



Five-Year Trends in Pediatric Mental Health Emergency Department Visits in Massachusetts: A Population-Based Cohort Study

Meng-Yun Lin, PhD^{1,2}, Jihye Kim, PhD³, R. Christopher Sheldrick, PhD⁴, Megan H. Bair-Merritt, MD^{3,5}, Michelle P. Durham, MD^{6,7}, Emily Feinberg, ScD^{3,8}, and Megan B. Cole, PhD⁴

Objectives To evaluate temporal changes in pediatric emergency department (ED) visits for mental health problems in Massachusetts based on diagnoses and patient characteristics and to assess trends in all-cause pediatric ED visits.

Study design This statewide population-based retrospective cohort study used the Massachusetts All-Payer Claims Database, which includes almost all Massachusetts residents. The study sample consisted of residents aged <21 years who were enrolled in a health plan between 2013 and 2017. Using multivariate regression, we examined temporal trends in mental health–related and all-cause ED visits in 2013–2017, with person-quarter as the unit of analysis; we also estimated differential trends by sociodemographic and diagnostic subgroups. The outcomes were number of mental health–related (any diagnosis, plus 14 individual diagnoses) and all-cause ED visits/1000 patients/quarter.

Results Of the 967 590 Massachusetts residents in our study (representing 14.8 million person-quarters), the mean age was 8.1 years, 48% were female, and 57% had Medicaid coverage. For this population, mental health–related (any) and all-cause ED visits decreased from 2013 to 2017 ($P < .001$). Persons aged 18–21 years experienced the largest declines in mental health–related (63.0% decrease) and all-cause (60.9% decrease) ED visits. Although mental health–related ED visits declined across most diagnostic subgroups, ED visits related to autism spectrum disorder–related and suicide-related diagnoses increased by 108% and 44%, respectively.

Conclusions Overall rates of pediatric ED visits with mental health diagnoses in Massachusetts declined from 2013 to 2017, although ED visits with autism- and suicide-related diagnoses increased. Massachusetts' policies and care delivery models aimed at pediatric mental health may hold promise, although there are important opportunities for improvement. (*J Pediatr* 2022;246:199–206).

Mental health and other behavioral disorders affect as many as 1 in 5 children,¹ with elevated risk among children living in low-income households.^{1,2} Across the US, rates of pediatric emergency department (ED) visits with mental health diagnoses have increased substantially.^{3–7} Although EDs are designed to address unplanned acute care needs,⁸ they often serve as the safety-net for children seeking mental health care.^{9–11} Reasons for this include under-diagnosis, lack of mental health treatment due to limited health system capacity and training,^{2,12} and cultural and systemic barriers to mental health care.^{13,14} However, an estimated 84% of children visiting EDs for mental health issues do not see a mental health specialist during the encounter.⁶ Pediatric ED visits for mental health are also twice as likely to lead to hospitalization compared with other pediatric ED visits,¹⁵ often with extended periods of ED boarding.¹⁶

As a result of the *Rosie D. v. Romney* ruling of 2007, Massachusetts established the Children's Behavioral Health Initiative to improve the diagnosis and treatment of pediatric mental health problems. The Children's Behavioral Health Initiative restructured the mental health system for Medicaid-covered children, including new systems for screening and identifying needs, mental health evaluations, intensive care coordination for high-risk families, use of a single care planning team, and provision of home-based mental health services.¹⁷ Starting in 2008, Massachusetts mandated statewide pediatric behavioral health

From the ¹Department of Social Sciences and Health Policy, Wake Forest School of Medicine, Winston-Salem, NC; ²Department of Medicine, Boston University School of Medicine, Boston, MA; ³Department of Pediatrics, Boston Medical Center, Boston, MA; ⁴Department of Health Law, Policy, and Management, Boston University School of Public Health, Boston, MA; ⁵Division of Pediatrics and ⁶Departments of Psychiatry, Boston University School of Medicine, Boston, MA; and ⁷Department of Psychiatry, Boston Medical Center, Boston, MA; and ⁸Department of Community Health Sciences, Boston University School of Public Health, Boston, MA

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ADHD	Attention-deficit/hyperactivity disorder
APCD	All-Payer Claims Database
ASD	Autism spectrum disorder
ED	Emergency department
ICD	International Classification of Diseases
PTSD	Post-traumatic stress disorder

screenings for children, which substantially increased the identification of children at risk.¹⁸⁻²⁰ In 2004, the state also established the Massachusetts Child Psychiatry Access Program, a hotline that pediatric clinicians can call and be connected with child psychiatrists to get support for managing and prescribing for pediatric mental health issues.²¹ Various local efforts also have been made throughout the state to improve integration of mental health services into pediatric primary care and emergency care. For example, community health centers and Boston Children's Hospital initiated programs to fully integrate behavioral health services into pediatric primary care in 2016 and 2013, respectively.²²⁻²⁴ A Boston-area mental health association also implemented a dedicated service line to provide crisis evaluation and treatment services to vulnerable populations.²⁵

Understanding heterogeneity in pediatric ED use for mental health with respect to age, sex, clinical diagnoses, and income groups is key to targeting specific subpopulations needing additional services.

The objectives of our analyses were twofold: first, using all-payer claims data that capture the near-universe of children in Massachusetts, we examined rates of pediatric ED visits with mental health diagnoses across Massachusetts from 2013 to 2017—the most recent years of available data as of the time of this analysis—as well as rates of all-cause ED visits as a secondary outcome to provide context underlying statewide trends. Second, we characterized the nature of temporal changes in mental health–related ED visits according to diagnosis type and key patient characteristics. Of note, we do not evaluate the effects of specific policies on trends in ED visits, but rather describe these trends in the context of the Massachusetts policy environment.

Methods

The primary data source was the 2013-2017 Massachusetts All-Payer Claims Database (APCD). The APCD contains comprehensive claims data from all public and private payers in Massachusetts, representing the near-universe of children in Massachusetts with the exception of those in some self-insured private plans.²⁶ Individuals in the APCD are followed longitudinally for as long as they are enrolled in a health plan operating in Massachusetts, where 99% of children were insured as of 2018.²⁷ We also used the 2017 American Community Survey to obtain ZIP code–level sociodemographic information.²⁸ The Boston Medical Center Institutional Review Board deemed this study exempt.

Study Sample

Our study population was an open retrospective cohort of children aged 0-21 years who were enrolled in a health plan between January 1, 2013, and December 31, 2017. We included individuals aged 18-21 years for consistency with recent pediatric recommendations.²⁹ For each study quarter, children remained in our sample if they were aged ≤ 21 years and had continuous insurance coverage within the quarter ($n = 15\,336\,666$ person-quarters). We excluded children

with missing sociodemographic data ($n = 543\,686$ person-quarters) and quarters when children did not reside in Massachusetts ($n = 10\,687$ person-quarters). The final analytic study sample included 14 782 293 person-quarters, representing 967 590 unique patients.

Outcome Measures

Outcomes included counts of ED visits with any mental health–related diagnosis and all-cause ED visits, measured as the number of visits per 1000 patients per quarter. We identified ED visits using revenue codes, place of service codes, and/or Current Procedural Terminology codes (Table I; available at www.jpeds.com). We defined mental health visits as ED presentation with a mental health diagnosis, either principle or secondary, using a comprehensive set of *International Classification of Diseases* (ICD) codes (Table II; available at www.jpeds.com).³⁰ In our primary analyses, we used both primary and secondary diagnoses to define mental health–related ED visits. This approach supports a stable transition during the change from ICD-9 to ICD-10 in Q4 of 2015 and is more sensitive in capturing the universe of children with mental health needs who utilize the ED. However, we present sensitivity analyses in which we define mental health visits using primary diagnosis.

Additional outcomes included ED visits for 14 clinical subcategories of diagnoses, each estimated separately: attention-deficit/hyperactivity disorder (ADHD); depressive disorders; anxiety disorders; disruptive, impulse-control, and conduct disorders; other mood disorders; autism spectrum disorder (ASD); schizophrenia spectrum and other psychotic disorders; bipolar disorders; trauma- and stressor-related disorders, including post-traumatic stress disorder (PTSD); obsessive-compulsive disorders; feeding and eating disorders; personality disorders; motor disorders; suicidal ideation, suicide attempts, and self-inflicted harm; and all other mental health disorders. ICD-9 and ICD-10 codes used to identify each subdiagnosis are provided in Table II.

Patient Covariates

Measured characteristics included age, sex, payer type, and ZIP code–based poverty group. Payer type was defined as Medicaid, private insurance, or uninsured/other; uninsured patients were largely self-pay patients covered by Massachusetts' Health Safety Net.³¹ Because the APCD does not contain information on individual socioeconomic status, we merged area-level poverty from the American Community Survey using the 5-digit patient ZIP code.

Statistical Analyses

Our unit of analysis was the person-quarter. We used generalized estimating equations with a negative binomial distribution and log link and an exchangeable correlation structure to estimate changes in quarterly rates of ED visits over time. The primary exposure variable was calendar time, measured in quarters. Models also were adjusted for patient age, sex, payer type, and area poverty. First, we performed parallel analyses for ED visits with any mental

health diagnosis, all-cause ED visits, and ED visits for our 14 mental health subdiagnoses. Second, to examine differential trends in ED visits by patient characteristics, we conducted subgroup analyses according to age, sex, payer type, and poverty area by adding an interaction term between the year-quarter indicators and each subgroup variable. Finally, we performed sensitivity analyses using outcomes defined by primary diagnosis to assess the robustness of main estimates. For all models, we estimated standard errors robust to heteroscedasticity using White–Huber variance estimators clustered at the individual level.^{32,33} All presented results were calculated as average marginal effects, as derived from our regression models. Analyses were performed using Stata version 16.1 (StataCorp).

Results

Population Characteristics

Of the 14.8 million person-quarters in our study sample (Table III), the mean age was 8.1 ± 6.7 years, and 48% were female. The majority of children had Medicaid coverage (57%), and >30% lived in a ZIP code with a poverty rate >25%. Between 2013 and 2017, there were some meaningful changes in the demographic composition of the study population, including a reduction in the proportion of children with private coverage and a corresponding increase in the proportion with Medicaid coverage as a result of some self-insured private plans no longer submitting claims to the APCD starting in 2016,²⁹ as well as an increase in the proportion of the population aged 18-21 years.

Table III. Demographic characteristics of the study sample (2013-2017)

Characteristics	2013-2017	2013*	2017*
Number†	14 782 293	2 823 813	2 841 189
Age, y, mean \pm SD	8.1 ± 6.7	9.2 ± 6.2	10.2 ± 6.6
Age group, %			
<5 y	25.6	26.4	24.1
5-12 y	34.5	35.7	35.3
13-17 y	23.0	25.6	21.1
18-21 y	16.9	12.4	19.5
Sex, %			
Female	48.4	48.7	48.2
Male	51.6	51.3	51.9
Insurance type, %			
Medicaid	57.2	47.8	67.4
Private	42.0	51.1	31.8
Uninsured and other	0.9	1.1	0.8
Area poverty rate, %‡			
<5%	19.6	21.0	17.8
5-<10%	18.3	19.2	17.4
10-<15%	11.8	11.8	11.8
15-<25%	19.1	18.6	19.7
25-<40%	22.4	21.0	24.0
$\geq 40\%$	8.4	7.9	9.0

*The first and last years of the study are shown. For each individual study year, see Table IX.
 †Represents person-quarters, which includes 967 590 unique persons from 2013 to 2017.
 ‡ZIP code-level poverty rate based on percentage of children living in households at <100% of the federal poverty level.

Trends in Pediatric Mental Health–Related and All-Cause ED Visits

Between 2013 and 2017, Massachusetts experienced a statistically significant decline in pediatric ED visits with mental health diagnoses and all-cause ED visits (Figure 1 and Table IV), with the largest declines occurring within 2013. The average ED visit rate for mental health disorders dropped from 18 visits/1000 patients/quarter in 2013 to 12 visits/1000 patients/quarter in 2017, equivalent to a relative decrease of 33.6% (95% CI, 31.5-35.7). All-cause ED visit rates decreased from 205 visits/1000 patients/quarter in 2013 to 156 visits/1000 patients/quarter in 2017, for a 23.6% relative decrease (95% CI, 23.2%-24.1%). Regression results are provided in Tables V and VI (available at www.jpeds.com).

