

Substance use disorder treatment completion rates in adolescent inpatients and factors affecting these rates

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Abstract

The objective of this study is to investigate treatment completion rates among adolescents receiving inpatient treatment for substance use disorders (SUDs) and the sociodemographic characteristics, parental attitudes, and psychiatric comorbidities influencing these rates. The sample consisted of 110 adolescents (84 males, 26 females; aged 14–18) diagnosed with SUDs. Structured psychiatric interviews were conducted, and parental attitudes were evaluated using the Parental Attitude Scale and the Family Life and Child-Rearing Attitude Scale. Participants also completed the Multidimensional Scale of Perceived Social Support and the Adolescent Dissociative Experiences Scale. Only 22.7% of participants completed treatment. Those who completed treatment had a later onset of substance use (13.88±1.31 vs. 12.95±1.82 years), shorter duration of use (31.27±15.91 vs. 48.19±21.08 months), and higher rates of ADHD (76% vs. 42.4%) and heroin use (64% vs. 40%). Democratic and involved parental attitudes were associated with higher compliance. Families should be integrated into the treatment process to enhance outcomes, and treatment approaches should be tailored to adolescents' clinical and psychosocial profiles.

Keywords: adolescents, substance use disorders, treatment compliance, parent-child relationships, psychiatric comorbidity

Main points

- Adolescents who started substance use at an older age were more likely to complete inpatient treatment.
- Democratic and supportive parental attitudes improved adolescents' treatment adherence.
- Co-occurring ADHD symptoms were associated with better compliance in structured treatment programs.
- A family history of substance use and criminal behavior reduced the likelihood of treatment completion.

Introduction

Adolescence is a critical developmental period marked by intense psychological and neurobiological changes that increase vulnerability to substance use and its adverse effects (Luciana & Feldstein Ewing, 2015). According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), substance use disorders (SUDs) involve cognitive, behavioral, and psychological symptoms that persist despite harmful consequences (American Psychiatric Association, 2022). SUDs have become a significant global

public health issue and are increasingly prevalent among adolescents. In Turkey, 35.4% of individuals aged 15 to 24 have used substances at least once in their lifetime (T.C. İçişleri Bakanlığı Emniyet Genel Müdürlüğü, 2019).

SUD treatment is a complex and lengthy process that must be carried out by a team of experts. Treatment commonly includes both outpatient and inpatient components (Ghosh et al., 2023). Inpatient treatment has been shown to be effective in reducing the severity of SUDs and improving long-

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Received: July 6, 2025 **Accepted:** October 5, 2025 **Published online:** July 7, 2026

This study was derived from the medical residency thesis of Leyla Çelebi, titled "Madde Kullanım Bozukluğu Olan Erkek ve Kadın Ergenlerde Ebeveyn Tutumlarının ve Psikiyatrik Eş Tanıların Yataklı Tedaviyi Tamamlama Üzerine Olan Etkileri", conducted under the supervision of Assoc. Prof. Ali Güven Kılıçoğlu at University of Health Sciences, Bakırköy Prof. Dr. Mazhar Osman Mental Health and Neurological Diseases Health Practice and Research Center, in 2019.

Cite as: Çelebi, L., Kılıçoğlu, A. G., & Algedik, P. (2026). Substance use disorder treatment completion rates in adolescent inpatients and factors affecting these rates. *Addicta: The Turkish Journal on Addictions*, Advance online publication. <https://doi.org/10.15805/addicta.2026.511>

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term outcomes (Reif et al., 2014). However, early termination of inpatient treatment negatively impacts recovery, making it crucial to identify factors that reduce the risk of premature discontinuation.

The risk of early termination of inpatient treatment in adolescents with SUDs is associated with individual, environmental, and clinical factors. Factors such as early age-onset substance use, long-term substance use, type of substance used, lack of social support, and psychiatric comorbidity determine both the severity of SUDs and treatment compliance (Kenne et al., 2010).

Psychiatric comorbidities play a critical role in both the development and treatment process of SUDs (Choi et al., 2018). While psychiatric disorders may increase the risk of substance use in some individuals, substance use may also create a predisposition to psychiatric disorders through changes it causes in brain chemistry. Conditions such as attention deficit hyperactivity disorder (ADHD) and bipolar disorder, in particular, can increase substance use due to the impulse control problems they cause.

On the other hand, some patients may turn to substance use to cope with the symptoms of their disease (Andersson et al., 2021). Emotional and psychophysiological difficulties experienced during SUD treatment may increase distress in patients with comorbid psychiatric diseases, causing early withdrawal from the treatment process (Kenne et al., 2010).

