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Researcher Contact Information:

Laura Mills M.A., PhD Candidate

laura.m@pineriverinstitute.com

389 Cox Mill Road, Barrie, ON L4N 7S8 705-717-9434

Researcher Bios

Laura Mills is completing her PhD at York University in Quantitative Methodology and is the Director of Research at Pine River Institute, a co-educational residential treatment centre and wilderness experience for youth aged 13-19 who have experience with substance abuse and co-occurring complex problems. She is dedicated to knowledge exchange and collaborative processes that broaden our understanding of treatment effectiveness and expectations.

Professor Pepler, York University, is a distinguished researcher and her research has changed the way we think about bullying, aggression and other forms of violence, especially among marginalized and alienated young people. She speaks widely to professional and community audiences about children at risk. Dr. Pepler has a strong publication record and has edited four volumes in the past four years on understanding and addressing children's aggression, bullying, and victimization.

Professor Rob Cribbie, York University, is the Associate Coordinator at the Statistical Consulting Service, York University, and professor of quantitative methodology at the graduate and undergraduate levels. Dr. Cribbie's research interests focus on the application of statistics within psychological research, including robust statistical analyses, multiple comparisons and the measurement of change.

Conflict of Interest

The primary author is the Director of Research & Evaluation at the residential treatment centre that was the focus of this study. This is not a conflict, but we wanted full transparency.

This manuscript has never been published and is not currently submitted to another journal.

Running Head: RESIDENTIAL TREATMENT FOR SUBSTANCE ABUSING YOUTH

Effectiveness of Residential Treatment for Substance Abusing Youth:

Benefits the Pine River Institute Program

Laura Mills, York University

Debra Pepler, York University

Rob Cribbie, York University

Abstract

We investigated the effectiveness treatment for substance abusing youth at an innovative residential program in Canada, the Pine River Institute. We explored: (a) whether pre-treatment problems were predicted by individual differences; (b) what predicted treatment progression; (c) the amount of improvement pre- to post-treatment; and (d) what predicted those improvements. From data from 148 youths, we found that: (a) parental divorce and mental health issues were associated with pre-treatment problems; (b) youths who attended PRI in more recent years progressed further through treatment; (c) improvements were significant and large; and (d) youths who progress further in treatment experience greater improvements.

Keywords: Adolescent Substance Abuse, Youth Addiction Treatment, Residential Youth Treatment

Residential Treatment for Substance Abusing Youth:

Benefits of the Pine River Institute Program

Over half of North American teens experiment with alcohol and 17% experiment with marijuana (Paglia-Boak, Adlaf, Mann, 2011; Palmer et al., 2009). Although experimentation is considered somewhat normative, it may lead to abuse. Indeed, 22% of youths repeatedly use alcohol, 10% repeatedly use marijuana, and 4-6% depend on or abuse these substances (Paglia-Boak, 2011; Palmer et al., 2009, see also Fergusson, Horwood, & Lynskey, 1993; Lewinsohn, Hops, Roberts, Seeley, & Andrews, 1993; Warner, Kessler, Hughes, Anthony, & Nelson, 1995). If early experimentation progresses to abuse, healthy development may be impeded. Youth substance abuse is associated with decreased school engagement, achievement, and progress (Renna, 2007; Winters, 1999), lower rates of high school graduation and subsequent lower income (Griffin, Ramchand, Edelen, McCaffrey, & Morral, 2011; Larm, Hodgins, Larsson, Samuelson, and Tengström, 2008; Renna, 2007), and detrimental substance use in adulthood (Palmer et al., 2009). Youth substance abuse also impacts communities and social and health services; it is associated with criminal behaviour (Harrison and Asche, 2001) and hospitalization (Griffin et al., 2011). It is critical to interrupt substance abuse if it manifests during adolescence and divert youth toward healthy development and to accomplish this, it is imperative to identify effective treatment strategies. In the current study, we investigated whether a residential treatment program was effective diverting youth toward healthy development. We also explored whether treatment was effective for youths across a variety of individual differences and histories. Specifically, we evaluated whether treatment was associated with changes in substance abuse severity, school attendance, delinquent behaviour, and hospitalization, and we explored

whether these changes were associated with age, gender, parental marital status, history of abuse, mental health issues, parent treatment engagement, treatment progression, and year of treatment.

Treatment for Adolescent Substance Abuse

Intervention for youth substance abuse can take many forms including outpatient, day, inpatient, and/or outdoor behavioural treatment. The focus of this study is multi-dimensional residential treatment. The limited research on outcomes for residential programs suggests positive changes in psychological and behavioural issues, particularly for those who complete treatment (Jainchill, Bhattacharya, & Yagelka, 1995). Additionally, one study indicated greater reductions in substance use for residential than for outpatient treatment (Dasinger, Shane, & Martinovich, 2004). On other developmental outcomes, residential treatment is associated with academic engagement or re-engagement (Latimer et al., 2000) and reduced criminality (Williams & Chang, 2000). If, however, adolescents re-engage with substances post-treatment, they are more likely to show low rates of graduation, professional employment, marriage, and financial responsibility for offspring (Anderson, Ramo, Cummins, & Brown, 2010). Edelen, Slaughter, McCaffrey, Becker, and Morral (2010) found benefits of residential treatment specifically for young offenders across a comprehensive set of outcomes that included substance abuse, crime, psychological functioning, institutionalization, general health, and academics or vocation. In contrast, Vaughan and Howard (2004) found negligible support for residential treatment, but cautioned that there is a lack of strong methodological designs in evaluations of such programs. With the current study, we aimed to partially address this gap by examining treatment effectiveness and how effectiveness might vary across youth differences and program factors.

