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Authors

Earlywine, Joel
Bagley, Sarah
Rodean, Jonathan
et al.

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Medications for Alcohol Use Disorder and Retention in Care in Medicaid-Enrolled Youth, 2014–2019

Joel J. Earlywine, MSc[1,2], **Sarah M. Bagley, MD, MSc**[3,4,5], **Jonathan Rodean, MPP**[6], **Bonnie T. Zima, MD, MPH**[7], **Nicholas Chadi, MD, MPH**[8], **Douglas L. Leslie, PhD**[9], **Scott E. Hadland, MD, MPH, MS**[3,4,10,11]

[1.]Mathematica, Seattle, WA

[2.]Department of Health Law, Policy, and Management, Boston University School of Public Health, Boston, MA

[3.]Grayken Center for Addiction and Department of Pediatrics, Boston Medical Center, Boston, MA

[4.]Division of General Pediatrics, Department of Pediatrics, Boston University School of Medicine, Boston, MA

[5.]Section of General Internal Medicine, Department of Medicine, Boston University School of Medicine, Boston, MA

[6.]Children's Hospital Association, Lenexa, KS

[7.]UCLA-Semel Institute for Neuroscience and Human Behavior, University of California Los Angeles, Los Angeles, CA

[8.]Division of Adolescent Medicine, Department of Pediatrics, Sainte-Justine University Hospital Centre, University of Montreal, Montreal, QC, Canada

[9.]Department of Public Health Sciences, Penn State College of Medicine, Hershey, PA

[10.]Division of Adolescent and Young Adult Medicine, Mass General for Children, 175 Cambridge St., 5th Floor, Boston, MA

[11.]Department of Pediatrics, Harvard Medical School, 25 Shattuck St., Boston, MA

Abstract

Background: Alcohol use disorder (AUD) is a pediatric-onset condition needing timely, effective treatment. Medications for AUD are part of nationally recommended treatments for youth. This study measured receipt of medications and behavioral health services for AUD, and subsequent retention in care.

Send correspondence to: Scott E. Hadland, MD, MPH, MS, Division of Adolescent and Young Adult Medicine, Mass General for Children, 175 Cambridge St., 5th Floor, Boston, MA, 02114, **Phone:** 617-724-3873, **Fax:** 617-726-5961, shadland@mgh.harvard.edu.

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Methods: This retrospective cohort study used claims data from >4.7-million publicly-insured youth aged 13–22 in 15 states from 2014–2019. Timely treatment was defined as receipt of medication (naltrexone, acamprosate, or disulfiram) and/or behavioral health services within 30 days of incident AUD diagnosis. Associations of age and other characteristics with timely treatment were identified using modified Poisson regression. Retention in care (i.e., no period ≥60 days without claims) was studied using Cox regression.

Results: Among 14,194 youth with AUD, 10,851 (76.4%) received timely treatment. Only 2.1% of youth received medication (alone or in combination); nearly all (97.9%) received behavioral health services only. Older (16–17 years) and younger adolescents (13–15 years) were 0.13 (95% CI, 0.07–0.26) and 0.24 (95% CI, 0.11–0.51) times as likely, respectively, to receive medications than young adults ≥21. Median retention in care for youth receiving medications was 119 days (IQR, 54–321) compared with 108 days (IQR, 43–243) for behavioral health services alone (p=0.126). Young adults ≥18 years were 1.12 (95% CI, 1.06–1.18) times as likely to discontinue treatment compared with adolescents <18.

Conclusions: This study found that more than 7 in 10 youth received AUD treatment, but only 2 in 100 received medications. Future studies should further characterize the effectiveness of medications and determine whether low rates of receipt represent underuse.

INTRODUCTION

Alcohol-related deaths in the United States (US) have more than doubled since 1999 and tabulate to over 70,000 deaths annually, a count comparable to drug overdoses (1). Alcohol use is causally linked to many chronic diseases and contributes to the three leading causes of death among adolescents and young adults (“youth”) – motor vehicle crashes, homicide, and suicide (2–4). Heavy alcohol use is highly prevalent, with more than 14 million US youth reporting past month binge drinking in 2017 (5). Binge drinking commonly begins in adolescence and is an established risk factor for the development of an alcohol use disorder (AUD) in which youth engage in persistent alcohol use despite harmful consequences (6,7).

Early intervention for AUD is of high public health significance because evidence-based treatments are available and may avert adverse, long-term physical and mental health consequences throughout the life course. Food and Drug Administration (FDA) approved medications for AUD include naltrexone, acamprosate, and disulfiram. These medications, particularly naltrexone and acamprosate, are effective, front-line treatment for AUD and help maintain abstinence among adults (8,9). Although these three medications are only FDA-approved for persons aged 18 and older, the Substance Abuse and Mental Health Services Administration (SAMHSA) recommends considering them for adolescents given the often limited efficacy of psychosocial interventions when provided without medications, and demonstrated efficacy of pharmacotherapy in adults (8–11). For other substance use disorders, such as opioid use disorder, medications are effective (8) and associated with improved retention in addiction treatment among youth (12). Retaining youth with AUD in care is critical because treatment requires continuity of care amid relapses, which are common, and to mitigate the progression of negative, long-term outcomes in adulthood (13,14).