The role of parents in adolescents' substance use and treatment is one of the main areas of focus for research. Parental attitudes in terms of adolescents' predisposition to substance addiction are evaluated in two dimensions: rule-setting and caring. Based on these two dimensions, parents of adolescents with SUDs are evaluated in four different categories according to their parenting styles: authoritarian (more rule-setting, less caring), democratic (more rule-setting, more caring), permissive/indulgent (less rule-setting, more caring), and neglectful (less rule-setting, less caring (Bircan et al., 2019)).

Studies conducted in Turkey have shown that adolescents with SUDs often perceive lower levels of parental involvement (Bircan et al., 2019). Moreover, the impact of parental attitudes on substance use varies across cultures. While democratic parenting protects against substance use in many European and Latin American settings, authoritarian parenting has shown protective effects in the United States and some Northern European countries. In contrast, neglectful parenting consistently correlates with higher substance use risk across all cultures (Calafat et al., 2014). Although the influence of parenting on SUD development has been well-documented, research on its role in inpatient treatment adherence remains limited.

This study aims to comprehensively examine the factors affecting treatment completion rates in adolescents receiving inpatient treatment for SUDs. We hypothesized

that adolescents with later onset and shorter duration of substance use, supportive parental attitudes, and specific psychiatric comorbidities such as ADHD would demonstrate higher treatment completion rates. Furthermore, we aim to contribute to the literature by highlighting how clinical, psychosocial, and familial factors may interact to influence treatment compliance in adolescents with SUDs.

Materials and Methods

Study Design and Population & Sample

This prospective, cross-sectional, single-center observational study was conducted in a child and adolescent substance use treatment center affiliated with a tertiary training and research hospital (center name blinded for peer review). The study population consisted of all consecutive adolescent patients aged between 14 and 18 years who were diagnosed with SUDs according to DSM-5 diagnostic criteria and hospitalized in the same treatment center within a one-year period (April 2018–March 2019). Patients diagnosed with mental retardation, bipolar disorder, psychotic disorder, or hospitalized for judicial reasons (hospitalizations under probation or the Turkish Civil Code (TMK) 432 which regulates restriction of freedom by compulsory placement/detainment) were excluded from the study. In the end, the study sample consisted of 110 adolescents with SUDs.

A post-hoc power analysis based on the substance use duration of the 110 patients included in the study (31.27 ± 15.91 months for those who completed treatment and 48.19 ± 21.08 months for those who did not complete treatment) revealed that the study had a statistical power of 82% within a 95% confidence interval.

Informed consent was obtained from all study participants and their legal guardians. The study was carried out in a single-center child and adolescent substance use treatment unit affiliated with a tertiary training and research hospital. All eligible adolescents aged 14–18 years who met DSM-5 diagnostic criteria for SUD and were admitted between April 2018 and March 2019 were consecutively recruited. Sociodemographic and clinical data were collected through structured interviews lasting approximately 45 minutes, and standardized assessment tools were administered to all participants by trained clinicians. During hospitalization, patients followed a 60-day structured treatment program including individual and group therapy, supplemented with pharmacological treatment when needed. All procedures were conducted in accordance with ethical approval and under the supervision of a multidisciplinary clinical team.

Data Collection

Participants' sociodemographic characteristics such as gender, age, educational level, family structure, and parents' education levels; and substance use-related characteristics such as age of onset of substance use, duration of substance use, number of substances they used, duration of smoking and

alcohol use, the number of substances used, the time elapsed between hospitalization and last substance use, criminal charge and prison stay history, duration of hospitalization, and treatment completion status were recorded.

Each interview lasted approximately 45 minutes, and participants' information was recorded in accordance with confidentiality principles. During data collection, the same procedures were applied to all participants in order to increase the accuracy and reliability of the interviews, and the entire process was carried out meticulously.

Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL)

This semi-structured interview assesses current and past psychiatric disorders in children and adolescents. The validity and reliability of the Turkish version were established by Gökler et al. (2004).

Parental Attitude Scale (PAS)

The PAS is a 26-item self-report scale used to assess parental attitudes across three subscales: acceptance/involvement, psychological autonomy, and control/supervision. Higher scores indicate a stronger presence of the respective parental attitude. The validity and reliability of the Turkish version were confirmed by Yılmaz (2000), who reported Cronbach's α coefficients of 0.82, 0.76, and 0.79 for the three subscales, respectively (Yılmaz, 2000).

Family Life and Child-Rearing Attitude Scale (FLCRAS)

The FLCRAS is a 60-item Likert-type scale that includes five subscales: excessive motherhood, democratic attitude, rejection of housewifery, husband-wife discord, and authoritarian attitude. The internal consistency (Cronbach's α) values for these subscales range from 0.71 to 0.84. The validity and reliability of the Turkish version were established by Küçük (1987).

