AN EXAMINATION OF COGNITIVE CHANGES AMONG YOUTH IN COMMUNITY-BASED AND JUVENILE JUSTICE SECURE RESIDENTIAL TREATMENT

by

RACHEL DAWN CRAWLEY

Bachelor of Science, 2004
Sam Houston State University
Huntsville, Texas

Master of Arts, 2010
Amberton University
Garland, Texas

Master of Science, 2013
Texas Christian University
Fort Worth, Texas

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by

Rachel D. Crawley

Dissertation approved:

Major Professor

For The College of Science and Engineering

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

An Examination of Cognitive Changes among Youth in Community-Based and Juvenile Justice Secure Residential Treatment

Cognitive-based interventions are effective at improving treatment outcomes among substance users (Carroll et al., 1994; Carroll et al., 2000) and heavily emphasized in many evidence-based substance abuse treatment practices for adolescents (National Institute on Drug Abuse, 2012; Wetherill & Tapert, 2013; Winters, Botzet, & Fahnhorst, 2011). Interventions aimed specifically at improving skills such as self-regulation, awareness, and planning enhance the positive effects of substance abuse treatment (Dansereau, Knight, & Flynn, 2013; DeVito et al., 2011; Konova, Moeller, & Goldstein, 2013). Thus, increasing clinical attention to cognition is recommended (Bickel, Christensen, & Marsch, 2011; Bickel & Yi, 2008; Brady, Gray, & Tolliver, 2011; Sofuoglu, Sugarman, & Carroll, 2010). It is clear, however, that treatment-enrolled adolescents may be at varying stages of neurological development, so no single intervention is appropriate for all youth in treatment (see Brady, Gray, & Tolliver, 2011). Studies also show that youth involved with juvenile justice may have greater cognitive impairments than youth in the community (Bartol & Bartol, 2005; Walters, 2014; Wasserman et al., 2003). Differences in reasoning capacity among youth may be an important consideration for treatment practices, specifically when determining which clinical approach would be the most efficacious for specific samples of adolescents. Therefore, more research is needed to better understand the unique needs of youth in substance abuse treatment and to inform policy around setting-appropriate assessments and interventions.

Despite the evidence that focusing on improving higher-level thinking enhances substance abuse treatment for youth, these constructs are not frequently studied as outcome measures, and findings from the few studies that have examined cognitive functioning during standard treatment are contradictory (Alfonso, Caracuel, Delgado-Pastor, & Verdejo-García, 2011; Dingwall, Maruff, Fredrickson, & Cairney, 2011; Joe, Rowan-Szal, Greener, Simpson, & Vance, 2010; Knight, Dansereau, Becan, Rowan, & Flynn, 2014; Rowan-Szal, Joe, Simpson, Greener, & Vance, 2009; Rupp, Kemmler, Kurz, Hinterhuber, & Fleischhacker, 2012). In order

to advance adolescent treatment, a better understanding is needed regarding how cognition changes during the standard treatment process and how cognitive needs may differ between youth detained within the juvenile justice system and youth outside the secure detention system. This study addresses a gap in the literature by examining important thinking skills (urgency, deliberate planning, and criminal thinking) among youth in community-based and secure juvenile justice-based residential treatment settings. The following paragraphs introduce the literature related to cognitive functioning in treatment, the unique needs of juvenile delinquent populations, the hypotheses and methods, and the results and discussion for this study.

Evidence-Based Treatment Approaches Emphasize Cognition

Many evidence-based treatment approaches include cognitive skill development such as introspection, decision making, problem solving, planning, impulse control/self-regulation, and improving attitudes toward avoiding drugs and criminal behavior (see National Institute on Drug Abuse, 2012; Wetherill & Tapert, 2013). Cognitive-Behavioral Therapy (CBT) uses skill-development strategies aimed at improving thinking abilities (e.g., thought/state awareness, self-monitoring, deliberate behaviors, and avoidance/coping planning) and correcting problematic behavior patterns (Carroll & Onken, 2005). CBT is advantageous because the cognitive skills learned during treatment also transfer to non-treatment contexts (e.g., at home, with family and friends, etc.; Carroll et al., 1994; Carroll et al., 2000). Other popular evidence-based approaches that address problem-solving, impulse control, and/or criminal thinking include the Matrix Model (McDowell, 2006; Rawson et al., 2004; Rawson et al., 1995), family-based therapies (e.g., Multidimensional Family Therapy; Baldwin, Christian, Berkeljon, Shadish, & Bean, 2012; Danzer, 2013; Henderson, Dakof, Greenbaum, & Liddle, 2010; Liddle, 2013; Rowe, Liddle, Dakof, & Henderson, 2009), Adolescent Community Reinforcement Approach (Dakof, Godley, & Smith, 2011; Godley et al., 2014; Godley, Smith, Meyers, & Godley, 2009), and Assertive Continuing Care (Garner, Godley, Funk, Lee, & Garnick, 2010; Godley, Godley, Dennis, Funk, & Passetti, 2002; National Institute on Drug Abuse, 2012; Ruiz, Korchmaros, Greene, & Hedges, 2011). Thus, cognitive-based approaches are commonly used in treatment.

Facilitating the development of cognitive skills (e.g., thought/state awareness, self-monitoring, and planning) is important for adolescents. The teenage years correspond with natural neurocognitive maturation during which higher-level reasoning improves and begins to override impulsive systems. This results in a decrease in risky behavior and an increase in the use of rational thinking and deliberate behavior (Casey, Getz, & Galvan, 2008; Durston et al., 2006; Spear, 2009; Steinberg, 2008). However, interruptions such as heavy substance use in the normal maturation process may result in cognitive impairments (Clark, Thatcher, & Tapert, 2008; De Bellis et al., 2005; Jacobsen, Mencl, Westerveld, & Pugh, 2004; Lubman, Yücel, & Hall, 2007; Medina, Schweinsburg, Cohen-Zion, Nagel, & Tapert, 2007; Squeglia, Jacobus, & Tapert, 2009). In addition to the challenges of normal and/or possibly disrupted development, there is also a high prevalence of co-occurring mental health problems among youth who abuse drugs (e.g., attention-deficit hyperactivity disorder, problem behaviors, and oppositional defiant disorder; Armstrong & Costello, 2002; National Institute on Drug Abuse, 2012; Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality, 2012a; 2012b). The presence of co-occurring disorders may exacerbate the effects of substance use on neurocognitive development, or vice versa, by further interfering with the normal growth trajectory, or interfering with a youth's ability to respond to interventions aimed at facilitating adaptive maturation. These issues may compound the cognitive vulnerabilities of teens in substance abuse treatment.

Cognitive Functioning Deficits Interfere with Substance Abuse Treatment

Substance abuse treatment-seekers are prone to deficits in higher-level thinking such as decision making, self-control, and planning (Brady, Gray, & Tolliver, 2011). For example, drug users often demonstrate poor inhibitory control, problems with visual and working memory, difficulty sustaining attention, and poor decision making and problem solving skills (Brady et al., 2011; Glass et al., 2009; Jovanovski, Erb, & Zakzanis, 2005; London et al., 2005; Salo et al., 2005; Scott et al., 2007; Solowij & Battisti, 2008). Adolescents are especially vulnerable to cognitive challenges due to neurological development imbalances such as the comparatively

large influence of the impulsive systems on behavior compared to that of the rational systems (Anokhin, Golosheykin, Grant, & Heath, 2011; Bickel et al., 2007; Chambers, Taylor, & Potenza, 2003). Thus, developing youth are more susceptible to problems with self-regulation, impulsivity, and low use of deliberative thinking and decision making. These issues negatively impact treatment in several ways. First, problems with self-regulation (e.g., impulsivity) predict shorter treatment retention (Aharonovich, Brooks, Nunes, & Hasin, 2008; Aharonovich et al., 2006; Verdejo-García et al., 2012; Vocci, 2008). Problems with delayed discounting (difficulty delaying gratification for longer-term benefits; de Wit, 2009; Perry & Carroll, 2008) are likewise associated with poor treatment outcomes and lower abstinence from drugs during treatment (Krishnan-Sarin et al., 2007; Stanger et al., 2012; Stanger et al., 2013). In addition, both positive and negative urgency (behaving impulsively when experiencing positive or negative emotions) also impact treatment negatively. Higher positive urgency inhibits desire for help (Becan, Knight, Crawley, Joe, & Flynn, 2015), and higher negative urgency is related to stronger expected positive benefits of drug use and weaker expected negative consequences of drug use (Doran et al., 2012; Vangsness, Bry, & LaBouvie, 2005). Second, because of the heavy influence of impulsive systems, youth generally engage less in analytic thinking and decision making (Bickel & Yi, 2008) which may hinder their ability to learn new coping skills in CBT settings (Kiluk, Nich, & Carroll, 2011).