Factors Associated with Youth Substance Abuse

Research on youth treatment outcomes should include the measurement of domains directly relevant to development and to relationship systems thought to support and interact with development (Williams & Chang, 2000). Dodge and colleagues (2009) provided evidence for a dynamic cascade model in which developmental and relationship factors independently, interactively, and cumulatively predict illicit substance use during or before twelfth grade. The model includes: early child issues such as temperament and behaviour; early family ecology factors such as low socio-economic status and being raised by one biological parent; early guardian factors such as abuse and lack of consistent structure; early child internalizing and externalizing disorders; early peer rejection and lack of social adjustment; lack of parental monitoring and low family functioning during adolescence; and deviant peers during adolescence. The cascade model helps to explain the etiology of early substance use as an interactive, evolving, and accelerating flow of experiences. If youth substance use progresses to abuse, the model can also help conceptualize factors that impact the diversity of substance abuse severity and related experiences such as academic engagement, delinquent behaviour, and hospitalizations. Research on some of these factors is outlined below.

Gender. Substance use appears to differ according to gender, with male youth more likely to engage with substances than female youth (Siebenbruner, Englund, Egeland, & Hudson, 2006). In terms of diversity at pre-treatment, the severity of youths' use does not differ across gender, history of physical abuse, prior treatment, or chemical dependency. Female youths, however, are more likely to report depressive symptoms, suicidality, and history of sexual abuse, whereas male youths are more likely to report criminality (Harrison & Asche, 2001). We expected that the severity of substance abuse and related issues at intake would not differentiate male and female youths.

With regard to treatment process and outcome factors, female youths are more likely to complete treatment (Harrison and Asche, 2001) and have lower post-treatment substance use severity than male youths (Harrison & Asche, 2001; Latimer et al., 2000; Titus, Dennis, White, Scott, and Funk, 2003). In line with this literature, we expected that female youths would be more likely to complete treatment and would experience greater decreases in substance abuse and related issues.

Age at admission. Age is associated with increases in ability to take responsibility and perspective of others and of one's future (Modecki, 2008) and thus should serve to protect or divert youths from the cascade of substance use. On the other hand, the cascade model indicates that problems tend to build and accelerate over time; thus, older youths may have a more severe array of issues than younger youths. Neither of these suppositions has been supported in the literature as age has not been found to differentiate youths' residential treatment completion (Neumann et al., 2010), post-residential-treatment drug abuse (Winters, Stinchfield, Opland, Weller, & Latimer, 2000), academic progression, employment, independent living, or marital status (D'amico, Ramchand, & Miles, 2009). We included age as an exploratory predictor of substance abuse and related issues without directional expectations.

Parental divorce. Being raised in a home with only one biological parent is among the social ecology factors that may initiate the cascade of substance use (Dodge et al., 2009), as is well documented in the literature. Specifically, youth with divorced parents are at a greater risk of early-onset substance use (Costa, Jessor, & Turbin, 1999; Doherty & Needle, 1991; Needle, Su, & Doherty, 1990) and heavy drinking behaviour in young adulthood, particularly among male adults (Huurre et al., 2009). Likewise, youth with risky drinking behaviour are more likely to have divorced parents than youth who abstain or consume alcohol in moderation (Tomcikova,

Geckova, VanDijk, & Reijneveld, 2011). We thus expected that youths who had divorced or separated parents would show more severe substance abuse at treatment intake.

In terms of treatment, there is some evidence that youths with divorced parents are less likely to complete residential treatment (Neumann et al., 2010) and we expected to find this in the current study. In terms of treatment outcomes, it is unknown whether parental divorce is a factor, but effective treatment is intended to target issues that are associated with parental divorce, such as attachment problems (Schumaker, Deutsch, & Brenninkmeyer, 2009). We expected that youths with divorced parents would have similar scores on substance abuse and related issues at post-treatment as those without divorced parents. Thus, we expected youths with divorced parents to change more than those without divorced parents, since we expected differences at pre-treatment.

Mental health. The co-occurrence of youth substance abuse and mental health is estimated at between 50% (Williams & Chang, 2000) and 75% (Winters, 1999), with the most common co-occurring disorders being conduct, attention deficit hyperactivity, and mood disorders (Winters, 1999). Youth with mental health problems are more likely to report family and peer problems and a history of abuse than are youths who report no mental health problems (Grella, Hser, Joshi, & Rounds-Bryant, 2001). Youths with co-occurring substance abuse and mental health issues are more likely to have tried substances at a younger age (Chang, Lichtenstein, & Larsson, 2012) and use substances more frequently and at higher doses (Tomlinson, Brown, & Abrantes, 2004) than youths without co-occurring diagnoses. In the current study, we expected youths with co-occurring mental health issues and substance abuse to report more severe pre-treatment substance abuse and related issues.

Given that substance abusing youths with co-occurring mental health diagnoses are at greater risk for not completing treatment (Winters, 1999), we expected youths with co-occurring mental health diagnoses in the current study to have lower rates of treatment completion than youths without other mental health problems.