Multidimensional Scale of Perceived Social Support (MSPSS)

The MSPSS is a 12-item, 7-point Likert-type self-report scale used to assess perceived social support across three domains: family, friends, and significant others. Total scores range from 12 to 84, with higher scores indicating greater perceived support. The validity and reliability of the Turkish version were confirmed by Eker (2001), who reported Cronbach's α values between 0.80 and 0.95 for the subscales (Eker, 2001).

Ethics Committee Approval and Permissions Required

This study was approved by the institutional ethics committee (Approval No: 135, Date: 06.03.2018)

Treatment Protocols

A 60-day structured treatment program was applied to the patients during their hospitalization. The treatment protocol consisted of individual supportive/motivational psychotherapy and group therapy sessions. Individual supportive/motivational psychotherapy sessions featured Ögel and Şimşek's motivational interviewing techniques, whereas the group therapy sessions featured the 12-session tobacco, alcohol, and substance addiction awareness program (SAMBA) (Ögel et al., 2012). The SAMBA program covers topics such as the effects of alcohol and substances, addiction, brain and addiction, motivation, being healthy and free, impulse control, coping with desires, getting out of the vortex, risky situations, coping with insistence-safe behaviors, the cornerstones of the path to non-addiction, and the effects of smoking, respectively. Psychopharmacological treatment support was provided to patients in need, and a multidisciplinary team monitored the treatment process. All patients were followed up regularly for three months after discharge. According to the DSM-5 criteria, patients who have not used substances for three months were considered to be in early remission. Patients who completed the 60-day structured inpatient treatment protocol and attended two regular follow-up visits within the first month after discharge were deemed to have completed their treatment.

Statistical Analysis

Data were analyzed using SPSS Statistics 18.0 (Predictive Analytics Software Statistics for Windows, Version 18.0, SPSS Inc., Chicago, IL, US, 2009) software package. Descriptive statistics were presented as mean $\pm$ standard deviation for continuous variables and as frequencies and percentages for categorical variables. Normality of continuous data was assessed using the Kolmogorov-Smirnov test. For normally distributed variables (e.g., duration of substance use, PAS, and FLCRAS subscale scores), independent samples t-tests were applied. For non-normally distributed variables (e.g., age and number of criminal charges), the Mann-Whitney U test was used. Categorical variables such as psychiatric comorbidities, preferred substance, and parental attitudes were compared using Pearson's chi-square test (for expected counts ≥ 5) or Fisher's exact test (for expected counts < 5). A p-value ≤ 0.05 was considered statistically significant.

Results

The treatment completion rate among 110 patients, 84 (76.4%) males and 26 (23.6%) females, was 22.7%. The rates of those attending open high school (44% vs. 20%, $p=0.015$) and those whose fathers were university graduates (12% vs. 1.2%, $p=0.009$) were significantly higher in the group of

adolescents with SUDs who completed treatment (Group 1) than in the group of adolescents with SUDs who did not complete treatment (Group 2). The rates of those with a history of criminal charges, a familial history of criminal charges, and familial history of psychoactive substance use were significantly higher in Group 2 than in Group 1 ($p=0.020$, $p=0.007$, and $p=0.008$, respectively). There was no significant difference between the groups in terms of employment history, prison stay history, hospitalization history, history of spontaneous withdrawal from substance use, suicide attempt, self-harm, physical/sexual abuse history, age at hospitalization, grade level, number of criminal charges, and family structure (Table 1).

The age of onset of substance use was found to be later, and the duration of substance use was shorter in Group 1 than in

Group 2 ($p=0.015$ and $p<0.001$). The rate of heroin use was significantly higher in Group 1 than in Group 2 (64% vs. 40%, $p=0.034$). There was no significant difference between the groups in terms of the duration of use and preference rates of other substances, the number of substances used, the time elapsed between hospitalization and last substance use, and the duration of hospitalization (Table 2).

The mean PAS acceptance/involvement and control/supervision subscale scores and the mean FLCRAS democratic attitude subscale score were significantly higher, whereas the mean FLCRAS authoritarian attitude subscale score was significantly lower in Group 1 than in Group 2 ($p<0.05$).