Cognitive Functioning Can Improve with Intervention

Fortunately, research indicates that neurocognitive functioning partially recovers with sustained abstinence (Schulte et al., 2014). This is good news considering that brain regions associated with cognitive control and planning (prefrontal cortex and ventral tegmental area) are among the neural mediation mechanism candidates being considered as accounting for the behavioral success of brief cognitive-based interventions (Potenza, Sofuoglu, Carroll, & Rounsaville, 2011). Other studies also support the notion that targeted cognitive-behavior change directly impacts brain activity and subsequent behavior. For example, compared to other intervention types, cognitive-based interventions are more likely to activate areas of the brain

associated with awareness, control, and attention (anterior cingulate cortex, middle frontal gyrus, and precuneus; Konova, Moeller, & Goldstein, 2013). This relationship between physical and behavioral change suggests that behavioral measures of thinking reflect neurological status. In other words, cognitive-behavioral interventions that facilitate learning specific skills also physically reinforce specific brain pathways. For instance, CBT strategies improve cognitive control performance in treatment seeking adults (DeVito et al., 2011), and mindfulness strategies reduce cravings (Westbrook et al., 2011). Similarly among youth, research indicates that CBT approaches may be the most appropriate to improve reasoning, whereas mindfulness strategies may be more appropriate for youth with emotion- and behavioral-regulation difficulties (Wetherill & Tapert, 2013). Research suggests that additional CBT sessions or adjunct strategies aimed at improving higher-level thinking may be especially beneficial for youth who are still developing inhibitory control. Furthermore, behaviorally assessing their cognitive functioning or impairment may provide useful information about which approach (e.g., mindfulness or CBT) would be most appropriate (Wetherill & Tapert, 2013). Several researchers have suggested that assessing and rehabilitating cognitive functions (i.e., improving decision making and impulsivity) should be a primary clinical goal (Bickel, Christensen, & Marsch, 2011; Bickel & Yi, 2008; Brady, Gray, & Tolliver, 2011; Sofuoglu, DeVito, Waters, & Carroll, 2013; Sofuoglu, Sugarman, & Carroll, 2010).

Summary of the Relationship between Cognitive Functioning and Treatment

Research has established that substance users are vulnerable to cognitive deficits, those deficits can be barriers to treatment, and the appropriate application of cognitive interventions can change neurological pathways, improve functioning, and benefit the treatment experience. It is clear that higher-level thinking plays an important role in the treatment process, but less is known about how it changes during treatment. Understanding how cognitive constructs change in treatment is an important step toward enhancing policy and guiding future research (Brady, Gray, & Toliver, 2011); however, studies examining these changes during treatment have not reported consistent results. For example, several studies found that reasoning skills do not

change during standard treatment (Alfonso, Caracuel, Delgado-Pastor, & Verdejo-García, 2011; Rupp, Kemmler, Kurz, Hinterhuber, & Fleischhacker, 2012) but do change when those constructs are specifically targeted (Knight, Dansereau, Becan, Rowan, & Flynn, in press). In contrast, other studies found that cognitive functioning improved during substance abuse treatment without additional programming (Dingwall, Maruff, Fredrickson, & Cairney, 2011). Although these findings appear to indicate that specifically targeting higher-level processes may be more effective at improving thinking skills than general treatment protocols, a conclusion about how it changes during treatment in general cannot be drawn.

In addition, although criminal behavior is a prevalent problem among young treatment-seekers and is frequently an outcome measure in treatment studies (Henggeler, Clingempeel, Brondino, & Pickrel, 2002; Hser et al., 2001; Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality, 2012a, 2012b), little is known about how criminal thinking (beliefs related to criminal behaviors; e.g., rationalizing criminal activity; see Walters, 1990) changes in substance abuse treatment. As with other cognition-behavior relationships, greater criminal thinking among youth is related to more delinquent behavior (Dembo, Turner, & Jainchill, 2007). Research indicates that criminal behaviors tend to decrease following treatment (e.g., Henggeler et al., 2002; Hser et al., 2001), and criminal thinking among adult inmates in secure treatment settings can be reduced during treatment (Joe, Rowan-Szal, Greener, Simpson, & Vance, 2010; Rowan-Szal, Joe, Simpson, Greener, & Vance, 2009), but very few studies examine changes in criminal thinking among youth over the course of treatment. Considering the significant overlaps between adolescent substance use and crime (Belenko & Logan, 2003; Clark, 2004; Henggeler et al., 2002; Hicks, Iacono, & McGue, 2010; Kandel & Davies, 1992; Kandel & Yamaguchi, 2002; Zhang, 2004), and self-control and crime (Evans, Cullen, Burton, Dunaway, & Benson, 1997; Gottfredson & Hirschi, 1990; Pratt & Cullen, 2006), criminal thinking can be considered a type of reasoning

that is important to assess and deal with during treatment. More research is needed to understand how these various cognition constructs (e.g., urgency, planning, and criminal thinking) change during treatment.

Differences between Juvenile Justice-Involved and Juvenile Justice Non-Involved Youth

Evidence suggests that youth with more juvenile justice involvement or greater delinquency may demonstrate higher cognitive dysfunction than those with less juvenile justice involvement. Studies indicate that high impulsivity, poor cognitive development, high behavioral activation, and low behavioral inhibition among children are related to increased adolescent delinquency (Bartol & Bartol, 2005; Wasserman et al., 2003). In addition, among youth adjudicated delinquent, those who have engaged in both delinquency and substance use report more severe personality problems compared to youth who only engaged in one or the other (Walters, 2014). These youth also tend to continue engaging in crime and substance use which may indicate that they are less open to cognitive improvements (Walters, 2014). Regarding motivation, youth who are juvenile justice-mandated to treatment report lower problem recognition, desire for help, treatment readiness, confidence in treatment, and treatment satisfaction compared to non-mandated youth (Farabee, Nelson, & Spence, 1993; Marshall & Hser, 2002). Research also shows that youth with more problem behaviors often struggle with standard treatment (Godley, Godley, Funk, Dennis, & Loveland, 2001; Grella, Hser, Joshi, & Rounds-Bryant, 2001; O'Neill, Lidz, & Heilbrun, 2003; Wong, Hser, & Grella, 2002).

Given these findings, it is reasonable to expect that cognitive functioning and change during treatment may differ between youth enrolled in community-based versus juvenile justice-based settings. For example, considering that criminal behavior is related to criminal thinking, it is likely that juveniles in secure treatment settings have higher criminal thinking than those in community-based settings. Because evidence suggests that subgroups of youth may have different cognitive functioning levels, it is important to examine cognitive constructs across both samples of youth.

Study Aims and Hypotheses

Although multiple studies document the utility of targeted cognitive interventions for improving self-control and deliberative decision-making/planning, few examine how these constructs change during standard treatment among youth. In addition, few studies examine criminal thinking change among youth during treatment despite its link with criminal behavior. The first aim of this study is to address this gap in the literature by determining if specific aspects of cognition (urgency, deliberate planning, and criminal thinking) change over the course of standard residential treatment among youth. Hypothesis 1 states that, controlling for background characteristics, overall urgency, planning, and criminal thinking will improve during treatment.

Research suggests that youth in secure treatment settings may have more pronounced cognitive deficiencies than those in community-based settings (Bartol & Bartol, 2005; Walters, 2014; Wasserman et al., 2003), but little is known about the differences between youth in secure versus community-based treatment. The second aim of this study is to determine if adolescents in community-based residential treatment differ from those in juvenile justice-based secure treatment with regard to static cognitive functioning preliminary to examining differences in cognitive change during treatment. Hypothesis 2 states that, controlling for background characteristics and time in treatment, youth in community-based settings will report lower urgency, greater use of intentional planning, and lower criminal thinking than youth in juvenile justice-based settings.

Research indicates that youth with histories of more delinquency benefit less from treatment than youth with less severe delinquency histories (Godley, Godley, Funk, Dennis, & Loveland, 2001; Grella, Hser, Joshi, & Rounds-Bryant, 2001; O'Neill, Lidz, & Heilbrun, 2003; Wong, Hser, & Grella, 2002). Furthermore, youth mandated to treatment by juvenile justice are less motivated and engaged in treatment (Farabee, Nelson, & Spence, 1993; Marshall & Hser, 2002). Thus, in addition to possible static differences between youth in community-based settings and those in secure settings, these two samples of youth may also differ on cognitive change over time. The third aim of this study is to determine if changes in cognitive functioning

differ between youth in community-based treatment and youth in juvenile justice-based treatment. Hypothesis 3 states that, controlling for background characteristics, youth in community-based treatment settings will report greater improvements in urgency, intentional planning, and criminal thinking than youth in juvenile justice-based settings.

Method

Procedure

Data were collected as a part of the Texas Christian University Adolescent Project (Knight, Becan, Landrum, Joe, & Flynn, 2014). This larger study aimed to make substance abuse treatment assessments that are commonly administered to adults more accessible for use in adolescent treatment settings. The project was funded by the National Institute on Drug Abuse, National Institutes of Health. Eight community-based residential substance abuse treatment programs located in 3 states in the Southwest, Pacific Coast, and New England regions of the U.S. were recruited in 2010 to participate in the study. In 2012, two secure juvenile justice treatment programs located in a Mid-western U.S. state were recruited to participate. Data collection procedures were reviewed and approved by the Institutional Review Boards at Texas Christian University and the parent agencies for participating treatment programs. All participating facilities agreed via a qualified service organization agreement with the research team to incorporate a youth assessment package into their standard operating protocols and, in exchange, provide de-identified assessment data. The research team then provided analytic and reporting services for the participating programs. Because adolescent-identifying data were not available to the research team, consent from adolescents enrolled in treatment and their guardians was not required. Youth completed assessments voluntarily as a part of their standard treatment protocol. Youth were permitted to refuse assessment completion.

Procedure for Community-Based Programs. Prior to incorporating the assessment package into their standard operating procedures, each facility chose representatives to participate in a researcher-lead training. During training, facility staff were introduced to the research study's aims and assessment package, and were trained to use a web-based assessment

program to administer the client assessments, track assessment completion across time, and interpret the reports generated by the program. Facilities then began conducting assessments via the web-based assessment program at treatment intake, 35 days, and 90 days into treatment.