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Fewer than 10% of adults with AUD receive recommended medication treatment and among youth (9), little is known about the extent and timeliness of recommended care. The percentage of youth receiving treatment could be even lower than adults given the limited availability of youth-specific, developmentally appropriate addiction care (15,16). Moreover, understanding factors that retain youth in treatment is essential to identify target areas for quality improvement, particularly ensuring receipt of pharmacotherapy when appropriate (13). Differences in retention in treatment relative to age is of particular interest since minors may receive treatment in different settings from young adults aged 18 and older despite their close developmental stages (15–17). To our knowledge, nearly all studies of medications for AUD have been among adults, highlighting the need to understand medication use for AUD among youth.

This study had two goals. First, it sought to measure timely receipt (i.e., within 30 days of diagnosis) of behavioral health services and/or pharmacotherapy for AUD in a large sample of publicly insured youth from 15 states and identify potential associations of age and other factors with treatment receipt. Second, the study sought to identify potential associations among age, receipt of AUD medications and retention in care.

METHODS

Study Design and Sample

A cohort of 4,744,948 youth aged 13–22 from 15 states in all US census regions was retrospectively identified using the IBM MarketScan Medicaid Database from January 1, 2014 to December 31, 2019. The database provided clinical information on all documented inpatient, outpatient, emergency department, behavioral health, and retail prescription drug claims. Eligible youth had at least six months of continuous insurance enrollment. The study was not considered human subjects research by the Boston University Medical Campus Institutional Review Board as all data were deidentified.

Youth were identified as having AUD if they had a primary or secondary diagnosis of AUD using International Classification of Diseases, Ninth and Tenth Revision, Clinical Modification [ICD-9-CM/ICD-10-CM] in ≥1 inpatient or emergency department claim or ≥2 outpatient claims (Supplemental Table 1); diagnosis codes were restricted to those for ‘alcohol dependence’ to limit the sample to youth likely to require AUD treatment (18). To be eligible for the treatment analysis, enrollees needed a ≥90-day window prior to first diagnosis without an AUD diagnosis or receipt of naltrexone, acamprosate, or disulfiram, and ≥1 month of enrollment following diagnosis. Data were included from the first observed episode of care, defined by date of first observed AUD diagnosis, and excluded subsequent episodes of care.

Variables

Timely treatment was defined as receipt of behavioral health services and/or naltrexone, acamprosate, or disulfiram within 30 days of AUD diagnosis. As a sensitivity analysis, the distribution of treatment receipt was examined at two, three, six, nine, and 12 months after diagnosis of AUD (Supplemental Table 2). Current Procedural Terminology and

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Healthcare Common Procedure Coding System (HCPCS) codes were used to define receipt of behavioral health services (Supplemental Table 3). National Drug Codes and were used to identify naltrexone (oral and injectable), acamprosate, and disulfiram dispensing in pharmacy claims (Supplemental Table 4), and office-based injectable naltrexone administration was additionally identified using HCPCS code J2315.

Time from first receipt of behavioral health services or AUD medication to time of treatment discontinuation was used to define retention in care. Discontinuation of treatment was defined as the last date of any behavioral health services or AUD medication claim preceding 60 or more days without a treatment claim. Youth were censored if they disenrolled from their insurance plan or had only one treatment claim and no subsequent claims.

Potential confounders included sociodemographic, clinical, Medicaid managed care status, initial treatment setting, and year of diagnosis. Sociodemographic covariates included age at diagnosis, sex, and race/ethnicity. Clinical covariates were based on ICD-9 and ICD-10 codes (Supplemental Table 1) to identify comorbid diagnoses of pregnancy, depression, anxiety disorder, attention deficit hyperactivity disorder (ADHD), nicotine use, cannabis use, and other substance use during the three months prior or one month after receiving an AUD diagnosis. Medicaid managed care was included as a health plan characteristic at time of diagnosis. Lastly, location of diagnosis (inpatient, emergency department, and outpatient) and year of diagnosis as an indicator variable were included.

Statistical Analysis

Analyses used multivariable modified Poisson regression (19), an approach appropriate for a binary outcome that provides relative risks (rather than odds ratios) and, compared to logistic regression, results in estimates that are relatively robust to unmeasured confounders (20–22). A multivariable model was constructed that estimated changes in the probability of receiving timely treatment relative to sociodemographic, clinical characteristics, Medicaid managed care status, initial treatment setting, and year of diagnosis. Next, among those receiving timely treatment, a subsequent multivariable model was used to examine changes in the probability of receiving an AUD medication (either alone or in combination with behavioral health services) relative to receipt of behavioral health services alone.

The Kaplan-Meier estimator was used to estimate the probability of being retained in treatment between youth who received any AUD medication and youth who did not, as well as between young adults (aged 18–22 years at diagnosis) and adolescents (aged 13–17 years). Multivariable Cox proportional hazards regression was used to estimate adjusted hazard ratios of being retained in care. Models examined AUD medication receipt, receipt of a higher level of behavioral health services (i.e. inpatient, residential, partial hospitalization, or intensive outpatient care) within 3 months of diagnosis, as well as sociodemographic, clinical, and health plan characteristics, while controlling for year as an indicator variable. In order to meet the proportional hazards assumption, youth who had only one claim for treatment and no subsequent claim were censored.