The rate of ADHD was significantly higher in Group 1 than in Group 2 (76% vs. 42.4%, $p=0.006$). There was no significant

Table 1. Comparison of sociodemographic and clinical characteristics of adolescents who completed and did not complete treatment

	Overall Sample (n=110)	Adolescents Who Completed Treatment (n=25)	Adolescents Who Did Not Complete Treatment (n=85)	P
Gender				
Female	26 (100)	7 (26.9)	19 (73.1)	0.559*
Male	84 (100)	18 (21.4)	66 (78.6)	
Enrolment in open high school, yes	28 (100)	11 (39.3)	17 (60.7)	0.015*
History of criminal charges, yes	70 (100)	11 (15.7)	59 (84.3)	0.020*
History of employment, yes	67 (100)	16 (23.9)	51 (76.1)	0.719*
History of prison stay, yes	12 (100)	1 (8.3)	11 (91.7)	0.291*
History of hospital stay, yes	38 (100)	11 (28.9)	27 (71.1)	0.258*
History of spontaneous withdrawal from substance use, yes	84 (100)	22 (26.2)	62 (73.8)	0.119*
History of suicide attempts, yes	36 (100)	8 (22.2)	28 (77.8)	0.930*
History of self-harm, yes	85 (100)	18 (21.2)	67 (78.8)	0.474*
Exposure to physical abuse, yes	19 (100)	4 (21.1)	15 (78.9)	0.999*
Exposure to sexual abuse, yes	9 (100)	3 (33.3)	6 (66.7)	0.422*
Age at hospitalization	16.85 ± 1.22	17.08 ± 1.19	16.79 ± 1.23	0.206**
Grade level at hospitalization	8.35 ± 1.59	8.84 ± 1.43	8.20 ± 1.62	0.184**
Number of criminal charges	1.97 ± 1.83	1.45 ± 1.21	2.07 ± 1.91	0.126**
Family type				
Nuclear family	68 (100)	14 (20.6)	54 (79.4)	0.380*
Extended family	5 (100)	0 (0.0)	5 (100.0)	
Divorced parents	26 (100)	7 (26.9)	19 (73.1)	
Deceased parent	11 (100)	4 (36.4)	7 (63.6)	
Family structure				
Living with both parents	73 (100)	14 (19.2)	59 (80.8)	0.212*
Living with one parent	37 (100)	11 (29.7)	26 (70.3)	
Father's Educational Level				
Literate	4 (100)	3 (75.0)	1 (25.0)	0.009*
Elementary school	83 (100)	15 (18.1)	68 (81.9)	
Middle school	10 (100)	2 (20.0)	8 (80.0)	
High school	9 (100)	2 (22.2)	7 (77.8)	
University	4 (100)	3 (75.0)	1 (25.0)	
Familial history of criminal charges, yes	48 (43.6)	5 (20.0)	43 (50.6)	0.007*
Familial history of substance use, yes	52 (47.3)	6 (24.0)	46 (54.1)	0.008*

*. Pearson's Chi-Square, Fisher's Exact or Fisher-Freeman-Halton test.

**. Mann-Whitney U test.

Note: Bold p-values indicate statistical significance ($p\leq 0.05$).

Table 2. Comparison of duration of substance use, preferred substance, and parental attitudes of adolescents who completed and did not complete treatment

