General Psychiatry

# Psychiatric comorbidities in children with conduct disorder: a descriptive analysis of real-world data

Tashalee R Brown ,[1] Anita S Kablinger,[2] Robert Trestman,[2] Eraka Bath,[1] Cynthia Rogers,[3] Binx Yezhe Lin,[2,4,5] Kevin Young Xu [6]

**To cite:** Brown TR, Kablinger AS, Trestman R, *et al*. Psychiatric comorbidities in children with conduct disorder: a descriptive analysis of real-world data. *General Psychiatry* 2024;**37**:e101501. doi:10.1136/gpsych-2023-101501

► Additional supplemental material is published online only. To view, please visit the journal online (https://doi.org/10.1136/gpsych-2023-101501 ).

BYL and KYX are joint senior authors.

Received 20 December 2023
Accepted 15 March 2024



For numbered affiliations see end of article.

**Correspondence to**
Dr Kevin Young Xu;
xukeviny@wustl.edu

Dr Binx Yezhe Lin;
yezhe.lin.bee@gmail.com

**To the editor:**

Two recent advisories from the US surgeon general have underscored the unprecedented public health crisis in youth mental health and emphasised the need for "timely data collection and research to identify and respond to youth mental health needs more rapidly".[1] Increased rates of suicidal behaviour, depression and anxiety symptoms and substance use, particularly in adolescents and young adults, are part of an emerging landscape of high volumes of emergency room visits and hospitalisations for behavioural problems.[2 3] Conduct disorder (CD) has emerged as an increasingly common presenting concern in adolescents and young adults receiving emergency and inpatient psychiatric care.[4–6] Yet, CD remains among the least studied of paediatric psychiatric disorders, even though it is thought to be associated with a myriad of devastating social, legal and psychiatric consequences that may persist into adulthood and is frequently comorbid with other psychiatric disorders.[7] Although recent studies estimate that CD affects approximately 2%–3% of the school-aged paediatric population worldwide,[8] ambiguity remains about its association with other psychiatric conditions. CD is posited to be associated with increased rates of anxiety, depression, substance use and attention-deficit hyperactivity disorder (ADHD), as well as other externalising disorders, with a multisite analysis in Europe examining nearly 800 children with CD and found that more than one-third likely suffered from current ADHD symptoms and over three-fourths suffered from oppositional defiant disorder symptoms.[9] Yet, estimates of comorbidity based on clinical data collected in settings that reflect actual psychiatric care, particularly in the USA, are lacking. Furthermore, many of the estimates of psychiatric comorbidity in adolescents and young adults, defined as ages 12–25, with CD, were conducted >10 years ago, preceding the ongoing paediatric mental health crisis in the USA.

Untreated co-occurring psychiatric conditions in adolescents and young adults with behavioural disorders like CD can exacerbate behavioural dysregulation and increase the likelihood of criminal legal system involvement.[10–12] Against this backdrop, there is an urgent need for up-to-date and population-level estimates of the psychiatric comorbidities in young people with CD. To our knowledge, there are no observational studies that provide essential descriptive statistics on the prevalence of psychiatric comorbidities in young people with CD. Recent advances in the analysis of real-world clinical evidence, defined as routinely collected healthcare data derived from sources outside typical clinical research settings (ie, electronic health records (EHRs), insurance claims and billing data, and government registries), may hold promise in helping us understand the prevalence of co-occurring psychiatric conditions in people with CD. To address these gaps in our understanding of CD and its co-occurring psychiatric conditions, this brief report used real-world EHR spanning over 113 million people worldwide, with the greatest representation in the USA, to estimate the rates of psychiatric comorbidity in adolescents and young adults, defined as ages 12–25 years, with CD.

## METHODS

This descriptive analysis used the TriNetX data, which is a federated research network capturing deidentified real-time EHRs. This dataset includes comprehensive data related to clinical diagnoses, procedures and treatments, prescription medications and

laboratory data, sourced from over 119 million people (including adolescents and young adults, defined as ages 12–25 years) across 80 healthcare organisations (HCOs) in multiple countries). The TriNetX data include data from inpatient and outpatient (ie, specialty, primary care) settings. Due to the nature of the protected health information in the TriNetX data, detailed geographic and institutional information is not provided. TriNetX uses privacy-preserving record linkage (via cryptographic tokens) to enrich clinical data from the EHR of HCOs with closed claims data, and hospital and government mortality data. These data were determined not to be human subjects research by the Institutional Review Board, as our data were deidentified. We followed the Strengthening the Reporting of Observational Studies in Epidemiology and the Reporting of Studies Conducted Using Observational Routinely Collected Health Data Statement for Pharmacoepidemiology reporting guidelines.

