

ORIGINAL ARTICLE

## Assessing Covariates of Drug Use Trajectories Among Adolescents Admitted to a Drug Addiction Center: Mental Health Problems, Therapeutic Alliance, and Treatment Persistence

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This study aimed to assess covariates of drug use trajectories among 102 adolescents admitted to a drug user treatment program between November 2005 and November 2006 in Québec, Canada. The influences of mental health, therapeutic alliance, and treatment persistence were examined. The Addiction Severity Index was used to measure drug use severity and mental health problems; the California Psychotherapy Alliance Scales was used for therapeutic alliance. Latent growth curve analysis showed associations between (1) mental health and initial drug use severity; (2) therapeutic alliance and initial drug use severity; and (3) number of post-treatment sessions attended and drug use severity over time.

**Keywords** adolescence, addiction, treatment, mental health, therapeutic alliance, drug use trajectories

### INTRODUCTION

In Québec, Canada, 5.9% of high school students show signs of at-risk psychotropic drug use, whereas 6.0% ex-

hibit problematic use requiring specialized intervention (Cazale, Fournier, & Dubé, 2009). In the United States, according to the National Survey on Drug Use and Health (NSDUH), 9% of adolescents exhibit problematic drug use that is serious enough to lead to a diagnosis of substance abuse (Burrow-Sanchez, 2006). Adolescents struggling with addictive behavior are a group of special concern. The precocity of problems related to substance use increases the probability of enduring addiction problems in adulthood (Flanzer, 2005). Addiction is also particularly worrisome when it begins during adolescence, a pivotal period in a person's neurobiological and social development (Patton & Viner, 2007). Indeed, adolescent substance misuse is associated with important deleterious effects on mental and physical health (Brook, Finch, Whiteman, & Brook, 2002; Brook, Saar, Zhang, & Brook, 2009; Degenhardt, Hall, & Lynskey, 2003) and social adjustment (Brook, Stimmel, Zang, & Brook, 2008; Ferguson & Horwood, 1997).

Although it has been established that entering drug addiction treatment<sup>1</sup> is more effective than the lack of any treatment (Hser et al., 2001), exact explanations of

<sup>1</sup>Treatment can be usefully defined as a unique, planned, goal directed, temporally structured, multidimensional change process, which may be phase structured, of necessary quality, appropriateness, and conditions (endogenous and exogenous), implemented under conditions of uncertainty, which is *bounded* (culture, place, time, etc.), which can be (un)successful (partially and/or totally), as well as being associated with iatrogenic harm and can be categorized into professional-based, tradition-based, mutual-help based (AA, NA, etc.) and self-help ("natural recovery") models.

Whether or not a treatment technique is indicated or contraindicated, and its selection underpinnings (theory-based, empirically-based, "principle of faith-based, tradition-based, budget-based, etc.) continues to be a generic and key treatment issue. In the West, with the relatively new ideology of "harm reduction" and the even newer quality of life (QOL) and "wellness" treatment-driven models, there are now new sets of goals in addition to those derived from/associated with the older tradition of abstinence-driven models. Conflict-resolution models may stimulate an additional option for intervention. Treatment is implemented in a range of environments; ambulatory as well as within institutions which can also include controlled environments such as jails, prisons, and military camps. Treatment includes a spectrum of clinician-caregiver-patient relationships representing various forms of decision-making traditions/models: (1) the hierarchical model in which the clinician-treatment agent makes the decision(s) and the recipient is compliant and relatively passive, (2) shared decision making, which facilitates the collaboration between clinician and client(s)/patient(s) in which both are active, and (3) the "informed model" in which the patient makes the decision(s). Within this planned change process, relatively recently in various parts of the world, active substance users who are not in "treatment," as well as those users who are in treatment, have become social change agents, active advocates, and peer health counselors. . . which represent just a sampling of their new labels. There are no unique models or techniques used with substance users—of whatever types and heterogeneities—which are not also used with nonsubstance users. Editor's note.

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therapeutic changes remains unclear (Waldron & Turner, 2008; Winters, Botzet, & Fahnhorst, 2011). Based on results from their meta-analysis of treatment effectiveness for adolescent substance abuse,<sup>2</sup> Waldron and Turner (2008) conclude that several treatment approaches were equally effective, while documenting that the effects varied greatly among the youths. To support person-centered approaches to treatment, Waldron and Turner (2008) highlight the importance of better understanding of how the relationship between a young person and the professional working with him or her influences recovery. Similarly, in their critical review, Winters and colleagues (2011) note the fact that nonspecific factors related to treatment approach—such as psychiatric comorbidity or aftercare—influence adolescents' recovery. However, a critical examination of the literature confirms, again according to Winters and colleagues (2011), that despite some promising results, key variables that help understand adolescents' recovery require further study.