Trends in Pediatric ED Use by Diagnostic Subcategories

In analyses stratified by diagnosis subcategory, depressive disorder was the most common mental health diagnosis presented at ED visits (4.9 visits/1000 patients/quarter in 2013), followed by anxiety disorder (3.9 visits/1000 patients/quarter) and ADHD (3.1 visits/1000 patients/quarter) (Table IV; Figure 2, available at www.jpeds.com). ED visit rates for most conditions declined between 2013 and 2017. Among the top 10 most prevalent mental health diagnoses, the largest observed relative decreases included ED visits with diagnoses of other mood disorders (−71.2% decline; 95% CI, −74.1% to −67.9%), schizophrenia spectrum disorders (−51.6%; 95% CI, −57.5% to −45.0%), bipolar disorders (−47.3%; 95% CI, −52.7% to −41.3%), PTSD and other stress-related disorders (−43.2%; 95% CI, −48.7% to −37.2%), and ADHD (−40.5%; 95% CI, −45.2% to −35.3%). Conversely, the relative rates for ASD and suicide-related diagnoses rose by 108.3% (95% CI, 88.9%-129.6%) and 44.0% (95% CI, 37.4%-50.9%), respectively.

Trends in Pediatric ED Use Across Patient Subgroups

Although mental health ED visit rates were generally flat for children aged <5 years, rates decreased over time for older groups, and the rate of decline was most pronounced among young adults (56.7% decrease), dropping from an average of 40.6 visits/1000 patients in 2013 to 17.6 visits/1000 patients in 2017 (Figure 3). We observed a steady decline in visits for mental health conditions among both males and females, with slightly higher visit rates among females. ED visit rates for mental health were consistently higher among Medicaid enrollees compared with children with private coverage. Between Q3 and Q4 of 2013, there was a sharp decrease in mental health–related ED visits among Medicaid enrollees, but visits of privately insured children remained mostly unchanged. We did not observe a statistically significant change in ED visit rates for mental health conditions in later years regardless of insurance type. We found a sharp decline in ED visits for mental health conditions among the

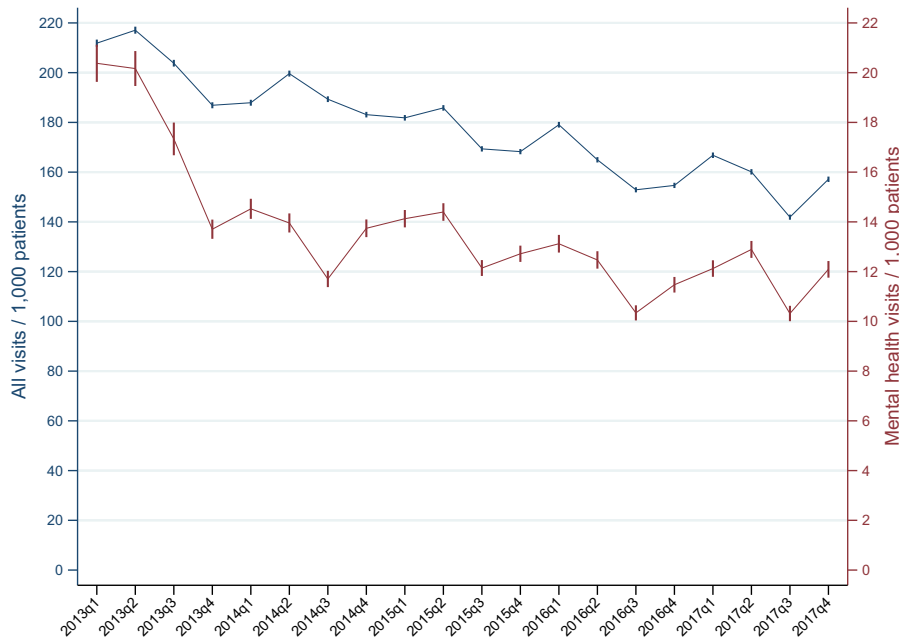


Figure 1. Risk-adjusted pediatric (aged 0-21 years) mental health and all-cause ED visit rates in Massachusetts, 2013-2017. All estimates are adjusted for age, sex, insurance type, and ZIP code-based poverty group.

higher-poverty groups between Q3 and Q4 of 2013, with no disparities in rates among poverty groups thereafter.

Over the 5-year period, all-cause ED rates decreased by 54.3% among young adults, including a rapid decrease within 2013, from an average of 356.8 ED visits/1000 patients in 2013 to 162.9 ED visits/1000 patients in 2017 (Figure 4; available at www.jpeds.com). Other all-cause ED trends were similar to those observed during mental health ED visits, with one exception: all-cause ED visit rates were

consistently higher among children in higher-poverty ZIP codes, and these disparities were constant over time.

Sensitivity Analyses

We identified fewer overall mental health-related ED visits when using primary diagnosis only, as anticipated. Mental health-related conditions accounted for 5.2% of the overall ED visits when defining by primary diagnosis, compared with 8.0% when considering both principal and secondary

Table IV. Trends in risk-adjusted pediatric (age 0-21 years) mental health-related ED visit rates by clinical subcategory

Outcomes	Mental health-related ED visit rates (visits per 1000 patients per quarter)					Relative change, % (95% CI)*
	2013	2014	2015	2016	2017	
Mental health ED visit rate (any)	17.9	13.5	13.3	11.9	11.9	-33.6 (-35.7 to -31.5)
Depressive disorders	4.9	4.2	4.0	3.7	3.8	-22.9 (-26.5 to -19.1)
Anxiety disorders	3.9	3.4	3.6	3.4	3.4	-12.0 (-17.3 to -6.4)
ADHD	3.1	1.8	2.0	1.8	1.8	-40.5 (-45.2 to -35.3)
PTSD and other trauma- and stressor-related disorders	2.6	1.4	1.3	1.4	1.5	-43.2 (-48.7 to -37.2)
Conduct disorders	2.0	1.7	1.6	1.4	1.3	-33.8 (-39.4 to -27.7)
Suicidal ideation, attempts, and self-inflicted injury	1.8	1.8	2.1	2.2	2.6	44.0 (37.4-50.9)
Bipolar disorders	1.2	1.0	0.9	0.7	0.6	-47.3 (-52.7 to -41.3)
Schizophrenia spectrum and other psychotic disorders	0.8	0.7	0.6	0.4	0.4	-51.6 (-57.5 to -45.0)
Other mood disorders	1.4	1.1	0.9	0.5	0.4	-71.2 (-74.1 to -67.9)
ASD	0.5	0.7	0.9	1.0	1.1	108.3 (88.9-129.6)
Feeding and eating disorders	0.2	0.1	0.1	0.1	0.1	-16.8 (-34.7 to 6.1)
Obsessive-compulsive disorders	0.1	0.1	0.1	0.1	0.01	-92.8 (-95.7 to -88.0)
Personality disorders	0.1	0.1	0.1	0.1	0.1	-17.3 (-36.3 to 7.4)
Motor disorders	0.1	0.1	0.1	0.1	0.1	-26.2 (-52.8 to 15.3)
Other mental health disorders	3.0	2.7	2.5	0.8	0.8	-73.5 (-75.2 to -71.5)
All-cause ED visit rate	204.9	190.0	176.3	162.9	156.5	-23.6 (-24.1 to -23.2)

All estimates are adjusted for age, sex, insurance type, and ZIP code-based poverty group. *Changes between 2013 and 2017.

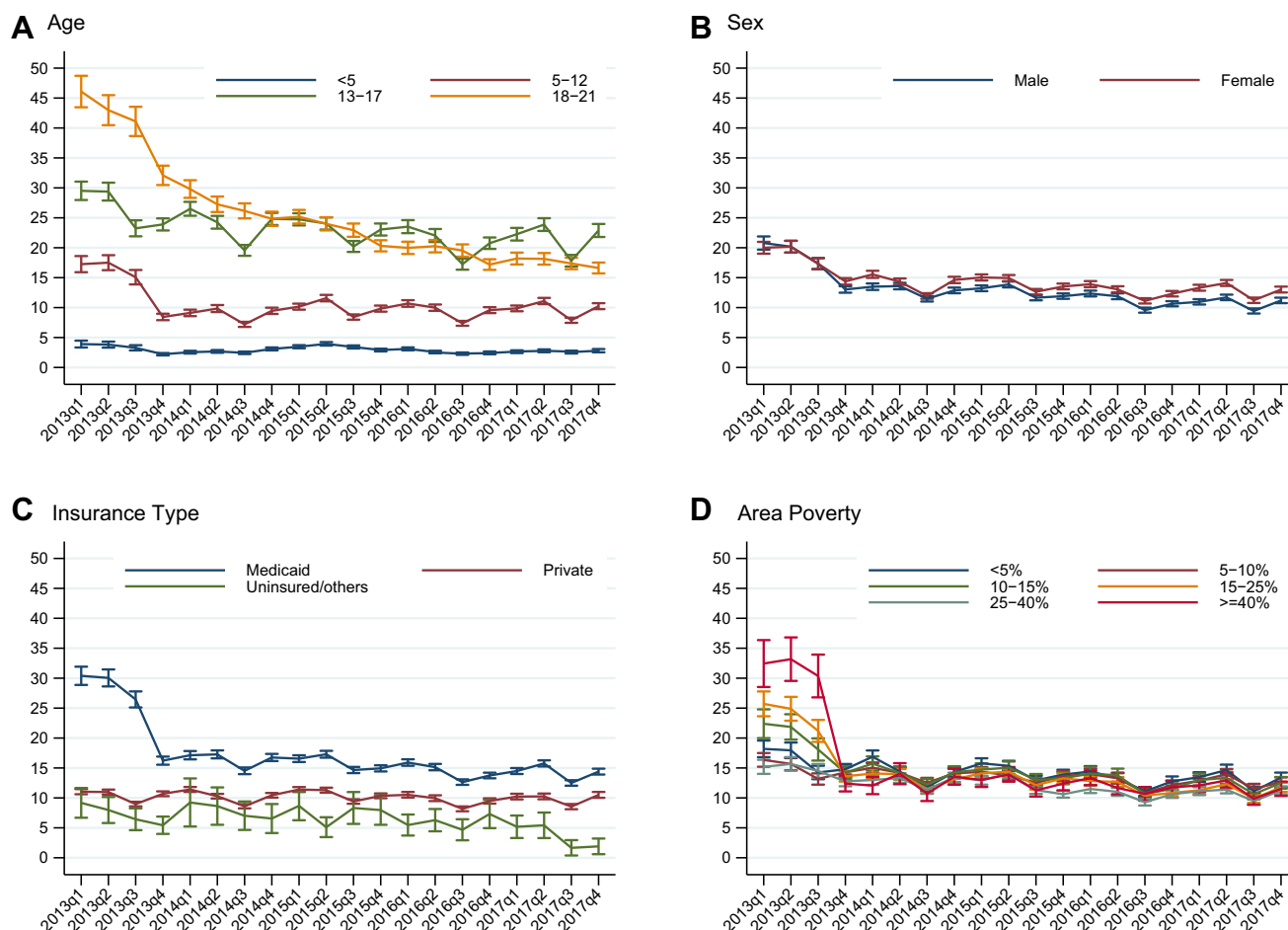


Figure 3. Risk-adjusted pediatric (aged 0-21 years) mental health-related ED visit rates by subgroup, 2013-2017. All estimates are adjusted for age, sex, insurance type, and ZIP code-based poverty group.

diagnoses (Table VII; available at www.jpeds.com). Nonetheless, sensitivity analyses examining trends in mental health-related ED visits identified by primary diagnosis were largely consistent with our main results (Figures 5 and 6, Tables VIII and IX; available at www.jpeds.com).

Discussion

Using all-payer claims data to assess trends in pediatric ED use for mental health across different clinical and sociodemographic groups, we found a downward trend in ED visits over time in Massachusetts, a national leader in addressing pediatric mental health.^{21,34-36} Patients aged 18-21 years and those enrolled in Medicaid experienced the largest declines in mental health ED use; however, disparities in ED visit rates with and without mental health diagnoses still existed for Medicaid-enrolled children. Although ED rates declined across most clinical subgroups from 2013 to 2017, ED visit rates for ASD and suicidal ideation or suicide attempts

increased, with relative increases of 108% and 44%, respectively.

