, 3.00)	2.08 (2.05, 2.11)

Rate ratios were estimated from adjusted generalized linear models including all presented variables. Enrollees with unknown CRG were excluded. The interaction term CRG*number of BHD classes was included. All $P < .001$ except IP, Native American ($P = .05$)

Table 4. Rate Ratios of ED visits and hospitalizations in enrollees ages 6-20 years with BHD compared to without BHD in NYS Medicaid, 2014 (N=1,494,502)

All rate ratios and p values were obtained using adjusted or unadjusted generalized linear models. The reference group was enrollees without BHD. Multivariate models were adjusted by age group, area of residence, receipt of cash assistance, race/ethnicity, receipt of foster services, and clinical risk group (models for each age group were adjusted by these covariates except age group). The interaction term CRG*BHD was included. *$P < .05$

	Rate Ratio (95% CI)			
Outcome	All Ages	6-11 years	12-17 years	18-20 years
ED				
Non-BH Related	1.50* (1.50, 1.51)	1.29* (1.28, 1.30)	1.56* (1.54, 1.57)	1.77* (1.75, 1.79)
All Cause	2.07* (2.06, 2.08)	1.54* (1.53, 1.55)	2.27* (2.25, 2.30)	2.60* (2.57, 2.62)
IP				
Non-BH Related	1.29* (1.27, 1.327)	1.41* (1.35, 1.47)	1.47* (1.42, 1.53)	1.07* (1.04, 1.11)
All Cause	4.49* (4.42, 4.56)	3.57* (3.47, 3.68)	6.54* (6.37, 6.72)	3.56* (3.48, 3.64)
ED and IP				
Non-BH Related	1.49* (1.48, 1.50)	1.30* (1.29, 1.31)	1.55* (1.54, 1.57)	1.68* (1.66, 1.70)
All Cause	2.24* (2.23, 2.25)	1.64* (1.62, 1.65)	2.53* (2.51, 2.55)	2.72* (2.69, 2.74)

	Adjusted Rate Ratio (95% CI)			
Outcome	All Ages	6-11 years	12-17 years	18-20 years
ED				
Non-BH Related	1.33* (1.32, 1.35)	0.84 (0.70, 1.01)	1.38* (1.35, 1.42)	1.60* (1.56, 1.63)
All Cause	1.73* (1.71, 1.75)	0.94 (0.79, 1.13)	1.85* (1.80, 1.89)	2.24* (2.19, 2.28)
IP				
Non-BH Related	0.81* (0.79, 0.83)	0.41* (0.25, 0.68)	0.88* (0.84, 0.92)	0.90* (0.85, 0.94)
All Cause	1.90* (1.86, 1.94)	0.95 (0.73, 1.23)	2.15* (2.07, 2.24)	2.54* (2.44, 2.63)
ED and IP				
Non-BH Related	1.21* (1.19, 1.22)	0.72* (0.61, 0.86)	1.25* (1.23, 1.28)	1.46* (1.43, 1.48)
All Cause	1.71* (1.69, 1.73)	0.92 (0.80, 1.07)	1.84* (1.80, 1.88)	2.24* (2.20, 2.28)

Drug-Drug Interaction (DDI) analysis: In 2014, 2.5 million persons under 21 were enrolled in NYS Medicaid, and 2.26 million received services. Of those, 1.6 million (72%) filled at least one prescription. Of those who received services, 438,749 (19.4%) people under age 21 years had an encounter with an associated mental health diagnosis, and 147,517 (6.5%) people under age 21 years received a BMHRx regardless of whether or not they had a diagnosis of a BMH condition. This piece of the study includes the union of these two groups and includes analyses of 2,500,493 children and adolescents. There are some notable differences between the DDI cohort and the overall population of NYS Medicaid children. The largest percentage of Medicaid children reside in New York City (58%), but there is a higher percentage of DDI enrollees residing in the rest of the state (76%). This difference is correlated with the observed differences in race/ethnicity distributions, with more Whites in the DDI cohort than in the overall population (59% versus 26%). Within-Medicaid socioeconomic status is represented by the indicators for cash assistance and supplemental security income (SSI), with those receiving financial assistance generally more vulnerable. The DDI cohort has a higher percentage who are receiving cash assistance (81% versus 43%) and SSI (57% versus 5%) than does the overall population of Medicaid children.

Medication use: Eighty-four distinct oral

BMHRx were filled by Medicaid enrollees in 2014 and evaluated. Polypharmacy was common among patients using BMHRx, as 55,620 patients received two or more BMHRx with 30 days or more concurrency (≤32-day gap allowed), generating 11,660 distinct drug combinations. This represents 2.5% of any patient using a Medicaid service and 37.7% of those receiving any BMHRx. Removing the requirement for 30 days of concurrency to 1 day or more concurrency increased the number potentially experiencing polypharmacy to 65,748 patients, with 20,906 distinct drug combinations. This represented 2.9% of any patient using a Medicaid service and 44.6% of those receiving any BMHRx.