So far, studies have focused mostly on adult populations (Dennis et al., 2002; McLellan & Meyers, 2004). Outcomes of studies of adults cannot be systematically applied to adolescents because of the unique developmental period, which youth are going through (Bender, Springer, & Kim, 2006). Due to the limited number of studies on this topic, it is difficult to draw conclusions regarding factors that enhance recovery among adolescents in treatment for substance abuse, and even more so for those who have mental health issues (Pagey, Deering, & Sellman, 2010).

Among drug using adults, therapeutic alliance established at the beginning of treatment is predictive of improvements early on in the process, although results are less consistent over time (Meier, Barrowclough, & Donmall, 2005). Therapeutic alliance usually refers to an active and purposeful collaboration between therapist and patient (Cournoyer, Brochu, Landry, & Bergeron, 2007). Because research examining alliance in adolescent populations is a new area of investigation (Waldron & Turner, 2008), only a few studies have focused on therapeutic alliance in substance abusing adolescents undergoing treatment (Hogue, Dauber, Stambaugh, Cecero, & Liddle, 2006). Therefore, it is difficult to draw conclusions regarding the effects of the therapeutic alliance on a youth's recovery, especially since results differ from one study to the next. Indeed, some studies have shown links between quality of alliance and persistence in treatment (Robbins et al., 2006) and reduced substance use at three and six months postintake (Auerbach, May, Stevens, & Kiesler, 2008; Shelef, Diamond, Diamond, & Liddle, 2005; Shirk, Karver, & Brown, 2011; Tetzlaff et al., 2005). However, other studies have found no link between adolescent perception of alliance and post-treatment substance use (Hogue et al., 2006; Marcus, Kashy, Wintersteen, & Diamond, 2011). In a meta-analysis, Shirk and colleagues (2011) maintain that the effects of therapeutic alliance on recovery appear to be more moderate in therapies

for problematic drug use than in therapies for mental health problems, and that these effects are smaller for adolescents than preadolescents. These differences could explain result inconsistency from study to study. These findings confirm the importance of not applying the results obtained from adult studies to adolescent populations.

Specific individual or personal characteristics, such as concomitant mental health problems, can also influence therapeutic outcomes (Asay & Lambert, 1999; Bender et al., 2006; Health Canada, 2001; Pagey et al., 2010). Following recommendations outlined in "best practices" guides, mental health problems must be considered when planning adolescent substance use interventions (Bender, et al., 2006; Bertrand, Beaumont, Durand, & Massicotte, 2006; Health Canada, 2001). Indeed, the occurrence of these problems along with addiction adds to the complexity of the clinical presentation (Najt, Fusar-Poli, & Brambilla, 2011). First, mental health problems concomitant with drug addiction seem to be associated with less favorable therapeutic outcomes (Babor, Webb, Burleson, & Kammer, 2002; Grella, Hser, Joshi, & Rounds-Bryant, 2001; Hawkins, 2009; Rowe, Liddle, Greenbaum, & Henderson, 2004; Tomlinson, Brown, & Abrantes, 2004). However, a number of studies do not document these links (Statistics Canada, 2004). Some results are even contradictory, suggesting that concomitant mental health problems may favorably influence treatment outcomes (Agosti, & Levin, 2007; Battjes, Gordon, O'Grady, Kinlock, & Carswell, 2003; Brown, Myers, Mott, & Vik, 1994), namely treatment persistence (Battjes et al., 2003). Although there is consensus that drug addiction and concomitant mental health problems are interrelated, the influence of mental health problems on the process of recovery of youth in drug treatment and the mechanisms explaining this influence are still poorly understood (Bender et al., 2006; Dennis, Scott, Funk, & Foss, 2005). Yet, adolescents with mental health problems increasingly attend substance user treatment services (Ilgen et al., 2011). Therefore, further studies are needed to better understand how mental health problems affect treatment outcomes and to identify the best practices to help adolescents struggling with dual disorders (Bender et al., 2006) and to connect substance user services with mental health ones (Ilgen et al., 2011).

On the other hand, treatment persistence seems to exert a favorable influence on adolescent recovery, regardless of the type of treatment offered (Agosti & Levin, 2007; Garner et al., 2009; Hser et al., 2001; Williams & Chang, 2000). In a literature review on this issue, Winter and colleagues (2011) stress the importance of developing strategies to ensure treatment retention among adolescents. However, it is important to remain cautious when interpreting results, given the paucity of empirical data. Furthermore, adult treatment persistence studies remind us of the importance of gaining a better understanding of the influence of this complex dimension, given their inconsistent results depending on the type of measures being considered, for instance, intensity, duration and type of services (Tremblay, Bertrand, Landry & Ménard, 2010).

<sup>2</sup>The journal's style utilizes the category *substance abuse* as a diagnostic category. Substances are used or misused; living organisms are and can be *abused*. Editor's note.

Therefore, the primary purpose of this longitudinal study conducted in a natural clinical setting was to fill the aforementioned gaps in existing literature. Specifically, the objectives of this study were two-fold: to describe the drug use trajectories of adolescents admitted into a drug addiction treatment center; and to investigate the contribution of covariates likely to account for differences in the trajectories: (1) mental health; (2) therapeutic alliance; and (3) treatment persistence.