During our study period, ED visits for ASD and suicide-related diagnoses rose. This is consistent with national trends, with studies finding that across all states, rates of ED visits for ASD among adolescents increased 5-fold from 2005 to 2013.³⁷ The increasing ASD-related ED visits could be driven in part by children with co-occurring intellectual disability, who account for nearly one-third of individuals with ASD.³⁸ Prior studies have documented a higher prevalence of unmet health care needs for children with ASD with co-occurring intellectual disability,^{39,40} which may drive patients to seek care in the ED. Previous studies on suicide-related ED visits and suicide rates among children and adolescents also have shown increasing national rates.^{5,6,41-44} In Massachusetts, Centers for Disease Control and Prevention data suggest that suicide rates among children aged ≥ 10 years increased by 35.3% from 1999 to 2016.⁴⁵

Our main findings deviate from national data, which show that pediatric ED visits for mental health disorders rose by

21%–86% nationally over a similar time period.^{3–7,46} In contrast, our study found that in Massachusetts, pediatric ED visits with any mental health diagnosis dropped by 34% from 2013 to 2017. Although the decline occurred primarily during 2013 for children aged <18 years, the subsequent flat rates denote a different pattern than steadily increasing national trends. We extend prior work by examining temporal trends in pediatric ED visits in a state that may serve as a national model for improving pediatric mental health care. We also investigate heterogeneity in trends of mental health–related ED visits in a way that is more robust than most prior work by assessing differences across age groups, sexes, 14 clinical sub-diagnoses, payer types, and ZIP code–based income groups.

The fact that trends in Massachusetts differ from national and international data^{47,48} may be due to the health care landscape of Massachusetts. For example, the 2007 *Rosie D. v. Romney* ruling and the resulting health care delivery reforms may have enhanced access to primary care and mental health care for children. Moreover, the 2008 mandate for statewide behavioral health screening for children may have led to better identification of children at risk. Although not explored extensively in our study, these results may reflect a substitute effect wherein Massachusetts children may be increasingly more likely to be treated in a primary care or outpatient setting instead of an ED for mental health needs. Alternatively, this could reflect that children may be increasingly better linked to primary care and mental health treatment, thereby precluding the need for ED visits. The underlying mental health status and needs of children also may be different in Massachusetts relative to other states. For instance, prior studies have documented that the unmet need for mental health services for school-age children in Massachusetts is below the national average.^{49,50}

Although the disparity in ED visit rates between Medicaid vs privately insured children narrowed during our study period, substantial disparities remained. High rates of pediatric ED use among Medicaid enrollees suggest that additional efforts must be made to improve access to regular care. However, despite persisting disparities, trends among Massachusetts Medicaid enrollees compare favorably to those seen nationally; across the US, pediatric ED visits by Medicaid patients, including mental health–related visits, have been increasing significantly over time.^{5,51,52}

We observed a sharp drop in mental health–related ED visits among Medicaid-enrolled and high-poverty group children between Q3 and Q4 of 2013. To further investigate, we conducted extensive additional analyses to explore several hypotheses. We found that this drop was driven largely by individual outliers initially using the ED > 4 times a quarter, often spaced 7 days apart (Figures 7–22; available at www.jpeds.com).

This study has some limitations. First, even though our methods are consistent with those of several prior studies that used diagnostic codes captured in insurance claims to identify mental health-related ED visits,^{53–55} claims are used for billing purposes and are subject to missing codes

or potential reporting errors. Although this could undercount total mental health–related ED visits, we have no reason to believe that this would be different over time, and claims are widely used to examine the utilization of mental health services.^{56,57} Second, our findings are descriptive only and do not evaluate the effects of specific policies or practices on ED visits. Future work should assess the impact of state-specific pediatric mental health and general pediatric health policies on these outcomes, especially in light of both mental health and all-cause ED visit declines. Third, some self-insured employer plans did not submit claims data to the APCD starting in 2016, in response to the US Supreme Court ruling making it optional for self-insured private plans to do so.²⁶ Although this reduced the total number of children captured in our denominator, the Massachusetts APCD still captures most of the state’s population and all major insurers.⁵⁸ We did not observe discontinuities in other population demographics or ED visit counts before and after 2016 (Table X; available at www.jpeds.com). Fourth, 2013 was the first year of data available to our study team, and thus we were unable to assess trends over a longer time period. Finally, we were unable to assess pediatric ED visits for substance use disorders, because these diagnoses were redacted. This may have resulted in an underestimate of ED visit rates among older children and young adults.

Despite these limitations, our findings have 3 important implications. First, declining rates of mental health–related ED visits in Massachusetts, unlike those observed elsewhere, suggest that the state’s policies and care delivery models aimed at pediatric mental health hold promise. Although more research is needed to identify the most promising practices in the state and the impact of specific policies on health outcomes, other states may look to Massachusetts as a model for improving pediatric care. Second, there are opportunities to enhance access to mental health services through integration into primary care, particularly for Medicaid enrollees and those with ASD and suicidal ideation or behavior, for whom mental health–related ED visit rates are persistently high or increasing. Third, our findings highlight the need for greater disaggregation of data when studying pediatric mental health outcomes, including understanding variations across and within states. Finally, the proportion of mental health–related ED visits among all pediatric ED visits rose during the coronavirus-19 pandemic.^{59,60} Future studies examining whether the favorable pattern observed in Massachusetts persisted during and after the pandemic are warranted. Given that some mental health disorders frequently co-occur in individuals with intellectual disabilities, mental health–related ED visits within this vulnerable subgroup also warrant exploration. ■

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Reprint requests: Megan B. Cole, PhD, MPH, Boston University School of Public Health, Talbot 240W, 715 Albany Street, Boston, MA 02118. E-mail: mbccole@bu.edu

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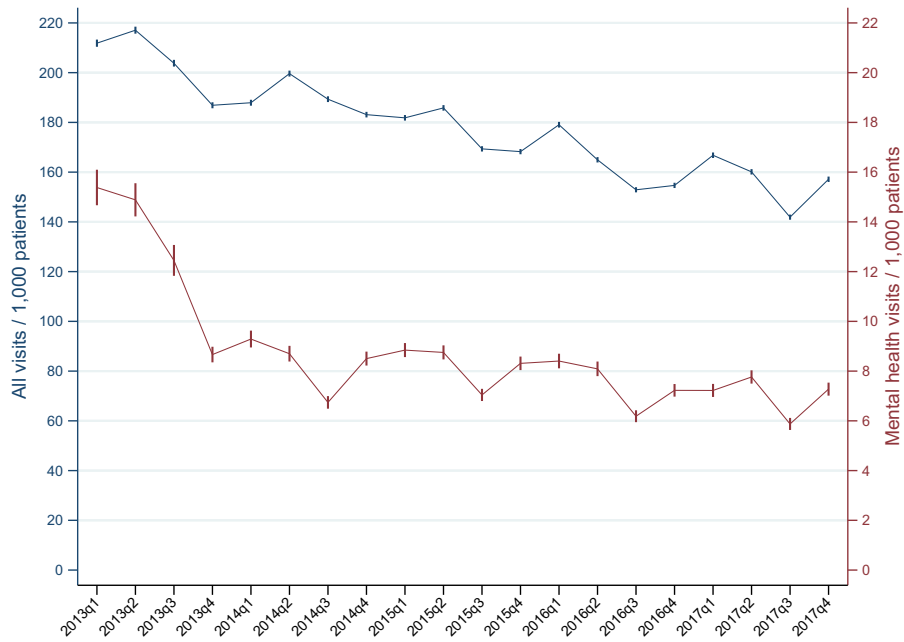


Figure 2. Risk-adjusted ED visit rates among 0- to 21-year-olds in Massachusetts, 2013-2017 (mental health disorders defined by principal diagnosis).

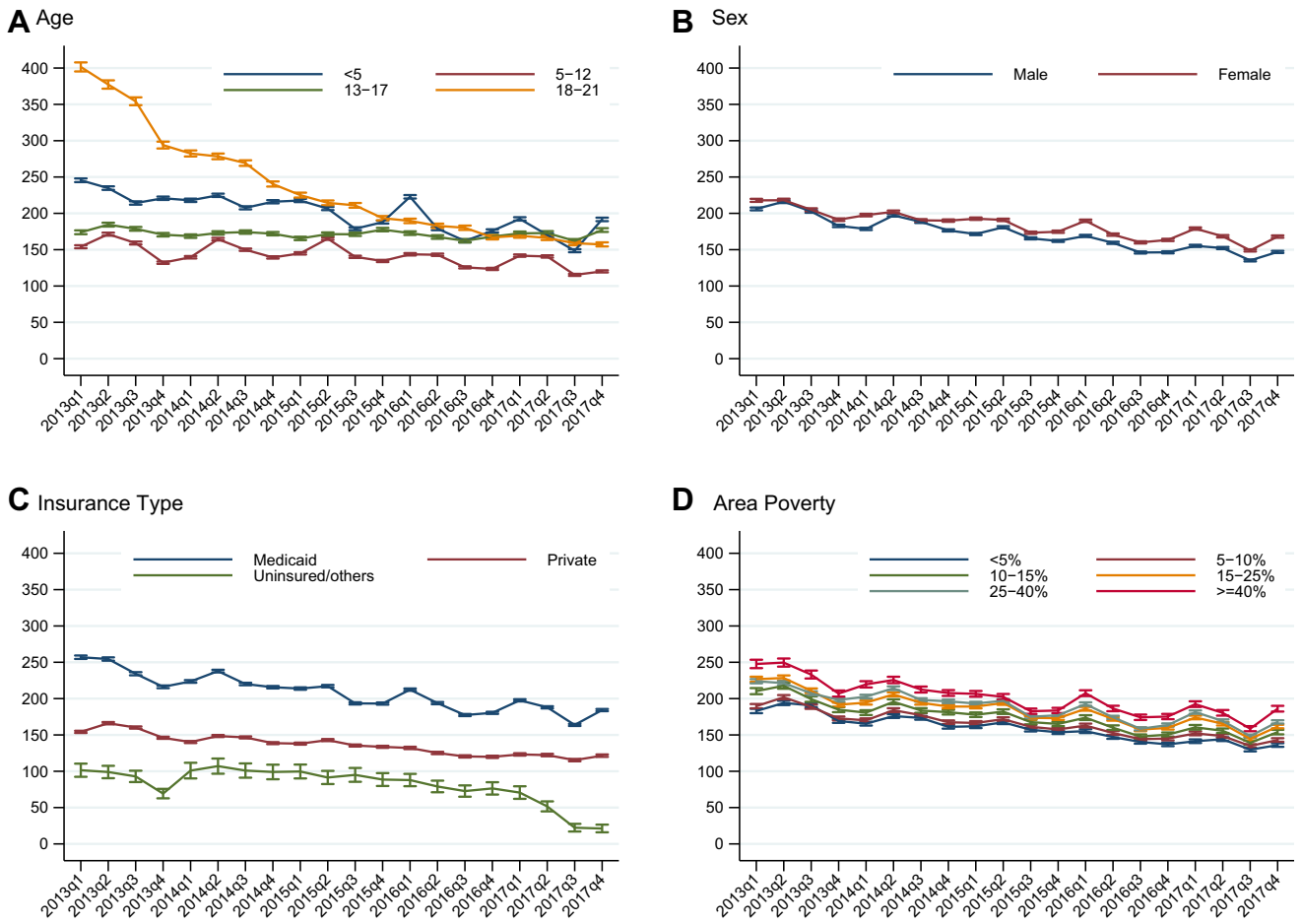


Figure 4. Risk-adjusted pediatric (aged 0-21 years) all-cause ED visit rates by subgroup, 2013-2017. All estimates are adjusted for age, sex, insurance type, and ZIP code-based poverty group.