After treatment, youths leave residence and go back to contexts with serious environmental stressors and triggers. Mental health issues add complexity to decisions and behaviours in these contexts that may re-initiate the cascade of substance use. Indeed, youths with mental health problems, and in particular multiple diagnoses (Grella et al., 2001; Shane, Jasiukaitis, & Green, 2003), report higher rates of relapse (Winters, 1999), heavy drinking, use of stimulants and hallucinogens, suicidal thoughts, hostility, low self-esteem, school absence, family problems, and arrests (Grella et al., 2001) after residential treatment than do youths without mental health problems. We expected that treatment would divert substance abusing youth without co-occurring mental health diagnoses from abuse and related issues more so than those with co-occurring mental health diagnoses.

History of abuse. Dodge et al. (2009) articulated that although childhood physical abuse did not independently predict early onset substance use, low engagement by parents and their attitude toward (or use of) violence were risk factors. This is supported by findings of a high prevalence of abused youth who seek treatment for substance abuse; an estimated 63% who enter residential or outpatient treatment have experienced a history of physical, sexual, or emotional abuse (Titus et al., 2003). Further, youths who have experienced abuse have more severe substance abuse issues than those who have not experienced abuse (Shane, Diamond, Mensinger, Shera, & Wintersteen, 2006), and have more issues with co-occurring stress and confrontational behaviour (Titus et al., 2003). In line with these findings, we expected that at pre-treatment,

youths with a history of abuse would have more severe substance abuse and related issues than those who do not have such experience.

Youth with histories of abuse are less likely to complete treatment (Neumann et al., 2010); therefore, we expected a lower rate of treatment completion among youths with a history of abuse than those without. Residential treatment, however, may serve to interrupt the cascade of substance abuse by addressing the role played by youths' experiences of abuse, since this treatment approach is designed to instill longstanding and profound changes in approaches to coping with stressors. Along these lines, research outcomes for abused youths have had mixed results. Specifically, Titus and colleagues (2003) did not find a pre- to post-treatment difference in substance abuse between youths who reported abuse histories and those who did not. In contrast, Shane and colleagues (2004) found that youths who had a history of abuse showed less post-treatment substance abuse decrease and less sustained treatment success. We explored the association between history of abuse and changes across substance use and related issues without *a priori* directional hypotheses.

Treatment

Residential treatment is expected to divert youths from the cascade that was initiated at some point in development and intensified from use to abuse during adolescence. Successful diversion should allow youths to have healthy approaches to lifestyle, behaviours, and relationships. The evidence for treatment effectiveness is emerging with findings that: it tends to be more helpful than no treatment (Harrison & Asche, 2001; Williams & Chang, 2000), treatment completion is associated with better outcomes; and youth who seek treatment continue to be a high-risk group compared to youth who have never sought or demonstrated a need for treatment (Winters, 1999). More research is required to shed light on the amount of change that

should be expected as a result of treatment, what aspects of treatment are most beneficial (e.g., duration), what type of treatment is effective for youths with particular characteristics (e.g., mental health issues), and whether treatment gains are sustained in the years after treatment. Few substance abuse programs, however, engage in outcome-oriented research. Indeed, of 144 highly regarded programs in the United States (85 of which were residential), less than 6% were competent in measuring the outcomes of their clients (Brannigan, Schackman, Falco, & Millman, 2004). We propose to contribute to the evidence base by investigating changes on substance abuse, academics, delinquent behaviour, and hospitalization that are associated with residential treatment with the expectation that change will be significant and large, and that changes within the first six months post-treatment will be sustained in the subsequent two years. We will also explore whether treatment change differentiates youths with varied characteristics of age, gender, parental divorce, mental health issues, and history of abuse, along with the treatment factors outlined below.

Treatment Factors

Parent engagement. The cascade model posits that parental withdrawal or inability to monitor or supervise children is a factor in the initiation of early substance use. Parental withdrawal interacts, and often becomes evident concurrently, with early problematic youth temperament and later behavioural problems (Dodge et al., 2009). Substance abuse treatments that promote appropriate family structure, monitoring, supervision, and other positive parenting practices have the potential to divert youth from the cascade effect. Although Harrison & Asche (2001) found little evidence to suggest that parent engagement is a factor in treatment completion or later treatment success, there is some evidence that parental engagement with youths' substance abuse treatment can enhance treatment success and is associated with sustained

treatment gains (Hair, 2005; Plant & Panzarella, 2009; Sunseri, 2001; Winters, 1999). In line with these later findings, we expected that youths whose parents were more engaged with treatment would experience more treatment success and sustained gains than those whose parents were less engaged.

Progression through treatment. The cascade of early-onset substance use may be initiated any time during youth development and increase and accelerate, in some cases over several years. The effects of this cascade are often profoundly instilled in behaviour. Residential treatment is unique in its approach and intensity and, in particular, duration. Over the course of residence, youths can take time to first unravel core underlying issues and then build acceptance or coping skills to navigate the profound initiating and sustaining elements of their cascades. In line with this reasoning, longer stays have been found to be associated with higher rates of post-treatment success (Latimer et al., 2000; Plant & Panzarella, 2009).

Another measure of treatment progression is completion. Completion is not the norm in residential settings, ranging from only 10% to 66%, with a median of 25% (Williams & Chang, 2000), but is associated with treatment success. Compared to those who drop out, youths who complete treatment are more likely to be abstinent after treatment (Harrison & Asche, 2001), have greater reductions in substance abuse (Jainchill et al., 1995), and experience more social behaviour benefits (Hogue et al., 2008). In fact, Winters et al. (2000) found that treatment completion was associated with improvements three to four times the rates of non-completion. For the current project, treatment progression was expected to be associated with greater reductions and sustained success of substance abuse and related issues.