Our sample consisted of people between the ages of 12 and 25 years who were in the TriNetX databases on and before the date of 1 October 2023. We selected the lower threshold of 12 years to focus our sample beginning from early adolescence to an upper threshold of 25 years to represent a commonly used upper limit of young adulthood. We obtained a cohort of people with an International Classification of Diseases-10 Clinical Modification (ICD-10-CM) diagnosis of CD (F91). Given that the specificity of ICD codes is typically improved with multiple claims, we required at least two diagnoses of CD to mitigate misclassification bias.[13] The presented data were queried on 22 November 2023 and again on 28 January 2024. Among all persons with CD, we extracted descriptive characteristics such as age at the time of index diagnosis (the first time they received the diagnosis), sex (assigned male at birth, assigned female at birth), race/ethnicity and clinical characteristics, namely co-occurring psychiatric disorders such as ADHD, mood and anxiety disorders, psychotic disorders, personality disorders and substance use disorders. To evaluate the types of treatments individuals were receiving, we used linked pharmacy records to extract data on prescriptions (filled in the 2 years preceding and including the date of the index/first CD diagnosis) for antipsychotics, selective serotonin reuptake inhibitors (SSRIs), stimulants for ADHD (ie, amphetamine salts, methylphenidate, lisdexamfetamine) and mood stabilisers such as lithium, lamotrigine, carbamazepine and valproate, using a combination of RxNorm and Anatomical Therapeutic Chemical codes. We subsequently conducted descriptive analyses using the TriNetX data to query the prevalence of co-occurring psychiatric disorders in the 2 years preceding and including the date of the index/first diagnosis (observation window shown in online supplemental efigure), as well as demographic characteristics of people who received a diagnosis of CD. Overall, 92.9% (66 376/71 419) of the sample had greater than 2 years of data. For HCOs that returned data coded by ICD-9, TriNetX mapped ICD-9 codes to ICD-10-CM codes using General Equivalence Mapping algorithms. Diagnostic codes are provided in online supplemental etable.

## RESULTS

As shown in table 1, a total of 71 419 persons between the ages of 12 and 25 who had at least two diagnoses of CD were included in this study. The mean (standard deviation (SD)) age at the time of index CD diagnosis was 14.7 (2.7) years. 64.8% were assigned male at birth. 15 303 (21.4%) were non-Hispanic black and 41 248 (57.8%) non-Hispanic white. In the retrieved cohort of CD individuals, more than 90% of them were in the USA.

Psychiatric comorbidities were common with more than half of persons exhibiting co-occurring disorders. Overall, 41 608 (58.3%) had a diagnosis of ADHD in the 2 years preceding the diagnosis of CD. 32.6% (n=23 256) received psychostimulant scripts for the treatment of ADHD in the 2 years preceding CD diagnosis. Specifically, 7633 (10.7%) received amphetamine salts, 7861 (11.0%) received dextroamphetamine, 12 220 (17.1%) received methylphenidate, 3651 (5.1%) received dexmethylphenidate, and 5738 (8.0%) received lisdexamfetamine.

Furthermore, 33 246 (46.6%) had a diagnosis of a mood disorder (ie, major depressive disorder, bipolar disorder), 6981 (9.8%) had post-traumatic stress disorder, 7341 (10.3%) had a generalised anxiety disorder, 3074 (4.3%) had schizophrenia-spectrum disorders, 3334 (4.7%) had a diagnosis of a personality disorder), and 4998 (7.0%) had a diagnosis of an impulse control disorder.

Notably, approximately as many individuals received antipsychotics (n=21 359, 29.9%) as SSRIs (n=20 468, 28.7%). Finally, 12.5% of individuals had diagnoses for autism spectrum disorders (n=8943) and 14.0% for substance use disorders (n=9963), with cannabis use disorder overwhelmingly being the most common substance use problem (n=6356, 8.9%) among people in the cohort who had a diagnosis of substance use disorder.