	Overall Sample (n=110)	Adolescents Who Completed Treatment (n=25)	Adolescents Who Did Not Complete Treatment (n=85)	p
Duration of Substance Use (months) [§]	44.19 ± 21.18	42.80 ± 19.57	44.60 ± 21.73	0.711***
Number of Substances Used [§]	3.58 ± 1.58	3.40 ± 1.58	3.64 ± 1.59	0.289**
Age of Onset of Substance Use(years) [§]	13.17 ± 1.75	13.56 ± 1.63	13.06 ± 1.78	0.413**
Time between Hospitalization and Last Substance Use (days) [§]	4.61 ± 5.82	4.92 ± 4.83	4.52 ± 6.11	0.384**
Duration of Smoking (months) [§]	62.46 ± 25.13	55.83 ± 23.36	64.42 ± 25.44	0.149**
Duration of Alcohol Use (months) [§]	33.72 ± 15.02	32.47 ± 17.09	34.10 ± 14.47	0.539**
Duration of Bonsai Use (months) [§]	28.81 ± 20.17	22.08 ± 14.02	30.59 ± 21.27	0.208**
Duration of Marijuana Use (months) [§]	27.59 ± 21.13	25.50 ± 19.95	28.15 ± 21.57	0.707**
Duration of Powdered Marijuana Use (months) [§]	35.17 ± 21.87	60.00 ± 0.00	30.20 ± 20.31	0.252***
Duration of Skunk Use (months) [§]	22.06 ± 16.69	6.00 ± 0.0	23.13 ± 16.70	0.337***
Duration of Glue-Thinner Use(months) [§]	14.54 ± 16.87	17.00 ± 24.35	13.95 ± 15.33	0.922**
Duration of Lighter Fluid Use(months) [§]	20.40 ± 18.83	19.80 ± 29.36	20.49 ± 17.55	0.363**
Duration of Inhaled Heroin Use(months) [§]	28.16 ± 17.44	30.44 ± 14.83	27.36 ± 18.36	0.548***
Duration of Intravenous (IV) Heroin Use(months) [§]	12.67 ± 20.20	18.50 ± 24.75	1.00 ± 0.0	0.480**
Duration of Ecstasy Use (months) [§]	26.13 ± 15.19	27.59 ± 18.02	25.57 ± 14.11	0.598***
Duration of Prescription Drug Use (months) [§]	21.50 ± 14.84	1.00 ± 0.0	28.33 ± 7.09	0.079***
Duration of Crack Cocaine Use (months) [§]	19.58 ± 21.69	17.57 ± 18.01	20.17 ± 22.97	0.757**
Duration of Methamphetamine Use (months) [§]	20.40 ± 18.36	4.00 ± 0.00	22.22 ± 18.45	0.377***
Preferred Substance‡				
Bonsai, yes	16 (14.5)	3 (12.0)	13 (15.3)	0.999*
Marijuana, yes	27 (24.5)	3 (12.0)	24 (28.2)	0.097*
Glue-Thinner, yes	7 (6.4)	0 (0)	7 (8.3)	0.348*
Heroin, yes	50 (45.5)	16 (64.0)	34 (40.0)	0.034*
Ecstasy, yes	7 (6.4)	3 (12.0)	4 (4.7)	0.192*
Other (cocaine, methamphetamine, prescription drug), yes	3 (2.7)	0 (0)	3 (3.5)	0.999*
Age of Onset of Substance Use (years) [§]	13.17 ± 1.76	13.88 ± 1.31	12.95 ± 1.82	0.015**
Duration of Substance Use (months) [§]	44.19 ± 21.18	31.27 ± 15.91	48.19 ± 21.08	<0.001***
Time between Hospitalization and Last Substance Use (days) [§]	4.61 ± 5.82	6.04 ± 7.13	4.17 ± 5.33	0.384**
Duration of Hospital Stay (days) [§]	30.11 ± 21.91	33.81 ± 23.32	28.96 ± 21.47	0.561**

‡: n (%), §: Mean ± Standard deviation.

*. Pearson's Chi-Square, Fisher's Exact or Fisher-Freeman-Halton test.

**. Mann-Whitney U test.

***. Independent Samples t-Test.

Note: Bold p-values indicate statistical significance (p ≤ 0.05).

difference in other comorbid psychiatric disorders. There was also no significant difference between the groups in the MSPSS and Adolescent Dissociative Experiences scores (Table 3).

Discussion

Multiple factors were found to influence treatment completion rates among adolescents with SUDs, including substance-related characteristics, parental attitudes, sociodemographic variables, and psychiatric comorbidities. Democratic parenting and high parental involvement appeared to support treatment adherence, while early-onset and prolonged substance use,

as well as personal and familial histories of criminal behavior, were associated with poorer outcomes. Contrary to prevailing literature, adolescents with ADHD and those using heroin demonstrated higher treatment compliance. This paradox may reflect the structured nature of inpatient programs, which align well with the needs of individuals with ADHD by providing routine, predictability, and targeted pharmacological support. In the case of heroin users, the severity of withdrawal symptoms and psychosocial repercussions may heighten motivation to remain in treatment. These patterns underscore the complex and sometimes counterintuitive ways in which neurodevelopmental profiles and substance-specific effects shape engagement in care.

Table 3. Comparison of parental attitudes, perceived social support, and psychiatric comorbidities of adolescents who completed and did not complete treatment