The importance of treatment progression warranted particular attention; therefore, we also treated it as an outcome variable to determine its association with any client characteristics. In

line with the literature, we expected that youths who were male, who had divorced parents, mental health issues, or histories of abuse would progress the least through treatment.

Year of departure. Year of departure was included as a predictor of treatment progression and treatment change to explore whether there were improvements over time as a function of stabilization of the therapeutic environment.

Pine River Institute Residential Treatment

This research focused on Pine River Institute (PRI), a 36-bed residential co-educational treatment program and wilderness experience in rural Ontario (Canada) for youths aged 13-19 with substance abuse and often co-occurring mental health issues. Referred youths are immersed in ongoing experiences of compromised health (e.g., hospitalizations), impaired development (e.g., school absence and delinquent behaviour), and chaotic relationships (e.g., deviant peers).

The treatment approach at PRI is an intensive community-milieu model, with youths attending individual, group, and family therapy in the context of a highly structured and nurturing environment. PRI is a community milieu that also includes school, daily living skills, physical activity, creative arts, nutrition programs, and a positive peer culture. To facilitate lasting changes, parents also engage in treatment to repair relationships, establish healthy boundaries and communication, and develop a healthy family structure.

The concept of maturation is a cornerstone of the PRI treatment philosophy. Impaired functioning is seen as a symptom of an underlying interruption in the development process. Youths are typically mired in an early stage of psychosocial development and the program encourages maturation across the domains of healthy relationships, empathic regard, individuation, future orientation, and social ethics (McKinnon, 2008). Through this development,

youths become increasingly mature with capacity for daily routines, self-care, leadership and commitment to the community via a five-stage treatment progression.

Youths first engage in a wilderness therapy experience (Phase 1), which has expectations of basic routines, small community living, recognition, and accountability. Youths are subsequently immersed in residential treatment and academics as they progress through Phase 2 when they are expected to demonstrate self-care, responsibility, accountability, and leadership. Youths then enter Phase 3, the transition phase, when they begin and gradually increase home visits while they continue to meet treatment and community expectations while acclimate to their family and home community. When youths leave the campus, they engage with PRI aftercare services (Phase 4) to help with full re-integration. Treatment progression varies by individual need, but is typically two months in wilderness, eight months in residence, and up to a year of aftercare engagement.

Method

Participants

The study sample was youths who attended and departed from PRI from June 1, 2006 to December 1, 2011 ($N=209$). Data were collected from parents of 150 PRI youth as part of ongoing data collection and were retained from 148 who consented to contribute to research. Consent forms outlined the voluntary nature of participation, limits of confidentiality, an explanation of PRI research, any risks, and potential benefits. Information was provided for whom to contact if the surveys induced discomfort or stress.

Pre-treatment surveys were administered by program staff via a secure email link at the time of application. Parents who preferred to complete research packages over the phone were given

appropriate contact information. At 3, 6, 12, and 24 months post-treatment, parents were contacted and sent surveys via a secure email link.

We undertook preliminary tests on pre-treatment scores to determine whether post-treatment respondents were from different populations as non-respondents (t -tests for numeric and χ^2 for dichotomous variables). The only factor that emerged as non-equivalent was treatment progression. Parents of youths who progressed through higher stages of treatment had higher response rates than those who departed early ($\chi^2_{(5)} = 17.746, p = .003; \Phi = .292$). Specifically, those departing in Stage 1 had a response rate of 38%, whereas the response rate across all other treatment progression categories was at least 65%. The highest rate of response (77%) was among parents whose youths completed residential treatment.

Responses at three and six months post-treatment were collapsed to create a single early post-treatment time point, '3-6M', that had 86 observations (55 at three months and 31 at six). Responses at one and two years were also collapsed to create a single later time-point, '1-2Y', that had 90 observations (72 at one year and 18 at two years). In cases where there were responses at both of the collapsed time-points, the earlier of the two was retained.

Study Hypotheses

H1: Youths with divorced parents, mental health issues, or history of abuse would have more severe pre-treatment substance abuse and related issues (after controlling for age, and gender) than those without divorced parents, mental health issues, or history of abuse.

H2: Treatment completion would be lower for youths who are male, have a history of mental health issues or abuse, whose parents are divorced, or who experienced treatment in the earlier years since program inception (after controlling for age).

H3: The decrease from pre-treatment to 3-6M or 1-2Y in substance abuse and related issues would be significant with large effect sizes.

H4: Changes in substance abuse and related issues would be associated with client characteristics and treatment process factors. Specifically, substance abuse and related issues were expected to decrease more among female youths, youths who have divorced parents, youths who do not have mental health issues, who progress further through treatment, whose parents are highly treatment engaged and/or those who went to PRI in later years.

Measures

Client factors.

Pre-treatment developmental predictor. At the time of application, parents indicated whether their child had any mental health diagnoses. The number of ‘yes’ responses was summed for a ‘*number of mental health diagnoses*’ score that ranged from zero to four.

Pre-treatment relationship predictors. *Parent divorce* was coded as yes (1) or no (0) for biological parental divorce or separation. If a youth had been raised or adopted by a stepparent, divorce was coded as ‘yes’. History of physical, sexual, or verbal abuse was coded as yes (1) or no (0) for *history of abuse*. All relationship predictors were obtained from parent applications.