## DISCUSSION

Overall, this analysis uses real-time administrative claims data for over 100 million enrollees, spanning public and private insurance (as well as uninsured people receiving medical care who are captured in EHR), making this the largest and most comprehensive characterisation of psychiatric comorbidities in people with CD to date. Comprehensive real-world data on the prevalence of co-occurring psychiatric disorders in adolescents and young adults, ages 12–25 years, with CD, is much needed amid the current paediatric mental health crisis in the US. People with CD often receive treatment in acute-care settings such as emergency rooms, where crowding, short patient stays, clinician task interruption and lack of longitudinal patient–physician relationships can hinder screening and intervention.[14] In a recent national survey, paediatric emergency medicine physicians (including both trainees and faculty) in the USA reported feeling underprepared in evaluating and treating children with unmet social needs.[14] Against this backdrop, our analysis, to the best of our knowledge, is among the first papers to use real-world data to characterise the prevalence of co-occurring psychiatric disorders in adolescents and young adults with CD, providing

**Table 1** Descriptive characteristics of people with conduct disorder

| | Individuals diagnosed with conduct disorder | |
|---|---|---|
| | n=71 419 | Percentage |
| Male (vs female) | 46 082 | 64.5% |
| Racial and ethnic characteristics | | |
| Non-Hispanic white | 41 248 | 57.8% |
| Non-Hispanic black | 15 303 | 21.4% |
| Hispanic | 6965 | 9.8% |
| Unknown ethnicity | 12 978 | 18.2% |
| Unknown race | 9993 | 14.0% |
| Asian | 1049 | 1.5% |
| Other race | 2994 | 4.2% |
| Native Hawaiian or Pacific Islander | 438 | 0.6% |
| Native American | 394 | 0.6% |
| Age at time of index (first) diagnosis, in years (SD) | 14.7 | 2.7 |
| Psychiatric diagnoses | | |
| Attention-deficit hyperactivity disorder | 41 608 | 58.3% |
| Generalised anxiety disorder | 7341 | 10.3% |
| Post-traumatic stress disorder | 6981 | 9.8% |
| Adjustment disorder | 7957 | 11.1% |
| Obsessive-compulsive disorder | 2682 | 3.8% |
| Mood (affective) disorders (major depressive or bipolar disorder) | 33 246 | 46.6% |
| Schizophrenia-spectrum disorders | 3074 | 4.3% |
| Personality disorders | 3334 | 4.7% |
| Impulse control disorders | 4998 | 7.0% |
| Autism spectrum disorders | 8943 | 12.5% |
| Intellectual disabilities | 5846 | 8.2% |
| Any substance use disorder (alcohol, stimulant, cannabis, sedative) | 9963 | 14.0% |
| Cannabis use disorder | 6356 | 8.9% |
| Psychotropic medications | | |
| Antipsychotics | 21 359 | 29.9% |
| Risperidone | 8088 | 11.3% |
| Aripiprazole | 7551 | 10.6% |
| Quetiapine | 4191 | 5.9% |
| Olanzapine | 3760 | 5.3% |
| Haloperidol | 3543 | 5.0% |
| Ziprasidone | 1579 | 2.2% |
| Lurasidone | 666 | 0.9% |
| Psychostimulants | 23 256 | 32.6% |
| Amphetamine stimulants | 12 046 | 16.9% |
| Amphetamine Salts | 7633 | 10.7% |
| Dextroamphetamine | 7861 | 11.0% |
| Methylphenidate | 12 220 | 17.1% |
| Dexmethylphenidate | 3651 | 5.1% |
| Lisdexamfetamine | 5738 | 8.0% |
| Antidepressants and mood stabilisers | | |

Continued

Table 1 Continued

| | Individuals diagnosed with conduct disorder | |
|---|---|---|
| | n=71 419 | Percentage |
| Any selective serotonin reuptake inhibitors | 20 468 | 28.7% |
| Lithium | 613 | 0.9% |
| Lamotrigine | 2640 | 3.7% |
| Carbamazepine | 529 | 0.7% |
| Valproate | 3592 | 5.0% |

up-to-date data on the epidemiology of CD to optimise treatment for this critically underserved population Our findings reveal a high prevalence of co-occurring psychiatric conditions, particularly ADHD and affective disorders. A sizeable minority of patients received diagnoses for addictive disorders, with cannabis use disorder being the most prevalent of substance use disorders. Even though almost 50% of the sample was documented to have a diagnosis of ADHD, only 33% received psychostimulants for ADHD. Approximately as many adolescents and young adults with CD received antipsychotics as psychostimulants in our cohort.