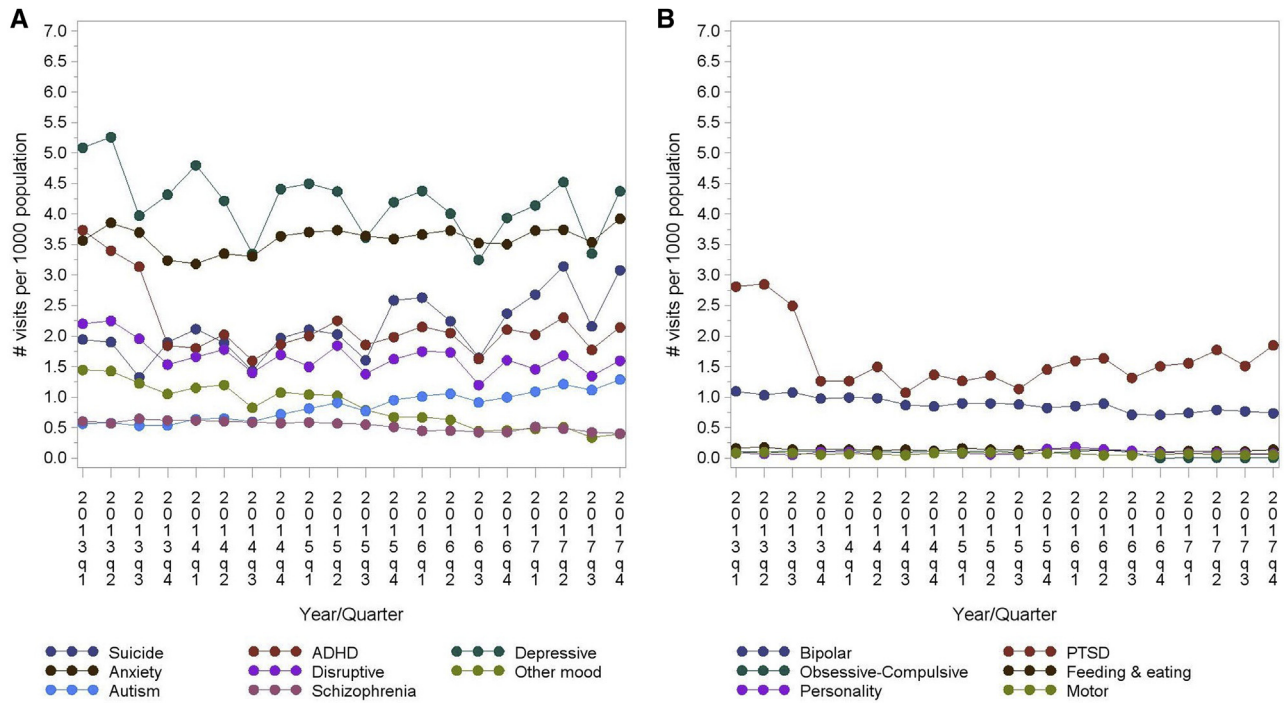
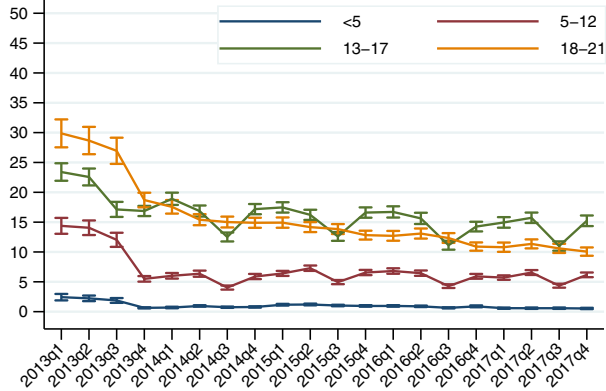
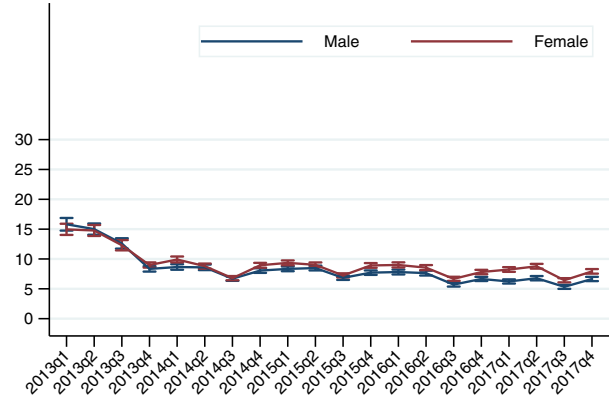


Figure 5. Risk-adjusted mental health-related ED visit rates among 0- to 21-year-olds in Massachusetts by subdiagnosis, 2013-2017 (mental health disorders defined by any diagnosis).

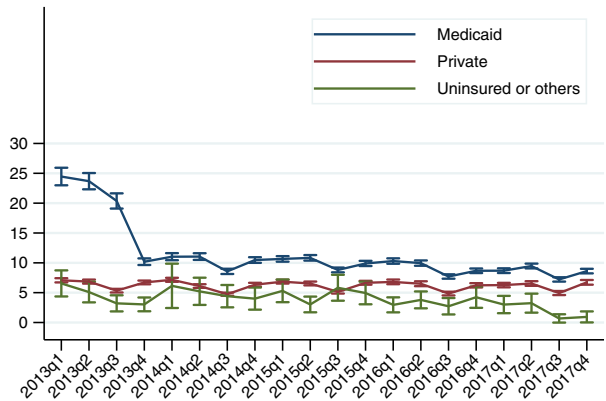
A Age



B Gender



C Insurance Type



D Area Poverty

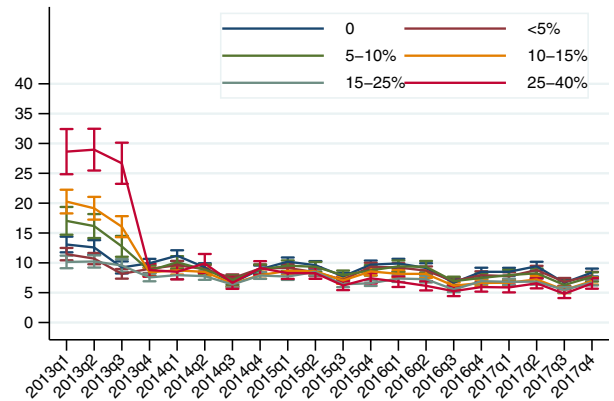


Figure 6. Risk-adjusted mental health-related ED visit rates among 0- to 21-year-olds in Massachusetts by subgroup, 2013-2017 (mental health disorders defined by principal diagnosis).

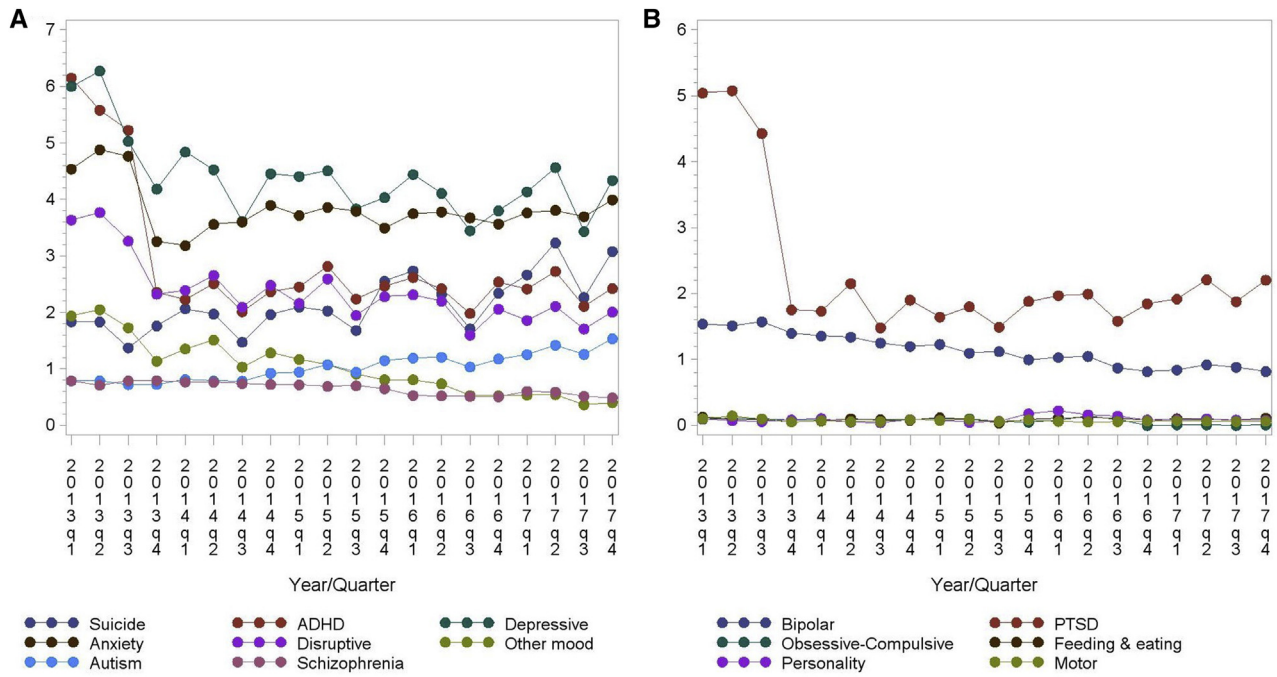


Figure 7. Mental health-related ED visits among Massachusetts children aged 0-21 years by subdiagnosis (any diagnosis): Medicaid-enrolled children only.

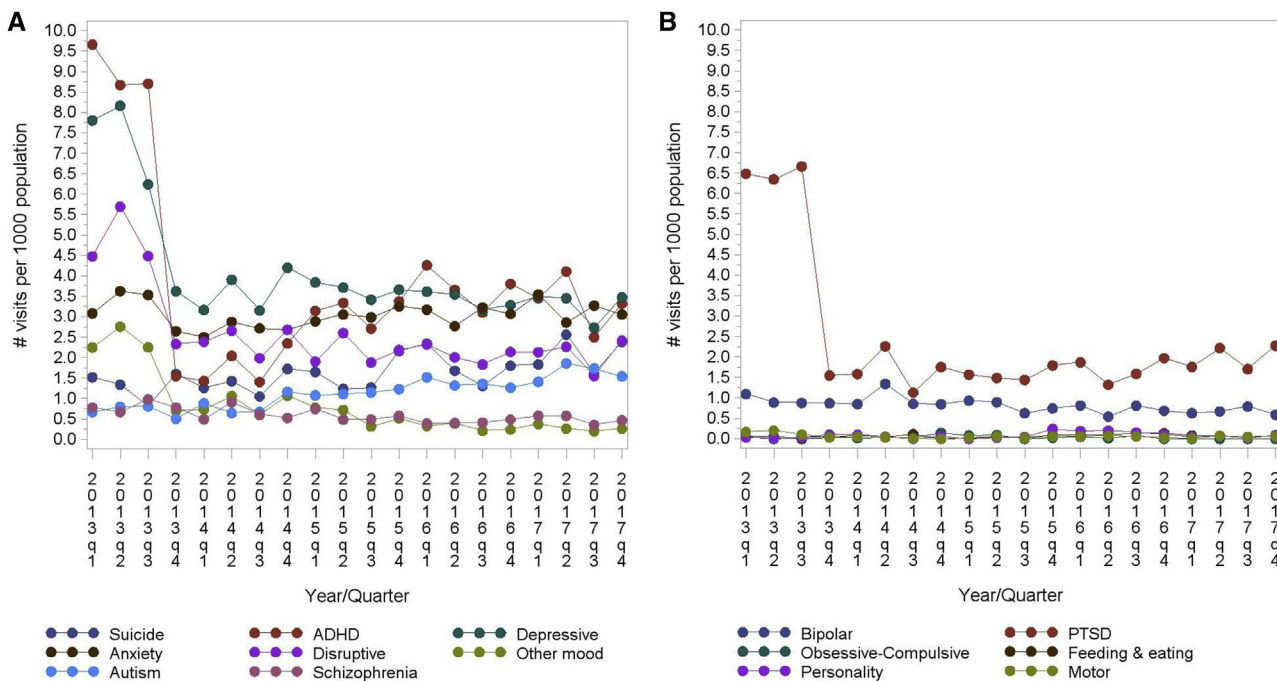


Figure 8. Mental health ED visits among Massachusetts children (aged 0-21 years) by subdiagnosis (any diagnosis): highest-poverty areas (>40%).