Treatment process factors. Parents support youth treatment by attending weekly therapeutic sessions, off-campus parent groups, weekend youth visits with group process meetings, multi-day off-campus retreats, and on-campus workshops. The number of these events was multiplied by the mean number of family members attending for a *parent engagement* measure. This variable had outliers causing problematic positive skew and was thus square-root transformed to adequately normalize the distribution, and these transformed scores were used in all analyses. In line with the therapeutic progression model at PRI, treatment progression

was measured as *phase at departure* and coded as departing early in phases one through three (1 – 3) or completion of residence (4). The year in which the student departed, *year of departure*, the program was coded as 2006-2007 (1), 2008-2009 (2), and 2010-2011 (3). These pairs of years were collapsed, as very few students departed during the first year of operation, and few students had reached a post-treatment data collection time-point if they had departed in the most recent year. All treatment process factors were collected from case file review.

Post treatment data collection time. *Early/late* indicated whether data were obtained from the earlier or later of the two times within either of the time-points and was coded as 0 and 1, respectively.

Outcome Indicators

Substance abuse severity. Knight, Roberts, Gabrielli, and VanHook (2010) define six stages of substance severity use: abstinence, secondary abstinence, experimentation, non-problematic use, problem use, abuse, and dependence. Similar to these categories, post-PRI-treatment *substance abuse* severity was coded as abstinent (1), social / occasional (2), periodic slips (3), and consistent and problematic (4). This scale was not administered at pre-treatment, as severe substance use was indicated or implied by most parents during intake. To derive a quantitatively similar measure, we reviewed parent applications and devised an algorithm for severity as a function of frequency of use and behaviour such as solitary use, reasons of use, time of use, and consequences of use, similar to other research (Latimer et al., 2000; Tucker, Ellickson, Collins, & Klein, 2006). Thus, pre-treatment substance abuse severity was based on: parent report of frequency of marijuana use; the number of addictive behaviours (including: using alone, injecting drugs, stealing to get substances, having a high tolerance or hangovers, passing or blacking out, vomiting from use, and overdosing); and the total number of reported

drugs ever used. *Consistent and problematic* (4) was indicated if marijuana use was daily, seven or more addictive behaviours were indicated, or drug of choice was something other than marijuana or alcohol (e.g., cocaine). *Periodic slips* (3) was indicated if marijuana use was multiple times per week, six to seven addictive behaviours were indicated, or there was parental knowledge of seven drugs used. *Social/Occasional* (2) was indicated if marijuana use was less than twice per week, four to five addictive behaviours were reported, or parents knew of four to five different drugs. *Low/No Use* (1) was indicated if there was no use of marijuana, less than four addictive behaviours (e.g., internet) were reported, or parents knew of lifetime use of less than four different drugs.

School attendance. Indicators of youths' *school attendance* in the three months prior to survey administration was coded as: not attending (1), truant and only attending a maximum of three days per week (2), attending four to five days per week (3). 'Attendance' applies equally to secondary and post-secondary school.

Police contact. *Police contact* over the three months prior to survey administration was coded as yes (1) or no (0). Explanations of police contact included (for example): 'picked up and released after exiting a known drug house', 'public intoxication', 'brought home by police', 'arrested for stealing', 'arrested and put in diversion program' and 'arrested and charged'.

Running away. *Running away* was measured by parent report in the three months prior to survey administration as yes (1) or no (0). If parents indicated that youth stays out all night without calling or letting them know where he or she is, running away was noted as 'yes', but for reports of threats by youth to leave home and reports such as 'left for a few hours and came home the same day', running away was coded as 'no'.

Hospitalizations. Parents classified youth *hospitalization* for mental health or substance use reasons over the three months before the survey as either yes (1) or no (0).

Analyses

Two-stage regression was used to test *H1*, *H2*, and *H4* for substance abuse and school attendance. First, for *H1*, each pre-treatment outcome variable was regressed on the six client factors. For *H2*, stage at departure was regressed on all client and treatment factors. For *H4*, change scores (calculated by subtracting pre-treatment from post-treatment scores at each post-treatment time-point) on substance use and school attendance at each of 3-6M and 1-2Y were regressed on all client and treatment predictors. Any predictors whose squared semi-partial correlation predicted 3%, or more, of the variance on the outcomes was retained for a final analysis. The choice of 3% was arbitrary since no standard exists in the literature, but this criterion was used to control for potentially confounding shared variability. For the final analyses, we regressed each outcome variable on the retained predictors with $\alpha=.05$ as the criterion for significance.

To test *H3*, the amount of treatment change, repeated measures ANOVA was employed to examine the extent of change for substance use and school attendance.

For the dichotomous outcome variables (hospitalization, running away, and contact with police), logistic regression was used with the same two-step approach to test *H2*. For *H3*, Cochran's Q was employed to investigate whether there was significant change in proportions over time on hospitalization, running away, and contact with police.

Results

Participant Profiles

Youths' mean age at the time of admission was 16.98 (SD=1.35), and 62% were male. Most lived in Ontario, 2% were from other provinces in Canada, and 3% were from other countries. Parents reported the primary drugs of choice for youths as marijuana (62%), alcohol (20%), and powder cocaine (7%), with the remainder reporting 'other' drugs such as ecstasy, ketamine, and opiates. Parents indicated that their children first started using marijuana at an average age of 13.7 (SD=1.33), alcohol at an average age of 13.7 (SD=1.36), and cocaine at an average age of 15.4 (SD=1.44).

Thirty-nine percent of PRI parents reported having divorced or separated from the youths' other biological parent. Twenty percent of parents reported that their child had a history of abuse and 40% of parents reported that their child had at least one mental health diagnosis, the most common being depression, anxiety, or oppositional disorder.

