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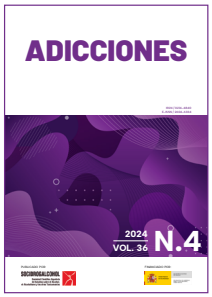

ORIGINAL

Integrated vs. parallel treatment in adolescents with substance use and comorbid disorders: A randomized trial

Tratamiento integrado vs. tratamiento paralelo en adolescentes con consumo de sustancias y trastornos comórbidos: Un ensayo aleatorizado

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Abstract

Integrated treatments are often recommended for adolescents with substance use disorders (SUD) and comorbid pathologies. This study aims to compare the effectiveness of two different intervention programs (integrated and parallel) and to investigate treatment outcome predictors. Seventy-five adolescents (13-17 years old) with substance use and comorbid disorders referred to our outpatient program were randomized to integrated (n = 33) or parallel (n = 32) treatment groups. Their sociodemographic variables, psychopathology, substance use problems, and global functioning were assessed at baseline and 12 months after treatment initiation. Both treatments were associated with positive pre-post changes in several outcome variables (severity of school, family, and psychiatric problems; global functioning; and stage of change). Integrated treatment showed better outcome on adherence (χ^2 = 14.328; p > .001) and a composite global measure based on the severity of drug-related problems (χ^2 = 8.833, p = .003). Following an adaptive treatment strategy, we offered patients who dropped out of parallel treatment (n = 12) the possibility of entering integrated treatment. Eleven of them accepted and constituted a third comparison group (parallel-to-integrated). Multivariate logistic regression analysis showed that the likelihood of a positive global treatment outcome increased with integrated or parallel-to-integrated treatment, internalizing or mixed comorbid disorders, older age, and fewer legal issues. Integrated treatment showed better adherence and global treatment outcomes than parallel treatment in adolescent patients with dual disorders. Older age and fewer legal issues were also related to a positive global treatment outcome.

Keywords: substance use disorders, adolescents, dual disorders, integrated treatment, outpatient program, comorbidity

Resumen

Los tratamientos integrados suelen recomendarse para adolescentes con trastornos por uso de sustancias (TUS) y patologías comórbidas. Este estudio compara la eficacia de dos programas de intervención (integrado y paralelo) e investiga factores predictores de resultados del tratamiento. Setenta y cinco adolescentes (13-17 años) con TUS y trastorno comórbido, remitidos a un programa ambulatorio, fueron asignados aleatoriamente a un tratamiento integrado (n = 33) o paralelo (n = 32). Se evaluaron variables sociodemográficas, psicopatología, consumo de sustancias y funcionamiento global al inicio del tratamiento y 12 meses después. Ambos tratamientos se asociaron con cambios positivos pre-post en diferentes variables (problemas escolares, familiares, psiquiátricos, funcionamiento global y estadio de cambio). El tratamiento integrado mostró mejores resultados en adherencia (χ^2 = 14,328; p > ,001) y en una medida global compuesta basada en la gravedad de problemas relacionados con drogas (χ^2 = 8,833; p = ,003). Siguiendo una estrategia de tratamiento adaptativa, ofrecimos a los pacientes que abandonaron el tratamiento paralelo (n = 12) la posibilidad de entrar en el integrado. Once aceptaron, constituyendo un tercer grupo de comparación («paralelo a integrado»). El análisis de regresión logística multivariante mostró que la probabilidad de resultado global positivo aumentaba en los pacientes de los grupos integrado y «paralelo a integrado», con trastornos comórbidos internalizantes o mixtos, mayor edad y menores problemas legales. El tratamiento integrado mostró mejor adherencia y resultados globales que el paralelo en adolescentes con patología dual. Una mayor edad y menos problemas legales también se relacionaron con un resultado global positivo.

Palabras clave: trastornos por consumo de sustancias, adolescentes, trastornos duales, tratamiento integrado, programa ambulatorio, comorbilidad

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Clinical studies with adolescents have revealed that substance use disorders (SUD) frequently coexist with other psychiatric disorders, such as depression, attention deficit-hyperactivity disorder, oppositional defiant disorder, and conduct disorder. Comorbidity rates are inconsistent, ranging between 40% and 50% in community SUD cohorts, between 62% and 88% in SUD treatment cohorts, and between 50% and 90% in psychiatric cohorts (Hawkins, 2009; Hulvershorn et al., 2015; Köck et al., 2022; Norberg et al., 2012). Moreover, adolescents with SUD and comorbid disorders usually have an earlier onset of substance use, greater frequency of use, and more chronic use than those without psychiatric comorbidity. They also present poorer family relationships and more parental psychopathology, as well as more severe school, social and legal problems that complicate therapeutic interventions and contribute to negative treatment outcomes (Cornelius et al., 2017; Díaz et al., 2011; Morisano et al., 2014).

A dual diagnosis results in patients having complex treatment needs that are often difficult to address in traditional outpatient mental health centers or SUD departments. These patients usually need more intensive and costly interventions than people with a single disorder, and it is not always possible to avoid chronicity and the accompanying physical, psychological, and social deterioration (Drake et al., 2008; Erskine et al., 2015; Norberg et al., 2012). Considering the handicap and high socioeconomic and human cost of treating dual disorders once they become established, much more attention needs to be devoted to designing effective means to better treat adolescents at high risk of developing chronic dual disorders (Köck et al., 2022).

Historically, SUD and comorbid mental health disorders were treated independently in patients with dual diagnosis, often sequentially, trying to stop substance use before addressing comorbid mental health problems. More recently, experts and clinical practice guidelines recommended addressing SUD and comorbid psychiatric disorders simultaneously, adopting either a parallel or integrated approach. In parallel interventions, different clinical teams address SUD and the other psychiatric conditions separately, whereas in integrated interventions, the same team simultaneously addresses both the SUD and comorbid mental health disorder, making ongoing adjustments to both treatments and considering their interaction (Drake et al., 2008; Morisano et al., 2014; van Wamel et al., 2021).