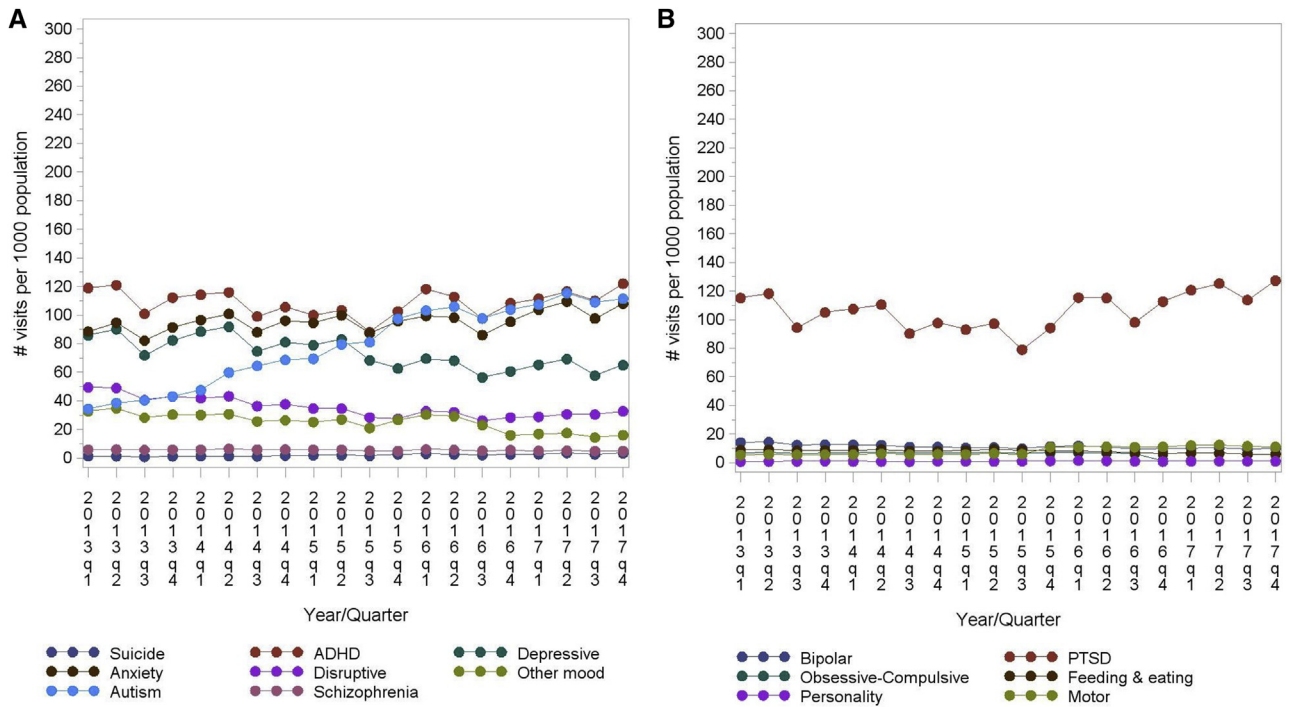


Figure 9. Trends in the frequency of non-ED mental health visits by diagnosis, full study population.

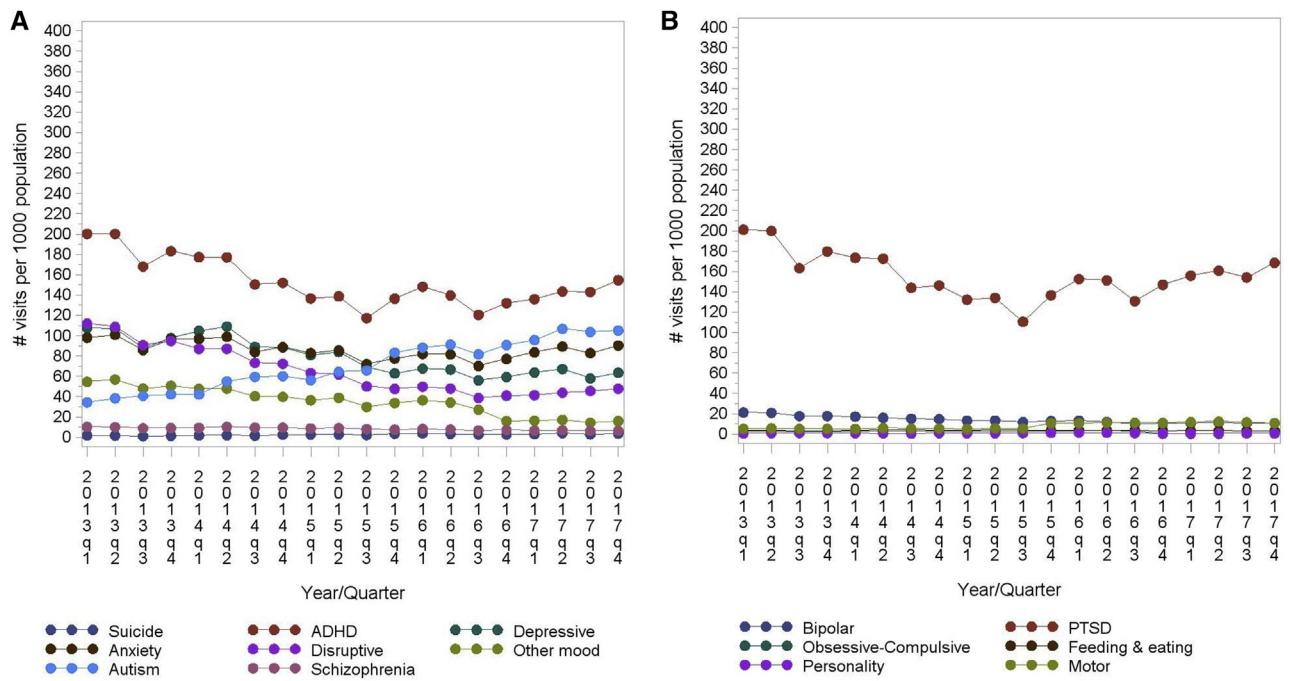


Figure 10. Trends in frequency of non-ED mental health visits by diagnosis, Medicaid recipients only.

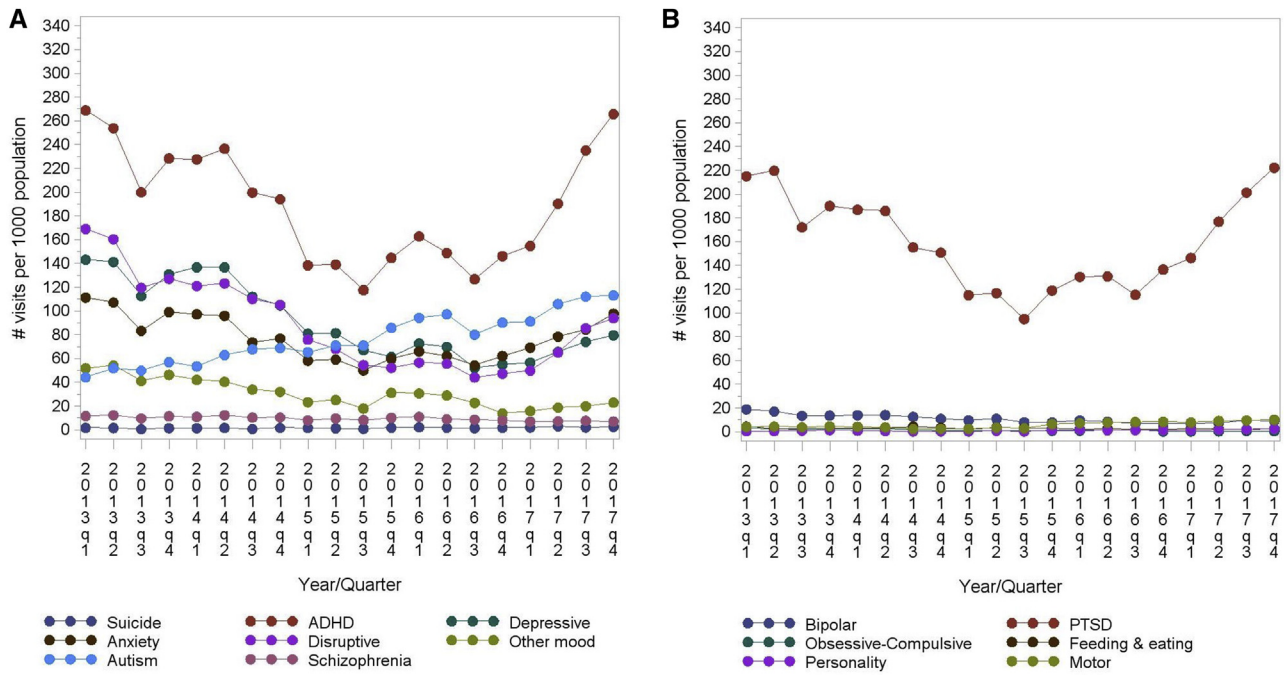


Figure 11. Trends in frequency of non-ED mental health visits by diagnosis among children residing in the areas of highest poverty ($\geq 40\%$).

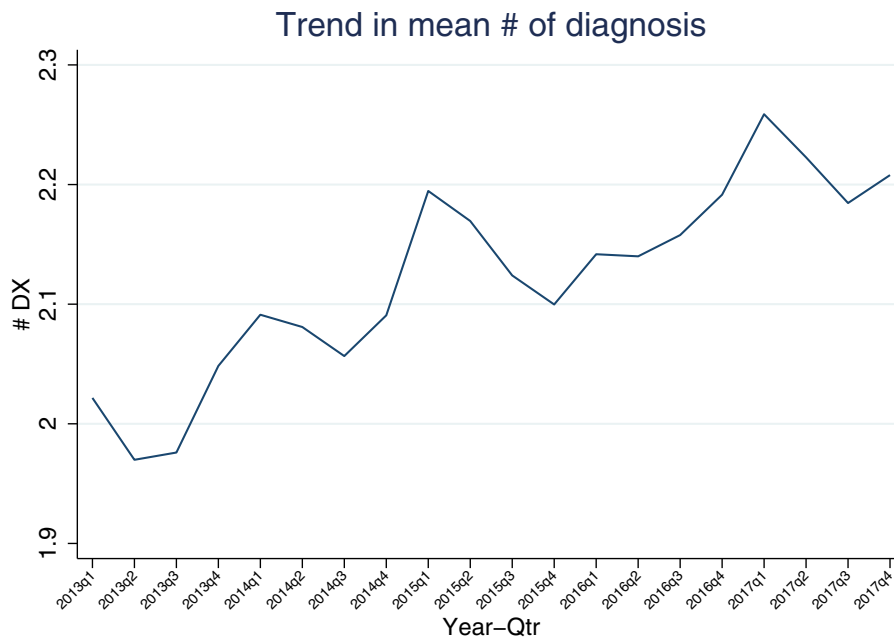


Figure 12. Trends in the mean number of diagnoses reported on claims among those who had an ED visit.

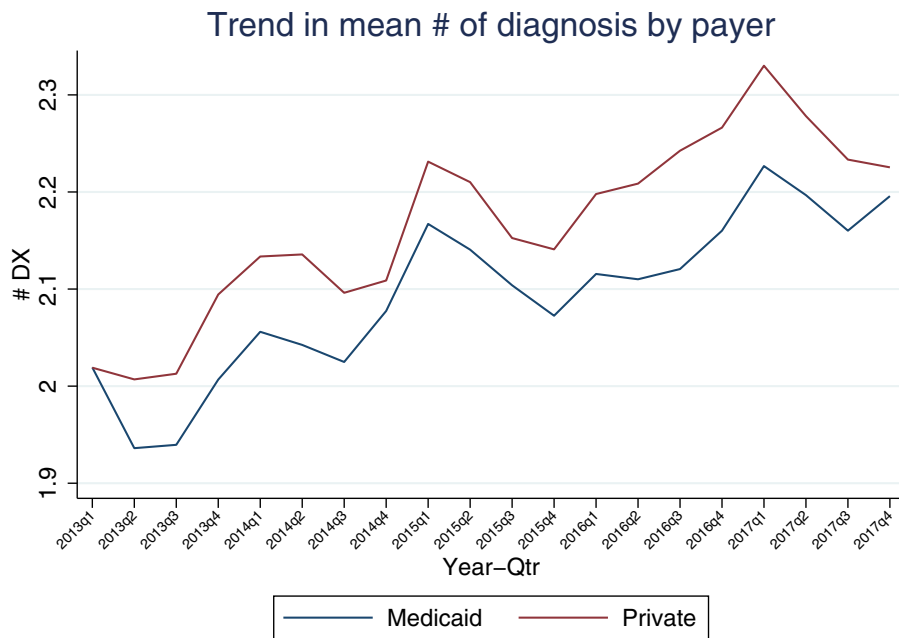


Figure 13. Trends in the mean number of diagnoses reported on claims among those who had ED visit: Medicaid vs private insurance.