Contraindicated DDIs overall: In total, 393 children or adolescents concurrently received two or more BMH drugs that were contraindicated in combination, restricting to those with at least 30 days of concurrency. Of the 84 BMHRx assessed, 24 medications were part of the contraindicated drug pairs prescribed. DDI over time is shown in the Figure below, stratified by age. A higher number of patients age 12-17 years were prescribed contraindicated DDIs than were younger (6-11 years) and older (18-21 years) patients. No children age 0-5 years were prescribed a contraindicated DDI.

Contraindicated DDIs based on concurrency: We performed a sensitivity analysis to examine the impact of length of concurrency on our findings. The overall rate of contraindicated drug combinations with 30 days or more of concurrency was 29.1 per 10,000 children with a BMH medication filled. Rates of medication pairs with contraindicated DDIs range from 0 (for 60 medications) to 4000 per 10,000 prescriptions with thioridazine. Other medications with a high incidence of contraindicated DDIs included ziprasidone (3247 per 10,000 or 364/1121 prescriptions, 32.5%) and pimozide (2286 per 10,000 or 8/35 prescriptions, 22.9%). Rates of contraindicated DDIs per 10,000 children were highest for ziprasidone (25.7), fluoxetine (6.8), and trazodone (5.5). Using ≥15-day concurrency with day supply and not changing the 32-day gap allowance, 565 people (0.38%) were prescribed a contraindicated drug combination. (The overall rate of contraindicated DDIs was 38.3 per 10,000 children. Contraindicated DDI rates increased with ≥15-day concurrency as evidenced by thioridazine having 5000 per 10,000 prescriptions (10/20, 50%), selegiline having 5000 per 10,000 prescriptions (3/6, 50%), and ziprasidone having 4291 per 10,000 prescriptions (518/1207, 42.9%). Rates of contraindicated DDIs per 10,000 children were still highest for ziprasidone, fluoxetine, and trazodone.

Finally, using ≥1-day concurrency, 710 persons (0.48%) were prescribed a contraindicated drug pair (data not shown). The overall rate of contraindicated DDIs was 48.1 per 10,000 children. Contraindicated DDI rates increased more with ≥1-day concurrency, as thioridazine had 6500 per 10,000 prescriptions (13/20 or 65%), ziprasidone had 5443 of 10,000 (657/1207, 54.4%), selegiline had 5000 per 10,000 prescriptions (3/6, 50%), and pimozide had 4286 per 10,000 prescriptions (15/35, 42.9%). The overall rate of contraindicated drug combinations among BMH prescriptions filled was 48.1 per 10,000 children. Rates of contraindicated DDIs per 10,000 children were highest for ziprasidone (44.5), fluoxetine (8.7), risperidone (8.3) trazodone (8.3), and quetiapine (7.3).

Specific contraindicated DDIs and clinical concerns

Not shown are detailed data about the contraindicated DDIs including specific drug pairs, rates per 10,000 prescriptions, and information about concurrency. The most common contraindicated drug pairs were fluoxetine-ziprasidone (n=99), trazodone-ziprasodone (n=88), quetiapine-ziprasidone (n=41), risperidone-ziprasidone (n=41), escitalopram-ziprasodone (n=37), and citalopram-ziprasidone (n=35). Days of concurrency among contraindicated drug pairs ranged from 0 to 360 days (and presumably longer than 1 year).

Given the high number of prescriptions and concerning DDIs that included ziprasidone, a post-hoc analysis revealed numerous BMH diagnostic classes used among persons that have DDIs with ziprasidone. It was found that 95% of persons that had DDIs with ziprasidone also had a BMH diagnosis, and 87% had two or more BMH diagnoses. The most common BMH diagnoses among persons prescribed ziprasidone and another contraindicated drug were mood disorders (n=247), ADHD (n=169), and anxiety (n=157).

OVERVIEW: 2.26 million children and young adults utilized a service paid for by NY State Medicaid in 2014. We refer to these children as "Medicaid Utilizers."