Several authors have argued that integrated interventions are the most effective way to treat adolescents with dual disorders due to both the neurodevelopmental characteristics and the socio-cultural aspects of substance use during adolescence (Hawkins, 2009; Hogue et al., 2014, 2018; Hulvershorn et al., 2015; Kaminer et al., 2017, 2018; Silvers et al., 2019). Integrated interventions address both substance use and psychiatric symptoms combining psychotherapeutic, psychosocial, and psychopharmacological techniques in an individualized and flexible way (Drake et al., 2008). Psychotherapeutic approaches usually include motivational and cognitive behavioral elements (Hogue et al., 2018, 2020), contingency management, or home incentives (del Palacio-Gonzalez et al., 2022; Hesse et al., 2021), continuous care (Dahlberg et al., 2022; Stanojlović & Davidson, 2020) parental psychoeducation, and family intervention (Hogue et al., 2021). Moreover, it is even more necessary to incorporate different interventions in an integrated and flexible way during adolescence than in adults, including components such as crisis interventions and continuous care (Passetti et al., 2016), booster sessions, phone contacts or reminders of appointments (del Palacio-Gonzalez et al., 2022; Pedersen et al., 2021), and new technologies (Martínez-Miranda & Espinosa-Curiel, 2022). Additionally, coordination with educational and social services can increase adherence and produce better and more stable outcomes in reducing use and increasing functionality (van Wamel et al., 2021).

However, integrated programs are costly, both economically and organizationally, and are not accessible to all adolescent patients with dual diagnoses (Glowacki et al., 2022; Libby & Riggs, 2005; Sterling et al., 2010). Additionally, a few studies have reported that some patients with SUD achieve positive outcomes with simpler interventions, like the use of urinalysis to monitor abstinence (Schuler et al., 2014) or other cost-effective brief interventions (Dennis et al., 2004; Ramchand et al., 2011; Winters et al., 2023). It could be the case that some adolescent patients with dual diagnoses could achieve good outcomes without an integrated approach (Goti et al., 2009; Winters et al., 2023) and studying the patient characteristics that predict good treatment outcomes, regardless of the modality of treatment used, could therefore inform the most appropriate therapy. Some authors have suggested that patients who are more emotionally distressed, less involved in illegal activities, or more motivated to abstinence at baseline could have better outcomes than those with more externalized problems or who lack commitment to abstinence (Garner et al., 2008; Hersh et al., 2013; Kaminer et al., 2018; Mason et al., 2008; Winters et al., 2008).

In this study, the first aim was to compare the effectiveness of integrated and parallel intervention programs in a naturalistic clinical setting among adolescents with dual diagnoses referred to a specialist service for adolescent SUD. We hypothesized that patients receiving integrated treatment would evidence better adherence and more positive results in different relevant outcome measures relative to the parallel treatment. The second aim was to

investigate the patients baseline characteristics that might be associated with a global positive treatment response in either the integrated or the parallel treatment condition. We hypothesized that adolescents with dual diagnoses, who have more severe emotional symptoms and more motivation to change, would respond more positively to treatment, irrespective of the treatment condition.

Material and methods

Participants

Participants were recruited prospectively using a screening procedure applied to all adolescents referred to the outpatient program of the Addictive Behaviors Unit of the Child and Adolescent Psychiatry and Psychology Department of a public general hospital in an urban setting in Spain. Patients were included if they were 12 to 17 years old, and met the criteria for dual disorder; that is, a SUD diagnosis (with active substance use) plus at least one other axis I mental health disorder, according to DSM-IV-TR. Patients were excluded if they met the following criteria: ongoing non-stabilized/active psychotic symptoms or severe suicidal thoughts interfering with assessment or requiring hospitalization, need for residential treatment, severe cognitive impairment (estimated IQ < 70), or not living in the area served by our hospital and being unable to attend the program regularly (See flowchart in Figure 1).

Procedure

We invited adolescents who met the described eligibility criteria to take part in a two-group parallel randomized trial. After obtaining written parental consent and adolescent assent, adolescent patients and their parents were assessed comprehensively. Baseline assessment was conducted in two sessions by a trained master's degree psychologist, blinded to the treatment condition, who had expertise with all the instruments used in this trial. Patients underwent a complete follow-up assessment 1 year after treatment initiation. Intermediate measures at 3 and 6 months were incomplete because many patients were reluctant to repetitive assessments and therefore, complete 1-year assessment were prioritized and included in the final analysis. We aimed to obtain data in face-to-face interviews, but when this was not possible, we relied on telephone interviews and some mailed questionnaires. The study procedure has been carried out following the Declaration of Helsinki and was approved by our institutional ethics committee at the Hospital Clínic of Barcelona (R: 2007/3650).

Treatment groups

In both treatment groups, 15 to 18 therapeutical sessions of about 45 minutes were delivered over a year approximately.

Parallel treatment

In the parallel treatment group, patients received separate interventions for substance abuse (about 5–6 sessions over approximately 3–4 months) and for the comorbid disorder (about 10–12 sessions during a year), delivered by different therapists and without a centralized case management component to oversee and coordinate all elements of patient treatment. In this condition, a clinician specializing in the treatment of adolescent SUD provided treatment outside the context of a stage-wise client level of engagement paradigm. This treatment comprised the following components, delivered sequentially: feedback of substance use assessment, motivational enhancement, coping with craving, family interventions (i.e., contingency management, managing SUD in adolescents and communication skills), refusal skills and other cognitive behavioral techniques for the adolescent, and relapse prevention. Whenever possible, SUD therapist provided feedback about alcohol and/or tetrahydrocannabinol (THC) urine quantification to motivate the reduction or cessation of substance use. Materials were adapted ad hoc from Cannabis Youth Treatment-5/7 project (CYT) (Dennis et al., 2004; Sampl & Kadden, 2001). Treatment for comorbid symptoms was based in psychoeducation, cognitive-behavioral and pharmacological techniques according to the clinical guidelines and the clinical protocols of the Department.

Integrated treatment

The integrated treatment approach included the same specific substance use motivational and cognitive-behavioral components as the parallel treatment approach; however, they were tailored flexibly and individually to the patient's current stage of change and its clinical and psychosocial characteristics. Two mental health professionals (a psychiatrist and a psychologist) specializing in the treatment of dual disorders in adolescents delivered the interventions. One of these specialists acted as a case manager and coordinated all therapeutic and psychosocial interventions. Patients received SUD therapy jointly with mental health interventions for their comorbid conditions, according to the principles of the Drake Model (Drake et al., 2008) and key elements of effective adolescent substance use and dual disorders treatment (Brannigan et al., 2004; Hogue et al., 2020; Meisel et al., 2022). Therapeutic sessions specifically addressed the interaction between mental health symptoms and substance use (i.e., substance use as self-medication or how substance use trigger psychiatric symptoms and vice-versa).