	Overall Sample (n=110)	Adolescents Who Completed Treatment (n=25)	Adolescents Who Did Not Complete Treatment (n=85)	p
Parental Attitude Scale [§]				
Acceptance/involvement	23.41 ± 5.20	26.00 ± 5.16	22.65 ± 4.99	0.004***
Psychological autonomy	16.19 ± 3.59	15.80 ± 2.60	16.31 ± 3.84	0.538***
Control/supervision	13.25 ± 4.98	14.72 ± 4.60	12.81 ± 5.03	0.048**
Family Life and Child-Rearing Attitude Scale [§]				
Excessive motherhood	51.42 ± 7.62	50.64 ± 8.85	51.65 ± 7.26	0.708**
Democratic attitude	26.64 ± 3.78	28.08 ± 3.94	26.21 ± 3.65	0.017**
Rejection of housewifery	32.54 ± 6.94	30.40 ± 7.13	33.16 ± 6.80	0.080***
Husband-wife discord	17.23 ± 4.20	16.72 ± 3.28	17.38 ± 4.44	0.217**
Authoritarian attitude	47.22 ± 8.05	44.24 ± 9.86	48.09 ± 7.27	0.035***
Adolescent Dissociative Experiences Scale [§]	31.77 ± 42.05	34.48 ± 45.47	30.98 ± 41.24	0.668**
Multidimensional Scale of Perceived Social Support [§]				
Social support received from family	22.03 ± 5.55	24.64 ± 4.07	21.26 ± 5.71	0.008**
Social support received from friends	13.38 ± 6.27	14.96 ± 6.92	12.92 ± 6.03	0.200**
Social support received from a significant other	17.73 ± 9.77	15.84 ± 10.43	18.28 ± 9.57	0.274**
Psychiatric Comorbidities [‡]				
Major Depression, yes	54 (49.1)	14 (56.0)	40 (47.1)	0.263*
Attention Deficit Hyperactivity Disorder, yes	55 (50.0)	19 (76.0)	36 (42.4)	0.006*
Oppositional Defiant Disorder, yes	38 (34.5)	7 (28.0)	31 (36.5)	0.434*
Conduct Disorder, yes	93 (84.5)	18 (72.0)	75 (88.2)	0.134*
Post-traumatic stress disorder, yes	13 (11.8)	1 (4.0)	12 (14.1)	0.082*
Social Anxiety Disorder, yes	17 (15.5)	5 (20.0)	12 (14.1)	0.496*
Generalized Anxiety Disorder, yes	8 (7.3)	4 (16.0)	4 (4.7)	0.077*
Panic Disorder, yes	3 (2.7)	1 (4.0)	2 (2.4)	0.898*
Specific Phobia, yes	6 (5.5)	0 (0.0)	6 (7.1)	0.344*
Obsessive Compulsive Disorder, yes	2 (1.8)	0 (0.0)	2 (2.4)	0.999*
Parental Attitude [‡]				
Democratic	36 (32.7)	11 (44.0)	25 (29.4)	0.172*
Neglectful	35 (31.8)	4 (16.0)	31 (36.5)	0.053*
Permissive/indulgent	20 (18.2)	6 (24.0)	14 (16.5)	0.389*
Authoritarian	19 (17.3)	4 (16.0)	15 (17.6)	0.999*

‡: n (%), §: Mean ± Standard deviation.

*: Pearson's Chi-Square, Fisher's Exact or Fisher-Freeman-Halton test.

**: Mann-Whitney U test.

***: Independent Samples t-Test.

Note: Bold p-values indicate statistical significance (p ≤ 0.05).

The treatment noncompliance rate of 77.3% observed in this study underscores the significant challenges in managing adolescent SUDs. Previous research has reported lower noncompliance rates, ranging from 17% to 57% (Brorson et al., 2013) and 60% to 65% (Thomasius et al., 2022). This discrepancy may be attributed to methodological differences, including more stringent criteria for treatment completion (i.e., a three-month remission), a narrower age range restricted to adolescence, and the unique sociocultural context of Turkey. Supporting this, Sarasvita et al. (2012) identified age as a critical determinant in treatment trajectories.

One of the most striking findings of the study is that early initiation of substance use and longer duration of use significantly reduce treatment completion rates. This finding

supports Trucco's (2020) critical period hypothesis regarding adolescents' substance use. The destructive effects of early age-onset substance use on neurobiological development negatively affect decision-making mechanisms and treatment motivation, mainly by disrupting the maturation process of the prefrontal cortex. From a neurodevelopmental perspective, early age-onset substance use paves the way for longer-term exposure and, therefore, the development of more severe addiction, as well as treatment resistance and poor treatment compliance, by increasing neurotoxic damage during the period when brain plasticity is most intense (Beuster & Arnott, 2007). Our finding that early-age onset and longer duration of substance use decrease treatment completion rates emphasizes the significance of early diagnosis and intervention while also pointing out the

need for individualization of treatment protocols according to the patient's neurodevelopmental characteristics. Another important finding related to substance use characteristics was that heroin users had higher rates of completing treatment. As a matter of fact, Cernasev et al. (2021) stated in their systematic review that the severe withdrawal symptoms that occur in heroin addiction are one of the primary motivational sources that strengthen the desire for treatment. The destructive effects of heroin use on social, financial, and health issues may be greater than those of other substances, which may increase treatment compliance.