- 50% male, mean age ~ 10 years
  28% White, 23% Hispanic, 18% Black, 8% Asian, 23% other
  - 57% from NYC, 43% from rest of state
- overall prevalence of BMHD: **148 per 1000 Medicaid utilizers**

In 2014, 334,990 children and young adults (15%) received at least one visit with a BMHD and/or mental health medication

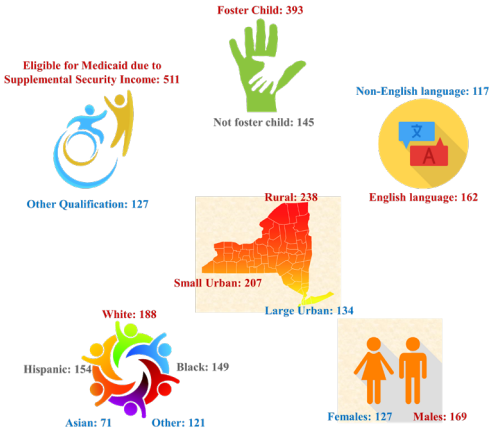
- With a mean of 1.88 diagnostic classes per child – 38% of those with BMHD also received behavioral or mental health medication

Top 10 Prescribed Behavioral Health Medications

#	Drug	n	#	Drug	n
1	Methylphenidate	40,689	6	Sertraline	13,556
2	Amphetamine/ Dextroamphetamine	27,905	7	Fluoxetine	11,179
3	Clonidine	20,935	8	Lisdexamfetamine Dimesylate	10,702
4	Risperidone	19,416	9	Quetiapine Fumarate	9,304
5	Guanfacine	18,454	10	Aripiprazole	9,053

Prevalence Of BMHD Per 1000 NY State Medicaid Utilizers*, by Characteristic

p<0.001 for all comparisons shown, BLUE: lower prevalence than overall population, RED: greater prevalence than overall population, GREY: prevalence at or around population mean



Key Finding 2014: 30+ days overlap any BMHRx, including one top 10 most frequently used medication

Children under 21 who used a Medicaid service in 2014	2,260,898	90%
Total Children with BMH drug use	147,517	7%
Children with 30 + days concurrent BMH drug prescriptions filled	55,620	38%

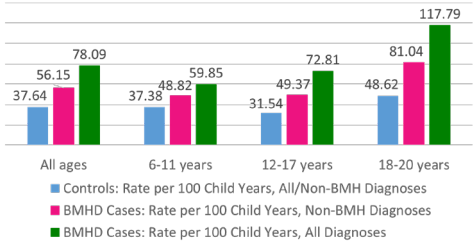
- 11,660 distinct Drug-Drug Combinations observed
- *221 children received CONTRAINDICATED Drug Pairs*

2014 Key Findings: Overlap and Contraindicated DDI involving top 10 most prescribed BMHRx

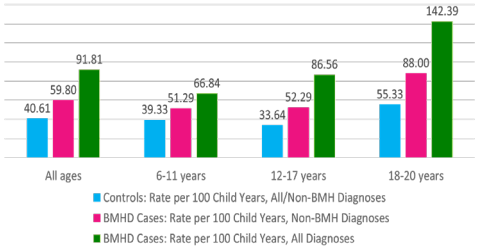
Top 10 BMH Drug	Children with Rx Filled	Children with contraindicated DDI, any overlap	Rate per 10,000 children	Children with contraindicated DDI, 30 days	Rate per 10,000 children
QUETIAPINE FUMARATE	9304	107	115	44	47
FLUOXETINE HCL	11179	128	115	101	90
ARIPIPRAZOLE	9053	102	113	39	43
RISPERIDONE	19416	123	63	43	22
SERTRALINE HCL	13556	3	2	0	0
METHYLPHENIDATE HYDROCHLORIDE	40,689	1	0.2	0	0

- **Any concurrency: *464 Children, 95% with Ziprasidone***
- **30 days or more: *267 children, 94% Ziprasidone***
- No contraindicated DDI: Amphetamine/Dextroamphetamine, Clonidine, Guanfacine, Lisdexamfetamine Dimesylate

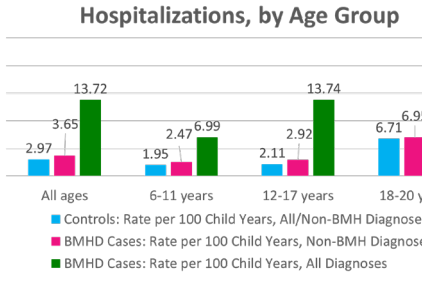
ED Visits, by Age Group



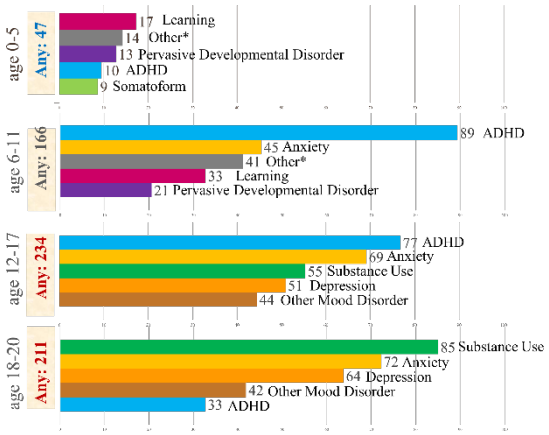
ED Visits and Hospitalizations, by Age Group