The sessions in the integrated intervention were distributed 4 weekly, 8 biweekly, and 6 monthly sessions over a year approximately. Another important component of the integrated treatment was the construction of the

therapeutic alliance, to enhance the adherence to treatment. If patients and/or parents missed an appointment, the therapist phoned them to remind the next citation, to intervene in family crisis, to motivate them to continue treatment, or to accept harm reduction purposes from the patient (Winer et al., 2022).

Assessments and outcome measures

Psychopathology, sociodemographic and clinical data

To obtain substance use and other mental health diagnoses according to the DSM-IV-TR (APA, 2002), we evaluated adolescent psychopathology by administering the Kiddie-SADS (Kaufman et al., 1996) to parents and adolescents at baseline, consulting the clinical records of the hospital or reference therapist in doubtful cases. For several analyses, clinical diagnoses comorbid with SUD were grouped as externalizing (attention deficit-hyperactivity disorder, oppositional defiant disorder, and conduct disorder), internalizing (anxiety, depressive, obsessive disorders), and mixed (bipolar disorder, mixed behavioral and emotional disorders).

Semi-structured interviews from the Collaborative Studies on Genetics of Alcoholism (adapted to Spanish) were administered to parents and patients to obtain measures of sociodemographic variables (age, gender, and socioeconomic status [SES]). The utility of these interviews for clinical and research purposes are established (Díaz et al., 2008, 2011).

Substance use pattern and age at first use

Initial age and quantity/frequency measures of substance use were obtained at baseline by semi-structured interviews. The pattern of use of each substance (e.g., tobacco, alcohol, cannabis, and other drugs) was coded into five categories (Díaz et al., 2008, 2011): 1) non-use; 2) occasional use, defined as from time to time, usually at parties or celebrations; 3) regular use, defined as several times a week for tobacco, almost weekly for alcohol and cannabis, or almost monthly for stimulants or other drugs, with no evidence of substance use-related problems; 4) substance use problems, defined as a quantity-frequency and/or situational pattern of drug use with a high probability to generate health or psychosocial problems in a short o middle-term, but still sub-diagnostic; and 5) SUD, which meets the diagnostic criteria for substance abuse or dependence according to the DSM-IV-TR (APA, 2002). Self-report data about current drug use was corroborated whenever possible by urinalysis. A Spanish version of the Cannabis Problem Questionnaire-CPQ (Fernández-Artamendi et al., 2012) was administered at baseline to determine the extent of problems related specifically to cannabis use.

Severity of addiction

The Spanish version of the Teen-Addiction Severity Index (Teen-ASI) (Díaz et al., 2008) was administered at baseline and at 3, 6 and 12 months of follow-up to assess the severity of problems arising from substance use in six domains: drug use, school status, family function, peer-social relationships, legal status, and psychiatric status. The version used in this study included 142 items, with each domain scored using a five-point scale (0 = none, 1 = a little, 2 = medium, 3 = much, 4 = extreme).

Family environment

Parents completed the Spanish version of the Family Environment Scale (Moos & Moos, 1981) at baseline to assess the quality of family relationships. This has proven reliability and both content and construct validity (Moos, 1990). We analyzed only the cohesion and conflict scales to control for possible confounding variables in the multivariate analyses.

Emotional and behavioral symptoms

To obtain dimensional data on adolescent behavioral and emotional problems in the 6 months before both starting treatment and the 12-month follow-up, patients and their parents completed the Youth Self-Report (YSR) scale and the Child Behavior Checklist (CBCL) at baseline and 12 months, respectively. These tools have both shown adequate reliability and validity (Achenbach & Rescorla, 2001). Direct scores for internalizing (i.e., withdrawn, somatic complaints, and anxious/depressed subscales) and externalizing (i.e., delinquent and aggressive behavior subscales) scales were used in the analysis.

Psychosocial functioning

The Children's Global Assessment Scale (CGAS) (Shaffer et al., 1983) was used to assess the level of psychosocial adaptive behavior, both before the start of treatment and at 12 months.

Stage of change

Each patient's therapist determined the stage of change at baseline and 12 months by asking a series of questions according to the guidance of Krebs y cols. (Krebs et al., 2018). This resulted in ordinal categorization into five stages: 1) precontemplation (no intention to change); 2) contemplation (intention to change within the next 6 months); 3) preparation (plans to act with the next month); 4) action (significant modifications in behavior and way of life); and 5) maintenance (working to prevent relapse).

Global treatment outcome

To account for the interaction between different treatment outcomes, both in substance use and in other affected areas, we created a composite measure similar to those

used in other studies of SUD (Anton et al., 2006; Weiss et al., 2009). This involved evaluating the overall effects of treatment based on the measures obtained in different Teen-ASI scales: the 12-month global treatment outcome was coded as positive if there was a reduction of ≥1 point in the drug scale and ≥1 point in at least two of the other scales and was coded as negative for all other outcomes.

Statistical analysis

After performing a descriptive analysis, we examined the normality of the data using histograms and the Shapiro–Wilk test. To check for equivalence between the integrated and parallel treatment groups, we performed comparative analyses for age, gender, and other sociodemographic variables. We used Student t-tests for quantitative variables and Pearson chi-squared tests for categorical variables with normally distributed data, and we used non-parametric tests for ordinal variables or those not fulfilling normative conditions or homoscedasticity. Measures of treatment abandonment or non-compliance were used to compare attrition rates between the two groups.

We performed two different repeated-measures analysis of variance (ANOVA) for the post-treatment measures (Teen-ASI scales scores, CGAS total score, and the CBCL and YSR internalizing and externalizing scale scores), with time set as the intra-subject variable (baseline vs 12 months follow-up). In the first, we examined differences between the two treatment groups (integrated vs parallel), while in the second, we compared three treatment groups (integrated, parallel, and change from parallel to integrated). The effect size was reported as eta squared (η^2).

Finally, multivariate binary logistic regression was performed to verify the predictive value of the treatment group and other variables related to a positive global outcome, controlling for possible confounding variables (e.g., age, gender, SES, and comorbid diagnoses). The variables were entered in successive forward steps (the Wald method).

Data were analyzed using IBM SPSS version 25.0 for Windows and JASP version 14.1.