The negative impact of a history of criminal charges on treatment completion aligns with the risk factors identified by Kelly et al. (2011). This relationship can be explained by the interaction of neurobiological and behavioral mechanisms, where impulsivity and poor self-control—often stemming from prefrontal cortex dysfunction—contribute both to increased vulnerability to substance use and difficulty adhering to the structured treatment environment. Accordingly, treatment protocols for adolescents with a criminal history should prioritize strengthening impulse control and self-regulation skills.

Adolescents who failed to complete treatment had significantly higher rates of familial history of criminal charges and psychoactive substance use. This suggests that familial risk factors influence the treatment process not only socially but also through behavioral and psychological pathways. As demonstrated by Ceballo and McLoyd (Ceballo & McLoyd, 2002) in a study conducted in poor neighborhoods, the presence of a familial history of criminal charges restricts the emotional support that parents can provide to their children and increases the level of stress within the family. As stated by Smith et al. (2022), this stressful environment may negatively affect treatment motivation by strengthening the perception of stigma in the adolescent and causing social isolation. Moreover, in a comprehensive genetic study, Deak and Johnson (2021) demonstrated that a familial history of substance use not only negatively affects the adolescent psychosocially but also creates a biological predisposition that may negatively affect treatment response. The combination of these multiple risk factors indicates the need for more intensive family interventions during the treatment process.

The relationship between ADHD and SUDs has gained a new dimension from the current neurodevelopmental perspective. As highlighted in the comprehensive meta-analysis by Zaso et al. (2020), the paradigm that ADHD negatively affects treatment success has been accepted for many years. However, the results of our study suggest that the structured treatment environment offers previously unforeseen advantages for adolescents with ADHD. This paradoxical effect reflects a complex interplay of neurobiological and environmental factors. The high treatment completion rates we observed in adolescents with ADHD contradict the traditional view put forward by Sarasvita et al. (2012) but highlight the therapeutic value of the structured environment offered by inpatient treatment programs. The mechanisms underlying this unexpected finding can be evaluated along

three main axes: (1) clear boundaries and predictable routines in the inpatient treatment environment provide a structure suitable for the neurocognitive profile of adolescents with ADHD; (2) the regulatory effect of regular stimulant treatment on prefrontal functions strengthens treatment compliance; in line with this, a pilot study by Levin et al. (1998) found that methylphenidate treatment in adults with both ADHD and cocaine dependence reduced cocaine use, suggesting that some individuals may engage in substance use as a form of self-medication; and (3) therapeutic literacy gained through previous psychiatric treatment experiences facilitates adaptation to the treatment environment (Levin et al., 1998).

Education's role in the treatment process is another important finding. The higher treatment completion rates in adolescents attending open high schools reflect the multidimensional effect of education on the therapeutic process. Makara and Madjar's (2015) study on adolescent development reveals that the structured goal setting and achievement-oriented atmosphere provided by the educational environment strengthens treatment motivation. This structured environment supports the sense of order and purpose that adolescents with substance use disorders often lack. The education-social support relationship emphasized in Lee and Henry's (2022) longitudinal study supports our finding and points out the importance of the autonomy offered to adolescents by flexible education models such as open high school in the treatment process. As demonstrated by Cruz and Vargas (2021) in their study on educational models, the open high school system can positively affect adolescents' ability to take responsibility in the treatment process by strengthening their sense of self-efficacy by providing them with the opportunity to manage their learning processes. These findings, which highlight the importance of educational support in treatment protocols, indicate the potential role of flexible educational models in increasing treatment completion rates, especially in the adolescent population.

A significant finding was the positive association between paternal education level and treatment completion. Fathers with higher education may promote treatment engagement by modeling effective problem-solving and fostering a supportive environment through greater health literacy. This pattern can be understood within the framework of social learning theory.

The role of parental attitudes in adolescents' treatment process is shaped by the complex dynamics of the cultural context. Our findings strongly confirmed the democratic parenting-treatment success relationship emphasized in Calafat et al.'s (2014) transcultural study. However, the nature of this relationship varies depending on the cultural setting. The prominence of the control/supervision dimension in our study may reflect fundamental paradigm differences between the East and West. This highlights the contrast between the constructive role of parental authority in collectivist societies and the socialization processes in which autonomy is prioritized in individualist cultures.

The qualitative dimensions of the parent-child relationship are among the critical factors that determine the course of the treatment process. In the PAS acceptance/involvement subscale, data support the relationship between parental acceptance and treatment compliance put forward in the meta-analytic study of Matejevic et al. (2014). The mechanisms underlying this relationship can be explained within the framework of the bidirectional model proposed by MacPherson (MacPherson et al., 2021) in her integrated cognitive behavioral therapy study. Parental involvement activates the adolescent's intrinsic motivational resources on the one hand, while strengthening the stress buffering systems on the other. This bidirectional effect is of great importance for the sustainability of the treatment process, especially in cases with a high risk of relapse.