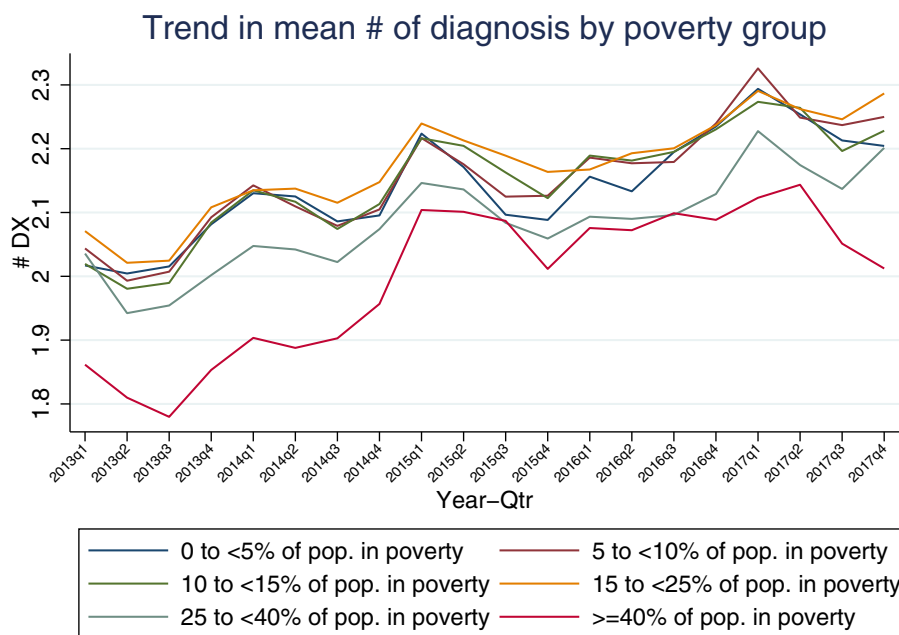


Figure 14. Trends in the mean number of diagnoses reported on claims among those who had an ED visit, by poverty group.

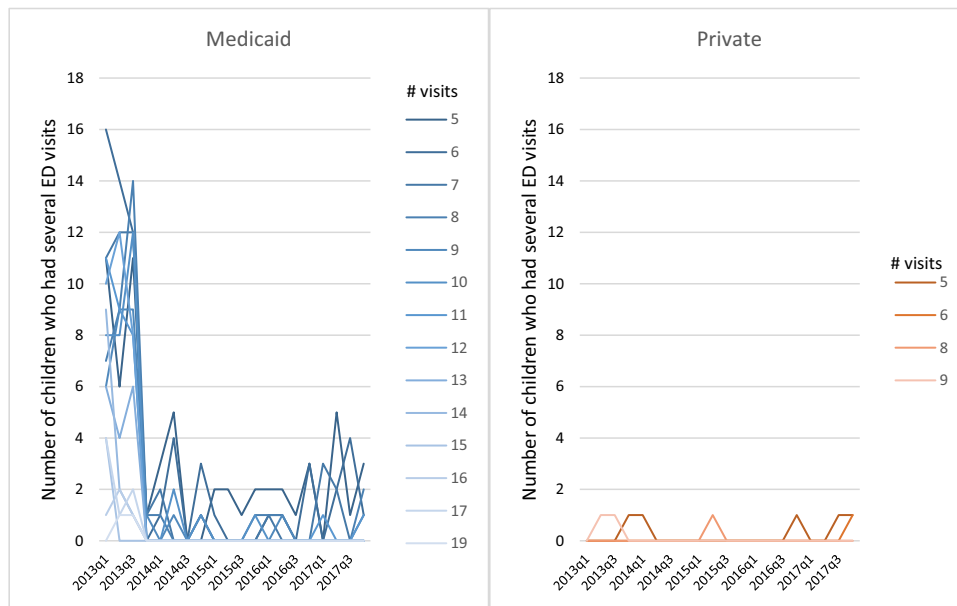


Figure 15. Number of children who had ≥ 5 ED visits/quarter with an ADHD diagnosis by number of ED visits: Medicaid vs private insurance.

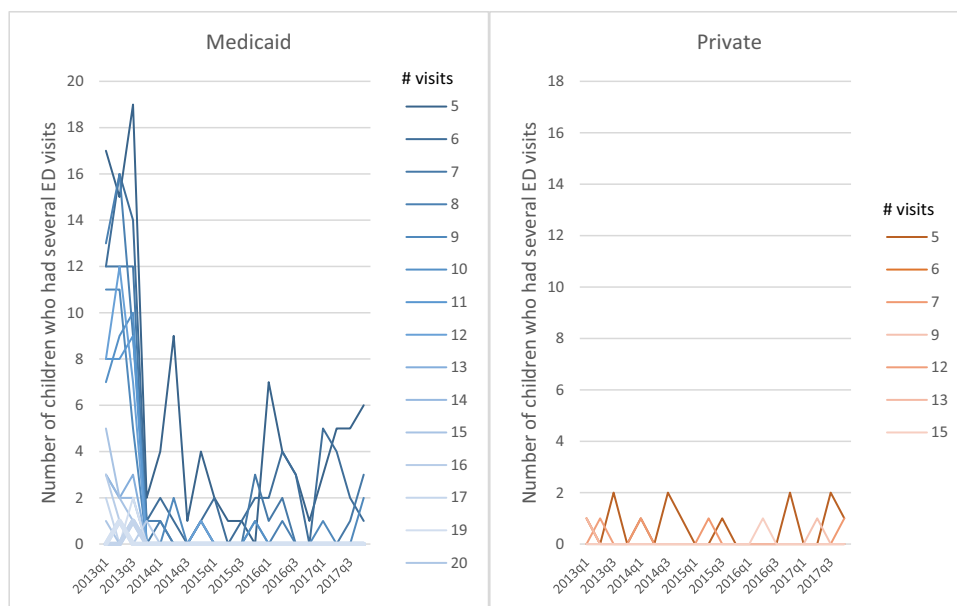


Figure 16. Number of children who had ≥ 5 ED visits/quarter with a PTSD-related diagnosis by number of ED visits: Medicaid vs private insurance.

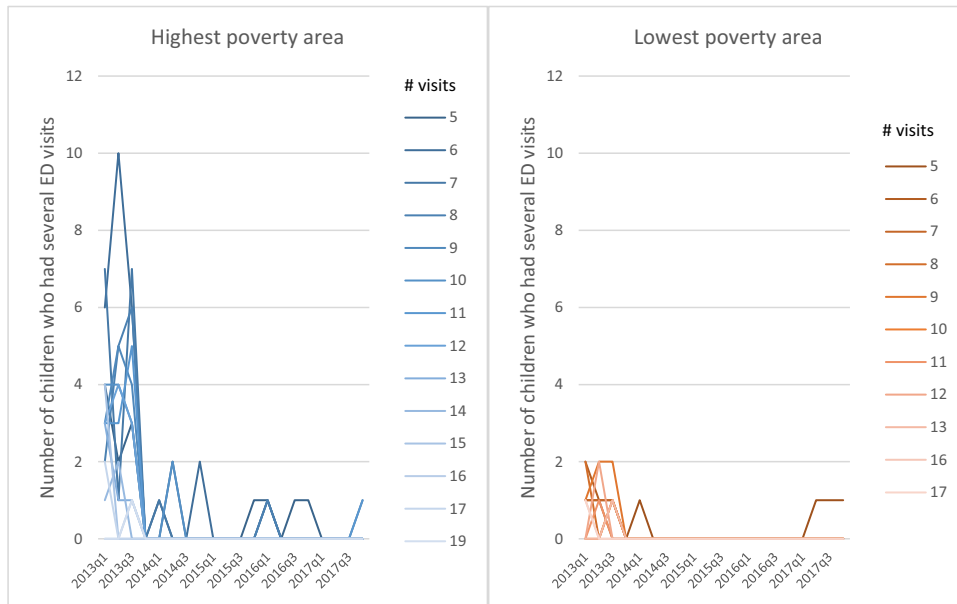


Figure 17. Number of children who had ≥ 5 ED visits/quarter with an ADHD diagnosis by number of ED visits: highest-poverty vs lowest-poverty areas.

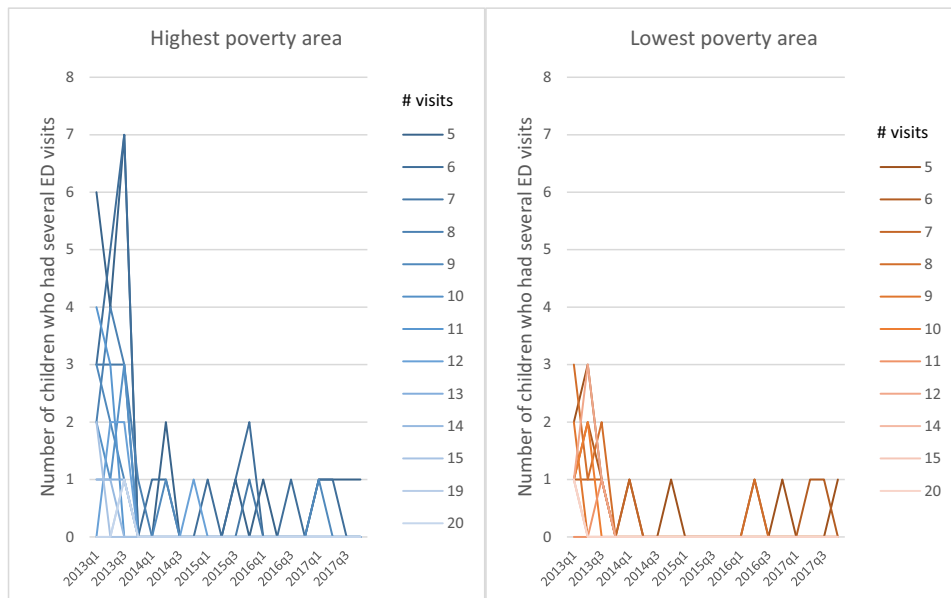


Figure 18. Number of children who had ≥ 5 ED visits/quarter with a PTSD-related diagnosis by number of ED visits: highest-poverty vs lowest-poverty areas.

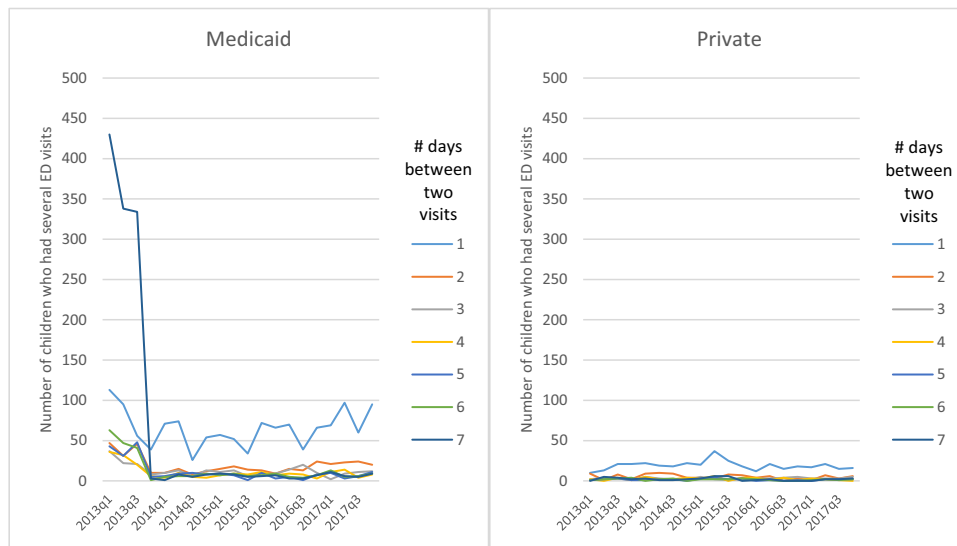


Figure 19. Number of days between 2 ED visits among children who had ≥ 5 ED visits within a quarter for ADHD: Medicaid vs private insurance.

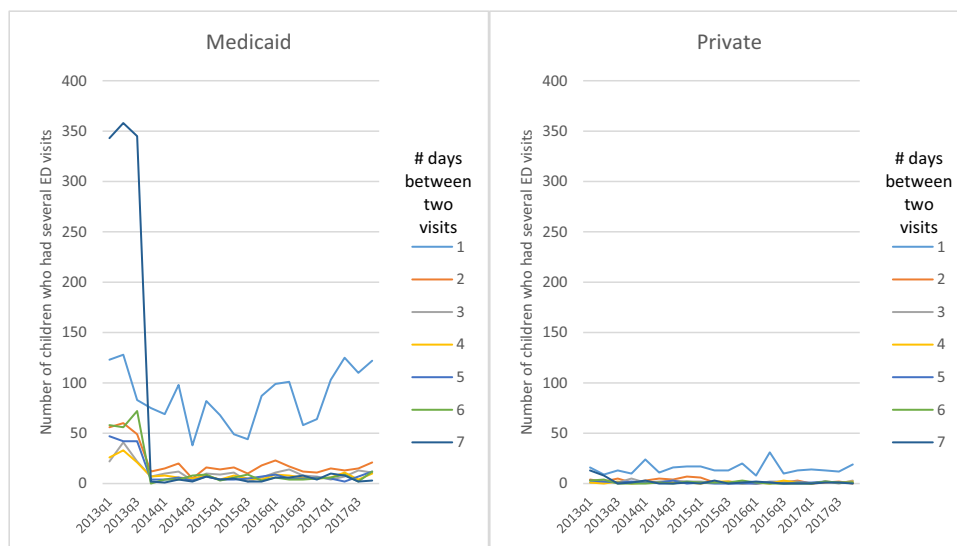


Figure 20. Number of days between 2 ED visits among children who had ≥ 5 ED visits within a quarter for PTSD-related diagnoses: Medicaid vs private insurance.

