Predictors of Attrition from Residential Treatment for Youth with Addictive Behaviors

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Abstract

The present study sought to examine predictors of attrition from residential treatment for adolescents with addictive behaviors. Using data from 137 adolescents and their families, latent variable models were constructed to examine three child/adolescent factors and three parenting factors as predictors of attrition. Findings indicated that emotional/social difficulties and parental involvement in treatment, as well as their interaction, had a direct effect on attrition. In addition, parenting in adolescence interacted with both substance/behavioral problems and early caregiver discipline to predict attrition. This study provided insight into the exacerbating effects of neglectful or absent parenting practices in the successful completion of adolescent substance use treatment.

Keywords: Adolescence, Behavioral Addictions, Residential Care, Attrition
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Adolescence is the developmental period most likely to involve the onset of substance use problems (Kessler et al., 2007). While the majority of adolescents report sporadic alcohol and cannabis use, over one-third of adolescents reported bingeing on alcohol in the past year and 3-5% report daily cannabis usage (Canadian Centre on Substance Abuse, 2007). Adolescents with substance use disorders are 1.4-4.6 times more likely to meet criteria for conduct disorder and are 1.3 times more likely to endorse oppositional defiant disorder (Hollen & Ortiz, 2015). Wines, Saitz, Horton, Lloyd-Travalglini, & Samet (2004) found that 28% of adolescents with a substance use disorder had a history of suicidal ideation and 21% had attempted suicide. Adolescent alcohol and substance use is also associated with increased risk of dependence in adulthood (Bukstein, 1995; King & Chassin, 2007), risky sexual behavior (Deas-Nesmith, Brady, White, & Campbell 1999; Guo et al., 2002; Kann et al., 1995), and fatal automobile accidents (Zakrajsek & Shope, 2006). Thus, early and effective interventions targeting these addictive behaviors may be important prophylactic measures for reducing risk of developing substance use disorders and a range of negative mental health outcomes.

The importance of treating addictive behaviors during this developmental period has generated significant research. For example, Hser et al. (2001) found that residential, short-term inpatient and outpatient treatments were effective at reducing substance use. In this study, as well as several others, a primary predictor of treatment success is treatment completion (Hser et al., 2001; Waldron & Turner, 2008; Williams, Chang, & Addiction Centre Adolescent Research Group, 2000). In other words, adolescents need to stay in treatment long enough to garner the benefits. This is a primary concern because rates of attrition are often high in the adolescent alcohol/substance use population (Williams et al., 2000). To reduce rates of treatment dropout in adolescent substance use treatment and increase chance of treatment success, predictors of attrition need to be identified. This is the focus of the present study.

Attrition

Rates of attrition, or “dropping-out” of a treatment before completion, vary from treatment to treatment, study to study. Concerning residential programs, some studies report a mean dropout rate for adolescent residential programs as high as 48% (e.g., Williams et al., 2000). A second study found that only 58.4% of adolescents stayed for at least 90 days in residential treatment (Hser et al., 2001). Pinpointing specific predictors of attrition might allow adolescents to be more appropriately matched to treatments where completion is more likely or provide insight into mechanistic variables operating within specific treatment protocols.

Predictors of attrition assessed by previous studies span a range of temporal distances, from childhood or even prenatal factors (e.g., history of parental substance use; Schroder, Sellman, Frampton, & Deering, 2009) to specific characteristics of the adolescent upon entering treatment (e.g., adolescent psychopathology symptoms; Pagnin, de Queiroz, & Saggese, 2005) to characteristics of the treatment itself (e.g., counsellor warmth; Cordaro, Tubman, Wagner, & Morris, 2012). A significant amount of research has focused on factors related to attrition in adolescent substance abuse settings (e.g., Schroder et al., 2009), with mixed results at best. The
present study seeks to clarify findings by examining a comprehensive list of predictors from multiple sources, utilizing latent variable modeling to organize and understand the data. Below we discuss both child/adolescent factors and parental factors because the efficacy of a treatment focused on a minor is often based not only on the characteristics of that child, but on the characteristics of the parents.