Correlations among Predictors

Correlations among the predictor variables are presented in Table 1 and indicate that female youths were more likely to have divorced parents and a history of abuse and more likely to be younger (M=16.7, SD=1.4) than male youths (M=17.2, SD=1.4). There were also correlations between treatment process factors: treatment progression was higher for youths in later years of program departure and parental engagement was higher in later years of youth treatment departure. Parent engagement with treatment was also positively related to treatment progression but this is likely because there are more opportunities for parent engagement among parents whose youths progress through higher treatment stages.

[Table 1 near here]

HI: Predictors of Pre-Treatment Severity

We expected that youths with divorced parents, those with mental health issues, and those with a history of abuse would have more severe substance abuse and other problems than those without these factors. Below are our findings for pre-treatment predictors of substance abuse, school attendance, running away, contact with police, and hospitalizations.

Substance abuse. Pre-treatment, 88.9% of youth were considered consistent problematic substance users, 23% had episodic slips, 6% were social users and 2% were low/no use (a small proportion of youths enter PRI directly from another treatment and some are admitted for behavioural reasons)., but initial analyses (Table 2) indicated that only parental divorce contributed to more than 3% of the variability in pre-treatment substance abuse. When substance abuse was regressed on parent divorce alone, 2% of the variability in the substance abuse was predicted ($\beta = .17, p = .043$), indicating that youths with parents who were divorced had more severe substance abuse at pre-treatment than youths whose parents were not divorced.

[Table 2 near here]

School attendance. At the time of admission to PRI, 38% of youths were not attending school, an additional 28% were truant, and 34% were attending regularly. Initial analyses (Table 2) indicated that none of the client characteristics uniquely predicted the variability in school attendance and nor was the overall model significant ($R_{adj}^2 = .10, n.s.$).

Running away. Forty percent of PRI youths had a recent history of running away at the time of admission. No client characteristics uniquely predicted running away at pre-treatment ($\chi^2_{(5)} = 1.56, n.s.$), as shown in Table 3.

Contact with police. During the months prior to admission, 63% of youths were reported to have had some contact with police and the initial regression with all client predictors was not

significant overall ($\chi^2_{(5)} = 149.78, p = .10$), and no individual client characteristic predicted contact with police (Table 3).

Hospitalization. Parents reported that 35% of PRI youths had had recent hospitalizations for substance use or mental health reasons prior to admission. All client characteristics together in the initial analyses did not predict whether or not youth had been hospitalized ($\chi^2_{(5)} = 147.77, p = .15$; Table 3) but mental health diagnoses was a significant individual predictor ($\beta = .67, p = .001$). With only mental health diagnoses as a predictor, we found that with each increase in the number of mental health diagnoses, youths were 1.84 times more likely to have been hospitalized ($\beta = .61, p = .002$). Note that the difference in amount of explained variance is an artifact of different standard error of the constant for the second stage analysis.

[Table 3 near here]

H2: Treatment progression

Thirty-one percent of youths in the sample completed all phases of residential treatment at PRI. Twenty-three percent departed during the transition phase, 34% during the residential phase, and 12% during the first phase (wilderness). We expected that phase of treatment departure would be lower for male youths, youths with mental health issues, those with divorced parents, or youths with a history of abuse. Initial analyses indicated that the full model predicted 5% of the variability of phase at departure ($p = .05$) and year of departure was the only factor predictive of more than 3% of this variability (Table 4). With just year of departure in the model, 6% of the variability in phase of departure was accounted for ($\beta = .25, p < .01$); youths who departed PRI in later years progressed further through treatment. Specifically, 29% of PRI youths departed in Phase 1 over the first two years of operation and only 2% departed this early

in treatment in the most recent two years. In the first two years, 25% of PRI youth completed the residential phase of treatment while 46% completed Phase 3 in the most recent two years.

[Table 4 near here]

H3: Amount of change

Substance use. Consistent with our expectations about the effectiveness of PRI, we found that youths' substance abuse was lower at 3-6M ($M=2.30$, $SD=1.07$) than at pre-treatment ($M=3.90$, $SD=.40$) ($F_{(83)} = 52.56$, $p < .001$). This effect was large ($\eta^2 = .65$), as hypothesized, and represented a reduction of more than four standard deviations. At the 1-2Y assessment, youths again had reduced substance abuse; scores at 1-2Y post-treatment ($M=2.36$, $SD=1.08$) were almost four standard deviations lower than scores at pre-treatment ($F_{(87)} = 114.06$, $p < .001$, $\eta^2 = .57$).

School attendance. Seven youths who were working full-time at 3-6M were eliminated from these analyses. The other youths increased their school attendance significantly from pre-treatment ($M=1.95$, $SD=.83$) to 3-6M post-treatment ($M=2.46$, $SD=.89$) ($F_{(56)} = 12.11$, $p = .001$, $\eta^2 = .18$), an increase of just over one half standard deviation. At 1-2Y, excluding the nine youths who were then working full-time, school attendance was also significantly higher ($M=2.31$, $SD=.96$) than at pre-treatment ($F_{(57)} = 8.25$, $p = .006$, $\eta^2 = .13$), an increase of 0.4 SD.

Running away. The proportion of youths who had run away at pre-treatment was higher than the proportion who ran away at 3-6M ($Z_{(1)} = -5.292$, $p < .001$) and at 1-2Y ($Z_{(1)} = -4.899$, $p < .001$), as shown in Table 5.

Contact with police. Youths reduced their contact with police from pre-treatment to 3-6M ($Z_{(1)} = -6.32$, $p < .001$) and to 1-2Y ($Z_{(1)} = -5.92$, $p < .001$) (Table 5).