Each facility and each facility staff member was assigned an identification number to use within the web-based system. To administer assessments, facility staff were instructed to use the log-in identification numbers they were provided to access the web-based assessment system. Staff then created an account for each newly enrolled treatment participant using randomly generated identification numbers. Youth identification numbers were not connected to identifiable information, and only treatment staff had access to information connecting youth identification numbers to identifying information. This information was not shared with research staff. Once a new account was created for a youth, staff entered basic treatment episode and demographic information about the youth (date of treatment enrollment, gender, race, etc.) and then scheduled the first assessment administration. Youth completed intake assessments via the web-based program using a point-and-click interface. Clients were monitored by treatment staff to avoid improper computer use. Staff were physically present and available to answer questions about the assessments, but youth completed the assessment items independently. Once a youth completed the first assessment administration, treatment staff could access a report generated by the web-based system that summarized the youth's responses and flagged responses that were among the lowest or highest 25% among the facility's general population. These reports could be printed and used to assist staff with treatment planning and documentation. Youth whose assessments were flagged (e.g., high levels of depression) were further assessed by the clinical staff. Assessment reports were also used to provide feedback to the youth about their progress in treatment.

Procedure for Juvenile Justice Programs. Study procedures for the juvenile justice programs differed due to the lack of internet access within detention centers. Because of this limitation, both facilities were equipped to conduct assessments using pencil-and-paper forms. Before the facilities incorporated the assessment package into their standard procedures,

researchers visited each location to conduct training on administering assessments and sharing data. During training, facility staff were introduced to the research study's aims and assessment package, and were trained to use pencil-and-paper assessment forms, to scan assessment forms using an automated data capture scanner provided by the research team, import scanned data into a spreadsheet that generated assessment summary reports, to interpret those reports, and to track assessment completion across time using a spreadsheet provided by researchers. The research team installed an automated data capture scanner at each facility and provided additional training on how to back up data, compress electronic files for transfer from the facility to the research team, and use secure data sharing software to transfer data files. Facilities then began conducting assessments via the pencil-and-paper forms at treatment intake, 35 days, and 90 days into treatment. Once a youth completed an assessment administration and program staff scanned the youth's response forms through the automated data capture system, staff could import the youth's data into a spreadsheet which generated a report that summarized the youth's responses and identified responses that significantly differed from the facility's general population. Similar to community-based reports, these spreadsheet-generated reports could be printed and used to assist staff with treatment planning and documentation.

Each facility and each facility staff member was assigned an identification number to include on the paper assessment forms. To administer assessments, facility staff were instructed to fill in administrative fields (e.g., facility identification, youth identification, date of assessment, assessment administration number, etc.) on the paper forms prior to administration. Youth were assigned unique identification numbers by facility staff but the research team did not have access to names or other identifying information linked to those unique numbers. Youth completed assessment forms independently, either individually or within a group of other youth while being supervised by facility staff. To track assessment completions for youth across time, facility staff entered youth identification numbers and treatment episode data into separate rows of a spreadsheet provided by researchers.

Program Sample

Community-Based Programs. Eight community-based, private non-profit adolescent residential treatment programs agreed to participate in the study. All programs were described as modified therapeutic communities with a cognitive-behavioral treatment philosophy, and most were affiliated with larger organizations. Programs were located in rural (n = 2), urban (n = 3), and suburban (n = 3) areas. Program size and planned length of stay varied from serving 25 to 100 youth daily and from 30 days to 12 months of planned treatment.

Juvenile Justice Programs. Two secure juvenile justice treatment programs agreed to participate. Both programs were described as modified therapeutic communities with a cognitive-behavioral treatment philosophy. Both programs were affiliated with larger juvenile justice and treatment systems, were in rural areas, and housed youth from rural, suburban, and urban areas. Programs included 2 to 6 counselors and served approximately 30 to 40 youth daily. Planned length of stay varied from 14 to 120 days and was dependent upon legal mandates and decisions.

Youth Sample

Participants included 359 male adolescents receiving services within the 10 programs described above. Each program contributed data from 11 to 96 youth (average = 36). Adolescents were 13 to 20 years old (M = 16.19). Most reported non-Hispanic ethnicity (51%), and the most frequently reported race was White (37%) or Other (36%; see Table 1). The majority of youth indicated that they have previously been involved in the juvenile justice system (picked up by police, 80%; on probation, 73%; and locked up in juvenile detention, 71%). Participants most frequently indicated that marijuana (28%) was the drug that caused them the most problems followed by “none” (23%). Nearly half of the sample (48%) scored within the high drug use severity category on the TCU Drug Screen II (ADOL; Knight, Simpson, & Hiller, 2002). Newly admitted clients completed TCU assessment forms at admission (Time 1), approximately 35 days into treatment (Time 2), and at about 90 days while still in treatment (Time 3).

Table 1
Sample Demographics by Treatment Setting

	Study Sample *n* = 359		Community-Based Sample *n* = 237		Juvenile Justice-Based Sample *n* = 122	
	Frequency of Youth	% of Sample	Frequency of Youth	% of Sample	Frequency of Youth	% of Sample
Ethnicity[a]						
Non-Hispanic	183	51	77	32	106	87
Hispanic	164	46	150	63	14	11
Missing	12	3	10	4	2	2
Race						
Black/African American[b]	77	21	25	11	52	43
White	132	37	84	35	48	39
Other	130	36	111	47	19	16
Missing	20	5	17	7	3	2
Age						
13 to 15	75	21	50	21	25	20
16 to 20	247	69	151	64	96	79
Missing	37	10	36	15	1	1
Lifetime Risk Factors (Youth answered 'yes')						
been in an alternative school program	196	55	109	46	87	71
been expelled from school or	164	46	97	41	67	55
gotten caught (truancy) for cutting classes	201	56	146	62	55	45
been suspended from school	293	82	188	79	105	86
quit or dropped out of school	83	23	35	15	48	39
lived with foster parents	34	9	20	8	14	11
been living on the street or in a shelter with no regular place to stay	56	16	42	18	14	11
been locked up in a juvenile detention facility	254	71	141	59	113	93
been on probation	261	73	154	65	107	88
been picked up by police	288	80	176	74	112	92
been treated for mental health problems	83	23	42	18	41	34
been treated for alcohol use problems	200	56	161	68	39	32
been treated for drug use problems	214	60	145	61	69	57
Polysubstance Use (Number of drugs used)						
1	48	13	24	10	24	20
2	103	29	64	27	39	32
3 or more	141	39	115	49	26	21
Missing	67	19	34	14	33	27
Drug Screen Score						
Low Severity (Scores 9 - 11)	136	38	59	25	77	63
High Severity (Scores 12 - 18)	173	48	142	60	31	25
Missing	50	14	36	15	14	11

	Study Sample n = 359		Community-Based Sample n = 237		Juvenile Justice-Based Sample n = 122	
	Frequency of Youth	% of Sample	Frequency of Youth	% of Sample	Frequency of Youth	% of Sample
Problem Drug Selection						
None	83	23	42	18	41	34
Alcohol	46	13	25	11	21	17
Marijuana	100	28	72	30	28	23
Heroin	15	4	15	6	0	0
Other Drugs	65	18	52	22	13	11
Missing	50	14	31	13	19	16
Previous Treatment Experience						
No previous episodes	134	37	86	36	48	39
At least 1 previous episode	182	51	122	51	60	51
Missing	43	12	29	12	14	11

[a]Non-Hispanic/Hispanic $\chi^2(1) = 93.25$, $p < .001$
[b]Non-Black/Black $\chi^2(1) = 46.31$, $p < .001$

Among youth in the community-based treatment settings, data were initially collected from 1079 males and females from April 2011 to October 2012. Data from male participants with treatment episode data, such as enrollment and discharge dates, were retained (n = 725). Youth were excluded if they were discharged prior to having the opportunity to complete the Time 3 assessment administration, reducing the sample size to 237. Among youth in the juvenile justice secure treatment settings**,** data were collected from 356 males from January 2013 to March 2014. Data from clients with treatment episode information (n = 318) and from those that had an opportunity to complete the Time 3 assessment administration (n = 122) were retained for the study.

Measures

Background Characteristics. Youth age in years, gender, and race/ethnicity were provided by the clinical staff at participating facilities. Legal history ("Have you ever been on probation?" and "How many times in the last 12 months have you been picked up by police?") was assessed at Time 1 using the TCU RSK Forms (Simpson, Joe, Knight, Rowan-Szal, & Gray, 2012). The TCU RSK Forms also collected age in years, ethnicity, race, family, and mental health and substance treatment history information.

Drug Use. Drug use frequency and severity are tied to psychological functioning (Adams et al., 2003; Shane, Jasiukaitis, & Green, 2003) as well as other treatment-related measures (e.g., motivation; Barnett et al., 2002; Battjes, Gordon, O'Grady, Kinlock, & Carswell, 2003; Breda & Heflinger, 2004; Breda & Heflinger, 2007; Slesnick et al., 2009). The extent of an adolescent's drug use may impact his initial cognitive functioning and capacity to change. However, measures of drug use severity that include identification of consequences (e.g., "Did your drug use cause emotional or psychological problems?") may introduce contamination in the form of problem recognition. To control for the possible effect of drug use but avoid problem recognition contamination, a measure of drug use frequency was included as a control variable in analyses. Frequency of drug use (1 = *Never*, 2 = *Only a few times*, 3 = *1-3 Times per month*, 4 = *1-5 Times per week*, and 5 = *About every day*) for 14 types of substances (e.g., alcohol, marijuana, inhalants, cocaine, etc.) was assessed by the TCU Drug Screen II (ADOL) Form (TCUDS II: Knight, Simpson, & Hiller, 2002). Youth responses were recoded such that a response of "Never" was indicated by a value of 0 and a response of "About every day" was indicated by a value of 4. Youth responses to these 14 items were then summed such that the values on the drug use variable ranged from 0 (no reported use of drugs) to 56 (daily use of all listed substances).