**Child/Adolescent Predictors of Attrition**

Early childhood factors could represent early cognitive and emotion vulnerability to maladaptive behavior; this is similar to the Dodge’s Cascade Model of delinquent behavior (Dodge, Malone, Greenberg, & Conduct Problems Prevention Research Group, 2008) where the beginning of a slippery slope is evident as early as problems in infancy and throughout childhood eventually lead to adolescent delinquency. Concerning the substance use and attrition literature, we are most concerned with three putative predictors 1) early academic achievement; 2) emotional/social difficulties; and 3) substance/behavioral problems.

While early academic achievement may seem to have little importance in predicting attrition in later years, it may be a more valid indicator of underlying vulnerabilities such as impulsivity, conscientiousness, and intelligence – all variables that may contribute to an adolescent sticking with a difficult treatment protocol. Later academic achievement is likely contaminated by concurrent substance abuse and potentially the association with deviant peers. In fact, academic dysfunction has been found to predict attrition from adolescent substance abuse treatment programs (Grella, Hser, Joshi, & Rounds-Bryant, 2001). However, other studies have found that early academic impairments, such as an attention deficit-hyperactivity disorder (ADHD) diagnosis, do not predict attrition (Schroder et al., 2009). No study to date has looked comprehensively at early academic achievement, including diagnoses of learning disabilities, as a predictor of attrition.

Previous research has shown that concurrent emotional and substance use issues predict higher attrition rates (Battjes, Gordon, O’Grady, & Kinlock, 2004). On the other hand, others have found that the presence of depression and/or anxiety was related to reductions in attrition in a day treatment program (Pagnin et al., 2005) and still others have found no relationship between depression and attrition (Schroder et al., 2009). Due to these conflicting findings, it is important that we clarify the relationship between emotional problems and treatment attrition. In addition to emotional problems, one might turn their attention to social problems. Indeed, social problems are often inextricably linked to emotional problems, with adolescents experiencing high levels of depression also reporting high levels of interpersonal stress (see Hammen, 2009). In addition, social difficulties in childhood like bullying (see Arsenault, Bowes, & Shakoor, 2010; Radiff, Wheaton, Robinson, & Morris, 2012) or poor social skills (see Segrin, 2000; Nilsen, Karevold, Roysamb, Gustavson, & Mathiesen, 2013) are likely precursors to both mental health and substance abuse issues. Finally, social and emotion difficulties may be specifically germane to attrition in residential treatment as opposed to outpatient therapy.

A final set of predictors involves the specific substance use behaviors and delinquent behaviors of the adolescent before entering treatment. Again, a social aspect is involved in terms
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of deviant peers. Conduct disorder or the presence of pretreatment delinquent behaviors predicts attrition from adolescent treatment programs (Grella et al., 2001; Kazdin, Mazurick, & Bass, 1993; Pagnin et al., 2005). Although, once again, findings are mixed (see Schroder et al., 2009). Deviant peers are considered a strong predictor of adolescent antisocial behavior (see Dodge et al., 2008) and have been shown to predict attrition from adolescent substance use treatment (Battjes et al., 2004). More severe substance use is also a predictor of attrition; for example, cocaine dependence predicted more sporadic attendance in an adolescent day program (e.g., Pagnin et al., 2005). While these substance and behavioral problems are often the most pressing at the start of treatment, it is unclear whether they are the primary predictors of treatment attrition when considering all other possible factors.

Parental Predictors of Attrition

Across research studies, findings have illustrated a strong relationship between adolescent drinking behaviors and parent rule-setting (Spijkerman, van den Ejinden, & Huiberts, 2008; van der Vorst, Engels, Meeus, & Dekovic, 2006; Yu, 2003). Importantly, targeting parent rule-setting along with an adolescent intervention has also been found to predict lower rates of weekly drinking in an adolescent population (Koning et al., 2009; Koning, van den Eijnden, Engels, Verdurmen, & Vollebergh, 2010). In addition, parenting style has been found to be related to adolescent drinking behavior (Bahr & Hoffman, 2010; Piko & Balazs, 2012); adolescents of parents characterized as being emotionally responsive and setting rules and demands were less likely to engage in heavy drinking. Relatedly, a recent study illustrated that parental warmth was related to positive substance use treatment outcomes in adolescents (Bertrand et al., 2013). These findings suggest that parenting factors might be important in further understanding attrition rates in an adolescent substance use treatment program.