Hospitalization. Reductions in proportions of recently hospitalized youth were significant from pre-treatment to 3-6M ($Z_{(1)} = -4.123, p < .001$) and 1-2Y ($Z_{(1)} = -4.796, p < .001$) (Table 5).

[Table 5 near here]

H4: Factors that influence change

We expected youths who were female, who progressed further through treatment, and whose parents were engaged with treatment to experience the largest decrease in substance abuse and related problems. Our findings for these investigations are below.

Substance abuse severity. Although neither gender nor parent engagement predicted substance use reduction, the initial analysis (Table 6) indicated that phase at departure and early/late (time of collection within the 3-6M time-point) were the only contributors to the variability of change on substance abuse. When analysed with just these predictors, the overall model predicted 11% of the variability of change ($p = .003$), with phase at departure as the only significant factor ($\beta = -.35, p = .001$). At 1-2Y (Table 6), phase at departure again contributed to the variability in substance abuse change, along with age, and the overall model predicted 5% of the variability. With just these two variables, the model predicted 7% of the variability ($p = .02$) in substance abuse change. Phase at departure ($\beta = -.26, p = .01$) was a significant factor, but not age at admission. As expected, the further youths progressed through treatment, the greater their reductions in substance abuse severity at both 3-6M (Figure 1) and 1-2Y.

[Table 6 near here]

[Figure 1 near here]

School attendance. The initial model with change in school attendance from pre-treatment to 3-6M regressed on all predictors accounted for 5% ($p = .24$) of the variability of change (Table 7) and the predictors that uniquely attributed to this variability were: gender, history of abuse,

parent engagement, and phase at departure. With just these predictors in the final model, 12% of the variability in school attendance change was accounted for ($p = .03$), although no individual predictor was significant. The initial model with all predictors accounted for 4% ($p = .24$) of the variability in change in school attendance from pre-treatment to 1-2Y and only parental divorce and early/late contributed to this variability (Table 7). With just these predictors in the final model, 1% of the variability was accounted for ($p = .31$) and neither predictor was individually significant.

Discussion

This study provided a comprehensive evaluation of a residential adolescent substance abuse treatment program. Youths who attended PRI during the study timeframe were typically 17-year-olds who had experience with multiple illicit drugs and had co-occurring problems with school attendance or delinquent behaviour and many had been hospitalized for substance abuse or mental health reasons. We proposed that residential treatment at Pine River Institute would serve to divert these youths away from substance abuse and its concomitant problems, and we explored client and treatment factors that influenced this diversion.

Dodge and colleagues (2009) described and tested a model of the development of substance use in adolescence and found that problematic child, parent, and peer characteristics and relationships can initiate a cascade of experiences that culminate in early substance use. In line with this model, we investigated whether differences in youths' age and gender, parent divorce, history of abuse, and mental health diagnoses were related to pre-treatment substance abuse severity, hospitalizations, school attendance, and delinquent behaviour. We found that parental divorce predicted more severe pre-treatment substance abuse, which suggests that elements of the cascade model extend beyond early illicit substance use to also affect severity of abuse and

that youths who live with only one biological parent may resort to substances to cope with the stress of a conflictual family environment, with the perceived loss of parental care, or because structural changes in the home allow for more freedom and less parental supervision (Huurre et al., 2009). We also found that mental health diagnoses were predictive of hospitalizations, which is intuitive and in line with our hypothesis.

Treatment at PRI is associated with improved health from pre- to post-treatment. There were significant and large reductions from pre-treatment to 3-6M and 1-2Y post-treatment in substance abuse, school absences, delinquent behaviour, and hospitalizations. For example, youths decreased substance abuse severity by nearly four standard deviations from pre- to post-treatment. There may be several reasons why these reductions were evident. First, treatment may have increased maturity such that youths could more effectively cope with elements of their past that initiated their particular cascade of substance use (e.g., history of abuse or parental divorce). Second, parental withdrawal is one of the elements of the cascade model and youths' may have increased their ability to contribute to appropriate family functioning, structure, and limit-setting, thereby diverting the cascade. Third, the association with deviant peers is another risk factor for the cascade, but youths who have attended PRI have experienced long-term positive peer culture and may wish to seek out similar environments post-treatment.

Youths who were at PRI in later years progressed further through treatment than those in earlier years, suggesting stabilization in program delivery. This is noteworthy, given well-known associations between treatment completion and later success. Pine River Institute enjoys a culture ingrained with the goal of encouraging youths to stay through to treatment completion and staff efforts are validated at regular knowledge exchange activities where program evaluation findings, including the benefits of treatment completion, are shared.

Reductions in substance abuse and increases in school attendance were not a function of gender, age, mental health issues, history or, in particular, parental marital status – a factor that was associated with more severe substance abuse at pre-treatment. In other words, an issue that contributed to substance abuse diversity before coming to PRI was not a factor in the diversity in treatment success. Reductions in substance abuse were, however, a function of treatment progression. This is a testament to the PRI treatment model that is based on individually-attuned expectations of social and emotional maturity and suggests that residential treatment fosters this maturity toward long-lasting effects. Importantly, treatment progression had a significant influence on the amount of improvement but treatment duration did not. To test this, we exchanged the variable ‘treatment progression’ with length of stay and the overall regression model worsened, with length of stay contributing only 0.2% of the variability in substance abuse reduction from pre-treatment to 3-6M. Thus, it is important for clinical programs to include individually-attuned treatment plans that consider the attainment of specific treatment objectives, rather than finite timelines.