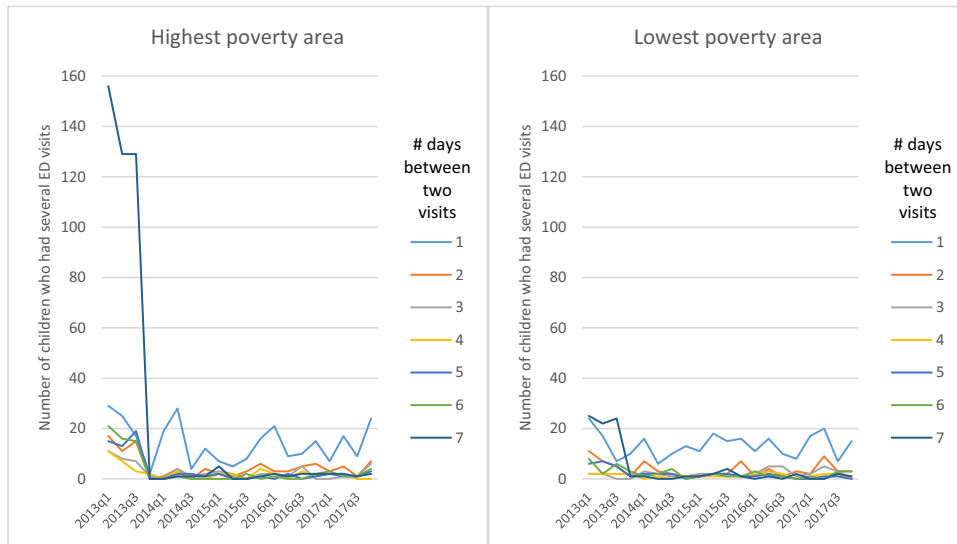


Figure 21. Number of days between 2 ED visits among children who had ≥ 5 ED visits within a quarter for ADHD: highest-poverty vs lowest-poverty areas.

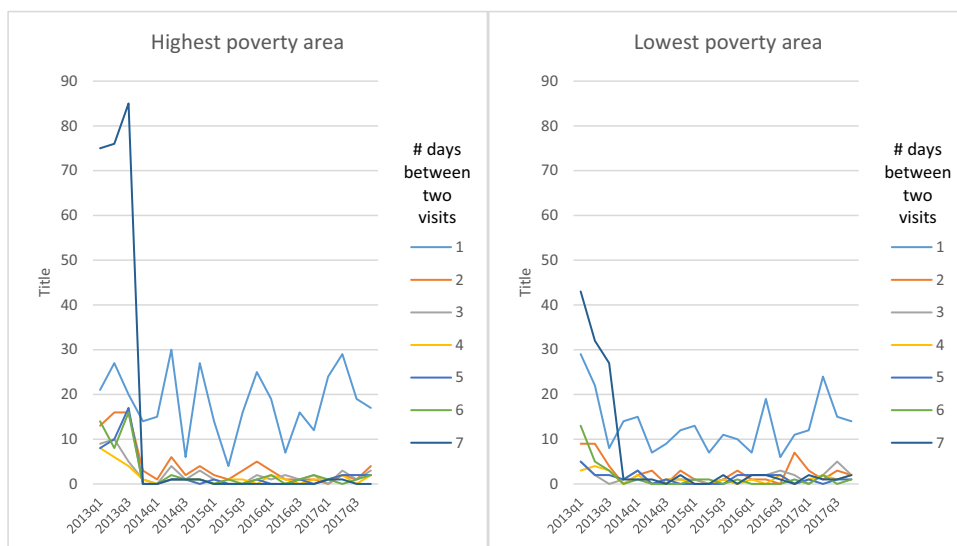


Figure 22. Number of days between 2 ED visits among children who had ≥ 5 ED visits within a quarter for PTSD-related diagnoses: highest-poverty vs lowest-poverty areas.

Table I. Codes used to classify visits as ED visits

Code types	Codes
Revenue codes	0450-0459
Place of service	23
Current Procedural Terminology (CPT) codes	99281-99285

Table II. ICD-9 and ICD-10 codes used to identify mental health–related conditions

Conditions	ICD-9 and ICD-10 Codes
ADHD*	ICD-9: 31400, 31404 ICD-10: F900-F902, F908-F909
Depressive disorders*	ICD-9: 29620-29626, 29630-29636, 29682, 3004, 311 ICD-10: F320- F325, F328- F333, F3340-3342, F338- F339
Anxiety disorders*	ICD-9: 30000-30002, 30009, 30021-30023, 30029, 30921, 3130, 31323 ICD-10: F4000- F4002, F4010- F4011, F40210, F40218, F40220, F40228, F40230- F40233, F40240- F40243, F40248, F40290- F40291, F40298, F40241-F40242, F408- F411, F413, F418-F419, F930, F940
Conduct disorders*	ICD-9: 3013, 3017, 31200-31203, 31210-31213, 31220-31223, 31230, 31232-31235, 31239, 3124, 31281-31282, 31289, 3129, 31381 ICD-10: F602, F631-F632, F6381, F6389, F639, F910-F913, F918-F919
Other mood disorders*	ICD-9: 29383, 29690, 29699 ICD-10: F341, F348- F349, F39
ASD*	ICD-9: 29900, 29901 ICD-10: F840, F845
Schizophrenia spectrum and other psychotic disorders*	ICD-9: 29381-29382, 29500-29505, 29510-29515, 29520-29525, 29530-29535, 29540-29545, 29550-29555, 9560-29565, 29570-29575, 29580-29585, 29590-29595, 2970-2973, 2978-2984, 2988-2989, 30120, 30122 ICD-10: F200-F203, F205, F2081, F2089, F209, F21-F24, F250-F251, F258-F259, F28-F29, F53, F59, F601
Bipolar disorders*	ICD-9: 30113 ICD-10: F3010-F3013, F302-F304, F308-F310, F3110-F3113, F312, F3130-F3132, F314-F315, F3160-F3164, F3170-F3178, F3181, F3189, F319, F340
PTSD and other trauma- and stressor-related disorders*	ICD-9: 3083-3084, 3089-3090, 30924, 30928-30929, 3093-3094, 30981-30983, 30989, 3099 ICD-10: F430, F4310-F4312, F4320-F4325, F4329, F438-F439, F941-F942, F948-F949
Obsessive-compulsive disorders*	ICD-9: 3003, 3014 ICD-10: F42, F4522, F605, F633
Feeding and eating disorders*	ICD-9: 3071, 30750-30753, 30759 ICD-10: F5000-F5002, F502, F508-F509, F9821, F9829, F983
Personality disorders*	ICD-9: 3010, 30110-30112, 30121, 30150-30151, 30159, 3016, 30181-30184, 30189, 3019 ICD-10: F600, F603-F604, F606-F607, F6081, F6089, F609
Motor disorders*	ICD-9: 30720-30723, 3073, 3154 ICD-10: F82, F950-F952, F958-F959, F984
Suicidal ideation, attempts, and self-inflicted injury†	Suicidal ideation ICD-9: V62.84 ICD-10: R45.851 Suicide attempt ICD-9: n/a ICD-10: T14.91 Self-inflicted harm ICD-9: E9500, E9501-E9511, E9518, E9520-E9521, E9528-E9531, E9538-E9539, E954, E9550-E9557, E9559, E956, E9570-E9572, E9579-E9589 ICD-10: T360X2A, T361X2A, T362X2A, T363X2A, T364X2A, T365X2A, T366X2A, T367X2A, T368X2A, T3692XA, T370X2A, T371X2A, T372X2A, T373X2A, T374X2A, T375X2A, T378X2A, T3792XA, T380X2A, T381X2A, T382X2A, T383X2A, T384X2A, T385X2A, T386X2A, T387X2A, T38802A, T38812A, T38892A, T38902A, T38992A, T39012A, T39092A, T391X2A, T392X2A, T39312A, T39392A, T394X2A, T398X2A, T3992XA, T400X2A, T401X2A, T402X2A, T403X2A, T404X2A, T405X2A, T40602A, T40692A, T407X2A, T408X2A, T40902A, T40992A, T410X2A, T411X2A, T41202A, T41292A, T413X2A, T4142XA, T415X2A, T420X2A, T421X2A, T422X2A, T423X2A, T424X2A, T425X2A, T426X2A, T4272XA, T428X2A, T43012A, T43022A, T431X2A, T43202A, T43212A, T43222A, T43292A, T433X2A, T434X2A, T43502A, T43592A, T43602A, T43612A, T43622A, T43632A, T43692A, T438X2A, T4392XA, T440X2A, T441X2A, T442X2A, T443X2A, T444X2A, T445X2A, T446X2A, T447X2A, T448X2A, T44902A, T44992A, T450X2A, T451X2A, T452X2A, T453X2A, T454X2A, T45512A, T45522A, T45602A, T45612A, T45622A, T45692A, T457X2A, T458X2A, T4592XA, T460X2A, T461X2A, T462X2A, T463X2A, T464X2A, T465X2A, T466X2A, T467X2A, T468X2A, T46902A, T46992A, T470X2A, T471X2A, T472X2A, T473X2A, T474X2A, T475X2A, T476X2A, T477X2A, T478X2A, T4792XA, T480X2A, T481X2A, T48202A, T48292A, T483X2A, T484X2A, T485X2A, T486X2A, T48902A, T48992A, T490X2A, T491X2A, T492X2A, T493X2A, T494X2A, T495X2A, T496X2A, T497X2A, T498X2A, T4992XA, T500X2A, T501X2A, T502X2A, T503X2A, T504X2A, T505X2A, T506X2A, T507X2A, T508X2A, T50902A, T50992A, T50A12A, T50A22A, T50A92A, T50B12A, T50B92A, T50Z12A, T50Z92A, T510X2A, T511X2A, T512X2A, T513X2A, T518X2A, T5192XA, T520X2A, T521X2A, T522X2A, T523X2A, T524X2A, T528X2A, T5292XA, T530X2A, T531X2A, T532X2A, T533X2A, T534X2A, T535X2A, T536X2A, T537X2A, T5392XA, T540X2A, T541X2A, T542X2A, T543X2A, T5492XA, T550X2A, T551X2A, T560X2A, T561X2A, T562X2A, T563X2A, T564X2A, T565X2A, T566X2A, T567X2A, T56812A, T56892A, T5692XA, T570X2A, T571X2A, T572X2A, T573X2A, T578X2A, T5792XA, T5802XA, T5812XA, T582X2A, T588X2A, T5892XA, T590X2A, T591X2A, T592X2A, T593X2A, T594X2A, T595X2A, T596X2A, T597X2A, T59812A, T59892A, T5992XA, T600X2A, T601X2A, T602X2A, T603X2A, T604X2A, T608X2A, T6092XA, T6102XA, T6112XA, T61772A, T61782A, T618X2A, T6192XA, T620X2A, T621X2A, T622X2A, T628X2A, T6292XA, T63002A, T63012A, T63022A, T63032A, T63042A, T63072A, T63082A, T63092A, T63112A, T63122A, T63192A, T632X2A, T63302A, T63312A, T63322A, T63332A, T63392A, T63412A, T63422A, T63432A, T63442A, T63452A, T63462A, T63482A, T63512A, T63592A, T63612A, T63622A, T63632A, T63692A, T63712A, T63792A, T63812A, T63822A, T63832A, T63892A, T6392XA, T6402XA, T6482XA, T650X2A, T651X2A, T65212A, T65222A, T65292A, T653X2A, T654X2A, T655X2A, T656X2A, T65812A, T65822A, T65832A, T65892A, T6592XA, T71112A, T71122A, T71132A, T71152A, T71162A, T71192A, T71222A, T71232A, X710XXA, X711XXA, X712XXA, X713XXA, X718XXA, X719XXA, X72XXXA, X730XXA, X731XXA, X732XXA, X738XXA, X739XXA, X7401XA, X7402XA, X7409XA, X748XXA, X749XXA, X75XXXA, X76XXXA, X770XXA, X771XXA, X772XXA, X773XXA, X778XXA, X779XXA, X780XXA, X781XXA, X782XXA, X788XXA, X789XXA, X79XXXA, X80XXXA, X810XXA, X811XXA, X818XXA, X820XXA, X821XXA, X822XXA, X828XXA, X830XXA, X831XXA, X832XXA, X838XXA