When considering treatment-specific factors in an adolescent population, it is important to consider how caregivers are involved in the treatment process. For many treatment programs, parental involvement is necessary for child attendance. As such, most research has examined parental involvement as a necessary component for treatment retention (see Nock & Ferriter, 2005). In this study, we examine parental involvement by investigating engagement with therapy, attendance to parent therapy sessions (once/month), attendance to parenting workshops, and attendance of both parents or one parent (while adjusting for length of stay). While parental involvement examined in this way has yet to be examined in the context of youth attrition rates in substance use programs, a considerable body of research supports it as a significant predictor in treatment outcomes for adolescents. Indeed, a meta-analysis of 49 youth treatment studies found that parental motivation to partake in treatment and parental participation in the intervention predicted favorable treatment outcomes (Karver, Handelsman, Fields, & Bickman, 2006). In addition, Patterson & Chamberlain (1994) illustrated that parental non-adherence (referred to as “resistance”) in parent training therapy was associated with higher likelihood of treatment attrition and that adherence to treatment explained 40% of the variance in changes in parent discipline, which was associated with favorable treatment outcomes in children. Further, a review of interventions aimed at increasing family treatment involvement concluded that brief
and intensive interventions addressing both practical and psychological barriers to involvement improved early engagement, and a combination of motivational interviewing, family systems, and enhancing familial coping support strategies provided at multiple points throughout treatment produced improvements in long-term engagement (Ingoldsby, 2010). With this in mind, a primary goal of the present study is to examine whether parental involvement in treatment is an important predictor in retaining adolescents in the treatment process.

Present Study

The attrition results above are not easily summarized when one considers the varied measurement approaches, disparate findings, and breadth of treatment and client types. It is possible that a more consistent picture regarding attrition in residential adolescent substance abuse treatment can be drawn when comprehensive predictors are grouped into categories and explored simultaneously in comprehensive latent variable models. Here we are able to examine a range of predictors grouped into three child/adolescent attrition factors (early academic achievement; emotional/social difficulties; substance/behavioral problems) and three parental factors (parenting in childhood; parenting in adolescence; parental involvement in treatment), as well as the interactions between these variables. We examined these questions in a population of adolescents enrolled in a residential treatment program for addictive behaviors.

Method

Sample

The original sample consisted of 139 consecutively admitted clients to an adolescent residential treatment program for addictive behaviors. During the admission process to the program, parents and adolescents were provided with consent documents that indicated their agreement to contribute to research and evaluation. Two adolescents declined this consent and their data is not included in this study. Participants were 28.1% female and ranged in age from 13.93 to 20 (mean = 17.16, SD = 1.41). No data on race or ethnicity were collected. Participants were from a variety of locations in Ontario, Canada, including rural, suburban, and urban areas. While all participants entered treatment with a primary presentation of addictive behavior, the majority also reported significant mental health concerns. There was available data for 129 participants regarding how long they waited before being admitted to the PRI program. Six outliers were identified as having z > 2.58; it is likely that these people were on the waitlist, disengaged with the process, and later re-engaged. With these six removed, the average wait was 204.5 days (SD = 125.49; range 3-531).

Treatment

This study was conducted in partnership with Pine River Institute (PRI), a 40-bed comprehensive therapeutic experience for the treatment of substance abuse in adolescents, located in rural Ontario, Canada. Approximately 80% of adolescents at PRI are funded by the government health system, while the remaining pay privately. However, most patients that initially pay eventually have their services covered by the government health system. PRI consistently runs at capacity and wait time for admission is typically 1.25 years if a funded bed is required or a few weeks if paying privately.
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Adolescents are placed in one of four teams, each consisting of a core staff including a therapist, teacher, and residential youth counsellors. PRI fosters a community milieu of accountability, respect, maturity, peer mentorship, and outdoor experiences. A recent study comparing PRI participants to a matched control group demonstrated that receiving treatment from PRI resulted in a significant reduction in rule-breaking and aggressive behavior, improved quality of life, and achieved abstinence from substance use (Hamdullahpur, Uliaszek, & Mills, 2018). Parental engagement with therapy is a cornerstone of the PRI approach, with parents attending family and group sessions, learning workshops, and multi-day retreats. We define parental engagement as a parent’s willingness and ability to actively engage in the treatment process. While we do not have demographic data on the parents in the study, of those parents that we do have data, 80.3% of mothers and 79.3% of fathers have at least a college education; 20.6% of mothers and 3.3% of fathers were unemployed or homemakers; and 67.2% of adolescent participants reside in two-parent homes.