Hospitalizations, by Age Group



Five Most Prevalent BMHD Classes per 1000, by Age Group

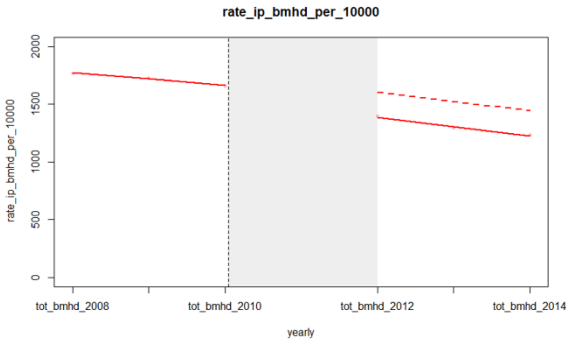


*BMHDs not otherwise classified as one of the following: ADHD/hyperkinetic, anxiety, depression, learning, other mood (not depression or anxiety), oppositional/defiant disorder, peripartum, pervasive developmental disorder, psychotic disorder, somatoform, stress, substance use, suicide/self harm, tic

ED and hospitalization increase not fully explained by increased ED use or hospitalization for BMHDx

ED or Hospitalization, for All Diagnoses in BMHD Children	ED or Hospitalization, for Reasons Other than BMHD
ED Visits : BMHD Children 2.02 (vs 1.54*) Hospitalizations : BMHD Children 1.54 (vs 1.21*)	ED Visits : BMHD Children 1.83 vs non-BMHD Children 1.54 Hospitalizations : BMHD Children 1.37 vs non BMHD Children 1.21

* All ED visits and hospitalizations in non-BMHD children are for reasons other than BMHD



Time-Series Analysis of Move to Carve In Pharmacy Benefit: Inpatient admissions in children with BMHDx: Rate of change increased (P = .06) with meaningful immediate intervention effect (P = .04). This is consistent with an effective intervention for which the benefit suggests additional accrual over time.

2014 Off-label use considering only FDA indications of 10 most prescribed BMHRx

USE OF *OFF-LABEL* MEDICATIONS IN CHILDREN/YOUTH UNDER 21

Medication	FDA Indications	Number of Children… Using Drug	Using Off-Label	Percent Off-Label	Off-Label Use per 1,000 Children with Any Rx Filled
RISPERIDONE	Schizophrenia (Psychosis) or Mood or Autism (Learning)	19,419	7,454	38.4%	50.5
CLONIDINE	ADHD	20,983	4,174	19.9%	28.3
GUANFACINE	ADHD	18,454	2,882	15.6%	19.5
METHYLPHENIDATE	ADHD or Narcolepsy (somatoform)	40,689	2,378	5.8%	16.1
SERTRALINE	OCD, Depression, Panic, PTSD, Anxiety, Premenstrual dysphoric disorder	13,557	2,132	15.7%	14.5
QUETIAPINE FUMARATE	Schizophrenia, Bipolar, or Depression	9,321	2,034	21.8%	13.8
FLUOXETINE	OCD, Depression, Panic, or Bulimia	11,181	1,925	17.2%	13.0
ARIPIPRAZOLE	Schizophrenia, Bipolar, Depression, Tourette's or Autism	9,053	1,847	20.4%	12.5
DEXTROAMPHETAMINE/AMPHETAMINE	ADHD or Narcolepsy	27,905	1,521	5.5%	10.3
LISDEXAMFETAMINE DIMESYLATE	ADHD or Binge Eating	10,702	618	5.8%	4.1
	SUMMARY: Unit of analysis = Medication/Child Pair	N = 181,264	26,965	14.9 %	N/A
	SUMMARY: Unit of analysis = Child	N = 114,367	21,990	19.2 %	149

Time-Series Analysis of Move to Carve In Pharmacy Benefit: ED Use
Rate of change among BMHD patients decreased (P = 0.02) with suggestion (P = .08) of meaningful immediate intervention effect. This is consistent with an effective intervention whose benefit accrues over time

For Both ED and inpatient, this change contrasts with findings in non BMHDx children, suggesting a greater impact in this population.