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Analyses were conducted using SAS version 9.4 (SAS Institute, Inc., Cary, NC) and all statistical tests were two-sided and considered significant at $p<0.05$.

RESULTS

Sample

A total of 4,744,948 youth aged 13–22 were enrolled in Medicaid from January 1, 2014 to December 31, 2019 and among these, 15,352 (0.3%) were diagnosed with AUD and 14,194 (0.3%) met study eligibility criteria (Table 1). Median age at diagnosis was 19 years (interquartile range [IQR], 17–21 years), 6,815 (44.4%) were female, 9,379 (61.1%) were non-Hispanic White youth, and 3,106 (20.2%) were non-Hispanic Black youth. Co-occurring mental health diagnoses were common with 8,503 (55.4%) having a diagnosis of depression; 7,504 (48.9%), anxiety disorder; and 4,296 (28.0%), ADHD. Other substance use (including but not limited to meeting criteria for a use disorder) was also prevalent among youth with AUD, including use of cannabis (9,235; 60.2%), nicotine (6,950; 45.3%), and other substances (7,276; 47.4%).

Receipt of Any Timely Treatment

Overall, 10,851 youth (76.4%) received any treatment for AUD within 30 days of diagnosis (Table 2), including 3,669 (80.5%) of adolescents <18 and 7,182 (74.6%) of young adults ≥18. Female youth were slightly less likely to receive any addiction treatment compared with male youth (adjusted relative risk [aRR]: 0.98; 95% CI, 0.96–0.99). Hispanic youth were less likely to receive any addiction treatment compared with non-Hispanic White youth (aRR: 0.94; 95% CI, 0.9–0.99). Youth were more likely to receive any treatment if they had a diagnosis of depression (aRR: 1.06; 95% CI, 1.04–1.08), anxiety disorder (aRR: 1.06; 95% CI, 1.04–1.08) and ADHD (aRR: 1.03; 95% CI, 1.01–1.05).

Receipt of Timely Medications

Among 10,851 youth receiving timely treatment, 10,619 (97.9%) received behavioral health services only and 232 (2.1%) received any medication for AUD alone or in combination with behavioral health services (Table 3). Youth receiving medications included 16 (0.4%) adolescents <18 and 216 (3.0%) young adults ≥18. Among youth receiving medications, 206 (88.8%) received naltrexone; 19 (8.2%), acamprosate; and 7 (3.0%), disulfiram. The median age of youth who received medications was 21 years (IQR, 19–22) compared with median age of youth who received behavioral health only (19 years; IQR, 17–21); the difference was significant ($p<0.001$). Older adolescents (16–17 years) were 0.13 (95% CI, 0.07–0.26) times as likely to receive medications and younger adolescents (13–15 years) were 0.24 (95% CI, 0.11–0.51) times as likely to receive medications compared to older young adults (21–22 years). Female youth were more likely to receive medications compared with male youth (aRR: 1.39; 95% CI, 1.03–1.86), and non-Hispanic Black youth were 0.52 (95% CI, 0.34–0.8) times as likely to receive medications compared with non-Hispanic White youth.

Retention in Care

A total of 9,949 youth received ≥1 episode of treatment not occurring on their day of diagnosis and contributed 1,204,775 person-days of follow-up. The number of youth who

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discontinued treatment was 7524 (84.6%) and crude incidence density was 6.2 discontinuing events per 1,000 person-days. Overall median number of days retained in treatment was 108 (IQR, 43–244). Youth who received medications with behavioral health services were retained in care for more days (119 days; IQR, 54–321) compared to those receiving only behavioral health services (108 days; IQR, 43–243; Figure 1A; p=0.126). Adolescents aged 13–17 at diagnosis were retained in the first year of any addiction treatment for more days compared to young adults aged 18–22 (Figure 1B; p<0.001).

In order to meet the Cox proportional hazards assumption, youth with only one treatment visit were excluded (861; 8.2%). Youth included in the analysis were more likely to be adolescents aged 13–17 (p<0.001), have a location of diagnosis in ED or inpatient (p<.001), have comorbid cannabis (p<.001) or other substance use (p=.028). Other covariates did not differ between the two groups (p>0.05 for all).

Compared to adolescents aged 13–17, young adults aged 18–22 were 1.41 (95% CI, 1.34–1.49) times as likely to discontinue treatment, and male youth were 1.13 (95% CI, 1.08–1.19) times as likely to discontinue treatment compared to female youth (Table 4). Pregnant youth were 1.11 (95% CI, 1.02–1.21) times as likely to discontinue treatment compared to youth who were not pregnant. Youth with a comorbid behavioral health diagnosis (i.e., depression, anxiety, or ADHD) were 0.83 (95% CI, 0.79–0.88) times as likely to discontinue treatment compared with youth without a comorbid behavioral health diagnosis. Finally, youth who received a higher level of behavioral health services were 0.86 (95% CI, 0.82–0.91) times as likely to discontinue treatment compared with youth who did not receive a higher level of behavioral health services.