There are four phases of treatment progression: Outdoor Leadership Experience (Phase 1), Residence (Phase 2), Transition between residence and home (Phase 3), and Outpatient aftercare (Phase 4). Youth precede to subsequent phases when the clinical team determines they have demonstrated appropriate levels of empathy, future orientation, emotion regulation, respect for societal and legal norms, and interpersonal functioning. Treatment duration varies by individual need, but is typically two months in Phase 1, 1.5 years across Phases 2 and 3, and 3 months to one year in Phase 4. The achievement of Phase 4 represents treatment completion. The outcome variable used in the present study is the phase of treatment progression achieved (1-4). Participants achieved the following phase of treatment: 1 (n = 20; 14.4%); 2 (n = 36; 25.9%); 3 (n = 18; 12.9%); 4 (n = 65; 46.8%). This allows for our attrition outcome to be an ordinal measure of treatment success gained before adolescents stopped treatment, instead of a dichotomous ‘drop out’ variable. We do recognize that the precise way to define attrition is an important topic of research in and of itself (Warnick, Gonzalez, Weersing, Scahill, & Woolston, 2012); here we define attrition as an adolescent leaving treatment against clinician recommendation to do so, a definition that has been used numerous times in previous research investigations (see Warnick et al., 2012 for a review). Importantly, we use a unique indicator of attrition that relies on an ordinal rather than dichotomous measure of attrition (i.e., based on which phase out of four phases of treatment each youth reached before dropping out), with a low phase of attainment representing an adolescent dropping out much earlier and at a much higher symptomatic level than someone leaving at a later phase.

Measures
Information was collected from four sources: (1) clinician-report of parental, childhood and adolescent behaviors; (2) parent admission applications (81% maternal caregiver), including questions on their child’s current presentation and historical factors, completed on average 289 (SD = 232) days prior to the youth’s entry to the program; (3) electronic client records documenting parental attendance throughout treatment. Little’s Missing Completely at Random (MCAR) Test was completed on all available data. This test was not significant (χ² (8807) =
6852.90, \( p < .05 \), indicating no evidence of systematic missingness. In addition, the dataset was examined for outliers, independence of errors, and multicollinearity, revealing no issues with any participant or variable.

**Data Analysis**

First, measurement models were estimated for each latent variable. Each was assessed for fit and individual predictors were examined for consistency with the theory. Second, the factor scores for these latent variables were saved to a data file. Third, these factor scores, as well as all two-way interactions, were entered as predictors in an ordinal logistic regression model predicting phase of treatment progression at departure.

**Results**

**Measurement Models**

Weighted least squares estimation in Mplus 8 was used to fit all latent variable models. This method was used to account for the presence of dichotomous and/or categorical variables which can cause biased fit results when maximum likelihood estimation is used. Close attention was paid to the comparative fit index (CFI), root mean square error of approximation (RMSEA) and weighted root mean square residual (WRMR) to determine model fit. All models achieved between adequate and excellent fit (Table 1).

**Early Academic Achievement.** The latent variable for early academic achievement included eight items assessing grade 3 and grade 6 achievement, parental assessment of underachievement, and both parental and clinician assessment of a learning disability or ADHD. Fit of this model was good (Table 1) and all indicators were significant with standardized factor loadings ranging from \(-.31\) (\(se = .09\)) for parent-reported achievement to \(.99\) (\(se = .06\)) for clinician-reported learning disability.

**Emotional/Social Difficulties.** The latent variable for emotional/social difficulties included eight items assessing aggression, early conduct disorder (in childhood), social skills, self-confidence and hospitalization for mental health. Fit of this model was excellent (Table 1) and all indicators were significant with standardized factor loadings ranging from \(-.35\) (\(se = .16\)) for parent-reported hospitalization for mental health to \(.95\) (\(se = .07\)) for early conduct disorder.

**Substance/Behavioral Problems.** The latent variable for substance/behavioral problems included six items assessing parent-reported adolescent substance use and overdose, as well as parent- and clinician-reported self-harm and suicidality. Fit of this model was excellent (Table 1) and all indicators were significant with standardized factor loadings ranging from \(.37\) (\(se = .16\)) for parent-reported adolescent substance use to \(.85\) (\(se = .08\)) for parent-reported self-harm.