Results

Sample description

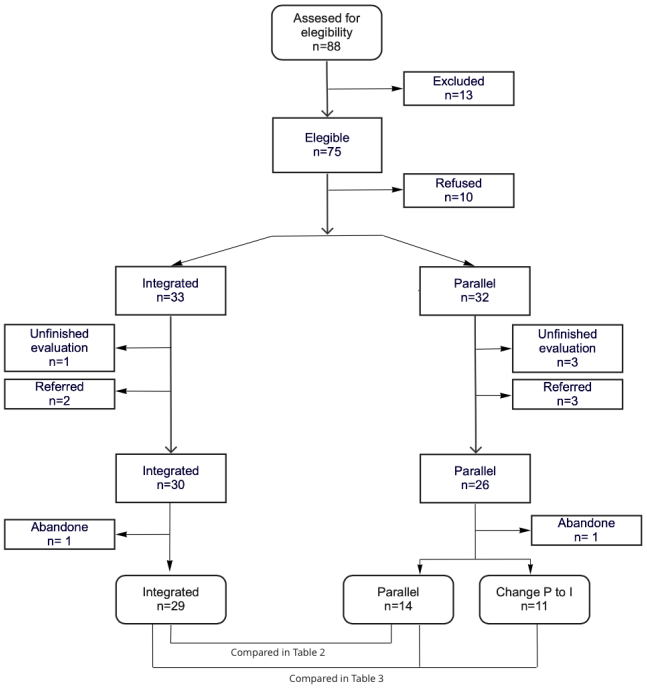
Over an initial 14-month period, we assessed 88 adolescents with dual disorders and identified 75 eligible participants; however, 10 refused, leaving a final sample of 65 patients. Of these, we randomly assigned 33 and 32, respectively, to the integrated and parallel outpatient treatment groups. Another 4 patients failed to complete the initial evaluation (integrated group = 1, parallel group = 3) and 5 needed referral for inpatient or residential treatment (integrated group = 2, parallel group = 3). The Flowchart in Figure 1 provides full details.

The age of participants ranged from 13 to 17 years (M = 16.29, SD = 1.24), with males accounting for 60.71% of the cohort. Almost half of the patients came from two-parent biological or foster families and had lived at home since the child's birth. Patients came predominantly from families of middle SES. All analyzed patients were regular users of cannabis, and many of them also used other substances at least occasionally (alcohol, 96.43%; tobacco, 94.64%; other drugs, 48.21%). All participants had a diagnosis of SUD and at least one other DSM-IV-TR disorder (see Table 1).

Comparison of baseline measures between the integrated and parallel treatment groups

Table 1 shows the comparative analysis of baseline measures between the groups initially randomized to the integrated (n = 30) and parallel (n = 26) treatment groups. Groups were not significantly different by gender, age, family cohesion or conflict, and CGAS score. Both groups mainly comprised externalizing and mixed clinical diagnoses and showed no significant differences in the percentages of each diagnostic category. The groups also did not differ by substance use variables, except for age at first use of "other drugs," which was slightly lower in the parallel group (p = .032).

Figure 1
Diagram of study enrollment flow



Attrition data

After treatment initiation, 12 patients in the parallel group and 1 patient in the integrated group dropped out due to non-compliance or complaints of worsening symptoms, with the attrition analysis showing significant differences between the groups ($\chi^2 = 14.328$; $p > .001$). Allowing for an adaptive treatment strategy (Santisteban et al., 2015), we offered these patients the opportunity to continue their treatment with the integrated methodology. Those who accepted the offer became the third treatment group of the study (parallel-to-integrated) and we used their baseline and follow-up data in a post-hoc comparative analysis with the parallel and integrated groups. After inclusion in the parallel-to-integrated group, patients received the same therapeutic procedures than the integrate group.

Comparative analyses between two treatment groups: integrated and parallel

Repeated-measures ANOVA and chi-square tests comparing patients who remained in the initial treatment groups revealed that both treatment modalities (integrated and parallel) were associated with positive pre-post changes in the Teen-ASI school, family, and psychiatric scores, CGAS, and stage of change. No statistically significant

Table 1
Baseline sociodemographic characteristics, psychiatric diagnoses, and substance use by treatment group

	Integrated treatment n = 30	Parallel treatment n = 26	Statistic test $t/U/\chi^2$	*p* value
Age (years)	16.40 (1.163)	16.12 (1.177)	$t = 0.908$	0.368
Gender (% male)	20 (66.7%)	14 (56.3%)	$\chi^2 = 0.960$	0.327
Socioeconomic status				
Low	7 (23.3%)	11 (47.8%)		
Middle	17 (56. 7%)	9 (30.4%)	$\chi^2 = 3.012$	0.222
High	6 (20%)	5 (21.7%)		
Main comorbid DSM-IV-TR diagnosis:				
Attention deficit-hyperactivity disorder	7 (23.3%)	6 (23.1%)		
Oppositional defiant disorder	3 (10%)	3 (11.5%)		
Conduct disorder	2 (6.7%)	3 (11.5%)	$\chi^2 = 6.501$	0.483
Affective disorder (mood/anxiety)	3 (10%)	4 (15.4%)		
Behavior/emotion mixed disorder[#]	8 (26.7%)	8 (30.8%)		
Eating disorder	1 (3.3%)	2 (7.7%)		
Psychotic disorder	3 (10%)	-		
Other disorders[£]	3 (10%)	-		
Comorbid diagnosis (added to SUD):				
Externalizing	14 (46.7%)	12 (46.1%)	$\chi^2 = 0.050$	0.975
Internalizing	4 (13.3%)	4 (15.4%)		
Mixed	12 (40%)	10 (38.5%)		
CGAS	49.23 (13.554)	48.42 (11.583)	$t = 0.238$	0.812
Pattern of use				
Alcohol (at least regular use)	22 (73.3%)	23 (88.5%)	$\chi^2 = 5.032$	0.284
Tobacco (at least regular use)	24 (80%)	26 (100%)	$\chi^2 = 6.407$	0.171
Cannabis (at least regular use)	30 (100%)	25 (96.1%)	$\chi^2 = 2.145$	0.543
Other drugs (at least occasional use)	10 (30.40%)	13 (40.7%)	$\chi^2 = 3.327$	0.505
Age at first use:				
Alcohol	13.70 (1.137) (n = 27)	13.62 (1.203) (n = 26)	$t = 0.275$	0.785
Tobacco	13.17 (1.704) (n = 30)	12.88 (1.366) (n = 26)	$t = 0.676$	0.502
Cannabis	13.67 (1.539) (n = 30)	13.62 (1.472) (n = 26)	$t = 0.127$	0.899
Other drugs[1]	16.20 (0.919) (n = 10)	15.08 (1.320) (n = 13)	$t = 2.291$	0.032
CPQ[2]	7.960 (4.668)	8.250 (5.024)	$t = -0.123$	0.903
Teen-ASI Drugs (continuous measures)	3.10 (0.803)	2.96 (1.038)	$t = 0.562$	0.576
School	2.90 (0.845)	3.00 (1.020)	$t = -0.401$	0.690
Family	3.00 (1.017)	3.00 (0.849)	$t = 0.000$	1.000
Social	1.97 (1.129)	2.19 (0.939)	$t = -0.806$	0.424
Legal	1.00 (1.390)	1.08 (1.440)	$t = -0.203$	0.840
Psychiatric	2.73 (1.143)	2.92 (0.891)	$t = -0.685$	0.496
Stage of change (continuous)	1.93 (0.753) (n = 30)	2.08 (0.935) (n = 26)	$t = -0.641$	0.524
Pre-contemplative	9 (30.00%)	8 (28%)	$\chi^2 = 2.530$	0.470
Contemplative	14 (46.66%)	10 (40%)		
Preparation	7 (23.33%)	6 (24%)		
Action	-	2 (8%)		