DISCUSSION

In this 15-state sample of Medicaid-enrolled youth with AUD, we found 76% received any treatment within 30 days of receiving an AUD diagnosis. Nearly all (97.9%) youth who received any treatment received behavioral health services only, while only 2.1% received naltrexone, acamprosate, or disulfiram. The proportion of adolescents receiving any treatment (80.5%) was higher than young adults (74.6%, p<.001). Adolescents were less likely to receive medications than young adults, and once in treatment, adolescents were retained in care for more days and young adults were more likely to discontinue treatment. Despite the overall low number and proportion of youth receiving medications, non-Hispanic Black youth were still less likely to receive medications.

Medications were dispensed sparingly, despite their recommended use for treatment of AUD among young adults and suggested use among adolescents. Clinical data from adults show medications for AUD reduce cravings for alcohol and are associated with reductions in heavy drinking episodes. The low rate of receipt we observed among young adults ≥18 merits consideration, since this may represent undertreatment in an adult population. The paucity of studies examining medications for AUD among young adults could contribute to hesitation around medication use in this group despite FDA approval and recommended use. Despite scant clinical trial data of AUD medications in adolescents, SAMHSA nonetheless recommends considering their use in individuals <18. Owing to a dearth of studies specific

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to this population, non-FDA approval for adolescents, and lack of strong recommendations, clinicians may be less likely to prescribe medications for AUD. The low rate of receipt of medications observed among adolescents in this study should prompt further examination in other clinical cohorts to better understand whether medications are underused in this age group.

Medication receipt for youth with AUD is similar to the proportion of youth receiving medications for nicotine use disorder (1.3%) (23), and far lower than rates of youth with opioid use disorder (23%–26%) (24,25). This is somewhat surprising since, unlike for methadone and buprenorphine in the treatment of opioid use disorder, there are no restrictions on which clinicians can prescribe medications for AUD. Importantly, most adolescents with AUD consume alcohol in binges, rather than daily drinking, which is more common in adults (5). Thus, these low rates of AUD medication use may be associated with provider perceptions that binge-drinking may not be as appropriate for the prescription of medications than for daily smoking or daily opioid use, which is a more prevalent pattern among youth with nicotine and opioid use disorders (5,23,25). Preliminary findings from case reports, pilot studies, and clinical trials with adolescents shows AUD medications are likely safe and well-tolerated, may promote abstinence from alcohol, and might decrease cravings in this age group (26–30). More clinical trial data are needed to support their potential future FDA approval. Even still, given the infrequency of medication use for other substance use disorder, it is unlikely FDA approval of AUD medications alone would be sufficient to increase their use. Potential strategies to increase medication use, particularly for young adults for whom medications are recommended, include continuing education for practicing clinicians and stronger training on AUD screening, diagnosis, and treatment in medical school and residency training curricula (31).

Our findings highlight differences in retention in care by patient characteristics. Young adults, males, and pregnant females were more likely to discontinue treatment compared to their counterparts. A higher proportion of adolescents received any treatment and were less likely to discontinue it, which may reflect family involvement in care. Data suggest family-based treatment for adolescent substance use disorders increases retention in care (32–35). Although we did not observe an association between receipt of AUD medications and retention in care, data from adult clinical trials suggest offering evidence-based medications for AUD to younger adults could promote their engagement in treatment and improve clinical outcomes (36). Future studies should seek to understand differences in retention by medication type and their administration (e.g., for naltrexone, oral daily tablet vs extended-release injectable).

Males were more likely to discontinue treatment relative to females. Criteria for binge drinking alcohol is higher for males compared to females, defined by SAMHSA as 5 or more alcoholic drinks for males or 4 or more alcoholic drinks for females on the same occasion on at least 1 day in the past month (37). While this may be biologically appropriate, a higher threshold for males may create a social normalization of heavy drinking which could cause alcohol use disorders to go untreated (38). Finally, pregnancy is a barrier to entry of treatment programs, and women often face social barriers (e.g., stigma) that inhibit initiation, engagement, and retention in care (39). Non-Hispanic Black youth

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received any addiction treatment at the same rate as non-Hispanic White youth, but were 48% less likely to receive medications. Small sample sizes may have precluded us from uncovering other racial disparities, and future studies should seek to uncover and address potential inequities.

Our study is not without limitations. First, we cannot rule out the possibility of unmeasured confounders due to the observational nature of this study. Second, due to an exceptionally low number of youth receiving medications, this study may have lacked sufficient power to detect a potential effect of medications on retention in care compared to behavioral health services only. Third, we were unable to examine severity of AUD and frequency of alcohol use (i.e. daily vs weekly drinking) in youth, which may affect the propensity and indication to prescribe medications. Fourth, since we relied on claims data for billing diagnoses, prevalence of AUD among youth may actually be higher, and it is likely many youth with AUD went unrecognized. Fifth, youth might come from states or have insurance plans with shared Medicaid policies that do not cover AUD medications, particularly among adolescents <18. Sixth, although this study benefited from a large sample size, results may not be generalizable outside the Medicaid population. Last, it is possible that only a small number of clinicians and facilities are responsible for prescribing the medications dispensed in this study; further studies are needed to understand the providers and programs that are prescribing medications.