Treatment Setting. Youth enrolled in any of the community-based residential substance abuse treatment facilities comprised the community-based group (coded as 0 for analyses; reference group). Youth enrolled in juvenile justice-based treatment facilities comprised the juvenile justice-based group (coded as 1 for analyses).

Criminal Thinking. Criminal thinking, assessed at Times 1 and 2, was a latent variable representing the Personal Irresponsibility, Power Orientation, and Cold Heartedness Scales (TCU ADOL CTS Scales; Knight, Becan, Landrum, Joe, & Flynn, 2014; Knight, Garner, Simpson, Morey, & Flynn, 2006). The Personal Irresponsibility Scale assessed willingness to accept responsibility for consequences (e.g., "Nothing you do here is going to make a difference in the way you are treated" and "You are not to blame for everything you have done®"; note that ®

indicates that the item is reversed when computing the scale score). The Power Orientation Scale assessed the need to be in control of situations (e.g., "You like to be in control" and "You argue with others over relatively trivial matters"). The Cold Heartedness Scale assessed the lack of emotional investment in others (e.g., "You worry when a friend is having problems®" and "You feel people are important to you®").

Urgency. Urgency was assessed at Times 1, 2, and 3 and was a latent variable representing the Negative Urgency and Positive Urgency (THKFORMs; Knight, Becan, Landrum, Joe, & Flynn, 2014; adapted from Cyders et al., 2007) Scales. The Negative Urgency Scale assessed the tendency to behave impulsively when experiencing negative emotions (e.g., "When I am upset I often act without thinking" and "I often make matters worse because I act without thinking when I am upset"). The Positive Urgency Scale assessed the tendency to behave rashly when experiencing positive emotions (e.g., "When I am really happy, I tend to get out of control" and "When I am really excited, I tend not to think of the consequences of my actions").

Planning. Planning was assessed at Times 1, 2, and 3 and was a latent variable representing the Decision Making and Premeditation Scales from the Client Evaluation of Self and Treatment (CEST; Garner, Knight, Flynn, Morey, & Simpson, 2007; Joe, Broome, Rowan-Szal, & Simpson, 2002). The Decision Making Scale (Knight, Becan, Landrum, Joe, & Flynn, 2014) assessed the tendency to make deliberate decisions (e.g., "You plan ahead" and "You think about the consequences of your actions"). The Premeditation Scale (Knight et al., 2014; adapted from Whiteside & Lynam, 2001) assessed the tendency to think before making a decision or acting (e.g., "Before making up my mind, I consider the advantages and disadvantages" and "I am a cautious person").

The criminal thinking, urgency, and planning scale items utilized a 5-point Likert-type response option (1 = *Disagree Strongly*, 3 = *Uncertain*, and 5 = *Agree Strongly*). Several scales included reverse-scored items (indicated by ®). These items were reflected by subtracting the raw response value from 6. All scales were calculated by reflecting reverse-scored items,

averaging the item values, and multiplying the mean by 10. Scale scores ranged from 10 to 50. To create a meaningful zero-point for interpretation, scale scores were centered at zero by subtracting 10 from the score. Thus, for analyses, scale scores ranged from 0 to 40.

Time in Treatment. Some studies suggest that time spent in treatment is related to treatment outcomes (e.g., Simpson, Joe, & Rowan-Szal, 1997). In order to control for the possible effect that being in treatment longer may have on cognitive change, Time in Treatment variables were included in the analyses. Time in Treatment represented the number of days youth were in treatment at the point of assessment. Time in Treatment 1 equaled the difference in days between the date of the Time 1 assessment and the date the youth enrolled in treatment. For example, a youth's Time in Treatment 1 value equaled 5 if he was enrolled on May 1, 2001, and completed his Time 1 assessment on May 6, 2001. Similarly, Time in Treatment 2 equaled the difference in days between the date of the Time 2 assessment and the date the youth enrolled in treatment, and Time in Treatment 3 equaled the difference between the date of the Time 3 assessment and the enrollment date.

Analytic Strategy

Missing Data. Previous studies from the larger project suggested that there were some cases of missing data within the sample (for examples see Becan, Knight, Crawley, Joe, & Flynn, 2015; Crawley, Becan, Knight, Joe, & Flynn, in press). Data from the final sample were analyzed using SAS 9.2 (SAS Institute Inc., 2008) to determine (a) the proportion of youth with missing data at each assessment administration, (b) if missing data represented a pattern, and (c) if missing data were ignorable. Missing data were considered to be ignorable if missingness was random or unrelated to the variables of interest (Enders, 2011b; SAS Institute Inc., 2010). It is not possible to test whether data are missing completely at random or missing at random because the potential predictors of missingness that are not measured in any given study are not able to be observed or tested. An acceptable method for determining if missing data are ignorable was used, which is to rule out potential observable predictors of missingness.

Dichotomous variables were created to indicate missingness on variables of interest at each time point. Indicators were coded as 0 indicating that data were missing or 1 indicating that data were not missing. PROC FREQ commands were used to compile frequency tables indicating the percentage of the sample missing data at each assessment administration. PROC MI was then used to analyze missing data patterns. Finally, missingness indicator variables were then used as dependent measures in logistic regression models to determine if demographic variables or data collected at previous time points predicted missingness. Procedures for analyzing missingness and establishing the most appropriate method to handle missing data suggested by the literature were followed (see Enders, 2011a; Kline, 2011; Langkamp, Lehman, & Lemeshow, 2010; Muthén & Muthén, 1998-2012; Schumacker & Lomax, 2010).

Assumptions. In addition to missing data analyses, data from the final sample were also analyzed to determine the most appropriate estimator to use for hypothesis testing. Repeated measures structural equation modeling using maximum likelihood assumes that data are continuous, complete, normally distributed, and linear (Muthén & Muthén, 1998-2012). Samples with missing and non-normal data can be analyzed with more robust estimators such as robust maximum likelihood (MLR) or weighted least squares (WLS). Dependent measures for this study were continuous, but not complete. PROC UNIVARIATE commands were used to compute values indicating variable distribution characteristics to test for normality. Growth trajectory plots were used to determine if data followed a linear pattern of growth from Time 1 to Time 3. In addition, PROC MIXED was also used to estimate empty models predicting drug use and dependent measures at Times 1, 2, and 3 by facility to rule out the need for multilevel modeling. Mixed models for community-based and juvenile justice secure samples were conducted separately.

Additional Covariates. Research suggests that there may be significant differences between youth enrolled in the two treatment settings on key background characteristics (age, ethnicity, race, drug use, and history of treatment; e.g., Farabee, Nelson, & Spence, 1993; Kline, 1997; Marshall & Hser, 2002). Chi-square, logistic regression, and analysis of variance were

used to identify possible differences. Background characteristics that differed significantly between groups were included in subsequent hypothesis-testing analyses.

Measurement Model. The measurement model was tested using SAS 9.2 (SAS Institute Inc., 2008) and MPlus 7 (Muthén & Muthén, 1998-2012) software prior to hypothesis testing as suggested in the literature (Kline, 2011; Muthén & Muthén, 1998-2012; Schumacker & Lomax, 2010). First, criminal thinking, urgency, and planning scales were analyzed for reliability by calculating the Cronbach alpha values for each item and the overall scale. Scales were determined to be reliable if the overall standardized alpha value met or exceeded .70 (Cronbach, 1951; Kline, 1999). Scales with reliability values below .70 were further examined and considered for inclusion in the model based on sample size, number of scale items, and general reliability of the construct (Cortina, 1993; Kline, 1999). A confirmatory factor analysis was conducted to determine the reliability of the hypothesized latent variables. The overall model fit statistics, standardized factor loadings, and R^2 values were used to determine the best fitting model (Kline, 2011). The following suggested criteria were used to determine good model fit: (a) RMSEA less than .05 with an upper 90% confidence interval limit less than .10, (b) CFI greater than .95, and (c) SRMR less than .05 (Kline, 2011; Muthén & Muthén, 1998-2012; Schumacker & Lomax, 2010). While non-significant chi-square values are desirable, they are less likely to occur with larger sample sizes (Kline, 2011; Muthén & Muthén, 1998-2012; Schumacker & Lomax, 2010), thus a non-significant overall chi-square value was not considered necessary to establish good fit. The criteria for ideal standardized factor loadings for latent variables was set at values of .70 or above (Kline, 2011). The initial measurement model was tested first, then modification indices were used to respecify model effects. Each recommended change was selected from the modification indices list according to its theoretical fit and expected impact on the overall model, and each respecification was tested one at a time. Satorra-Bentler chi-square difference tests (Satorra & Bentler, 1999) were used to determine if new respecifications were a significantly better fit to the data than the previous model.

Respecification continued until a model met the criteria for a good fit to the data or there were no more acceptable suggested modification indices.