## METHOD

### Design

A longitudinal study was conducted in a natural setting. This type of design can help increase the external validity of study results (Cahill, Barkham, & Stiles, 2010; Dinger, Strack, Leichsenring, Wilmers, & Schauenburg, 2008; Gibbons et al., 2010; Wright, Sabourin, Mondor, Mcduff, & Mamodhousen, 2007). In addition, this study design helped document the contribution of different variables on the drug use trajectories of youth in treatment.

### Sample and Procedure

Data were collected at three points in time: at treatment entry (T0), and at the three (T1) and the six-month (T2) follow-ups. The sample—102 adolescent girls and boys aged 14 to 18—was recruited at a residential drug addiction treatment center. All 131 youths admitted to the center between November 4, 2005 and November 2, 2006 were approached to participate in the study. Most of them (78%) agreed to take part in the study. The clinicians responsible for adolescents' admission were in charge of participant recruitment. Once participants had given their consent to communicating their names and phone numbers to the principal researcher, a research assistant contacted them to set up appointments to complete the questionnaires. Adolescents who had major cognitive disorders and those with significant reading or writing disabilities were excluded. The overall process complies with ethical regulations in human subjects research. The protocol was approved by the ethics and addiction research committee (CÉRT).

The center where adolescents were recruited offers a 10-week residential treatment program based on the Alcoholics Anonymous approach, which aims at abstinence. Several therapeutic activities and services are offered such as individual and group therapy, family consultation, parental skills enhancement, school, and medical services. Six months of weekly outpatient follow-up is available to those who have completed their residential treatment program. All study participants and one of their parents had to sign informed consent forms so that they could take part in the study. The study was approved by the Québec Department of Health (Ministère de la Santé et des Services sociaux) ethics committee in charge of evaluating studies of minors.

The adolescents mean age was 15.53 years (S.D = 1.10) (Table 1). Almost 60% of the sample (59.8%) was boys, and 40.2% was girls. Participants were divided into three family-type categories: (1) intact family (36.3%);

TABLE 1. Participants' sociodemographic characteristics

Variables	Means, standards deviation, and proportions
Mean age	15.53 (1.10)
Gender	
Boys	59.8%
Girls	40.2%
Family structure	
Intact family	36.3%
Reconstituted family	44.1%
Single parent	18.6%
Missing	1.0%
Live with parent(s)	
Yes	71.6%
No	25.5%
Missing	2.9%
Level of education	
Elementary school	14.3%
High school (7–9 grade)	71.5%
High school (10–11 grade)	12.1%
Particular path	2.2%

(2) blended family (44.1%); and (3) single-parent family (18.6%). For 1% of the youths, the family type was unknown. Furthermore, 71.6% of the participants lived with at least one of their parents, whereas the others lived in rehabilitation centers or foster homes. In terms of education, 14.3% of the participants had finished only elementary school, 71.5% had completed the first three years of high school, 12.1% had finished senior high school, and 2.2% reported having done some high school studies.

The follow-up rate was 77.4% (79/102) at the three-month follow-up, and 69.6% (71/102) at the six-month follow-up. These rates, given the type of population under investigation, are similar to those found in studies of comparable populations (Hser et al., 2001). In terms of drug use severity at treatment entry, it should also be noted that there was no significant difference between youths who left the study at the three- or six-month follow-ups and the others. Regarding sociodemographic variables, participants who dropped out of the study at either the three-month (16.0 years old) or the six-month follow-up (15.9 years old) were significantly older (three-month follow-up:  $p = .008$ ; six-month follow-up:  $p = .013$ ) than those who completed the study (15.4 years old). Also, those who left at the six-month follow-up were less likely to be living with either one of their parents ( $p = .041$ ).

### Measures

The *Indice de Gravité d'une Toxicomanie pour les Adolescents (IGT-ADO)* is a validated instrument (Landry, Guyon, Bergeron, & Provost, 2002) adapted from the Addiction Severity Index (McLellan, Luborsky, O'Brien, & Woody, 1980). The *IGT-ADO* measures drug use severity and associated problems, using 10 scales with composite scores ranging from 0 to 1. For the purposes of this study, only scores pertaining to severity of drug problems and psychological problems were considered. These two independent constructs showed satisfactory internal

consistency ( $\alpha = 0.70$  to  $0.85$ ) and good test–retest reliability ( $r = 0.68$  to  $0.92$ ; Landry et al., 2002). The *IGT-ADO* was administered to the adolescents by a clinician at treatment entry and by a research assistant at the two follow-up assessments. Sociodemographic data, including age, sex, schooling, and family structure (living with one parent, with both, or with neither one), were also collected using the *IGT-ADO* and questionnaire.