This study is strengthened by its use of real-world clinical evidence, allowing us to study the epidemiology of CD using larger and more inclusive populations than what is often accomplished in clinical trials and cohort studies, in line with the US surgeon general's call for "integrated, real-time data infrastructure for understanding youth mental health trends".[1] Yet, there are key limitations. First, we cannot rule out misclassification of diagnoses and medication consumption in the administrative data, especially since pharmacy claims may not reflect the actual consumption of medication. Second, while the TriNetX data is multinational, the overwhelming majority of the data comes from the USA; as the Diagnostic and Statistical Manual of Mental Disorders (DSM) is typically used to diagnose CD in the USA, our data may not necessarily be generalisable to countries that use ICD systems. Third, by nature of its deidentified real-time data, the TriNetX accessible to us lacks refinement capabilities (ie, data on the type of clinician that gave the diagnosis of CD), as seen in other administrative databases such as MarketScan and CMS Medicaid data, which limits our ability to conduct in-depth causal inference work beyond descriptive data. While CD diagnoses are typically made using DSM criteria, our TriNetX interface only permits access to ICD codes. Because TriNetX data stem from a conglomerate of EHR data, people who do not have access to healthcare (ie, people diagnosed with CD who are incarcerated and are not receiving consistent healthcare) are under-represented.

Finally, against the backdrop of mass incarceration and structural racism in the US mental health systems, it is important to emphasise concern surrounding how the diagnosis of CD may increase the likelihood of criminal legal system involvement.[10–12] The USA has one of the highest rates of incarceration in the world, with the growth in incarceration rates occurring disproportionately in black Americans, many of whom suffer from trauma and have unmet mental health needs.[15] Studies have shown that adolescents who are involved in the criminal justice system have significant substance use disorders and mental health needs that are often untreated.[12] Data from the present study are likely to help efforts, such as the Juvenile Justice Behavioral Health Services Cascade,[12] to address the mental health needs of justice-involved children and provide trauma-informed alternatives to incarceration. Future research is urgently needed to elucidate racial and ethnic disparities in CD diagnoses and downstream mental health outcomes, as well as comprehensively assess the extent to which co-occurring psychiatric disorders in adolescents and young adults with CD, ages 12–25 years, are being adequately treated.

**Author affiliations**
[1]University of California Los Angeles David Geffen School of Medicine, Los Angeles, California, USA
[2]Department of Psychiatry and Behavioral Medicine, Virginia Tech Carilion School of Medicine, Roanoke, Virginia, USA
[3]Washington University in St Louis School of Medicine, St Louis, Missouri, USA
[4]Clinical Research Center for Mental Disorders, Chinese-German Institute of Mental Health, Shanghai Pudong New Area Mental Health Center, School of Medicine, Tongji University, Shanghai, China
[5]Department of Psychosomatic Medicine, Shanghai East Hospital, Tongji University School of Medicine, Shanghai, China
[6]Department of Psychiatry, Washington University School of Medicine in Saint Louis, St Louis, Missouri, USA

**X** Tashalee R Brown Tlee_B@ and Kevin Young Xu @kevinyxu

**Contributors** BYL had full access to all of the data in the study and took responsibility for the integrity of the data and the accuracy of the data analysis. TRB, BYL and KYX: concept and design. TRB, ASK, RT, EB, CR, BYL and KYX: acquisition, analysis or interpretation of data. TRB, BYL and KYX: drafting of the manuscript. TRB, ASK, RT, EB, CR, BYL and KYX: critical revision of the manuscript for important intellectual content. BYL: statistical analysis. BYL, RT and ASK: obtained funding. BYL, RT and ASK: administrative, technical or material support. TRB, KYX, RT and ASK: supervision.

**Funding** The funder or sponsor had no role in the study design, analysis, data interpretation or preparation of the manuscript. The effort was supported in part by NIDA (K12 DA041449, KYX) and the APA Psychiatric Research Fellowship funded by NIDA (KYX). BYL was an APA/APA Foundation Public Psychiatry Fellow at the time of acceptance. The contents of this publication are solely the responsibility of the author and do not necessarily represent the official views of the Department

of Health and Human Service, APA or APA Foundation. Mention of trade names, commercial practices or organisations does not imply endorsement by the US Government. ASK receives research funding from Alto Neuroscience, Liva Nova, Curemark and Beam Diagnostics.