There were several limitations to this study. Clearly, the state of the art in evaluating treatment effectiveness is a randomized clinical trial. It was not ethically possible to conduct such a study, given PRI’s rolling admission protocols. Given the encouraging results of the present study, we will be working toward a more rigorous design for subsequent studies. At this point, PRI has new research protocol that will capture information from a waiting list comparison group. Secondly, 20% of youths were reported by parents to have experienced a history of abuse, which may be an under-estimate, given the rates found by Titus et al., (2003) of 63%. Anecdotal reports from PRI staff suggest that ‘most’ youths have experienced some form of abuse at the hands of adults in their lives. This abuse, however, is often revealed later in

therapy but was not disclosed during the pre-treatment data collection. Thirdly, the use of single-respondent data from parents excluded self- and clinician-reports. Although PRI currently collects data from these sources, complete matching for a representative sample was, at the time of this study, not possible. We also recognize that the use of parent reports may invite ‘optimism’ bias, particularly at post-treatment assessment points. Fourth, measures of recent contact with police, hospitalization, and running away may be slightly over-estimated; historical survey questions ask for frequencies over the most recent 90-days but responses were open-ended and timelines were sometimes vague. We took the most conservative approach possible in our data interpretation but remain cautious. New research questions have been implemented that are less ambiguous with respect to the behaviour and time frame of interest. Finally, standardized measures of all indicators, fidelity checks on treatment protocols, physical health, family functioning, peer relations, and post-treatment continued care were not available, but are planned for future research.

It is worth noting that obtaining information on youths, particularly after adolescent substance abuse treatment, is known to be problematic. For example, Williams and Chang (2000) reviewed 53 studies in 2000 and found that 17% had response rates below 50%; 48% had response rates less than 75%. In the current study, the 148 respondents represent a 71% response rate – very successful in the context of in-house research efforts.

Single-program studies such as ours augment the evidence base for residential treatment and contribute to creating benchmarks for success. We found that parent divorce is associated with pre-treatment substance use severity, but not with treatment completion or later outcomes and that youth with mental health issues are more likely to have been hospitalized pre-treatment, but that these issues are not associated with treatment completion or substance abuse change.

Second, we found that changes on health outcomes were substantial. Finally, and most importantly, we found that progression through treatment fosters the greatest reductions in substance abuse pre- to post-treatment and that PRI is systematically improving their ability to retain youths through completion of treatment. In sum, we found that Pine River Institute is effective at diverting youth away from substance abuse and its concomitant issues.

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Tables

Table 1.

Correlations between Predictors

Predictors	Gender	Age	Divorce	Abuse	Diag.	Progress	Engage
Age	.17*						
Divorce	-.18*	.10					
Abuse	-.18*	-.09	.13				
Diag.	.05	.03	-.06	-.02			
Progress	-.10	.01	.01	.08	0		
Engage	-.09	-.03	.05	-.01	.01	.30***	
D-Year	.06	.04	.14	.03	.11	.25**	.49***

Note: * $p < .05$; ** $p < .01$; *** $p < .001$; Diag=N Mental Health Diagnoses; D-Year=Year of Departure; Engage=Parent Treatment Engagement

Table 2.

Youth Characteristic Predictors of Pre-Treatment Substance Abuse and School Attendance

	Substance Abuse	School Attendance
	β	β
Gender	.01	-.04
Age at Admission	.11	-.05
Parental Divorce	.18*	-.17
N MH Diagnoses	.01	.14
History of Abuse	-.12	.17

Note: * $p < .05$

Table 3.

Odds Ratios for Youth Characteristic Predictors of Pre-Treatment Crises

	Running Away	Contact with Police	Hospitalizations
Gender	.84	1.90	.48
Age	.88	1.27	.99
Divorce	1.16	1.98	.81
Diagnoses	1.04	1.14	1.96**
Abuse	.93	1.12	1.43

Note: ** $p < .01$

Table 4.

Predictors of Phase of Departure

Predictor	β
Gender	-.13
Age at Admission	.03
Parental Divorce	-.07
N MH Diagnoses	-.02
History of Abuse	.21
Year of Departure	.27**

Note: ** $p < .01$

Table 5.

Delinquent Behaviour and Hospitalization from Pre-Treatment to 3/6 and to 1-2Y

Outcome	Pre-Treatment	3-6M	1-2Y
Running Away	40%	11%	11%
Contact with Police	63%	10%	22%
Hospitalizations	35%	9%	7%

Table 6.

Predictor Beta Values for Change in Substance Abuse at 3-6M and 1-2Y

	3-6M	1-2Y
Gender	.16	.01
Age at Admission	.09	.08
Parental Divorce	-.04	-.16
N MH Diagnoses	-.02	-.26
History of Abuse	.03	.02
Parent Engage	.01	.05
Departure Phase	-.33**	-.47*
Year of Departure	-.01	-.01
Early/Late	.19	.10

Note: * $p < .05$; ** $p < .01$

Table 7.

Predictor Beta Values for Change in School Attendance at 3-6M and 1-2Y

	3-6M	1-2Y
Gender	.24	-.01
Age at Admission	-.07	.17
Parental Divorce	.13	.20
N MH Diagnoses	.11	.04
History of Abuse	-.25	-.06
Parent Engage	.22	-.02
Departure Phase	-.21	.14
Year of Departure	-.01	.21
Early/Late	.11	.28*

Note: p < .05

Figure

Figure 1

Substance Abuse Severity at Pre-Treatment and 1-2Y Post-Treatment by Phase at Departure