CONCLUSION

In this large study examining receipt of medications for AUD and retention in care among youth, we found more than 7 in 10 youth received any treatment, but only 2 in 100 received medications. Given national bodies recommend use or consideration of AUD medications, even in adolescents, clinical trials are urgently needed to assess effectiveness of these medications, to better guide how and when to use medications, and for whom. Data are also needed to inform how to select among AUD medications, how long youth should remain on them, and how they should be incorporated into behavioral health services to maximize engagement and retention in addiction treatment. In the interim, as alcohol-related mortality accelerates, and alcohol use persists as an ongoing problem in youth, policymakers and clinicians might consider strategies to enhance access to and use of recommended behavioral treatment and pharmacotherapy when appropriate.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Implications and Contribution

Alcohol use disorder is a pediatric-onset condition requiring timely detection and treatment. Among 14,194 US youth with alcohol use disorder, more than 7 in 10 received treatment. Two in 100 received recommended pharmacotherapy. Adolescents were less likely than young adults to receive medications but were ultimately retained in care longer.

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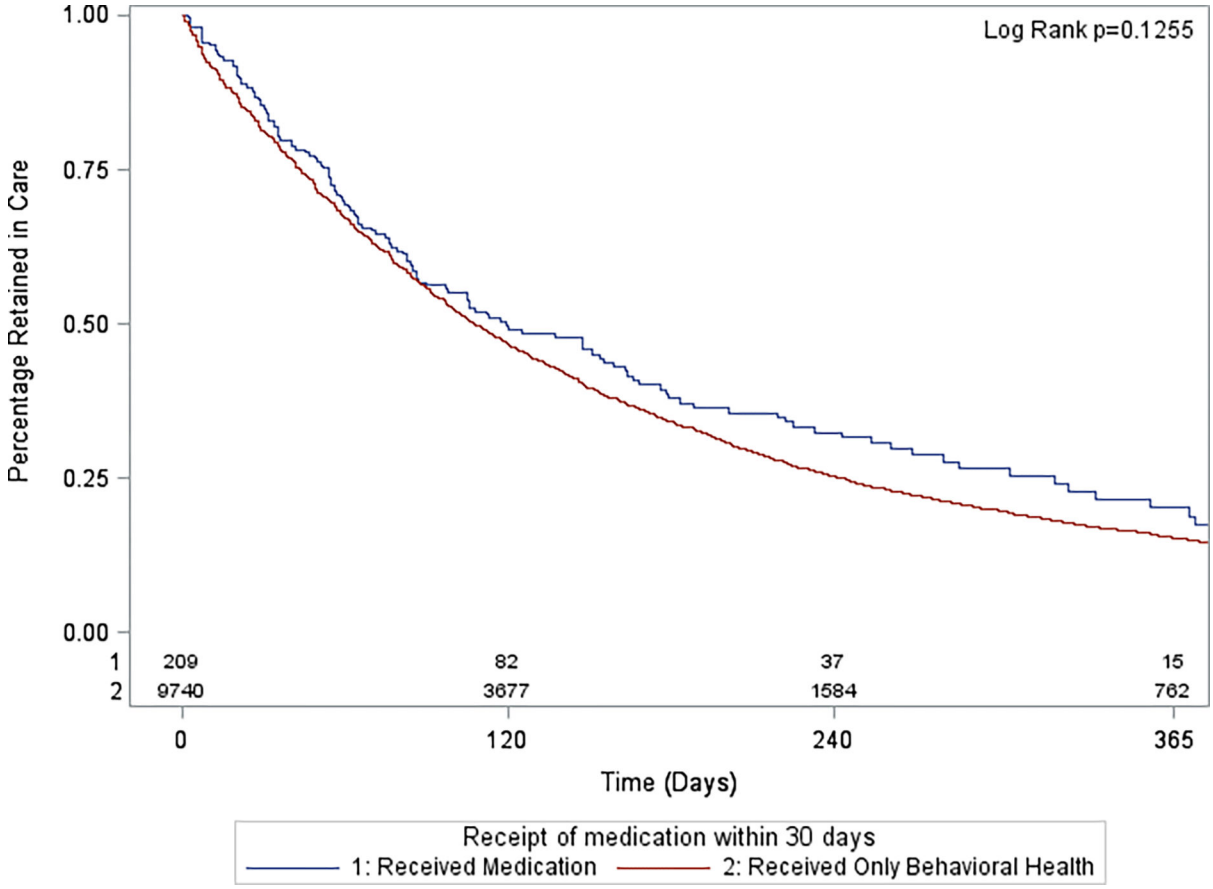