Hypothesis Testing. Hypothesis 1 stated that cognitive functioning (as measured by urgency, planning, and criminal thinking) would improve during treatment. Background characteristics identified in preliminary analyses, drug use, and time in treatment were controlled for in the models. To test hypothesis 1, repeated measures structural equation modeling was used to estimate the direct effects of cognitive latent variables (urgency, planning, and criminal thinking) at Time 1 on their repeated Time 2 measures, and the effects of urgency and planning at Time 2 on Time 3 (see Figure 1). MPlus 7 software (Muthén & Muthén, 1998-2012) was used to conduct analyses. The hypothesized model was tested first. Preliminary analyses indicated that, due to missing data, the robust maximum likelihood estimate was the most appropriate estimation for the hypothesized model (MLR; Kline, 2011; Muthén & Muthén, 1998-2012;

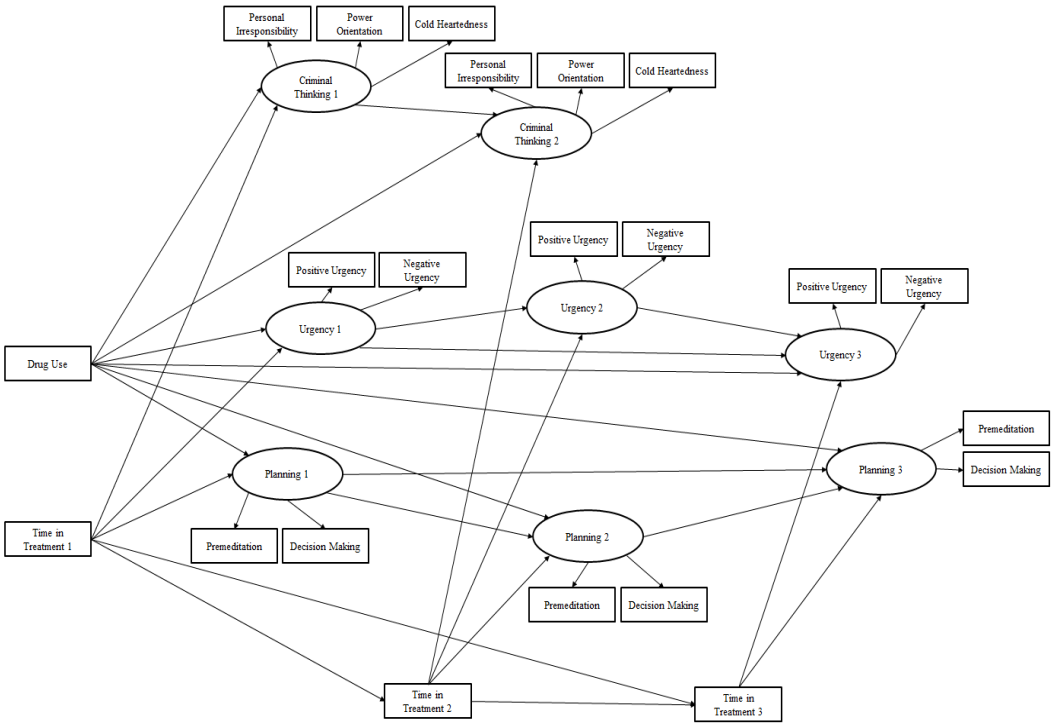

Figure 1. The planned hypothesis 1 model was expected to show that criminal thinking, urgency, and planning would change during treatment.

Schumacker & Lomax, 2010). The following criteria were used to determine good model fit: (a) RMSEA less than .05 with an upper 90% confidence interval limit less than .10, (b) CFI greater than .95, and (c) SRMR less than .05 (Kline, 2011; Muthén & Muthén, 1998-2012; Schumacker & Lomax, 2010). As previously mentioned this study aimed to minimize chi-square values, but those values were not used as primary criterion for good fit. After testing the hypothesized model, modification indices were computed and used to specify the most parsimonious, best-fitting model to the data. This re-specification process was conducted by following these steps.

1) Modification indices from the hypothesized model were examined.
2) The single suggested modification with the greatest estimated impact on model fit that was also consistent with current theoretical and empirical knowledge was specified to estimate a new model.
3) The new model was evaluated for fit, and the new model fit statistics were compared to the previous model fit statistics using the Satorra-Bentler scaled chi-square difference test (Satorra & Bentler, 1999).
4) These steps were repeated until the newest model met the criteria for good fit, the Satorra and Bentler chi-square difference test comparing the previous and new models was non-significant, or appropriate suggested model specifications were exhausted.

Hypothesis 2 stated that youth in juvenile justice-based settings would report higher urgency, lower planning, and higher criminal thinking than youth in community-based settings when controlling for background characteristics, time in treatment, and drug use. To test hypothesis 2, structural equation modeling was used to simultaneously estimate the direct effects of treatment setting (community-based versus juvenile justice-based) on Time 1 latent measures of urgency, planning, and criminal thinking (see Figure 2). A final model, or model of "best fit," was specified utilizing the modification indices in the manner described for hypothesis 1.

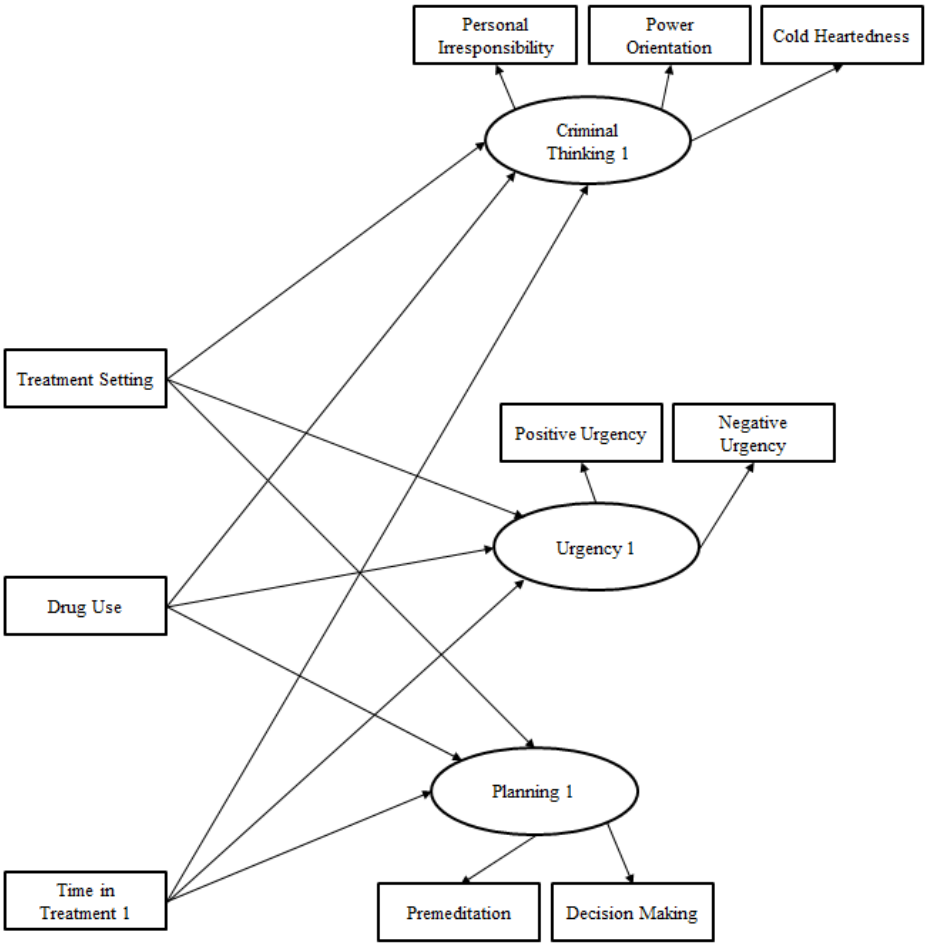

Figure 2. The planned hypothesis 2 model was expected to show that youth in juvenile justice settings would report higher criminal thinking and urgency, and lower planning than those in the community-based programs.

To test hypothesis 3, repeated measures structural equation modeling was used to estimate changes in the cognitive constructs (see Figure 3). The hypothesized model estimated the effect of treatment setting (community-based versus juvenile justice-based) on cognitive change by estimating the direct effect of the binary observed variable "treatment setting" on latent cognitive constructs. Background characteristics, drug use, and time in treatment were controlled for in the model. A final model was specified using the modification indices in the manner described for hypothesis 1.