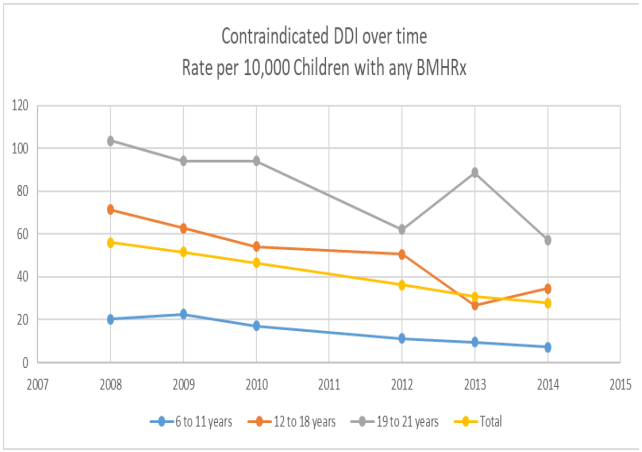
Micromedex presents a summary of risks associated with contraindicated drug pairs. The risks for the contraindicated DDIs revealed in this analysis were reviewed in Micromedex, and some of the risks included potentially life-threatening situations. The most common contraindicated DDIs we found among BMHRx are those that Micromedex suggests carry a risk of potentially lethal cardiac dysrhythmia due to prolongation of the QT interval (n=413 patients with at least 30-day concurrency). The second most common contraindicated DDIs that we found were reported by Micromedex to carry a risk of serotonin syndrome (n=278 patients with at least 30-day concurrency), another serious and potentially lethal complication. Additional study is needed to understand clinical outcomes associated with exposure to these risks.

ADDITIONAL FINDINGS: An interrupted time-series analysis did not demonstrate change in contraindicated DDI associated with the move to carve in the pharmacy benefit with MCO for any age group or overall that was implemented in November 2011 (using 2012 as a washout year). In 2014, there were 15 drugs that were prescribed without an appropriate diagnosis for at least 50% of the members using it. Of those 15 drugs, seven were prescribed to fewer than 30 children. The eight drugs that had 50% or more of overall off-label use *and* were prescribed to 30 or more members were CHLORDIAZEPOXIDE/CLIDINIUM BR (off label rate=100%); GABAPENTIN (70%); NORTRIPTYLINE HCL (69%); IMIPRAMINE (66%); DESVENLAFAXINE SUCCINATE (62%); VILAZODONE HCL (62%); PROCHLORPERAZINE (56%); and TRAZODONE HCL (54%).

Logistic regression found that, in each year and each age group, with White race as the baseline, Black race, Asian race, and Hispanic ethnicity are all protective in terms of likely off-label use. Although racial and ethnic associations with DDI decreased over time from 2008 to 2014, a similar pattern was observed, with White race having a higher odds of filling concurrently a contraindicated drug pair than Black race, Asian race, or Hispanic ethnicity. This bears additional scrutiny to understand the extent to which these findings may represent differential prescribing habits or access for different races.

Analysis at Right (PCMH) ➔

Propensity scores were created to consider propensity to receive care from a PCMH. We conducted one-to-one matched analysis as well as the quintile analysis shown at right.



Propensity-Score by Quintile Analysis--All Ages					
	PCMH Status of Member's Attributed PCP				
	Y		N		Quintile
N Mbrs	72,457		220,257		1
N Members with an ED visit	14,103	19.5%	39,667	18.0%	1
ED Visit Count	21,793		59,158		1
N Members with an Inpatient Visit	4,814	6.6%	12,657	5.7%	1
Inpatient Visit Count	5,528		14,603		1
N Members with 30 day DDI (rate per 10,000)	8	1.1	26	1.2	1
N Members with Off-Label (FDA+Compendia) (rate per 10,000)	646	89.2	2,359	107.1	1
N Mbrs	99,787		186,840		2
N Members with an ED visit	25,585	25.6%	46,228	24.7%	2
ED Visit Count	42,998		76,266		2
N Members with an Inpatient Visit	8,078	8.1%	14,000	7.5%	2
Inpatient Visit Count	9,403		16,335		2
N Members with 30-day DDI (rate per 10,000)	25	2.5	26	1.4	2
N Members with Off-Label (FDA+Compendia) (rate per 10,000)	1,558	156.1	3,176	170.0	2
N Mbrs	127,527		168,563		3
N Members with an ED visit	37,932	29.7%	45,896	27.2%	3
ED Visit Count	66,867		79,131		3
N Members with an Inpatient Visit	10,432	8.2%	12,392	7.4%	3
Inpatient Visit Count	12,254		15,198		3
N Members with 30-day DDI (rate per 10,000)	15	1.2	15	0.9	3
N Members with Off-Label (FDA+Compendia) (rate per 10,000)	1,719	134.8	2,481	147.2	3
N Mbrs	138,410		156,233		4
N Members with an ED visit	46,845	33.8%	48,782	31.2%	4
ED Visit Count	85,758		86,553		4
N Members with an Inpatient Visit	13,179	9.5%	13,209	8.5%	4
Inpatient Visit Count	15,568		16,184		4
N Members with 30-day DDI (rate per 10,000)	21	1.5	36	2.3	4
N Members with Off-Label (FDA+Compendia) (rate per 10,000)	2,039	147.3	2,438	156.0	4
N Mbrs	158,471		133,721		5
N Members with an ED visit	56,726	35.8%	45,409	34.0%	5
ED Visit Count	102,524		79,543		5
N Members with an Inpatient Visit	14,722	9.3%	11,476	8.6%	5
Inpatient Visit Count	17,413		13,754		5
N Members with 30-day DDI (rate per 10,000)	48	3.0	47	3.5	5
N Members with Off-Label (FDA+Compendia) (rate per 10,000)	2,539	160.2	2,731	204.2	5