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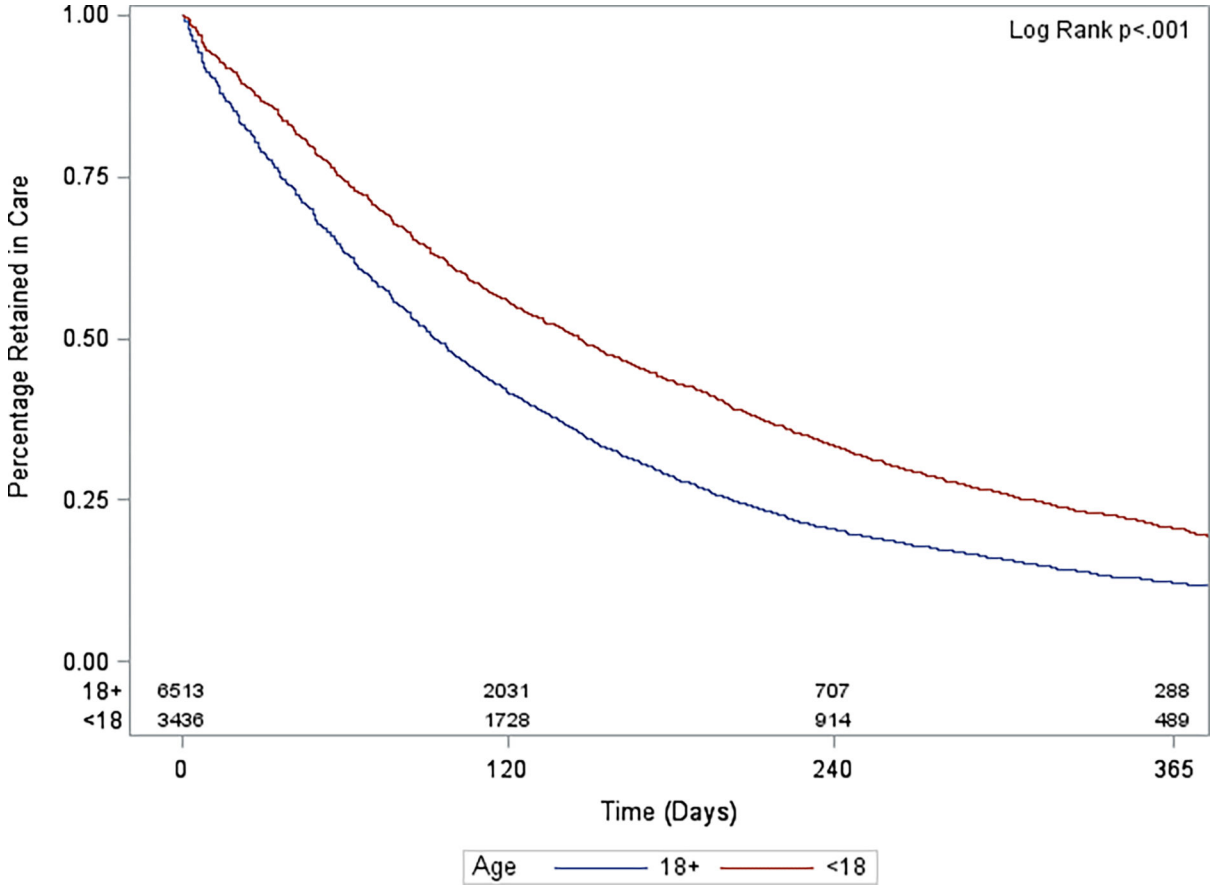

Figure 1:
Retention in Care According to (A) Timely Receipt of Alcohol Use Disorder Medication Within 3 Months of Diagnosis and (B) Age Among Youths

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Table 1.

Baseline characteristics of overall sample of 4,744,948 youth according to diagnosis of alcohol use disorder (AUD): January 1,2014 to December 31, 2019.

Characteristic	Youth without AUD (*n* = 4,729,596) N, (Column %)	Youth with AUD (*n* = 15,352) N (Column %)	*p* Value
Age of diagnosis			N/A
21–22 years	N/A	5,239 (34.1)	
18–20 years	N/A	5,192 (33.8)	
16–17 years	N/A	3,372 (22.0)	
13–15 years	N/A	1,549 (10.1)	
Sex			<0.001
Male	2,258,501 (47.8)	8,537 (55.6)	
Female	2,471,095 (52.2)	6,815 (44.4)	
Race/ethnicity			<0.001
White non-Hispanic	2,187,731 (46.3)	9,379 (61.1)	
Black non-Hispanic	1,536,475 (32.5)	3,106 (20.2)	
Hispanic	398,773 (8.4)	662 (4.3)	
Other/Missing	606,617 (12.8)	2,205 (14.4)	
Medicaid managed care	2,742,603 (58.0)	10,586 (69.0)	<0.001
Pregnancy[a,b]	482,992 (10.2)	1,826 (11.9)	<0.001
Depression[a]	747,180 (15.8)	8,503 (55.4)	<0.001
Anxiety disorder[a]	873,402 (18.5)	7,504 (48.9)	<0.001
Attention deficit hyperactivity disorder[a]	623,500 (13.2)	4,296 (28.0)	<0.001
Nicotine use[a]	350,825 (7.4)	6,950 (45.3)	<0.001
Cannabis use[a]	186,957 (4.0)	9,235 (60.2)	<0.001
Other substance use[a]	171,129 (3.6)	7,276 (47.4)	<0.001
Location of diagnosis			N/A
Inpatient	N/A	3,109 (20.3)	
Emergency department	N/A	1,556 (10.1)	
Outpatient	N/A	10,687 (69.6)	
Year of diagnosis			N/A
2014	N/A	2,476 (16.1)	
2015	N/A	2,472 (16.1)	
2016	N/A	2,627 (17.1)	
2017	N/A	3,391 (22.1)	
2018	N/A	2,058 (13.4)	
2019	N/A	2,328 (15.2)	

[a]At or during the 3 months prior to or 1 month after receiving AUD diagnosis

[b]Pregnancy reported as a percentage of *all* individuals in the sample; of females in the sample, 484,818 of 2,477,910 (19.6%) were pregnant

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Table 2.