Another unexpected finding was that perceived social support did not have a significant effect on treatment completion rates. In light of the conclusions of Klingemann et al.'s (2016) study on self-change processes, this finding can be explained by the unique developmental characteristics of adolescence. Accordingly, adolescents may reject external support and turn to internal motivation sources during their individualization processes. Hence, the role of social support in adolescents' treatment process needs to be re-evaluated. Therefore, the quality of social support in addiction treatment should be of a nature that takes into account the autonomy needs of adolescents and meets the structural requirements of the treatment rather than general emotional support. In addition, concerns about social stigma and privacy may lead adolescents to avoid using social support resources available to them. This finding highlights the need to restructure social support interventions in adolescent addiction treatment based on adolescents' developmental characteristics and individual preferences.

Limitations of the Study

The single-center design of this study limits the generalizability of its findings to broader populations. Sociocultural variables may also influence treatment completion rates and should be considered when interpreting the results. Moreover, the cross-sectional nature of parental attitude assessments may not adequately capture temporal changes in parent-child dynamics. Data collected via self-report scales may be subject to social desirability bias. ADHD diagnoses were based solely on face-to-face interviews using DSM-5 criteria and were not corroborated by neuropsychological testing. Similarly, adolescents' trauma histories were assessed through qualitative interviews rather than standardized scales, which, while offering rich subjective insight, limit systematic and comparative analysis. These factors constitute important methodological limitations of the study.

Conversely, the study's strengths include being among the first to examine treatment compliance in adolescents with

SUDs undergoing inpatient care in Turkey, and its prospective, observational design and rigorous methodology contribute to a low risk of bias. Insights into factors influencing treatment adherence and outcomes in inpatient settings are valuable for clinical practice and offer direction for future research, particularly given the significance of the adolescent population and the complexity of the treatment process.

Conclusions

Adolescents are at risk for developing SUDs. Since their neurodevelopmental maturation is ongoing, they are more vulnerable to the adverse effects of substances. Therefore, fast and effective treatment options are vital for adolescents with SUDs. However, as important as the effectiveness of the treatment, its sustainability, flexibility, and adaptability to the patient are also important. In addition, as with other psychiatric diseases, there is no doubt that programs that include the family in the treatment processes of adolescents with SUDs will have a positive impact on treatment compliance and outcomes. Future studies should build on these findings by focusing on specific subgroups such as adolescents with neurodevelopmental comorbidities, where structured inpatient programs may offer unique benefits. In addition, family-centered interventions and parental training modules should be tested to further clarify the role of parenting in treatment adherence. Research is also warranted to examine the impact of flexible educational models and broader social support systems on treatment compliance. Long-term prospective studies are needed to evaluate the sustainability of treatment completion and relapse rates, and cross-cultural comparisons may provide deeper insights into the contextual factors shaping treatment outcomes.

Author contributions

Conception and design: L.Ç., A.G.K.; Data acquisition: L.Ç., A.G.K., P.A.; Data interpretation: L.Ç., A.G.K., P.A.; Drafting of the manuscript: L.Ç., A.G.K., P.A.; Critical revision of the manuscript: L.Ç., A.G.K., P.A. All authors reviewed the results, approved the final version of the manuscript, and agreed to be accountable for all aspects of this study.

Ethical approval

This study was approved by the the ethics committee of the Health Application and Research Center (SUAM), affiliated with a mental health and diseases hospital (Date: March 06, 2018, Decision/Protocol No: 135). Informed consent was obtained from all participants involved in this study.

Data availability statement

The data supporting the findings of this study are not publicly available due to privacy/ethical restrictions.

Conflict of interest

The authors declare that this study was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Funding

The authors declare that this study received no funding.

Generative AI statement

The authors declare that during the preparation of this study, the following AI-assisted technology was used: ChatGPT-5, 2024. Extent of Use: ChatGPT was used solely for language editing, grammar correction, and improving the clarity and readability of the manuscript. The authors confirm that all scientific content, study design, data collection, statistical analyses, and interpretation of results were conducted entirely by the authors. The AI tool was not used for data analysis, generation of results, or drawing scientific conclusions. All outputs generated by the AI tool were carefully reviewed, verified, and edited by the authors to ensure accuracy and integrity. The authors confirm that they have critically reviewed and edited any AI-generated content and take full responsibility for the integrity, accuracy, and originality of the publication. The authors certify that the original human contribution is maintained and that AI-assisted tools are not listed or cited as authors.

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