The California Psychotherapy Alliance Scales (CALPAS) (Gaston, 1991; Marmar, Weiss, & Gaston, 1989) is a validated instrument to measure therapeutic alliance. This instrument was used to collect information about therapeutic alliance, an active and purposeful collaboration between clinician and client (Cournoyer et al., 2007). During the first treatment session, shortly after completing the *IGT-ADO* evaluation, both clinician and participant completed the French version of the CALPAS (Cournoyer et al., 2007). This self-administered instrument includes 24 items that have been divided into four subscales: (1) the Patient Commitment scale (attitudes towards therapist and treatment, including affection and trust, and commitment to completing the treatment, even if it entails difficult moments and sacrifices); (2) the Patient Working Capacity scale (ability to work actively and purposefully in treatment); (3) the Therapist Understanding and Involvement scale (perception of the therapist's empathic understanding or active participation); and (4) the Working Strategy Consensus scale (i.e., perception of agreement with the therapist about how to proceed). A global score was computed for the clinician's perception of therapeutic alliance ( $\alpha = 0.94$ ) and for the client's perception of therapeutic alliance ( $\alpha = 0.84$ ).

Finally, treatment persistence was documented with data on services utilization by the adolescents from the adolescents' computerized clinical files. The indicators of treatment persistence are duration of services (in number of weeks), residential treatment completion, and number of post-treatment sessions attended. On average, the participants used the offered services for 14.23 weeks. Approximately half (51%) of the participants completed their residential program. Those who did so also attended, on average, 11.29 (S.D = 3.82) post-treatment sessions on an outpatient basis. Among youths who had left the residential program, 46% were expelled because they had broken the rules; the others had made the decision to end the treatment themselves. The qualitative component of the study (Bertrand, 2010) indicates that the young people who chose to leave residential treatment often did so in a context where they did not feel ready to commit to treatment at this time of their lives, with several of them mentioning being pressured by their families or other authorities such as schools.

### Data Analysis Strategy

Latent Growth Modeling (LGM), a type of Structural Equation Modeling, makes possible both optimal management of missing data and analysis of continuous, dichotomous, and categorical values.

LGM is of particular value when studying a complex social phenomenon and when longitudinal data are available (cf. Curran & Hussong, 2003). A distinctive feature of this technique is that it simultaneously calculates inter- and intrasubject variability. Furthermore, latent growth curves can explain differences between study participants upon entering treatment and changes over time related to drug use severity. Therefore, latent growth curve modeling was carried out using the *IGT-ADO* composite score at treatment entry and at the three- and six-month follow-ups.

The initial model (the unconditional model) was assessed to determine average trajectory regarding severity of drug use. Only the variables that represent the severity of these problems were included in the model. They were continuous and the tests for skewness (Time 1 = 0.450, Time 2 = 0.463, Time 3 = 0.735) and kurtosis (Time 1 = 0.813, Time 2 = -0.634, Time 3 = -0.038) confirmed distribution normality. LGM was therefore carried out using the maximum-likelihood (ML) technique for continuous, normal data. Mplus software was used for all analyses. For the missing data, the Mplus ML option was chosen; this method is used in cases where the missing data are randomly distributed. Mplus handles missing data on the dependant variable through use of the Expectation Maximization algorithm.

Covariates were subsequently added to the initial model, a procedure justified by the presence of significant variance within the unconditional model. Indeed, the covariates were added in an attempt to reduce the variance in the intercept and/or slope. A covariate that brings about a decrease in the variance constitutes an explanatory variable that can help account for the trajectory. Covariates included in the conditional model are age, sex, severity of psychological problems (*IGT-ADO*), therapeutic alliance (CALPAS, as reported by adolescent and clinician), and treatment persistence indicators (number of weeks of services use, residential treatment completion, and number of attended post-treatment sessions).

To validate the models, the root mean square error of approximation (RMSEA) (Brown & Cudeck, 1993), the comparative fit index (CFI) (Bentler, 1990), and  $\chi^2$  were used. Hu and Bentler (1999) suggest a RMSEA of  $<0.06$ , although they consider a criterion of 0.08 entirely acceptable in the case of relatively small samples ( $n < 500$ ), as in the case for the present study. The 90% confidence interval around the RMSEA point will estimate the real RMSEA value. These authors also suggest an ideal CFI of  $>0.96$  and, at the very least, 0.90. As for the value of  $\chi^2$ , although it is affected considerably by sample size, it must, ideally, be small enough not to reach the  $p < .05$  significance threshold (Bollen, 1989).

## RESULTS

### Drug Use Severity

To verify changes in participants' drug use severity between the three waves of data collection, Pearson product moment correlations were calculated (Table 2). No

TABLE 2. Pearson correlations on the drug use severity score for each time wave

Drug use severity	T0	T1	T2
Admission (T0)	1	0.08	-0.02
Three months follow-up (T1)	0.08	1	0.45**
Six months follow-up (T2)	-0.02	0.45**	1

\*\* $p < 0.01$ .

significant correlations between admission to treatment and the three- and six-month follow-ups were observed, suggesting that participants changed their drug use habits during this time period. However, a moderate correlation ( $r(71) = 0.45$ ,  $p < .01$ ) between T1 and T2 indicates some stability in participants' drug use. Nonetheless, this interindividual stability does not imply the absence of intraindividual change (Dekovic, Buist, & Reitz, 2004).