AIM 3 SURVEY Results

Sample: Consistent with the experience of NYSDOH-conducted surveys, there were many more surveys distributed than were responded to. Our unit of analysis was the practice, and we had imperfect and incomplete information to identify medical leadership in the practice, which is to whom this was targeted. We had 57,923 putative email addresses, associated with 36,886 NPI, which in turn were associated with 13,851 practices. As described above, we employed a standard strategy to email practices, and we maintained high fidelity to our approach. At 476 respondents completing surveys for their practices, the response rate is low, but we believe it to be the largest field survey of practices regarding medication reconciliation. Respondents ranged from solo practices to a few groups of more than 100. We received a sample from across NY State, including, 260 distinct 5-digit zip codes and 53 distinct 3-digit zip codes. Though analysis of the data is ongoing, we report here some interesting and key findings: 37% of practices included general pediatricians, 18% were pediatric specialists, and 27% were mental health clinicians; 23% had general internists, and 29% had family physicians.

- 60% of practices have a written med rec policy
- 95% e-prescribe all or most Rx
- 89% policy calls for med rec at all visits
- Practices (70%) typically follow up by phone or in person after changing chronic medications
- Use of reminder systems to prompt med rec varies by type of visit (e.g., 67% at intake visits, 42% at well-child visits, 57% at follow-up visit for hospital discharges vs 35% when notified of a hospital discharge)
- About 43% have disease-focused decision support, with asthma (63%) being most common

- 52% at least sometimes provide written medication lists to patients
- Medication lists frequently (97%) include Rx from the practice and, less often, other practices' Rx on their patients, even when they are sharing an EHR (43%)
- OTC medications (54%) are sometimes included, as are medications that patients report taking (71%)
- 71% specify a systematic approach for the medication history
- Most common BMHDx with decision support are depression (42%) and ADHD Rx management (32%)

- 35% of practices report that parents notify the practice at least most of the time when they initiate medication changes
- Sensitive Rx to adolescents are excluded from parent access to portals in 33% and not excluded in 55%
- 35% of practices report emphasizing the importance of parents notifying them when medication changes are initiated outside of the office
- 38% report real-time access to information regarding whether a prescription has been filled, and 26% receive monthly reports regarding Rx fills

CME POST TEST EVALUATION (N=208; 201 completed)

Q1: The survey helped me understand the topic. 57.4% Agree or Strongly Agree;

Q2 The survey provided information or raised questions that I will be able to use to benefit my practice. 62.0% Agree or Strongly Agree

Q3: How likely are you to change or implement a medication reconciliation strategy in your practice or engage in some other change in your professional work as a result of your participation in this survey? 77.2% Somewhat or Highly Likely to Make Changes

Q4. What changes are you likely to make (free text)? Of 97 responses, 80 indicated plans for change, many including working on medication lists, increasing communication with patients (including better medication histories), greater inclusion of medications other than prescriptions, doing med rec when learning of ED visits, and working with the EHR to improve its capacity to support med rec. A word cloud follows.

Q5: Do you believe the information presented during this CME activity was scientifically sound and free of commercial bias or influence? 98.1% Yes

Q6: Medication Reconciliation addresses which of the following medications? 96.5% Answered Correctly

Q7: What harms do Medication Reconciliation try to avoid? 97% Answered Correctly

Q8: What is NOT a key attribute of effective Medication Reconciliation? 82.1% Answered Correctly

Free-text comments suggest the that process of taking the survey may stimulate changes to enhance med rec, including by adding OTC medications to med rec, by involving pharmacists in med rec, and by increasing communication with patients.