(continued)

Table II. Continued

Conditions	ICD-9 and ICD-10 Codes
Other mental health disorders*	ICD-9: 2900, 29010-29013, 29020-29021, 2903, 29040-29043, 2908-2909, 2930-2931, 29389, 2939-2940, 29410-29411, 29420-29421, 2948-2949, 29910-29911, 29980-29981, 29990-29991, 30010-30016, 30019, 3005-3007, 30081-30082, 30089, 3009, 3020-3024, 30250-30253, 3026, 30270-30276, 30279, 30281-30285, 30289, 3029, 3060-3064, 30650-30653, 30659, 3066-3070, 30740-30749, 30754, 3076-3077, 30780-30781, 30789, 3079, 3080-3082, 3091, 30922-30923, 3100-3102, 31081, 31089, 3109, 31231, 3131, 31321-31322, 3133, 31382-31383, 31389, 3139, 3141-3142, 3148-3149, 31500-31502, 31509, 3151-3152, 31531-31532, 31534-31535, 31539, 3155, 3158-3159, 316 ICD-10: F0390-F0391, F440-F442, F444-F447, F4481, F4489-F449, F450-F451, F4520-F4521, F4529, F4541-F4542, F458-F459, F481-F482, F488-F489, F5101-F5105, F5109, F5111-F5113, F5119, F513-F515, F518-F521, F5221-F5222, F5231-F5232, F524-F526, F528-F630, F641-F642, F648-F649, F650-F654, F6550-F6552, F6581, F6589, F659, F66, F6810-F6813, F688, F69, F800-F802, F804, F8081, F8089, F809-F810, F812, F8181, F8189, F819, F842-F843, F848-F849, F88-F89, F938-F939, F980-F981, F985, F988-F989, F99

*Healthcare effectiveness data and information set codes provided by the National Committee for Quality Assurance.

†Suicidal ideation, suicide attempt, and self-inflicted harm codes provided by the Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality.

Table V. Risk-adjusted ED visits among 0- to 21-year-olds in Massachusetts, 2013-2017

Variables	IRR	95% CI	P value
Year-quarter			
2013-Q1	Ref		
2013-Q2	1.02	1.02-1.03	<.001
2013-Q3	0.96	0.95-0.97	<.001
2013-Q4	0.88	0.87-0.89	<.001
2014-Q1	0.89	0.88-0.89	<.001
2014-Q2	0.94	0.93-0.95	<.001
2014-Q3	0.89	0.89-0.90	<.001
2014-Q4	0.86	0.86-0.87	<.001
2015-Q1	0.86	0.85-0.87	<.001
2015-Q2	0.88	0.87-0.88	<.001
2015-Q3	0.80	0.79-0.81	<.001
2015-Q4	0.79	0.79-0.80	<.001
2016-Q1	0.85	0.84-0.85	<.001
2016-Q2	0.78	0.77-0.79	<.001
2016-Q3	0.72	0.71-0.73	<.001
2016-Q4	0.73	0.72-0.74	<.001
2017-Q1	0.79	0.78-0.79	<.001
2017-Q2	0.76	0.75-0.76	<.001
2017-Q3	0.67	0.66-0.68	<.001
2017-Q4	0.74	0.73-0.75	<.001
Female	1.07	1.07-1.08	<.001
Age group			
<5 y	Ref		
5-12 y	0.71	0.70-0.71	<.001
13-17 y	0.88	0.87-0.88	<.001
18-21 y	1.13	1.12-1.14	<.001
Insurance type			
Private	Ref		
Medicaid	1.53	1.52-1.54	<.001
Uninsured or others	0.59	0.57-0.60	<.001
Area poverty level			
<5%	Ref		
5-10%	1.03	1.03-1.04	<.001
10-15%	1.09	1.09-1.10	<.001
15-25%	1.16	1.15-1.17	<.001
25-40%	1.18	1.17-1.19	<.001
≥40%	1.27	1.26-1.28	<.001

IRR, incidence rate ratio.

Table VI. Risk-adjusted mental health ED visits among 0- to 21-year-olds in Massachusetts, 2013-2017

Variables	IRR	95% CI	P value
Year-quarter			
2013-Q1	Ref		
2013-Q2	0.99	0.96-1.02	.507
2013-Q3	0.85	0.82-0.88	<.001
2013-Q4	0.67	0.64-0.70	<.001
2014-Q1	0.71	0.68-0.75	<.001
2014-Q2	0.68	0.66-0.72	<.001
2014-Q3	0.57	0.55-0.60	<.001
2014-Q4	0.67	0.65-0.70	<.001
2015-Q1	0.69	0.66-0.72	<.001
2015-Q2	0.71	0.68-0.74	<.001
2015-Q3	0.60	0.57-0.62	<.001
2015-Q4	0.62	0.60-0.65	<.001
2016-Q1	0.64	0.62-0.67	<.001
2016-Q2	0.61	0.58-0.64	<.001
2016-Q3	0.51	0.48-0.53	<.001
2016-Q4	0.56	0.54-0.59	<.001
2017-Q1	0.59	0.57-0.62	<.001
2017-Q2	0.63	0.60-0.66	<.001
2017-Q3	0.51	0.48-0.53	<.001
2017-Q4	0.59	0.57-0.62	<.001
Female (vs male)	1.10	1.07-1.12	<.001
Age group			
<5 y	Ref		
5-12 y	3.65	3.49-3.82	<.001
13-17 y	8.17	7.83-8.52	<.001
18-21 y	8.51	8.16-8.88	<.001
Insurance type			
Private	Ref		
Medicaid	1.76	1.71-1.80	<.001
Uninsured or others	0.63	0.57-0.69	<.001
Area poverty level			
<5%	Ref		
5-<10%	0.95	0.92-0.98	.004
10-<15%	1.01	0.97-1.06	.490
15-<25%	0.99	0.96-1.03	.701
25-<40%	0.86	0.83-0.89	<.001
≥40%	1.05	1.00-1.11	.057

Table VII. Number of mental health–related ED visits using any diagnosis vs principal diagnosis, 2013–2017

Variables	Mental health visits determined by any diagnosis		Mental health visits determined by principal diagnosis only	
	N	%	n	%
All-cause ED visits	2 548 269	100.0	2 548 269	100.0
Mental health ED visits (any)	204 244	8.0	131 690	5.2
Mental health conditions				
ADHD	32 089	15.7	6101	4.6
Depressive disorders	62 050	30.4	36 094	27.4
Anxiety disorders	53 126	26.0	17 730	13.5
Conduct disorders	24 476	12.0	16 442	12.5
Other mood disorders	12 500	6.1	8002	6.1
ASD	12 529	6.1	2114	1.6
Schizophrenia spectrum and other psychotic disorders	7890	3.9	5108	3.9
Bipolar disorders	13 026	6.4	5440	4.1
PTSD and other trauma- and stressor-related disorders	23 857	11.7	12 847	9.8
Obsessive-compulsive disorders	1216	0.6	207	0.2
Feeding and eating disorders	2002	1.0	703	0.5
Personality disorders	1359	0.7	399	0.3
Motor disorders	1056	0.5	325	0.2
Suicidal ideation, attempts, and self-inflicted injury	31 518	15.4	8190	6.2
Other mental health disorders	28 412	13.9	11 988	9.1

All results shown are for 0- to 21-year-old individuals in Massachusetts.

Table VIII. Risk-adjusted mental health–related ED visits among 0- to 21-year-olds in Massachusetts, 2013–2017

Variables	IRR	95% CI	P value
Year-quarter	Ref		
2013-Q1	Ref		
2013-Q2	0.97	0.93-1.00	.081
2013-Q3	0.81	0.77-0.85	<.001
2013-Q4	0.56	0.53-0.60	<.001
2014-Q1	0.60	0.57-0.64	<.001
2014-Q2	0.57	0.53-0.60	<.001
2014-Q3	0.44	0.41-0.46	<.001
2014-Q4	0.55	0.52-0.58	<.001
2015-Q1	0.58	0.54-0.61	<.001
2015-Q2	0.57	0.54-0.60	<.001
2015-Q3	0.46	0.43-0.48	<.001
2015-Q4	0.54	0.51-0.57	<.001
2016-Q1	0.55	0.52-0.58	<.001
2016-Q2	0.53	0.50-0.56	<.001
2016-Q3	0.40	0.38-0.43	<.001
2016-Q4	0.47	0.44-0.50	<.001
2017-Q1	0.47	0.44-0.50	<.001
2017-Q2	0.50	0.48-0.54	<.001
2017-Q3	0.38	0.36-0.41	<.001
2017-Q4	0.47	0.45-0.50	<.001
Female (vs male)	1.09	1.06-1.12	<.001
Age group			
<5 y	Ref		
5-12 y	6.58	6.01-7.22	<.001
13-17 y	15.31	14.04-16.71	<.001
18-21 y	14.55	13.35-15.86	<.001
Insurance type			
Private	Ref		
Medicaid	1.95	1.89-2.01	<.001
Uninsured or others	0.63	0.56-0.70	<.001
Area poverty level			
<5%	Ref		
5-<10%	0.93	0.89-0.97	.001
10-<15%	1.02	0.97-1.08	.418
15-<25%	0.99	0.94-1.04	.683
25-<40%	0.81	0.78-0.85	<.001
≥40%	1.09	1.02-1.17	.016

Mental health disorders are defined by principal diagnosis.

Table IX. Trends in risk-adjusted mental health–related ED visit rates among 0- to 21-year-olds in Massachusetts by clinical subcategory, 2013–2017 (visits/1000 patients)

Outcomes	2013	2014	2015	2016	2017	Change, %*
ED visits	204.9	190.0	176.3	162.9	156.5	−23.6
Mental health-related ED visits	12.85	8.31	8.24	7.48	7.03	−45.2
ADHD	1.29	0.20	0.27	0.25	0.16	−87.8
Depressive disorders	3.14	2.37	2.23	2.13	2.13	−32.1
Anxiety disorders	1.71	1.01	1.20	1.11	0.97	−43.3
Conduct disorders	1.36	1.07	1.00	1.00	0.94	−31.3
Other mood disorders	0.93	0.72	0.57	0.30	0.22	−76.7
Autism spectrum disorder	0.07	0.10	0.17	0.20	0.14	80.5
Schizophrenia spectrum and other psychotic disorders	0.53	0.40	0.36	0.26	0.25	−53.3
Bipolar disorders	0.54	0.38	0.36	0.30	0.26	−52.2
PTSD and other trauma- and stressor-related disorders	1.74	0.67	0.59	0.67	0.72	−58.6
Obsessive-compulsive disorders	Model did not converge					N/A
Feeding and eating disorders	0.05	0.04	0.05	0.05	0.05	−1.7
Personality disorders	0.01	0.02	0.03	0.05	0.02	51.2
Motor disorders	0.02	0.02	0.02	0.03	0.02	14.6
Suicidal ideation, attempts, and self-inflicted injury	0.15	0.18	0.37	0.97	1.08	606.1 [†]
Other mental health disorders	1.46	1.16	1.04	0.24	0.24	−83.4

N/A, not applicable.

Mental health disorders defined by principal diagnosis.

*Changes between 2013 and 2017.

†Changes in suicide-related ED visits are likely overestimated when using the principal diagnosis only, owing to changes related to the ICD-9 to ICD-10 switch.

Table X. Sample demographics and ED visits by study year

Variables	2013	2014	2015	2016	2017
Individuals, n	747 312	802 784	836 283	757 595	741 912
Age, y, mean ± SD	9.2 ± 6.2	9.6 ± 6.5	9.9 ± 6.6	10.0 ± 6.6	10.2 ± 6.6
Female sex, %	48.7	48.6	48.4	48.4	48.2
Total number of ED visits*	503 034	523 794	522 401	461 746	447 773
Average number of ED visits per person*	0.72	0.69	0.66	0.64	0.63

*Weighted by the number of member enrollment days observed in the APCD.