**Early Caregiver Discipline.** The latent variable for early caregiver discipline included nine items assessing discipline style, rule setting, and parental modeling of aggression and deviance all during childhood or early adolescence. Fit of this model was excellent (Table 1) and
all indicators were significant with standardized factor loadings ranging from .48 (se = .14) for abusive/erratic discipline style to .996 (se = .05) for inconsistent permissiveness.

**Parenting in Early Adolescence.** The latent variable for parenting in early adolescence included eight items assessing parental monitoring, involvement, attunement, and warmth in adolescence. Fit of the original model was adequate and all indicators were significant, but a closer examination of the modification indices revealed a correlated error between parental knowledge of child’s activities and parental involvement in child’s activities. This correlated error term was added to the model and fit of the adjusted model was excellent (Table 1). Standardized factor loadings ranging from .28 (se = .17) for parental knowledge of child’s activities to .69 (se = .10) for paternal attunement.

**Parental Involvement in Treatment.** The latent variable for parental involvement in treatment included four items assessing clinician-rated parental engagement in therapy, parental attendance at PRI events, and the average number of caregivers at those events. Fit of the original model was excellent and indicators were significant but there was a Heywood case. Upon further examination, it was evident that there was a correlated error between maternal and paternal engagement with therapy. This correlated error term was added to the model and fit of the adjusted model was excellent (Table 1). Standardized factor loadings ranging from .28 (se = .18) for parental attendance to .76 (se = .33) for paternal engagement with therapy.

**Predicting Phase of Departure**

The correlations between factor scores are displayed in Table 2. Only the parental variables were significantly correlated with one another. All factor score variables were entered as predictors of phase of departure in an ordinal regression model. In addition, all two-way interactions were included in the model. Complementary log-log link function was used because higher ordinal categories were more likely than lower categories. -2 Log Likelihood (276.41, \( \chi^2 = 37.75, p < .05 \)) indicated that the model was predicting significantly better than the intercept model. There were significant main effects of emotional/social difficulties and parental involvement in treatment; the interaction of these variables was also significant. There were two additional significant interaction effects: substance/behavioral problems interacting with parenting in adolescence and early caregiver discipline interacting with parenting in adolescence. All results are displayed in Table 3.

**Discussion**

The present study sought to explore the impact of both child/adolescent factors and parental factors in predicting attrition from a residential substance abuse program for adolescents. Understanding the nature of attrition is necessary because it is the flip side of treatment success, with those adolescents that stay in treatment longer having better outcomes. This study capitalized on an ordinal measure of attrition and a comprehensive assessment of multiple factors examined in a single model so that unique effects and interactions could be explored. Results supported emotional/social difficulties and parental involvement in treatment, as well as their interaction, as predictors of attrition. Parenting in adolescence interacted with both substance/behavioral problems and early caregiver discipline to predict heightened attrition.
as well. These findings highlight the importance of parenting and parental involvement in treatment as a component of successful completion of residential therapy.

Emotional/social difficulties was the only child/adolescent factor to directly predict attrition above and beyond all other factors. This variable, which largely captures childhood problems like aggression and deficits in confidence and social skills, may represent vulnerability factors related to mental illness that often precede substance use disorders. These interpersonal problems may make it difficult for an adolescent to function in a residential program where they have roommates, communal meals, and myriad group-based activities. It is possible that those who evidenced high levels of these problems in childhood might seek intensive outpatient or day programs as an alternative treatment. It is interesting that this variable also interacted with parental involvement in treatment suggesting that adolescents with these vulnerabilities will fair even worse if their parents are unable or unwilling to participate in their treatment.

The finding that less parental involvement in treatment predicted greater attrition was not surprising. A significant body of literature supports parental involvement in treatment as an important predictor of favorable treatment outcomes and long-term engagement (Ingoldsby, 2010; Karver et al., 2006). This study extends these findings by illustrating that parental involvement also predicts attrition rates in adolescent residential treatment for addictive behaviors. This is important because it may be assumed that because an adolescent is in a contained environment away at a residential program that parental help and support is less needed. This does not appear to be the case. Future research should investigate if providing additional interventions aimed at increasing parental involvement are likely to reduce attrition and, consequently, increase positive treatment outcomes.