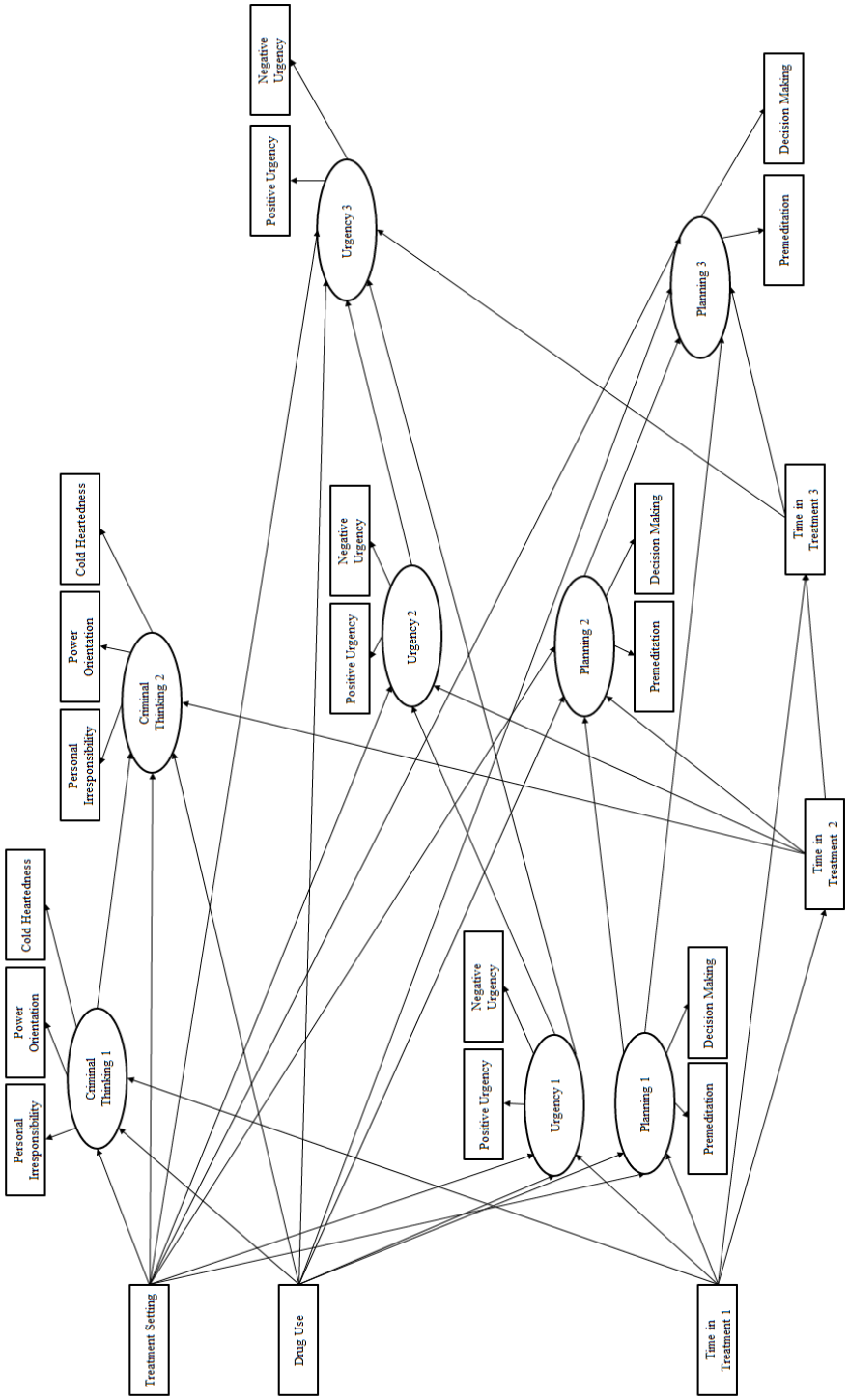

Figure 3. The planned hypothesis 3 model was expected to show that youth in community-based settings would report more positive changes during treatment than those in juvenile justice settings.

Results

Missing Data. Indicator variables were used to determine if youth who were in treatment during the targeted assessment administration time points were missing data on the criminal thinking, urgency, or planning scales at any of the time points. Frequency results revealed that, at Time 1 among the community-based sample, youth missing criminal thinking data comprised 20% of the sample, those missing urgency data comprised 16%, and 16% were missing planning data. At Time 2, 48% were missing criminal thinking data, 48% were missing urgency data, and 47% were missing planning data. At Time 3, youth missing urgency responses comprised 36% of the sample and those missing planning responses comprised 36%. Among youth in the juvenile justice sample, 2% did not have Time 1 criminal thinking data, 4% were missing urgency responses, and 6% were missing planning data. At Time 2, 9% of the juvenile justice sample were missing criminal thinking data, 7% were missing urgency data, and 7% did not have planning responses. At Time 3, 9% of juvenile justice youth were missing urgency responses and 10% were missing planning data.

PROC MI analyses revealed that there were multiple missing data patterns and that these patterns were random. Separate logistic regression models predicting missing data (missing = 0, non-missing = 1) at Times 1, 2, and 3 among criminal thinking, urgency, and planning scales were estimated. Predictors in each model included treatment setting (community-based = 0, juvenile justice = 1), ethnicity (non-Hispanic = 0, Hispanic = 1), race (non-Black/African American = 0, Black/African American = 1), and age (ranging 13-20 years old). Results indicated that youth in the community-based sample were significantly more likely to be missing criminal thinking data than youth in the juvenile justice sample at Time 1 (model $\chi^2(4) = 8.65$, $p = .07$, Wald's $\chi^2 = 6.24$, $p < .05$, $\beta = -2.74$, $SE = 1.10$). Youth in community-based treatment were also more likely to be missing Time 2 criminal thinking (model $\chi^2(4) = 43.24$, $p < .001$, Wald's $\chi^2 = 38.08$, $p < .001$, $\beta = -2.80$, $SE = .45$), urgency (model $\chi^2(4) = 42.58$, $p < .001$, Wald's $\chi^2 = 37.38$, $p < .001$, $\beta = -2.89$, $SE = .47$), and planning assessment data

(model $\chi^2(4) = 42.21$, $p < .001$, Wald's $\chi^2 = 37.55$, $p < .001$, $\beta = -2.90$, $SE = .47$), and Time 3 urgency (model $\chi^2(4) = 30.88$, $p < .001$, Wald's $\chi^2 = 27.42$, $p < .001$, $\beta = -2.40$, $SE = .46$) and planning assessment data (model $\chi^2(4) = 28.52$, $p < .001$, Wald's $\chi^2 = 25.26$, $p < .001$, $\beta = -2.20$, $SE = .44$). Missing data in the community-based sample were primarily attributed to facility-level limitations. For example, incomplete Time 2 assessments were frequently caused by delays in scheduling follow-up assessments associated with changes in clinical staff or fluctuations in caseloads. Similarly, several facility-level events also led to missing assessment administrations in the juvenile justice sample. Differences in the overall proportion of missing assessment data between the community-based and juvenile justice treatment settings could possibly be due to a variety of factors. For instance, perhaps the increased structure and protocol adherence in juvenile justice secure settings could account for the lower proportion of missing assessment data. Treatment staff in juvenile justice secure settings may be more accustomed to tracking client behavior and following predetermined scheduling protocols than staff in community-based settings.

Separate logistic regression models predicting missing assessment data at Time 2 by ethnicity, race, age, time in treatment 1, and Time 1 measures of cold heartedness, power orientation, decision making, premeditation, negative urgency, and positive urgency were estimated. Results indicated that, compared to youth in juvenile justice settings, youth in the community-based treatment programs were significantly more likely to have missing Time 2 criminal thinking data (model $\chi^2(11) = 41.68$, $p < .001$, Wald's $\chi^2 = 31.28$, $p < .001$, $\beta = -2.91$, $SE = .52$), Time 2 urgency data (model $\chi^2(11) = 40.24$, $p < .001$, Wald's $\chi^2 = 30.44$, $p < .001$, $\beta = -3.05$, $SE = .55$), and Time 2 planning data (model $\chi^2(11) = 40.16$, $p < .001$, Wald's $\chi^2 = 30.56$, $p < .001$, $\beta = -3.06$, $SE = .55$). Controlling for treatment setting and demographic variables, assessment measures at Time 1 were not significant predictors of missingness at Time 2.

Similar logistic regression models were estimated predicting Time 3 missingness by treatment setting, time in treatment 1, ethnicity, race, age, and Time 1 measures of cold heartedness, power orientation, decision making, premeditation, negative urgency, and positive urgency. Results indicated that, compared to youth in juvenile justice settings, youth in community-based treatment were significantly more likely to have missing Time 3 urgency data (model $\chi^2(11) = 32.97$, $p < .001$, Wald's $\chi^2 = 25.40$, $p < .001$, $\beta = -2.80$, $SE = .56$) and missing Time 3 planning data (model $\chi^2(11) = 30.59$, $p < .001$, Wald's $\chi^2 = 23.62$, $p < .001$, $\beta = -2.53$, $SE = .52$). Controlling for treatment setting and demographic measures, Time 1 assessment values were not significant predictors of missingness at Time 3. Predicting missingness at Time 3, logistic regression model estimates indicated that demographic and Time 2 measures were not significant predictors of Time 3 missingness.

Missingness analyses did not indicate that data were not missing at random within each treatment setting. To retain statistical power in hypothesis analyses, data were imputed in 2 steps. First, missing demographic and Time in Treatment 1 variables were imputed using SAS PROC MI, the Markov chain Monte Carlo method. Second, missing dependent measure data were imputed using the robust maximum likelihood method (MLR) in MPlus. Demographic data imputation was not possible for 10 participants, thus the sample for hypothesis testing included 349 youth.

Assumptions. The assumptions for hypothesis testing were considered met if dependent measure data were continuous, complete, normally distributed, and demonstrated a linear growth pattern (Muthén & Muthén, 1998-2012). Dependent measures met the assumption of continuous data, but missing assessment responses violated the assumption that data were complete. Using SAS MI, independent measures were imputed, and the robust maximum likelihood estimator was chosen to appropriately deal with missing data (Kline, 2011; Muthén & Muthén, 1998-2012; Schumacker & Lomax, 2010). PROC UNIVARIATE results indicated that continuous data were within acceptable ranges for normally distributed data (between -1 and 1 for skewness and -2 and 2 for kurtosis; Bulmer, 1979; see Table 2). Growth trajectory plots indicated that growth models