**Patient consent for publication** Not applicable.

**Ethics approval** Not applicable.

**Provenance and peer review** Not commissioned; externally peer reviewed.



**ORCID iDs**
Tashalee R Brown http://orcid.org/0000-0002-2367-8821
Kevin Young Xu http://orcid.org/0000-0001-6595-695X

## REFERENCES

1 Protecting Youth Mental Health & Social Media and Youth Mental Health. The United States surgeon general's advisory. 2023.
2 Overhage L, Hailu R, Busch AB, *et al*. Trends in acute care use for mental health conditions among youth during the COVID-19 pandemic. *JAMA Psychiatry* 2023;80:924–32.
3 Bommersbach TJ, McKean AJ, Olfson M, *et al*. National trends in mental health-related emergency department visits among youth, 2011-2020. *JAMA* 2023;329:1469–77.
4 Downey LVA, Zun LS. Identifying undiagnosed pediatric mental illness in the emergency department. *Pediatr Emerg Care* 2018;34:e21–3.
5 Farquharson W IV, Schwartz JE, Klein DN, *et al*. Factors associated with police bringing children to a psychiatric emergency room. Psychiatr Serv 2023;74:488–96.
6 Manuel MM, Feng S-Y, Yen K, *et al*. The agitated pediatric patient located in the emergency department: the applied observational study. *J Am Coll Emerg Physicians Open* 2022;3:e12766.
7 Ayano G, Abraha M, Tsegay L, *et al*. Umbrella review of the global prevalence of conduct disorder in children and adolescents. *Psychiatr Q* 2024;95:173–83.
8 Polanczyk GV, Salum GA, Sugaya LS, *et al*. Annual research review: a meta-analysis of the worldwide prevalence of mental disorders in children and adolescents. *J Child Psychol Psychiatry* 2015;56:345–65.
9 Konrad K, Kohls G, Baumann S, *et al*. Sex differences in psychiatric Comorbidity and clinical presentation in youths with conduct disorder. *J Child Psychol Psychiatry* 2022;63:218–28.
10 Brown TR, Xu KY, Glowinski AL. Cognitive behavioral therapy and the implementation of antiracism. *JAMA Psychiatry* 2021;78:819–20.
11 Jansen MO, Brown TR, Xu KY, *et al*. Using digital technology to overcome racial disparities in child and adolescent psychiatry. *J Am Acad Child Adolesc Psychiatry* 2022;61:1211–7.
12 Belenko S, Knight D, Wasserman GA, *et al*. The juvenile justice behavioral health services cascade: a new framework for measuring unmet substance use treatment services needs among adolescent offenders. *J Subst Abuse Treat* 2017;74:80–91.
13 Rector TS, Wickstrom SL, Shah M, *et al*. Specificity and sensitivity of claims-based Algorithms for identifying members of Medicare plus choice health plans that have chronic medical conditions. *Health Serv Res* 2004;39:1839–57.
14 Assaf RR, Barber Doucet H, Assaf RD, *et al*. Social care practices and perspectives among US pediatric emergency medicine fellowship programs. *AEM Educ Train* 2022;6:e10737.
15 Alexander M. The new jim crow: mass incarceration in the age of colorblindness. New York: The New Press, 2010.

*Tashalee R Brown is a second-year Child and Adolescent Psychiatry Fellow at the David Geffen School of Medicine at the University of California-Los Angeles (UCLA) in the USA. She received her BS in Biomedical Engineering from Johns Hopkins University, USA in 2007. She subsequently completed her MD and PhD from the Weill Cornell/Rockefeller/Sloan Kettering Tri-Institutional MD-PhD Program in 2018 and adult psychiatry residency at Washington University in St. Louis, USA in 2022. Dr Brown began her child and adolescent psychiatry training at UCLA in 2022, serving as Justice, Equity, and Inclusion Chief. Her main research interests include the social determinants of mental health, the role of racism in perpetuating racial/ethnic disparities in mental health care, community-partnered mental health interventions, and the implementation of evidence-based anti-racism training in mental healthcare.*