A description of the participants' substance use at the three assessment points reveals a marked reduction in their use of alcohol and drugs (Table 3). Cannabis was the most commonly used substance in the 30 days preceding treatment entry, excluding tobacco. The average number of days of cannabis use (past 30 days) shows a reduction between treatment entry (16.81) and the three-month follow-up (2.83), whereas a slight increase in use is seen at the six-month follow-up (3.79). The second most frequently used substance was methamphetamine, whose use also diminished between treatment entry (4.57) and the three-month follow-up (0.58). The percentage of total abstinence in the past 30 days (excluding tobacco) increased considerably, going from 5.6% at treatment entry to 63.3% at the three-month follow-up and to 52.1% at the six-month follow-up.

## Latent Growth Curve Analyses

### Unconditional Model

The latent growth curve analyses used to establish drug use severity trajectories revealed a lack of significance for the linear model statistics:  $\chi^2$  ( $df = 3$ ,  $n = 102$ ) = 27.911;  $p = .0000$ , RMSEA = 0.285; and CFI = 0.000. The statistics of the second model, however, with Time 3 freely estimated to be 1.078, are excellent:  $\chi^2$  ( $df = 3$ ,  $n = 102$ ) = 0.027;  $p = .9866$ , RMSEA = 0.000; and CFI = 1.000. This third time factor shows a lesser decline between the three- and six-month follow-ups. The freely estimated model is therefore the one that was retained. In short, the participants were found to have significantly reduced the severity of their drug use by the three-month follow-up, and this improvement was maintained between the three- and six-month follow-ups, albeit to a lesser degree.

Factors of growth show a statistically significant intercept  $\alpha = 0.242$  (E-S = 0.010;  $p < .001$ ) and slope  $\beta = -0.122$  (E-S = 0.012;  $p < .001$ ). Estimators indicate a mean initial drug use severity of 0.242 and a decrease of 0.122 between admission and the three-month follow-up. Furthermore, a decrease of 0.0095 ( $0.078 \times 0.122$ ) is observed between the three-month and six-month follow-ups. The three mean trajectory values are, respectively, 0.242, 0.120, and 0.111. The variance of the slope is significant  $\text{Var}(\beta) = 0.011$  (E-S = 0.002;  $p < .001$ ), as is the variance of the intercept  $\text{Var}(\alpha) = 0.009$  (E-S = 0.001;  $p < .001$ ), showing variability for both the slope (change in time of the drug use severity) and intercept (drug use severity at admission).

### Conditional Model

Several covariates were found to be significant with respect to intercept: participant's age ( $p < .05$ ), *IGT-ADO* psychological score ( $p < .001$ ), overall therapeutic alliance score as reported by the clinician ( $p < .01$ ), and

TABLE 3. Participants trajectory of substance use in the 30 days preceding their treatment admission, the three- and six-month follow-ups

Substance use	Treatment admission ( $n = 90$ )	Three-month follow-up ( $n = 80$ )	Six-month follow-up ( $n = 71$ )
Number of days use/% of abstinent participants (past 30 days)			
Alcohol	3.12 (31.9%)	0.74 (71.3%)	1.93 (60.6%)
Heroin/Opiate/Analgesic/Narcotic	0.01 (98.9%)	0.00 (100%)	0.03 (97.2%)
Barbiturate	0.06 (98.9%)	0.11 (98.7%)	0.03 (98.6%)
Benzodiazepine	0.52 (95.6%)	0.43 (97.5%)	0.20 (98.6%)
Cocaine	1.37 (76.9%)	0.05 (97.5%)	0.18 (94.4%)
Methamphetamine or Speed	4.57 (44.0%)	0.58 (90.0%)	1.68 (84.5%)
Cannabis	16.81 (12.1%)	2.83 (76.3%)	3.79 (64.8%)
Hallucinogen	2.44 (62.6%)	0.35 (91.3%)	0.89 (88.7%)
Inhalant/Solvent/Volatile substance	0.19 (97.8%)	0.00 (100%)	0.21 (98.6%)
GHB	0.06 (96.4%)	0.00 (100%)	0.03 (96.7%)
Tobacco	24.862 (8.0%)	—	—
Substance use/Proportion of participants			
Alcohol use only	3.3%	11.4%	9.9%
Drugs use only	25.6%	7.6%	8.5%
Drugs and alcohol use	65.6%	17.7%	29.6%
Abstinence	5.6%	63.3%	52.1%