Sociodemographic and clinical characteristics of 14,194 youth with alcohol use disorder and receipt of any addiction treatment (behavioral health services or an evidence-based medication) within 30 days of diagnosis: January 1, 2014 to December 31, 2019.

Characteristic	Received Any Addiction Treatment (*n* = 10,851), %	Adjusted[a] RR (95% CI)
Age of diagnosis		
21–22 years (*n* = 4,834)	75.0	Reference
18–20 years (*n* = 4,800)	74.1	0.99 (0.97, 1.01)
16–17 years (*n* = 3,140)	80.9	1.00 (0.98, 1.02)
13–15 years (*n* = 1,420)	79.5	1.00 (0.97, 1.03)
Sex		
Male (*n* = 7,878)	77.4	Reference
Female (*n* = 6,316)	75.3	**0.98 (0.96, 0.99)**
Race/ethnicity[c]		
White non-Hispanic (*n* = 8,660)	79.1	Reference
Black non-Hispanic (*n* = 2,859)	74.6	0.99 (0.97, 1.02)
Hispanic (*n* = 630)	68.4	**0.94 (0.90, 0.99)**
Other/Missing (*n* = 2,045)	70.5	**0.92 (0.90, 0.94)**
Medicaid managed care		
No (*n* = 4,402)	66.8	Reference
Yes (*n* = 9,792)	80.8	**1.17 (1.14, 1.19)**
Pregnancy[b,c]		
No (*n* = 12,465)	76.3	Reference
Yes (*n* = 1,729)	77.2	1.02 (0.99, 1.05)
Depression[b]		
No (*n* = 6,177)	75.1	Reference
Yes (*n* = 8,017)	77.5	**1.06 (1.04, 1.08)**
Anxiety disorder[b]		
No (*n* = 7,111)	74.3	Reference
Yes (*n* = 7,083)	78.6	**1.06 (1.04, 1.08)**
Attention deficit hyperactivity disorder[b]		
No (*n* = 10,138)	75.1	Reference
Yes (*n* = 4,056)	79.8	**1.03 (1.01, 1.05)**
Nicotine use[b]		
No (*n* = 7,673)	78.3	Reference
Yes (*n* = 6,521)	74.3	0.98 (0.97, 1.00)
Cannabis use		
No (*n* = 5,549)	69.2	Reference
Yes (*n* = 8,645)	81.1	**1.06 (1.04, 1.08)**
Other substance use disorder[b]		

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Characteristic	Received Any Addiction Treatment (*n* = 10,851), %	Adjusted[a] RR (95% CI)
No (*n* = 7,447)	74.7	Reference
Yes (*n* = 6,747)	78.4	1.00 (0.98, 1.02)
Location of diagnosis		
Emergency department (*n* = 1,440)	24.6	Reference
Inpatient (*n* = 2,907)	60.1	**2.28 (2.07, 2.51)**
Outpatient (*n* = 9,847)	88.9	**3.48 (3.18, 3.81)**
Year of diagnosis		
2014 (*n* = 1,866)	75.3	Reference
2015 (*n* = 2,376)	74.8	0.97 (0.95, 1.00)
2016 (*n* = 2,532)	77.1	**0.96 (0.93, 0.99)**
2017 (*n* = 3,207)	78.1	**0.96 (0.93, 0.98)**
2018 (*n* = 1,964)	80.1	**0.97 (0.94, 0.99)**
2019 (*n* = 2,249)	72.8	**0.92 (0.89, 0.95)**

a. Adjusted for all other covariates listed in the table

b. At or during the 3 months prior to or 1 month after receiving AUD diagnosis

c. Pregnancy reported as a percentage of all individuals in the sample; as a percentage of females in the sample, 1729 of 6316 (27.4%) were pregnant

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Table 3.

Sociodemographic and clinical characteristics of 10,851 youth with alcohol use disorder and receipt of medications compared to those receiving behavioral health services within 30 days of diagnosis: January 1,2014 to December 31,2019.