[1] Age at first use: Other drugs, n = 23 (integrated: 10; parallel: 13).
[2] CPQ, n = 47 (integrated: 25; parallel: 22).
[#] Behavior/emotion mixed disorder, including disruptive behavior due to impulsivity/emotionality and Cluster B personality traits.
[£] Other disorders, including adaptive disorders, learning disorders, and autism spectrum characteristics, with clinically relevant consequences in personal, family, social, or academic dimensions.
* $p \leq 0.05$, ** $p \leq 0.01$.

differences existed between treatment groups, except for the global outcome measure based on Teen-ASI scores. Group by time interactions were also non-significant (Table 2).

Comparative analyses among the integrated, parallel, and parallel-to-integrated groups

Repeated-measures ANOVA and chi-square tests showed associations for the three treatment modalities (integrated, parallel and change parallel-to-integrated) with positive pre-post changes (time effects: baseline - 12 months follow-up) in several individual outcome variables (Teen-ASI drugs, school, family, social and psychiatric scores, CGAS, YSR internalizing and externalizing score, and stage of change). However, no statistical differences existed among treatment groups, except for the global treatment outcome measure. At 12 months, 75.9% (22/29) patients in the integrated group and 63.6% (7/11) in the parallel-to-integrated group attained a positive global outcome, compared to only 28.6% (4/14) of those receiving a parallel treatment (χ^2=8.922; p = .012). Group by time interactions were also non-significant (Table 3).

Post-hoc Tukey analyses showed that significant pre-post differences in specific outcome measures corresponded with either the integrated group (Teen-ASI school, family, and psychiatric scores, CGAS, stage of change) or the parallel-to-integrated group (Teen-ASI drugs, family, and social scores, and CGAS), but never with the parallel group. Group by time interactions were also non-significant. The supplementary material provides more detail.

Variables associated to a positive outcome.

Analyzing the baseline characteristics that could predict a positive outcome 1 year after starting treatment, we identified significant effects for comorbid diagnoses and some Teen-ASI scales, as detailed in Table 4. The analysis showed that externalizing disorders were more common in the negative global outcome group and that internalizing and mixed disorders were more common in the positive global outcome group (χ^2 = 6.885, p = .032). Regarding the

Table 2

Treatment outcomes from baseline to 12 months follow-up in the integrated and parallel treatment groups

	Treatment programs				Time		Groups		Time * Group	
	Integrated		Parallel							
Indicator	Baseline (n = 29)	Follow-up (n = 29)	Baseline (n = 14)	Follow-up (n = 14)	F *(1, 41)*	η²	F *(1, 41)*	η²	F *(1, 41)*	η²
Teen-ASI (0–4 cont)										
Drugs	3.07 (0.80)	2.38 (1.40)	2.64 (1.15)	2.00 (1.47)	8.240	0.065	1.648	0.024	0.010	0.000
School	2.86 (0.85)	1.89 (1.26)	2.75 (1.06)	2.42 (1.38)	8.721*	0.068	0.430	0.007	2.062	0.016
Family	2.97 (1.02)	1.93 (1.31)	3.00 (0.78)	2.57 (1.51)	12.868***	0.079	1.074	0.017	2.207	0.014
Social	1.97 (1.15)	1.52 (1.12)	2.21 (0.80)	1.79 (1.31)	8.132	0.034	0.612	0.012	0.004	0.000
Legal	0.90 (1.29)	0.66 (1.23)	0.93 (1.27)	0.86 (1.23)	0.674	0.004	0.104	0.002	0.199	0.001
Psychiatric	2.72 (1.16)	2.00 (1.36)	2.79 (0.98)	2.43 (1.09)	8.873*	0.044	0.505	0.009	1.022	0.005
CGAS (1–100)	48.86 (13.64)	61.38 (18.94)	48.07 (10.48)	54.50 (14.33)	13.268***	0.079	0.807	0.013	1.370	0.008
CBCL										
Internalizing	15.62 (8.18)	16.33 (10.95)	16.11 (9.29)	13.00 (5.75)	0.526	0.004	0.191	0.005	1.339	0.010
Externalizing	22.52 (7.87)	21.86 (10.12)	24.78 (7.86)	24.33 (11.75)	0.095	7.790e-4	0.523	0.014	0.009	0.000
YSR										
Internalizing	14.58 (9.52)	12.33 (9.84)	16.89 (9.01)	15.00 (11.28)	2.814	0.009	0.468	0.013	0.021	0.000
Externalizing	21.37 (7.77)	18.25 (9.65)	26.67 (7.26)	24.56 (9.34)	2.699	0.017	3.772	0.085	0.101	0.000
Stage of change (1-5)	1.93 (0.75)	3.17 (1.31)	1.86 (0.86)	2.57 (1.45)	18.941***	0.147	1.421	0.018	1.376	0.011
Pre-contemplative	9 (31.0%)	2 (6.9%)	6 (42.9%)	5 (35.7%)			χ^2 = 7.335			
Contemplative	13 (44.8%)	10 (34.5%)	4 (28.6%)	2 (14.3%)						
Preparation	7 (24.1%)	4 (13.8%)	4 (28.6%)	2 (14.3%)						
Action	-	7 (24.1%)	-	4 (28.6%)						
Maintenance	-	6 (20.7%)	-	1 (7.1%)						
Global outcome (positive)	-	22 (75.9%)	-	4 (28.6%)			χ^2 = 8.833**			

Note. * p < .05, ** p < .01, *** p < .001.