Table 2

Measure Distributions

	Study Sample				Community-Based Sample				Juvenile Justice Sample			
Variable	*n*	*M (SD)*	Skewness	Kurtosis	*n*	*M (SD)*	Skewness	Kurtosis	*n*	*M (SD)*	Skewness	Kurtosis
Age	322	16.19 (1.14)	-.07	.40	201	15.99 (.98)	-.79	.08	121	16.51 (1.32)	.07	-.23
Drug Use	318	8.03 (7.96)	2.17	6.50	208	9.28 (7.53)	1.58	2.43	110	5.67 (8.23)	3.62	16.59
Time in Treatment 1	329	6.26 (6.60)	1.45	1.93	209	6.98 (6.96)	1.08	.59	120	5.03 (5.74)	2.45	7.45
Time in Treatment 2	249	47.80 (15.79)	10.54	145.05	134	47.06 (8.52)	-.26	.74	115	48.65 (21.37)	9.26	94.17
Time in Treatment 3	267	90.38 (28.23)	10.67	133.18	155	88.83 (11.52)	-.05	.47	112	92.54 (41.44)	8.02	67.67
Cold Heartedness Time 1	309	25.16 (7.34)	.87	1.72	190	24.55 (7.31)	.84	1.60	119	26.13 (7.30)	.97	2.10
Cold Heartedness Time 2	234	24.36 (6.26)	.10	.09	123	22.78 (6.26)	.28	.38	111	26.13 (5.79)	.02	.18
Personal Irresponsibility Time 1	309	25.82 (6.42)	-.21	.49	190	25.91 (6.56)	-.10	.26	119	25.68 (6.21)	-.43	.97
Personal Irresponsibility Time 2	235	26.49 (7.29)	.12	-.19	124	27.06 (7.58)	.19	-.35	111	25.84 (6.92)	-.03	-.05
Power Orientation Time 1	309	29.00 (6.77)	-.12	.56	190	29.54 (7.03)	-.07	.33	119	28.14 (6.27)	-.30	1.05
Power Orientation Time 2	234	29.73 (7.04)	-.08	-.25	123	31.77 (7.02)	-.25	-.22	111	27.46 (6.36)	-.08	-.01
Decision Making Time 1	318	33.93 (7.57)	-.71	.78	201	34.24 (7.55)	-.76	1.11	117	33.41 (7.62)	-.65	.35
Decision Making Time 2	245	35.64 (6.69)	-.50	.81	131	35.65 (6.96)	-.74	1.46	114	35.62 (6.40)	-.15	-.20
Decision Making Time 3	263	35.98 (6.65)	-.48	.66	153	36.31 (6.94)	-.70	.99	110	35.52 (6.21)	-.13	.19
Premeditation Time 1	315	31.87 (7.91)	-.39	.23	198	32.24 (8.25)	.45	.44	117	31.25 (7.31)	-.32	-.33
Premeditation Time 2	238	33.44 (6.70)	-.57	1.11	125	33.58 (6.73)	-1.00	1.85	113	33.28 (6.70)	-.09	.47
Premeditation Time 3	264	33.60 (7.25)	-.30	.17	153	34.44 (7.26)	-.44	.92	111	32.44 (7.10)	-.13	-.66
Negative Urgency Time 1	315	29.30 (8.17)	-.15	-.06	198	29.87 (8.49)	-.23	.07	117	28.35 (7.54)	-.06	-.34
Negative Urgency Time 2	238	30.41 (7.70)	-.37	-.05	125	32.11 (8.15)	-.61	.20	113	28.54 (6.72)	-.39	-.09
Negative Urgency Time 3	264	29.33 (7.72)	-.32	-.05	153	29.85 (8.52)	-.35	-.28	111	28.61 (6.42)	-.49	.19
Positive Urgency Time 1	315	25.49 (7.16)	.14	-.04	198	25.68 (7.57)	.14	-.07	117	25.18 (6.43)	.08	-.21
Positive Urgency Time 2	237	26.77 (7.64)	-.03	-.28	124	27.57 (8.28)	-.13	-.48	113	25.90 (6.80)	-.01	.01
Positive Urgency Time 3	262	26.31 (8.15)	.08	-.30	151	26.39 (8.53)	.03	-.61	111	26.21 (7.63)	.16	.34
Social Desirability Time 1	318	4.73 (2.59)	.06	-.85	200	4.62 (2.71)	.08	-.92	118	4.92 (2.36)	-.04	-.73
Social Desirability Time 2	241	4.64 (2.58)	.25	-.64	128	4.18 (2.36)	.34	-.34	113	5.17 (2.72)	.06	-.85
Social Desirability Time 3	265	4.39 (2.64)	.17	-.71	154	4.25 (2.64)	.18	-.75	111	4.59 (2.63)	.17	-.65

for criminal thinking, urgency, and planning scales were generally linear. Using the MLR estimator to address the missing data assumption violation, all assumptions were considered met to estimate the measurement and hypothesized models. Results from PROC MIXED estimates of empty multilevel models predicting dependent measures by facility indicated that there was no significant between-facility variance for community-based or juvenile justice secure treatment settings.

Additional Covariates. A series of statistical tests were conducted to determine if youth in community-based and juvenile justice-based treatment settings differed on background characteristics. First, chi-square results indicated that, compared to Hispanic youth, there were proportionally more non-Hispanic youth in the juvenile justice group than the community-based group (see Table 1). In addition, compared to non-Black/African American youth, there were proportionally more Black/African American youth in the juvenile justice group than in the community-based group. Ethnicity (non-Hispanic, Hispanic) and race (non-Black/African American, Black/African American) were used as covariates in subsequent analyses.

Second, multiple regression models predicting age and drug use by treatment setting, ethnicity, and race use were estimated. Results indicated that youth in juvenile justice agencies, non-Hispanic, and non-Black/African American youth were significantly older than youth in community-based agencies, Hispanic, and Black/African American youth (see Table 3).

Table 3
Age Regressed on Treatment Setting, Ethnicity, and Race

Independent Variable	β	*SE*	*t*-Value
Predicting Age[a]			
Treatment Set (Community-Based/Juvenile Justice)	.45	.15	2.93**
Ethnicity (Non-Hispanic/Hispanic)	-.46	.15	-3.02**
Race (Non-Black/Black)	-.58	.17	-3.51***
Predicting Drug Use[b]			
Treatment Set (Community-Based/Juvenile Justice)	-2.61	1.08	-2.42*
Ethnicity (Non-Hispanic/Hispanic)	-.40	1.04	-.38
Race (Non-Black/Black)	-4.38	1.17	-3.74***
Age	.88	.39	2.25*

[a]Intercept = 16.80, $SE = .26$, $t(1) = 63.40$, $p < .001$
[b]Intercept = -3.90, SE = 6.83, t(1) = -.57, $p = .57$
* $p < .05$. ** $p < .01$. *** $p < .001$.

Predicting drug use, youth in community-based agencies reported significantly greater drug use than those in juvenile justice settings. In addition, older youth and non-Black/African American youth reported significantly more drug use.

Third, logistic regression models predicting problem drug selection by treatment setting, ethnicity, race, age, and drug use indicated that lower drug use predicted a greater likelihood of a youth selecting "none" as the substance that caused them the most problems (see Table 4). Selection of alcohol as the most problematic substance was more likely when youth were non-Hispanic as well as when youth were non-Black/African American. Youth in juvenile justice secure settings were less likely to report marijuana as their problem drug compared to youth in community-based settings. Lower drug use was also associated with being more likely to select marijuana as the most problematic substance. The likelihood of selecting other types of substances (e.g., heroin, methamphetamine, cocaine, etc.) as the most problematic drug increased with drug use.

Fourth, logistic regression was used to examine the relationships between independent measures (treatment setting, ethnicity, race, age, and drug use) and previous treatment experience (no previous treatment experience/any previous treatment experience). Results indicated that older youth were more likely to indicate a history of previous treatment episodes (model $\chi^2(5) = 5.44$, $p = .36$, Wald's $\chi^2 = 4.15$, $p < .05$, $\beta = -.22$, $SE = .11$). Preliminary analyses indicated group differences in ethnicity, race, and age. These indicators were included as covariates in subsequent analyses along with planned covariates drug use and time in treatment.

Measurement Model. Results of reliability estimates for Time 1 measures indicated that overall internal consistency for negative urgency, positive urgency, premeditation, decision making, power orientation, and cold heartedness met or exceeded the desirable alpha value of .70 (see Table 5). The internal consistency of personal irresponsibility did not meet the acceptable alpha value for the study sample or for either treatment sample. Personal irresponsibility was therefore removed from criminal thinking factors in the hypothesized models. Examining scale reliability by treatment setting indicated that the reliability for decision making for youth in

Table 4
Problem Drug Type Regressed on Treatment Setting, Ethnicity, Race, Age, and Drug Use

Independent Variable	Estimate	*SE*	Wald's χ^2 Value
None[a]			
Treatment Setting (Community-Based/Juvenile Justice)	-.56	.36	2.34
Ethnicity (Non-Hispanic/Hispanic)	-.30	.37	.66
Race (Non-Black/Black)	-.26	.37	.52
Age	.00	.13	.00
Drug Use	.20	.04	22.21***
Alcohol[b]			
Treatment Setting (Community-Based/Juvenile Justice)	-.33	.40	.68
Ethnicity (Non-Hispanic/Hispanic)	.91	.41	4.80*
Race (Non-Black/Black)	.93	.47	3.91*
Age	.06	.15	.17
Drug Use	.02	.02	.81
Marijuana[c]			
Treatment Setting (Community-Based/Juvenile Justice)	.76	.33	5.06*
Ethnicity (Non-Hispanic/Hispanic)	.01	.31	.00
Race (Non-Black/Black)	-.41	.35	1.36
Age	-.02	.12	.03
Drug Use	.06	.02	6.44*
Other Drugs[d]			
Treatment Setting (Community-Based/Juvenile Justice)	.40	.47	.76
Ethnicity (Non-Hispanic/Hispanic)	-.45	.38	1.38
Race (Non-Black/Black)	.60	.60	.98
Age	-.05	.15	.10
Drug Use	-.18	.03	38.47***

Note. Probability modeled as independent variable = 0 (e.g., the probability of youth reporting problem drug as a substance other than the independent variable).
[a]Model Wald's $\chi^2(5) = 33.42$, $p < .001$; Intercept = .57, $SE = 2.25$, Wald's $\chi^2 = .06$, $p = .80$
[b]Model Wald's $\chi^2(5) = 9.89$, $p < .10$; Intercept = -.78, $SE = 2.63$, Wald's $\chi^2 = .09$, $p = .77$
[c]Model Wald's $\chi^2(5) = 11.30$, $p < .05$; Intercept = .46, $SE = 2.03$, Wald's $\chi^2 = .05$, $p = .82$
[d]Model Wald's $\chi^2(5) = 53.05$, $p < .001$; Intercept = 3.90, $SE = 2.65$, Wald's $\chi^2 = 2.16$, $p = .14$
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 5
Scale Reliability Values for Time 1 Measures