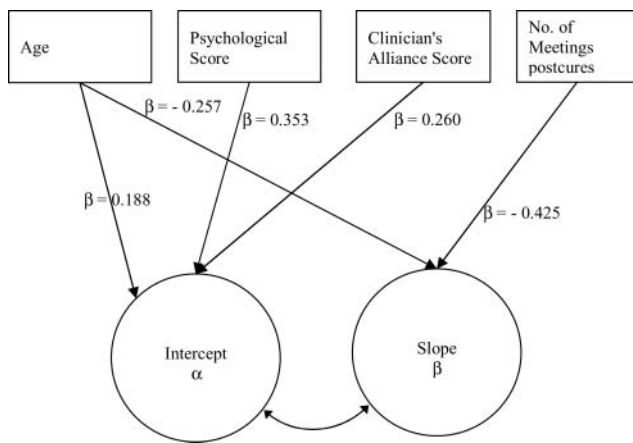


FIGURE 1. Latent growth model: effects of covariates on intercept and slope. \*All effects are significant to  $p < .05$ .

number of post-treatment sessions attended ( $p < .10$ ). These covariates account for 26.1% of the variance in intercept of the basic model. In addition, they are all negatively associated with the slope of the drug use trajectory, and account for 30.1% of the variance in the slope of the basic model: age ( $p < .05$ ), IGT psychological score ( $p < .10$ ), overall therapeutic alliance score as reported by the clinician ( $p < .10$ ), and number of post-treatment sessions ( $p < .01$ ). The statistics of the model with the covariates are excellent:  $\text{Chi}^2$  ( $df = 6, n = 102$ ) = 3.132;  $p = .7921$ , RMSEA = 0.000; CFI = 1.000. Figure 1 illustrates the standardized betas, showing the effect of each covariate on intercept and slope. These covariates were added to the basic models, in order to verify their statistical effects. Only the covariates that were found to be significant at  $p < .05$ , with respect to the intercept and/or slope, were retained for the final model. It should therefore be noted that sex, therapeutic alliance as perceived by the youth, and treatment persistence indicators, with the exception of the number of post-treatment sessions attended, were not significant.

The results indicate that older participants had more severe drug use problems at treatment entry, with a ratio of 0.016 (SE = 0.008;  $p < .050$ ) on the IGT-ADO drug use severity scale for each additional year of age. However, the severity of their drug problems decreased more rapidly than those of the younger participants—by 0.025 (SE = 0.011;  $p < .050$ ) on the IGT-ADO drug use severity scale for each additional year of age. At treatment entry (T0), mental health problems are strongly associated with drug use severity, with a ratio of 0.171 (SE = 0.048;  $p < .001$ ) for each unit scored on the IGT-ADO psychological scale. The same observation applies to therapeutic alliance with the clinician, with a ratio of 0.035 (SE = 0.013;  $p < .010$ ). Albeit with marginal significance ( $p < .1$ ), a negative association between slope and therapeutic alliance as well as severity of mental health problems were also noted. Finally, results show that participants who attended more post-treatment sessions reported more rapid improvements in their efforts to cut down on their drug

TABLE 4. Conditional model

Parameters		Value (Standard error)
<i>Initial use</i>		
Intercept	A	-0.312* (0.149)
Age		0.016* (0.008)
Psychological score		0.171*** (0.048)
Clinicians alliance score		0.035** (0.013)
Number of post-tx sessions		0.005† (0.003)
<i>Change over time</i>		
Slope	B	0.613** (0.192)
Age		-0.025* (0.011)
Psychological score		-0.11† (0.066)
Clinicians alliance score		-0.031† (0.017)
Number of post-tx sessions		-0.012** (0.004)
<i>Variance</i>		
Intercept	Var (a)	0.006*** (0.001)
Slope	Var (P)	0.008*** (0.002)
<i>Type of Model</i>		
$\text{Chi}^2$		3.132 (DoF = 6), $p = 0.7921$
CFI		1.000
RMSEA (90% C.I.)		0.000 (0.000–0.084)

$p < 0.1$ , \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

use. Indeed, for each additional session, there is a 0.012 (SE = 0.004;  $p < .010$ ) decrease in the slope on the IGT-ADO drug use severity scale. Table 4 provides a summary of this model, and Figure 1 describes the effects (standardized betas) of the significant covariates of the LGM on intercept and slope. Only the covariates significant to 5% are shown. Among the covariates that are associated with respect to the intercept, mental health appears to be the most important contributor ( $\beta = 0.35$ ), followed by therapeutic alliance ( $\beta = 0.26$ ) and age ( $\beta = 0.188$ ). Furthermore, post-treatment attendance ( $\beta = -0.425$ ) helps account for the slope more than age does ( $\beta = -0.26$ ).

## DISCUSSION

This study's main scope was to investigate the relative contribution of therapeutic alliance, mental health problems, and treatment persistence to account for differences in substance use trajectories of adolescents undergoing substance user treatment. Several covariates (age, mental health problems, therapeutic alliance, post-treatment sessions) were found to be significant with respect to initial drug use severity (intercept), and account for 26.1% of the variance. In addition, these covariates are all negatively associated with the slope of the drug use trajectory, and account for 30.1% of the variance in the slope. Among the covariates that are associated with respect to initial drug use severity, mental health problems appear to be the most important contributor, followed by therapeutic alliance, and age. Furthermore, post-treatment attendance helps account for the slope more than age does.