Table 3
Treatment outcomes from baseline to 12 months in the integrated, parallel, and parallel-to-integrated groups

	Treatment group						Time		Groups		Time*Group	
	Integrated		Parallel		Parallel-to-integrated							
Indicator	Baseline (n = 29)	Follow-up (n = 29)	Baseline (n = 14)	Follow-up (n = 14)	Baseline (n = 11)	Follow-up (n = 11)	F *(1, 51)*	η²	F *(2, 51)*	η²	F *(2, 51)*	η²
Teen-ASI (0–4 cont.)												
Drugs	3.07 (0.80)	2.38 (1.40)	2.64 (1.15)	2.00 (1.47)	3.27 (0.78)	2.00 (1.48)	18.789***	0.103	0.795	0.018	0.860	0.009
School	2.86 (0.85)	1.89 (1.26)	2.75 (1.06)	2.42 (1.38)	3.10 (1.10)	1.90 (1.20)	17.331***	0.104	0.231	0.006	1.457	0.018
Family	2.97 (1.02)	1.93 (1.31)	3.00 (0.78)	2.57 (1.51)	3.00 (1.00)	1.82 (1.17)	23.841***	0.111	0.648	0.016	1.511	0.014
Social	1.97 (1.15)	1.52 (1.12)	2.21 (0.80)	1.79 (1.31)	2.27 (1.104)	1.36 (0.92)	17.396***	0.060	0.323	0.009	1.028	0.007
Legal	0.90 (1.29)	0.66 (1.23)	0.93 (1.27)	0.86 (1.23)	1.09 (1.64)	0.91 (1.30)	1.025	0.004	0.154	0.005	0.112	0.001
Psychiatric	2.72 (1.16)	2.00 (1.36)	2.79 (0.98)	2.43 (1.09)	3.18 (0.75)	2.27 (0.91)	16.060***	0.069	0.657	0.018	0.831	0.007
CGAS (1–100)	48.86 (13.64)	61.38 (18.94)	48.07 (10.48)	54.50 (14.33)	47.36 (12.80)	61.73 (12.35)	26.210***	0.109	0.428	0.011	1.112	0.009
CBCL												
Internalizing	15.62 (8.18)	16.33 (10.95)	16.11 (9.29)	13.00 (5.75)	17.88 (10.59)	18.38 (8.73)	0.173	0.001	0.404	0.018	0.668	0.008
Externalizing	22.52 (7.87)	21.86 (10.20)	24.78 (7.86)	24.33 (11.75)	22.25 (6.63)	20.50 (8.98)	0.410	0.002	0.383	0.017	0.062	0.001
YSR												
Internalizing	14.58 (9.52)	12.33 (9.84)	16.89 (9.01)	15.00 (11.28)	13.25 (4.17)	9.88 (3.68)	5.776*	0.016	0.572	0.026	0.149	0.001
Externalizing	21.37 (7.77)	18.25 (9.65)	26.67 (7.26)	24.56 (9.34)	20.00 (8.44)	16.13 (5.28)	5.194*	0.025	2.608	0.096	0.117	0.001
Stage of change (1–5)	1.93 (0.75)	3.17 (1.31)	1.86 (0.86)	2.57 (1.45)	2.45 (0.93)	3.36 (1.33)	22.769***	0.135	1.413	0.039	0.781	0.009
Pre-contemplative	9 (31.04%)	2 (6.90%)	6 (42.86%)	5 (35.71%)	1 (9.09%)	-						
Contemplative	13 (44.82%)	10 (34.48%)	4 (28.57%)	2 (14.29%)	6 (54.55%)	4 (36.36%)	χ^2 = 11.556		χ^2 = 11.242			
Preparation	7 (24.14%)	4 (13.79%)	4 (28.57%)	2 (14.29%)	2 (18.18%)	2 (18.18%)						
Action	-	7 (24.14%)	-	4 (28.57%)	2 (18.18%)	2 (18.18%)						
Maintenance	-	6 (20.69%)	-	1 (7.14%)	-	3 (27.27%)						
Global outcome (positive)	-	22 (75.9%)	-	4 (28.6%)	-	7 (63.6%)			χ^2 = 8.922**			

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Teen-ASI scores, there was a better baseline functioning on the social ($p = .015$) and legal ($p = .010$) scales in the positive global outcome group. Finally, SES almost reached significance (tendency) for predicting the global outcome ($\chi^2 = 5.612$, $p = .060$), potentially indicating that low SES is slightly more represented in the negative outcome group and that high and middle SES are slightly more represented in the positive outcome group.

Multivariate analysis

We performed a binary logistic regression analysis to verify the predictive value of the treatment group, jointly considering other variables associated with a positive global outcome, using two different models. For model one, we selected the treatment groups and sociodemographic variables usually related to treatment outcome (i.e., age, gender, SES, and comorbid diagnoses) to control their possible effect over global outcome. For model two, we selected the treatment groups and those variables previously correlated with global outcome in our study (comorbid diagnostics, Rho = 0.340*; Teen-ASI social, Rho = -0.322*; and Teen-ASI legal, Rho = -0.290*).

Model one

In model one, the third step of the analysis obtained the best fit and significantly predicted global outcome ($\chi^2 = 25.1511$; $df = 5$, $p < .000$, Nagelkerke $R^2 = 0.50$). It correctly classified 79.6% of cases with a sensitivity of 84.4%. The Hosmer and Lemeshow test returned a non-significant result ($p = .720$), implying adequate model fit. The coefficients revealed that patients who received the integrated treatment (OR = 26.811; $p = .002$; 95% CI = 3.329 – 215.944) or the parallel-to-integrated treatment (OR = 26.361; $p = .011$; 95% CI = 2.14 – 324.635) had a higher likelihood of achieving a positive global treatment outcome. Additionally, age increased the probability of achieving a positive global treatment outcome (OR = 2.584; $p = .022$; 95% CI = 1.148 – 5.818), whereas externalizing comorbid diagnoses reduced the probability (OR = 0.054; $p = .006$; 95% CI = 0.007 – 0.425). Gender and SES were not significant.