***DISCUSSION AND CONCLUSIONS*:**

This project has broken important ground on several fronts. By taking a deep dive, we describe the epidemiology of children in NYS Medicaid who were prescribed BMHRx in greater detail than has been done previously. We have incorporated assessments of prescription fills that do not have an appropriate indication from either the FDA or accepted Compendia and thus add to the data regarding the potential overuse of inappropriate care. We recognize that child health clinicians generally incorporate their best judgment of their patients' interests when they prescribe. Thus, our finding of off-label use suggests that one gap may be in the level of evidence regarding the use of psychotropic medications in children. Certainly, the vast number of combinations of medications that we have identified extend well beyond the levels of evidence available to guide practice. Therefore, one interpretation of these data is that *in vivo* therapeutic trials are a common attempt to meet patient needs in the context of limited evidence. Well-intentioned (if not necessarily well-informed) pursuit of better outcomes may or may not have the desired outcome. This, too, deserves study.

Contraindicated drug-drug pairs are not common but occur with regularity. Ziprasidone is associated with more than 90% of these contraindicated potential DDI, and the potential side effects from the observed DDI are potentially devastating. Assessing clinical outcomes will enhance our understanding of the extent to which DDI concerns are or are not manifest in undesirable outcomes. We found that contraindicated pairs of medications decreased over time, perhaps at least in part due to a key policy change, the moving of the pharmacy benefit to be carved out of state management and into managed care contracts. A patient-centered medical home appears to have a variable relationship with outcomes. Hidden in our findings, it appears that likely off-label use and DDI may be less common among those in the propensity quintiles most likely to receive PCMH, with the opposite relationship in those who are in the quintiles less likely to have PCMH. This suggests the potential for important interactions. Perhaps the effectiveness of PCMH is greater in those most likely to receive PCMH and lower in those populations who are most vulnerable. PCMH clearly requires further study to test thoughtful hypotheses regarding what outcomes it may improve and in what circumstances. PCMH is not a magic bullet to improve drug use in the studied populations. Surveys of clinical practices are challenging for many reasons. We found that med rec is an emerging practice with much variability in general and (data not shown) within practice types as well. There are many potential areas of improvement to make med rec more effective, comprehensive, and patient centered. Participation in the survey and CME post-test appears to have motivated respondents to consider enhancements to the med rec practices in their clinical settings.

7. LIST OF PUBLICATIONS AND PRODUCTS

Papers

1. Bardach NS, Neel C, Kleinman LC, McCulloch CE, Thombley R, Zima BT, Grupp-Phelan J, Coker TR, Cabana MD. Depression, Anxiety, and Emergency Department Use for Asthma. In Press (July 2019) Pediatrics.
2. Ronis SD, Kleinman LC, Stange KC. A Learning Loop Model of Collaborative Decision Making in Chronic Illness. Academic Pediatrics. 2019 In Press.
3. Golchin N, Johnson H, Bakak PM, Dawson N, Winterstein A, Waldron J, Staley J, Pestana-Knight EM, Meropol S, Liu R, Feinstein JA, Bolen SD, Kleinman LC, Horace A. Outcome measures in pediatric polypharmacy research: a scoping review. Drugs Ther Perspect (2019) 35: 447. https://doi.org/10.1007/s40267-019-00650-8
4. Bakaki PM, Horace A, Dawson N, Winterstein A, Waldron J, Staley J, Pestana-Knight EM, Meropol SB, Liu R, Johnson H, Golchin N, Feinstein JA, Bolen SD, Kleinman LC. Defining pediatric polypharmacy: A scoping review. PLOS One. November 29, 2018. https://doi.org/10.1371/journal.pone.0208047
5. Baker C, Feinstein JA, Ma X, Bolen S, Dawson NV, Golchin N, Horace A, Kleinman LC, Meropol SB, Pestana Knight EM, Winterstein AG, Bakaki PM. Variation of the prevalence of pediatric polypharmacy: A scoping review. Pharmacoepidemiology and drug safety 28 (3), 275-287. 2019
6. Egorova N, Shemesh E, Pincus H, *Kleinman LC. Behavioral and Mental Health Diagnoses in Children and Adolescents Hospitalized in the US: Observations and Implications. Psychiatric Services. 69(8):910-918. doi: 10.1176/appi.ps.201700389. Epub 2018 Jun 1.
7. Bakaki PM, Staley J, Liu R, Dawson N, Golchin N, Horace A, Johnson H, Waldron J, Winterstein A, Kleinman LC, Bolen SD. A transdisciplinary team approach to scoping reviews: the case of pediatric polypharmacy BMC medical research methodology 18 (1), 102. 2018