Severity of mental health problems is associated with initial level of drug use severity; results of other studies support this finding. Thus, the link between addiction and concomitant mental health problems is even stronger in adolescents with more serious drug problems (addiction as opposed to abuse) (Chan, Dennis, & Funk, 2008). The presence of mental health problems, particularly depressive and anxiety disorders, is also associated with high prevalence of substance use (Lansford et al., 2008). Adolescent suicide is one of the most worrisome consequences of drug addiction and mental health problems. In particular, the concomitant presence of major depression and substance-use-related problem (alcohol or drug) increases the risk of suicidal behaviors (Dougherty, 2007; Renaud, Berlim, McGirr, Tousignant, & Turecki, 2008; Yaldizli, Kuhl, Graf, Wiesbeck, & Wurst, 2010). Our results shed light on the need to detect and assess mental health problems in youth in treatment for drug addiction, taking into account issues related to risks of attempting suicide. To this end, professional development is essential, in a context where mental health and addiction services tend to be provided in silo and not integrated (Ilgen et al., 2011; Lesage et al., 2008).

Results show that clinician's perception of therapeutic alliance is linked to initial level of drug use severity (intercept). Regarding the relationship between youths and their clinicians, the study participants with more severe drug problems developed a better therapeutic alliance. It seems that the accumulation of negative consequences associated with substance use favors youth's commitment to take steps to bring about change. In Battjes et al.'s study (2003), participants' perception of negative consequences linked to their drug use was associated with greater motivation to change. Acknowledgment of a drug problem and motivation to change can certainly encourage an adolescent to collaborate with the clinician, especially when choosing therapeutic targets (Schroder, Sellman, Frampton, & Deering, 2009). It is also possible that clinicians get more involved with adolescents whose drug problems are more severe. Regardless of how we understand the association between therapeutic alliance and severity of drug problem, we should note that these results are encouraging. Indeed, youth with the most severe drug problems is often perceived as being hard to treat; however, our study shows that, on the contrary, the therapeutic alliance is bolstered by the severity of their problems. Clinicians should be especially watchful to create therapeutic alliances at the very start of the process with youth whose drug use is less severe. A main target related to these youth, who may still consider that drug use is beneficial despite the consequences they have experienced, should be to prevent further aggravation of drug use.

Post-treatment attendance is also linked to initial level of drug use severity (intercept), but in a marginally significant manner. Despite the fact that prudent interpretation is necessary, these results suggest that youth manifesting more severe drug-use-related problems tend to require higher service intensity. At least, they have a greater tendency to use all services on offer, including therapy ses-

sions once they leave residential treatment. We should reiterate that in our study, about half of the youth do not complete the residential part of the treatment. Consequently, we must put in place strategies to foster commitment to treatment from the beginning (Winters et al., 2011), in particular by encouraging adolescents to engage in the process by involving them in all decisions related to types of goals for change and methods of treatment (Brunelle et al., 2010).

As regards the covariables associated with change in drug use over time, post-treatment sessions contributed more to the explanation of the slope than did age. This finding is similar to that of Datos-ADO study in which an association was found between treatment effectiveness and adolescents' time spent in treatment (Hser et al., 2001). This result underscores the possibility of getting adolescents to commit to treatment for a rather long period. Retention of youth in the early phase of treatment is an important challenge since adolescents are often referred by court, family members, or school. Intrinsic motivation to change often occurs when the youth experiences several consequences related with his or her substance use. Among adult populations (Burke, Arkowitz, & Menchola, 2003; Carroll et al., 2006), motivational interviewing (Miller & Rollnick, 2002) has been identified as an effective way to enhance motivation to change from the very beginning of treatment and to favor retention in treatment (Tremblay et al., 2010). Motivational interviewing has also shown good results with adolescents and substance-abusing youths (Bertrand et al., 2006; Tevyaw, O'Leary, & Monti, 2004; Tupker, 2004). The impact of this type of intervention—used in the early phase of treatment—on change in adolescents should be more extensively studied, including the potential contribution of therapeutic alliance upon change.

Finally, it should be noted that severity of mental health problems and therapeutic alliance are associated with marked improvements in terms of psychotropic drug use, albeit with marginal significance. These results, which must be reproduced before conclusions can be drawn, run counter to certain data indicating that mental health problems negatively influence therapeutic outcomes (Babor et al., 2002; Grella & Joshi, 2003; Tomlinson et al., 2004). With regards to early therapeutic alliance, no relationship with treatment outcomes among adolescents undergoing cognitive behavioral treatment was found (Hogue et al., 2006). Since data on this topic are rare and inconsistent, the relationship between these variables and adolescents' drug use severity trajectories must be further studied. The type of approach and framework that favor the reduction of drug problems among youths with concomitant mental disorders must be assessed (Shirk et al., 2011). The most effective methods for relieving their psychological distress must also be investigated.