Table 4
Possible predictive variables of treatment outcome (positive vs. negative)

	Global outcome		Statistic test t/U/χ^2	*p* value
	Positive n = 33	**Negative n = 21**		
Group of treatment				
Integrated	22 (66.7%)	7 (33.3%)		
Parallel	4 (12.1%)	10 (47.7%)	χ^2 = 8.922	0.012
Change parallel to integrate	7 (21.2%)	4 (19.0%)		
Age (years)	16.45 (1.148)	15.95 (1.203)	t = -1.538	0.130
Gender (% male)	18 (54.5%)	14 (66.7%)	χ^2 = 0.781	0.377
Socioeconomic status				
Low	7 (21.3%)	11 (52.4%)		
Middle	18 (54.5%)	7 (33.3%)	χ^2 = 5.612	0.060
High	8 (24.2%)	3 (14.3%)		
Family Environment Scale:	(n = 24)	(n = 13)		
Cohesion	37.08 (14.969)	38.92 (18.136)	t = 0.331	0.742
Conflict	53.33 (15.895)	57.92 (16.235)	t = 0.832	0.411
Main comorbid DSM-IV-TR diagnosis:				
Attention deficit-hyperactivity disorder	7 (21.2%)	4 (21.7%)		
Oppositional defiant disorder	2 (6.1%)	4 (17.4%)		
Conduct disorder	-	5 (21.7%)		
Affective disorder (mood/anxiety)	5 (15.1%)	2 (8.7%)	χ^2 = 13.434	0.062
Behavior/emotion mixed disorder	12 (36.4%)	4 (17.4%)		
Eating disorder	2 (6.1%)	1 (4.3%)		
Psychotic disorder	2 (6.1%)	1 (8.7%)		
Other disorders[£]	3 (9.1%)	-		
Comorbid diagnosis (added to SUD):				
Externalizing	10 (30.3%)	14 (66.7%)		
Internalizing	6 (18.2%)	2 (9.5%)	χ^2 = 6.885	0.032
Mixed	17 (51.5%)	5 (23.8%)		
CGAS	49.91 (13.749) (n = 33)	45.90 (10.094) (n = 21)	t = -1.150	0.255
CBCL	(n = 33)	(n = 18)		
Internalizing	16.70 (8.673)	16.72 (9.963)	t = 0.009	0.993
Externalizing	23.39 (8.728)	25.39 (8.965)	t = 0.773	0.443
YSR	(n = 32)	(n = 20)		
Internalizing	16.25 (9.109)	14.65 (7.110)	t = -0.668	0.507
Externalizing	21.53 (8.478)	25.65 (7.686)	t = 1.765	0.084
Teen-ASI (continuous)	(n = 33)	(n = 21)		
Drugs	3.03 (0.770)	2.95 (1.117)	t = -0.304	0.763
Family	2.82 (1.044)	3.24 (0.700)	t = 1.622	0.111
School	2.91 (0.914)	2.95 (0.973)	t = 0.165	0.869
Social	1.82 (1.131)	2.52 (0.750)	t = 2.524	0.015
Legal	0.58 (0.969)	1.52 (1.632)	t = 2.683	0.010
Psychiatric	2.85 (1.121)	2.81 (0.928)	t = -0.133	0.895
Stage of change (continuous)	2.12 (0.857) (n = 33)	1.86 (0.793) (n = 21)	t = -1.136	0.261
Pre-contemplative	8 (24.24%)	8 (34.78%)		
Contemplative	15 (45.45%)	8 (39.13%)	χ^2 = 2.268	0.519
Prep. Action	8 (24.24%)	5 (26.08%)		
Action	2 (6.06%)	-		

[£] Other disorders, including adaptive disorders, learning disorders, and autism spectrum characteristics, with clinically relevant consequences in personal, family, social, or academic dimensions.
*Significant p ≤ 0.05.
**Significant p ≤ 0.01.

Model two

In model two, the second step obtained the best fit, significantly predicting global outcome (χ^2 = 20.723; *df* =3, $p < .000$, Nagelkerke R2 = 0.45) and correctly classifying 80.4% of cases with a sensitivity of 81.3%. The Hosmer and Lemeshow test returned a non-significant result ($p = .681$), implying adequate model fit. Patients who received the integrated treatment (OR = 26.811; $p = .002$; 95% CI = 3.329 – 215.944) or the parallel-to-integrated treatment (OR = 26.361; $p = .011$; 95% CI = 2.141 – 324.635) had a higher likelihood of achieving a positive global treatment outcome. A lower Teen-ASI legal score (OR = 0.426; $p = .002$; 95% CI = 0.250 – 0.727) also increased the probability of achieving a positive global treatment outcome. The variables Teen-ASI social and comorbid diagnostics were excluded from the model.

Discussion

Concerning our first hypothesis, adolescents with dual disorders referred to a specialist addiction unit in a mental health center seem to benefit significantly more from an integrated than from a parallel treatment approach. Only two outcome measures—treatment adherence and the global outcome measure (accounting for improvements in drug use, family, school, social, legal, psychiatric according to Teen-ASI scores)—showed significant differences. The favorable treatment outcomes of patients reassigned from the parallel intervention to the integrated intervention during the study (parallel-to-integrated group) provided additional confirmation of the superiority of the integrated approach.

The univariable comparative analyses support the results of other studies favoring integrated interventions in adolescents with dual disorders (Esposito-Smythers et al., 2011; Hides et al., 2010; Latimer et al., 2003). Nevertheless, other authors have obtained mixed or confounding results when comparing parallel and integrated approaches (Adams et al., 2016; Rohde et al., 2014), possibly due to methodological differences in sample composition or outcome measures. For example, some studies have selected only patients with depression as a comorbid disorder with SUD (Hides et al., 2010), while other studies have considered substance use abstinence as the main outcome measure. However, it is well known that adolescents with dual diagnoses have difficulty achieving total abstinence, with risk reduction objectives acceptable early in their treatment (Kaminer et al., 2018). Another reason for the discordance between studies may be that adolescents with dual disorders constitute a very heterogeneous group with unstable post-treatment evolution (Santisteban et al., 2015).