The parenting in adolescence variable captured monitoring, attunement, and warmth. While this variable did not have a direct main effect on attrition, it did interact with one child/adolescent factor and one additional parenting factor to predict attrition. Concerning the former case, parenting in adolescence interacted with substance/behavioral problems to predict worse outcome. While neither of these variables was potent enough in this sample to detect significant direct main effects, it appears that when an adolescent is experiencing significant problems with substances and mental health and that is combined with a neglectful parenting style, this makes it less likely for the adolescent to be able to complete treatment. In this case, emphasis on parent training and improving the relationships between the adolescent and parent could be a protective factor for those with high levels of substance and behavioral problems.

Parenting in adolescence also interacted with early caregiver discipline, a variable capturing parenting style in childhood. This seems to indicate that early problems in parenting (poor rule setting, modeling anger and deviance) can be ameliorated by high levels of monitoring and warmth in adolescence. Stated differently, a continuation of poor parenting practices from childhood to adolescence seems to have a multiplicative effect on predicting the negative outcomes of attrition.

There are limitations to the current study. First, we did not examine treatment outcomes in this study. While our primary purpose was to identify predictors of attrition, it may have been
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informative to examine this along with positive therapeutic benefit, to identify factors that predict attrition and negative treatment outcomes. However, our outcome measure – Phase of treatment progression at departure- is a hybrid measure of attrition and outcome as moving to the next phase is not predicated on time, but on treatment outcome. In this way, those achieving a higher Phase are thought of as also having a better outcome. Also, another study examining a slightly different sample from the same institution has been submitted citing positive outcomes compared to a control condition (Hamdullahpur, Uliaszek, & Mills, 2018). Second, additional moderator variables such as gender, race, and socioeconomic status could not be examined because of incomplete data and the ethical parameters of the treatment site.

Overall, the above study used a naturalistic study design to examine variables associated with treatment attrition using an adolescent sample with addictive behaviors. This study examined a comprehensive set of factors that included both child/adolescent and parental factors to establish which factors were most predictive of attrition. We believe highlighting the role of emotional, social, and behavioral difficulties, as well as parenting and parental involvement in treatment, provides important information for future prevention and intervention efforts. In this way, future studies can specifically target the aforementioned variables to reduce treatment attrition and ultimately enhance treatment outcomes for adolescents with alcohol/substance use disorders.
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References


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Table 1.

*Fit Indices for Latent Factors.*

<table>
<thead>
<tr>
<th>Category</th>
<th>RMSEA (90% CI)</th>
<th>CFI</th>
<th>WRMR</th>
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<tr>
<td>Early Academic Achievement</td>
<td>.16 (.13-.20)</td>
<td>.86</td>
<td>1.56</td>
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<tr>
<td>Emotional/Social Difficulties</td>
<td>.04 (.00-.09)</td>
<td>.99</td>
<td>.69</td>
</tr>
<tr>
<td>Substance/Behavioral Problems</td>
<td>.04 (00-.11)</td>
<td>.99</td>
<td>.57</td>
</tr>
<tr>
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<td>.12 (.09-.15)</td>
<td>.94</td>
<td>1.38</td>
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<tr>
<td>Parenting in Adolescence</td>
<td>.05 (.00-.10)</td>
<td>.93</td>
<td>.60</td>
</tr>
<tr>
<td>Parental Involvement in Treatment</td>
<td>.15 (.02-.31)</td>
<td>.96</td>
<td>.05 (SRMR)</td>
</tr>
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</table>

*Note. RMSEA = Root Mean Square Error of Approximation; CI = Confidence Interval; CFI = Comparative Fit Index; WRMR = Weighted Root Mean Square Residual; SRMR = Standardized Root Mean Square Residual*
### Correlations Between Factor Scores.

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<tr>
<th></th>
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<th>SBP</th>
<th>ECD</th>
<th>PA</th>
<th>PIT</th>
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<td>Early Academic Achievement (EAA)</td>
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*Note. *** = p < .001*
Table 3.

**Ordinal Regression of Factor Scores Predicting Phase of Departure.**

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<th>Factor Score/Interaction</th>
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<td>.90</td>
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<td>5.65*</td>
</tr>
<tr>
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<td>.90</td>
<td>.89</td>
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<tr>
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<td>2.79</td>
<td>5.00*</td>
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<tr>
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<tr>
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*Note. * = p < .05"