The results of this study add to the understanding of the rehabilitation process of youths undergoing treatment for drug addiction, an area of study that is still relatively unexplored. Using growth curve analyses of longitudinal data, it was possible to better document the complexity of



the rehabilitation process. The contribution of covariates upon these trajectories was documented. Nonetheless, we should remember that, due to the relatively small sample size, we must remain prudent when drawing generalizations, and that other studies are needed before firmer conclusions can be reached. Certain associations may not have been detected, given the lack of statistical power. Therefore, small differences among the groups are more difficult to detect with a sample of fewer than 500 participants. However, latent growth analyses detect smaller effects with samples of all sizes than other statistical methods such as multivariate repeated-measures ANOVA (Fan, 2003). The final model also had excellent goodness of fit (Hu & Bentler, 1999), but sample size may have an impact on the value of fit indexes cause of lack of power (Kim, 2005). Moreover, the design of this study may not document any direct causal relationship between treatment episode and therapeutic outcome.

The number of follow-ups could also have been higher to detect longer term effects of treatment on the drug use trajectories of adolescents who are in drug treatment. However, this was not the main objective of our study. The six-month follow-up period was chosen because it is sufficient to achieve our objectives, as Mardsen and colleagues (2006) argue. The most significant improvements following onset of substance user treatment in adolescents occur at the beginning of the process, that is, in the first three months, in our study as in the *Cannabis Youth Treatment Study* (Dennis et al., 2004). This period is sufficiently lengthy to detect differences between the groups (Taxman & Belenko, 2012) and thus collect additional empirical information to enhance knowledge about drug treatment outcomes for youth and to improve clinical interventions offered to these youth.

Nonetheless, the results highlight the importance of studying variables that favor treatment persistence, since it is associated with better therapeutic outcome. On this subject, it appears that treatment motivation and parental support have significant impacts on treatment engagement and outcome (Bender et al., 2006; Winters et al., 2011). A more in-depth study of these factors, linked to treatment outcome of adolescents, is required. In addition, research on the interactions among therapeutic alliance, mental health, and drug addiction must be pursued to improve counselling and to better address the specific needs of every youth undergoing drug addiction treatment. The great variability of the trajectories observed shows the sheer complexity of the process of change in drug addiction, and the importance of adapting approaches to the individual realities of the youths who consult us. More research must be undertaken so that mechanisms underlying the outcomes of various types of drug treatment can be better understood, and the development or enhancement of new or existing services be better aligned.

#### Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

#### RÉSUMÉ

##### **Évaluation des covariables associées aux trajectoires d'usage de drogues parmi des adolescents admis à un centre de traitement en dépendances : problèmes de santé mentale, alliance thérapeutique et persévérance dans le traitement.**

Cette étude a pour but d'évaluer les covariables associées aux trajectoires d'usage de drogues parmi 102 adolescents admis dans un programme de traitement de la dépendance entre novembre 2005 et novembre 2006, au Québec, Canada. L'influence de la santé mentale, de l'alliance thérapeutique et de la persévérance dans le traitement a été examinée. L'Indice de gravité d'une toxicomanie (version française de l'*Addiction Severity Index*) a été utilisé afin de mesurer la gravité de la consommation de drogues et les problèmes de santé mentale. Aussi, la version française du *California Psychotherapy Alliance Scales* a été utilisée pour mesurer l'alliance thérapeutique. L'analyse des courbes de croissance latente montrent des associations entre: (1) la santé mentale et la gravité initiale de la consommation de drogues; (2) l'alliance thérapeutique et la gravité initiale de la consommation de drogues; et (3) le nombre des séances post-traitement auxquelles les participants ont assisté et la gravité de la consommation de drogues au fil du temps.

Mots clés: Adolescence, dépendance, traitement, santé mentale, alliance thérapeutique, Trajectoires d'usage de drogues.

#### RESUMEN

##### **Evaluación de las covariables asociadas a las trayectorias de consumo de drogas entre adolescentes admitidos en un centro de tratamiento de la toxicomanía: problemas de salud mental, alianza terapéutica y perseverancia en el tratamiento.**

La presente investigación tiene como objetivo evaluar las covariables asociadas a las trayectorias de consumo de drogas de 102 adolescentes admitidos en un programa de tratamiento de la toxicomanía en Quebec, Canadá, entre noviembre del 2005 y noviembre del 2006. Examinamos la influencia de la salud mental, la alianza terapéutica y la perseverancia en el tratamiento. La versión francesa del instrumento *Addiction Severity Index* fue utilizada con la finalidad de medir la gravedad del consumo de drogas y los problemas de salud mental. Además, la versión francesa del instrumento *California Psychotherapy Alliance Scales* fue utilizada para evaluar la alianza terapéutica. El análisis de curvas de crecimiento latente muestra asociaciones entre: (1) la salud mental y la gravedad inicial del consumo de drogas; (2) la alianza terapéutica y la gravedad inicial del consumo de drogas; y (3) el número de sesiones post-tratamiento a las cuales los participantes han asistido y la gravedad del consumo de drogas a lo largo del tiempo.



Palabras clave: Adolescencia, toxicomanía, tratamiento, salud mental, alianza terapéutica, trayectorias de consumo de drogas.

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