Concerning the second hypothesis about predictors of treatment outcome, considering the whole sample in the univariate comparative analysis and independently of the treatment group, different variables showed predictive ability. First, comorbid internalizing and mixed disorders were significantly associated with positive outcomes, whereas externalizing disorders predicted a negative global outcome. These results partially agree with some studies (Hersh et al., 2013; Mason et al., 2008) regarding internalizing disorders, and certainly agree with other studies (Tamm et al., 2013; Winters et al., 2008) for externalizing disorders. Following Santisteban et al. (2015), the interpretation of these results could be related to the theory that patients with internalizing disorders have more insight than those with externalizing disorders about their problems, and they are more motivated to resolve them. Additionally, self-perception of emotional distress associated to internalizing symptoms could act as motivator to enhance the willingness to change. A third possible explanation is that people with emotional suffering could develop better therapeutic alliance, an important factor to treatment adherence and success in psychotherapy (Santisteban et al., 2015).

Other possible explanation for the association of internalizing (and mixed) symptoms with positive results in both treatments (parallel and integrate) is that our treatments include family interventions (favoring communication and mutual understanding), and there is evidence that family-based treatment may be particularly useful for adolescents suffering emotional distress (i.e., depression, bipolar, borderline disorders) because they are more open to receive help from therapists and their family (Silvers et al., 2019; Wang et al., 2016). These results point to the need to screen SUD patients for internalizing and externalizing symptoms using short screening instruments, as proposed by Hesse et al. (2023), to identify those adolescents at high risk for dropout or negative treatment outcomes. Those patients with externalizing or disruptive disorders could need a modification of the components of the treatment (i.e., more parental psychoeducation to understand externalizing problems and their management, ethical thinking, anger management, empathy, or social skills training).

The Teen-ASI social and legal scores also showed some predictive value for the overall treatment outcome (positive results in adolescents with fewer social and legal problems). These findings partially align with those of other authors who found more legal problems in those achieving a negative outcome (Grella et al., 2001; Tamm et al., 2013). It is also important to note the quasi-significant effect for SES, in line with results obtained in other studies (Hersh et al., 2013), reflecting the advantages of a high SES for some patients, likely due to the greater opportunities to receive additional educational and therapeutic support.

Lastly, and contrary to our expectations, the stage of change did not predict a positive outcome 12 months after starting treatment. Several factors may have contributed to the discrepancy between our results and prior research documenting that patients who are more committed to abstinence have better treatment outcomes (Kaminer et al., 2018). First, in adolescents, contingencies and parental directions could help bring them to a period of abstinence, even if they lack the intrinsic motivation for change. Second, the stage of change and outcomes regarding substance use and related problems in adolescents often fluctuate, reflecting an underlying instability (Dahlberg et al., 2022). Third, we may have used an inappropriate method to measure or analyze this variable; for instance, not assessing commitment to abstinence, but rather their willingness to reduce or control use.

Clinical implications

The study results support the need to make integrated programs available for at least some adolescent patients with complex/severe dual disorders or those at high risk

(i.e., externalizing disorders, patients with difficulties engaging in treatment), consistent with the conclusions of several authors (Garner et al., 2008; Kaminer et al., 2017; Libby & Riggs, 2005; Wolff et al., 2020). For patients with lower risk (i.e., internalizing disorders, collaborative families, older adolescents or committed to abstinence), it may be appropriate to treat SUD and comorbid mental health conditions in parallel. Indeed, four patients in our study obtained a positive global outcome with a parallel treatment approach, although the small sample prevented statistical analysis of possible associated characteristics. Additionally, we found significant pre-post changes in several specific outcome measures among the 14 subjects treated in the parallel condition.

An adaptive strategy may be the most appropriate way to implement integrated and/or parallel treatments for adolescents with dual disorders, flexibly adapting interventions to the specific characteristics, needs, and changing situations of patients during treatment (Black & Chung, 2014; Grant et al., 2017; Kaminer et al., 2017; Kavanagh & Connolly, 2009; Marchand et al., 2019; Waldron & Turner, 2008). Mental health centers could adopt this strategy for adolescents by employing gradual or stepped programs (Kavanagh & Connolly, 2009), patient-treatment matching (Cornelius et al., 2017; Edalati & Conrod, 2019; Goti et al., 2009; Magallón-Neri et al., 2012), or modular treatments. This could pave the way to using a transdiagnostic approaches (Kim & Hodgins, 2018).

Limitations and strengths

The study results should be interpreted with caution due to several limitations. For example, the small sample size may have reduced the power needed to obtain significant results, the lack of a non-intervention control group (i.e., a waiting list) was not ideal, and the cohort studied prevents generalization to patients with dual diagnoses in inpatient or residential settings or who are affected by significant psychotic symptoms or cognitive deficits. Despite these limitations, the study has two main strengths. First, it has a high external validity in reflecting the difficulties of applied research in clinical practice in a naturalistic way, while simultaneously trying to maintain scientific rigor using an "as treated analysis" in a randomized design. Second, by offering the integrated treatment to poor responders in the parallel treatment group, we could test the adaptive treatment methodology proposed by other authors (Kaminer et al., 2017; Morisano et al., 2014; Santisteban et al., 2015).

Implications for future research

Firstly, this study could help with future analyses of the key research features for the treatment of adolescents with dual diagnoses. For example, we confirmed the usefulness of treatment adherence and a specific global outcome measure for identifying positive treatment outcomes. The ability to retain adolescents in treatment is key to treatment success in a group that is traditionally challenging to engage. Therapists must be highly accessible, make the time to call patients ("gentle chase"), coordinate with other professionals, and give extra attention to the family. These aspects are more strongly adhered to in integrated treatments, as is the case in our practice. Secondly, this study also has potential value in capturing pre-post treatment differences as a global outcome measure that considers improvements in different domains of adolescent life (e.g., our use of the Teen-ASI scales). Adolescents with SUD often have different treatment goals and outcomes compared to adults, experiencing less certainty about the need for absolute abstinence, and preferring reduced use instead. They also show frequent fluctuations along treatment in substance use, psychiatric symptoms, school performance or social adaptation. Lastly, although a more in-depth analysis of treatment outcome predictors is necessary, our findings on the effect of comorbid disorders, age, and social relationships could also inform the designs of not only screening and assessment instruments aiming to improve patient allocation to the most appropriate level of treatment but also more effective adaptive treatment strategies.

Conclusions

Adolescent patients with dual disorders gained benefit from both the parallel and the integrated treatment programs. However, they gained the greatest benefit from the integrated approach, which led to better adherence and a positive global treatment outcome. Features associated with the positive treatment outcome, independent of the treatment modality, included the presence of an internalizing comorbid disorder, older age, and having few legal problems.

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Conflict of interests

The authors report no conflict of interest.

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