Posters and Presentations

1. Kleinman, L. C., Borgelt, L., Bliss, K., Matson, J., Kuang, X.,… Shemesh, E. (accepted). Potentially off-label use of behavioral and mental health medications (BMHRx) in children under 21 years in New York State Medicaid. Poster to be presented at the 2019 AcademyHealth Annual Research Meeting, Washington, DC.
2. Bliss K, Borgelt L, Matson J, Toohey M, Rusch C, Coffey D, Kuang X, Schluchter M, Whitticar S, Olczyk A, Lo S, Rabin B, Shemesh E, Kleinman LC. Trends in the Prevalence of Contraindicated Behavioral Health Drug Prescribing Among New York State Children Enrolled in Medicaid: 2008 – 2014. Poster presented at AcademyHealth June 3, 2019, Washington, DC.
3. Bardach N, Harder V, McCulloch C, Shaw J, Thombley R, Kleinman LC, Cabana M. Does Asthma-Related Emergency Department Use Vary by Day of the Week? Poster presentation at PAS, April 30, 2019. Baltimore, MD.
4. Bardach N, Kleinman LC, Thombley R, McCulloch C, Shaw J, Harder V, Cabana M. Primary Care Connection After Asthma ED Visits and Relationship with Subsequent Utilization. Platform presentation at AcademyHealth, Washington, DC, June 4, 2019.
5. Bardach N, Kleinman LC, Thombley R, McCulloch C, Shaw J, Harder V, Cabana M. Primary Care Connection After Asthma ED Visits and Relationship with Subsequent Utilization. Platform presentation at PAS, April 29, 2019. Baltimore, MD.
6. Lo S, Borgelt L, Cajuste B, Olczyk A, Pace W, Toohey M. Bliss K, Matson J, Gleason K, Kleinman LC. Potentially Dangerous Combinations of Behavioral/Mental Health (BMH) Medications in Children in New York State (NYS) Medicaid. Poster presentation to AcademyHealth, June 25, 2018 Seattle, WA.
7. Olczyk A, Lo S, Borgelt L, Cajuste B, Shemesh E, Pace W, Toohey M. Bliss K, Matson J, Gleason K, Kleinman LC. Off-Label Use of Common Behavioral/Mental Health (BMH) Medications in Children and Young Adults in New York State (NYS) Medicaid. Poster presentation to AcademyHealth, June 24, 2018 Seattle, WA.
8. Lo S, Borgelt L, Cajuste B, Olczyk A, Pace W, Toohey M, Bliss K, Matson J, Gleason K, Kleinman LC. Potentially dangerous combinations of behavioral/mental health (BMH) medications in children in New York State (NYS) Medicaid. Platform presentation by Dr. Kleinman PAS Annual Meeting, Toronto, ON, May 7, 2018.
9. Cajuste B, Bliss K, Matson J, Lo S, Kleinman LC. Patient-Centered Medical Homes and Medication Use Among Children with Behavioral and Mental Health Conditions in NYS Medicaid. Presented as a poster at American Public Health Association, Atlanta, GA, September 2017.
10. Cajuste B, Bliss K, Matson J, Lo S, Meropol S, Rabin Fastman B, Kleinman LC. Impact of Patient Centered Medical Homes on Disparities in Emergency Department (ED) and Hospital Use in Children with Behavioral and Mental Health Diagnoses in NYS Medicaid. Oral presentation at American Public Health Association, Atlanta, GA, September 2017.
11. Cajuste B, Ronis S, Bliss K, Matson J, Meropol S, Borgelt L, Rabin Fastman B, Lo S, Masotya M, Anderson R, Kleinman LC. Increased Emergency Department Visits and Hospitalizations in Children with Behavioral and Mental Health Diagnoses in NY State Medicaid Are Not Explained By Services Primarily for Behavioral or Mental Health Diagnoses. Presented as poster at Academy Health, New Orleans, LA, June 2017.
12. Ronis S, Cajuste B, Bliss K, Matson J, Lo S, Masotya M, Rabin Fastman B, Meropol S, Anderson R, Kleinman LC. Variations in the Prevalence of Mental Illness Among Children and Young Adults in NY State Medicaid. Presented as poster at Pediatric Academic Societies, San Francisco, CA, May 2017.
13. Kleinman LC, Cajuste B, Matson J, Bliss K, Lo S, Masotya M, Meropol S, Ronis S, Anderson R, Rabin Fastman B. Hospitalizations & Emergency Department (ED) Visits in Children and Young Adults Diagnosed with Mental or Behavioral Conditions in NY State Medicaid. Presented as poster at Pediatric Academic Societies, San Francisco, CA, 2017

Although funding has ended, the team is working on completing and submitting for peer-reviewed publication five or more manuscripts on our epidemiological data analyses, policy analyses, and survey.

8. REFERENCES (Bibliographic References are available upon request and have been provided to the Project and Grants Officers).