Characteristic	Received medication (*n* = 232), %	Adjusted[a] RR (95% CI)
Age of diagnosis		
21–22 years (*n* = 3,625)	3.6	Reference
18–20 years (*n* = 3,557)	2.4	**0.74 (0.56, 0.99)**
16–17 years (*n* = 2,540)	0.4	**0.13 (0.07, 0.26)**
13–15 years (*n* = 1,129)	0.6	**0.24 (0.11, 0.51)**
Sex		
Male (*n* = 6,097)	1.6	Reference
Female (*n* = 4,754)	2.8	**1.39 (1.03, 1.86)**
Race/ethnicity[c]		
White non-Hispanic (*n* = 6,846)	2.5	Reference
Black non-Hispanic (*n* = 2,133)	1.1	**0.52 (0.34, 0.80)**
Hispanic (*n* = 431)	1.2	0.63 (0.26, 1.52)
Other (*n* = 1,441)	2.2	0.90 (0.62, 1.31)
Medicaid managed care		
No (*n* = 2,941)	1.6	Reference
Yes (*n* = 7,910)	2.4	1.35 (0.98, 1.86)
Pregnancy[b,c]		
No (*n* = 9,516)	1.9	Reference
Yes (*n* =1,335)	3.5	0.81 (0.56, 1.16)
Depression[b]		
No (*n* = 4,639)	1.3	Reference
Yes (*n* = 6,212)	2.7	**1.44 (1.03, 2.01)**
Anxiety disorder[b]		
No (*n* = 5,286)	1.5	Reference
Yes (*n* = 5,565)	2.7	1.11 (0.82, 1.52)
Attention deficit hyperactivity disorder[b]		
No (*n* = 7,615)	2.4	Reference
Yes (*n* = 3,236)	1.6	**0.72 (0.53, 0.99)**
Nicotine use[b]		
No (*n* = 6,006)	1.3	Reference
Yes (*n* = 4,845)	3.2	**1.34 (1.01, 1.80)**
Cannabis use		
No (*n* = 3,838)	2.3	Reference
Yes (*n* = 7,013)	2.0	**0.68 (0.52, 0.90)**
Other substance use disorder[b]		

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Characteristic	Received medication (*n* = 232), %	Adjusted[a] RR (95% CI)
No (*n* = 5,564)	1.1	Reference
Yes (*n* = 5,287)	3.2	**2.23 (1.65, 3.01)**
Location of diagnosis		
Emergency department (*n* = 354)	1.4	Reference
Inpatient (*n* = 1,747)	3.4	2.14 (0.86, 5.32)
Outpatient (*n* = 8,750)	1.9	1.47 (0.60, 3.55)
Year of diagnosis		
2014 (*n* = 1,406)	0.9	Reference
2015 (*n* = 1,778)	1.2	1.27 (0.63, 2.56)
2016 (*n* = 1,952)	1.5	1.48 (0.76, 2.88)
2017 (*n* = 2,504)	2.8	**2.11 (1.15, 3.89)**
2018 (*n* = 1,573)	3.1	**2.60 (1.39, 4.86)**
2019 (*n* = 1,638)	3.1	**2.47 (1.31, 4.64)**

a. Adjusted for all other covariates listed in the table

b. At or during the 3 months prior to or 1 month after receiving AUD diagnosis

c. Pregnancy reported as a percentage of all individuals in the sample; as a percentage of females in the sample, 1335 of 4754 (22.2%) were pregnant

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Table 4.

Retention in care among 9949 youth receiving treatment for alcohol use disorder (AUD).

Characteristic	Adjusted[a] HR (95% CI)	
	Attrition from Any Treatment[b,c] (*n* = 9,949)	Attrition from Behavioral Health Services[b] (*n* = 9,531)
Sociodemographic characteristics		
Age ≥18 years	**1.41 (1.34, 1.49)**	**1.41 (1.33, 1.48)**
Male sex	**1.13 (1.08, 1.19)**	**1.13 (1.07, 1.19)**
Non-Hispanic white	0.99 (0.95, 1.04)	0.99 (0.95, 1.04)
Capitated payment model	**0.82 (0.78, 0.86)**	**0.81 (0.77, 0.86)**
Clinical characteristics		
Location of diagnosis		
Emergency department	Reference	Reference
Inpatient	**1.17 (1.00, 1.36)**	1.16 (0.99, 1.36)
Outpatient	0.88 (0.77, 1.01)	0.92 (0.79, 1.06)
Pregnancy[d]	**1.11 (1.02, 1.21)**	**1.10 (1.01, 1.20)**
Comorbid behavioral health diagnosis (depression, anxiety, or attention deficit hyperactivity disorder)[d]	**0.83 (0.79, 0.88)**	**0.84 (0.79, 0.89)**
Nicotine use[d]	0.96 (0.91, 1.01)	0.96 (0.91, 1.01)
Cannabis use[d]	0.99 (0.94, 1.04)	0.98 (0.93, 1.03)
Other substance use[d]	1.00 (0.95, 1.05)	1.01 (0.96, 1.06)
Year of diagnosis		
2014	Reference	Reference
2015	1.07 (0.99, 1.16)	1.07 (0.99, 1.16)
2016	1.07 (0.99, 1.15)	1.05 (0.97, 1.14)
2017	0.92 (0.85, 1.00)	**0.91 (0.83, 1.00)**
2018	**1.09 (1.00, 1.19)**	1.08 (0.99, 1.18)
2019	**0.74 (0.66, 0.82)**	**0.73 (0.65, 0.80)**
Treatment received		
Higher level of behavioral health services[e] within 3 months of initiating episode of care	**0.86 (0.82, 0.91)**	**0.87 (0.82, 0.92)**
Received timely AUD medication within 30 days of diagnosis		
No medication	Reference	Reference
Any medication	0.85 (0.72, 1.01)	0.95 (0.79, 1.13)

[a] Multivariable models included all covariates listed in table

[b] Attrition defined as ≥60 days without any claims for behavioral health services or AUD medications

[c] Includes receipt of any behavioral health services or AUD medications

[d] Within one month after or during the three months prior to receiving AUD diagnosis

[e] Includes intensive outpatient treatment, partial hospitalization, residential care, or inpatient care

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