	Study Sample			Community-Based Sample			Juvenile Justice Sample		
Scale Items	*n*	*M* (*SD*)	Standardized Cronbach Coefficient Alpha	*n*	*M* (*SD*)	Standardized Cronbach Coefficient Alpha	*n*	*M* (*SD*)	Standardized Cronbach Coefficient Alpha
Negative Urgency	310		.83	195		.85	115		.79
Item 4. When I am upset I often act without thinking.	310	3.15 (1.12)	.81	195	3.17 (1.15)	.81	115	3.12 (1.07)	.79
Item 7. When I feel rejected, I will often say things that I later regret.	310	2.88 (1.10)	.79	195	2.91 (1.11)	.82	115	2.82 (1.07)	.73
Item 10. It is hard for me to resist acting on my feelings.	310	2.83 (1.03)	.82	195	2.85 (1.06)	.84	115	2.79 (.99)	.75
Item 19. Sometimes when I feel bad, I can't seem to stop what I am doing even though it is making me feel worse.	310	2.64 (1.06)	.81	195	2.69 (1.07)	.82	115	2.55 (1.05)	.77
Item 25. I often make matters worse because I act without thinking when I am upset.	310	2.92 (1.10)	.79	195	2.97 (1.10)	.82	115	2.83 (1.10)	.74
Item 27. In the heat of an argument, I will often say things that I later regret.	310	3.12 (1.17)	.79	195	3.23 (1.18)	.82	115	2.94 (1.13)	.73
Positive Urgency	306		.79	192		.83	114		.71
Item 9. When I am very happy, I feel like it is OK to give in to cravings or overindulge.	306	2.68 (.99)	.81	192	2.66 (.99)	.84	114	2.70 (.99)	.75
Item 11. When I am really happy, I Tend to get out of control.	306	2.41 (.98)	.76	192	2.40 (1.00)	.80	114	2.44 (.95)	.67
Item 17. When I am really happy, I often find myself in situations that I normally wouldn't be comfortable with.	306	2.58 (1.04)	.75	192	2.56 (1.06)	.79	114	2.60 (1.00)	.66
Item 29. Others are shocked or worried about the things I do when I am feeling very excited.	306	2.51 (.98)	.75	192	2.54 (.99)	.79	114	2.47 (.96)	.65
Item 31. When I get really happy about something, I tend to do things that can have bad consequences.	306	2.43 (1.04)	.74	192	2.43 (1.04)	.78	114	2.42 (1.06)	.64
Item 33. When I am really excited, I tend not to think of the consequences of my actions.	306	2.69 (1.07)	.76	192	2.78 (1.10)	.81	114	2.54 (1.00)	.64
Premeditation	309		.85	194		.87	115		.79
Item 2. Before making up my mind, I consider the advantages and disadvantages.	309	3.29 (1.07)	.82	194	3.34 (1.07)	.84	115	3.22 (1.07)	.77
Item 5. I am a cautious person.	309	3.09 (1.05)	.82	194	3.13 (1.07)	.85	115	3.03 (1.03)	.77
Item 8. I tend to follow a rational, "sensible" approach to things.	309	3.05 (1.02)	.86	194	3.10 (1.02)	.89	115	2.96 (1.02)	.80
Item 12. I usually think carefully before doing most things.	309	3.20 (1.04)	.81	194	3.20 (1.04)	.84	115	3.22 (1.05)	.75
Item 21. I like to stop and think things over before I do them.	309	3.25 (1.05)	.81	194	3.26 (1.06)	.84	115	3.23 (1.03)	.75
Item 32. I usually make up my mind through careful thinking.	309	3.22 (1.04)	.81	194	3.29 (1.01)	.85	115	3.10 (1.09)	.73
Decision Making	305		.71	192		.74	113		.67
Item 3. You consider how your actions will affect others.	305	3.44 (1.06)	.68	192	3.38 (1.08)	.72	113	3.56 (1.01)	.61
Item 4. You plan ahead.	305	3.68 (1.04)	.67	192	3.60 (1.07)	.70	113	3.82 (.98)	.62
Item 13. You think about consequences of your actions.	305	3.37 (1.15)	.64	192	3.39 (1.12)	.68	113	3.34 (1.21)	.58
Item 16. You think about what causes your current problems.	305	3.48 (1.11)	.69	192	3.59 (1.05)	.73	113	3.28 (1.18)	.61
Item 18. You think of several different ways to solve a problem.	305	3.54 (1.10)	.65	192	3.70 (.98)	.69	113	3.27 (1.21)	.59
Item 21. You have trouble making decisions. (R)	305	3.48 (1.11)	.77	192	3.41 (1.13)	.79	113	3.59 (1.08)	.74

Scale Items	Study Sample *n*	*M* (*SD*)	Standardized Cronbach Coefficient Alpha	Community-Based Sample *n*	*M* (*SD*)	Standardized Cronbach Coefficient Alpha	Juvenile Justice Sample *n*	*M* (*SD*)	Standardized Cronbach Coefficient Alpha
Item 23. You make good decisions.	305	3.16 (.98)	.79	192	3.16 (.97)	.73	113	3.18 (1.00)	.62
Item 26. You make decisions without thinking about consequences. (R)	305	3.08 (1.13)	.73	192	3.05 (1.13)	.74	113	3.14 (1.15)	.72
Item 33. You examine problems by looking at all the choices.	305	3.20 (1.13)	.65	192	3.30 (1.09)	.68	113	3.02 (1.19)	.61
Power Orientation	296		.77	178		.79	118		.73
Item 20. The only way to protect yourself is to be ready to fight.	296	3.04 (1.14)	.74	178	3.12 (1.07)	.76	118	2.92 (1.24)	.71
Item 22. You like to be in control.	296	3.43 (1.04)	.78	178	3.43 (1.00)	.80	118	3.43 (1.11)	.72
Item 24. When people tell you what to do, you become aggressive.	296	2.76 (1.01)	.73	178	2.79 (1.05)	.75	118	2.71 (.95)	.68
Item 28. You think you have to pay back people who mess with you.	296	2.78 (1.03)	.72	178	2.88 (1.04)	.74	118	2.64 (1.00)	.66
Item 29. You argue with others over relatively trivial matters.	296	2.72 (.97)	.74	178	2.80 (1.01)	.77	118	2.59 (.89)	.68
Item 32. When not in control of a situation, you feel the need to exert power over others.	296	2.70 (.94)	.74	178	2.69 (.96)	.76	118	2.71 (.91)	.71
Item 34. If someone disrespects you then you have to straighten them out, even if you have to get physical.	296	2.86 (1.11)	.73	178	2.97 (1.12)	.75	118	2.69 (1.09)	.69
Cold Heartedness	286		.76	170		.76	116		.76
Item 19. You worry when a friend is having a problem. (R)	286	2.29 (.99)	.69	170	2.25 (.93)	.71	116	2.36 (1.07)	.66
Item 23. You get upset when you hear about someone who has lost everything in a natural disaster. (R)	286	2.59 (1.04)	.70	170	2.62 (1.05)	.71	116	2.53 (1.02)	.69
Item 27. Seeing someone cry makes you sad. (R)	286	2.78 (1.01)	.69	170	2.75 (1.01)	.67	116	2.83 (1.01)	.72
Item 31. You feel people are important to you. (R)	286	2.27 (1.01)	.71	170	2.22 (.97)	.72	116	2.35 (1.07)	.69
Item 35. You are sometimes so moved by an experience that you feel emotions you cannot describe. (R)	286	2.75 (1.05)	.76	170	2.58 (1.03)	.75	116	3.00 (1.04)	.78
Personal Irresponsibility	229		.59	112		.54	117		.65
Item 21. You may be a criminal, but your environment made you that way.	229	2.87 (1.13)	.54	112	2.92 (1.08)	.45	117	2.82 (1.18)	.62
Item 25. You are in this program because you had a run of bad luck.	229	2.88 (1.17)	.59	112	2.89 (1.26)	.54	117	2.87 (1.08)	.63
Item 26. Laws are just a way to keep poor people down.	229	2.57 (1.04)	.45	112	2.71 (1.04)	.34	117	2.44 (1.03)	.54
Item 30. You are not to blame for everything you have done.	229	2.84 (1.06)	.62	112	2.96 (1.07)	.60	117	2.73 (1.03)	.65
Item 33. The real reason you are in this program is because of your race.	229	1.94 (.89)	.53	112	1.88 (.88)	.45	117	2.01 (.90)	.60
Item 36. Nothing you do here is going to make a difference in the way you are treated.	229	2.62 (1.14)	.53	112	2.67 (1.24)	.51	117	2.56 (1.04)	.55
Decision Making[a]	305		.80	192		.81	113		.81
Item 3. You consider how your actions will affect others.	305	3.44 (1.06)	.79	192	3.38 (1.08)	.79	113	3.56 (1.01)	.79
Item 4. You plan ahead.	305	3.68 (1.04)	.79	192	3.60 (1.07)	.79	113	3.82 (.98)	.80
Item 13. You think about consequences of your actions.	305	3.37 (1.15)	.75	192	3.39 (1.12)	.75	113	3.34 (1.21)	.77
Item 16. You think about what causes your current problems.	305	3.48 (1.11)	.78	192	3.59 (1.05)	.79	113	3.28 (1.18)	.78

Scale Items	Study Sample			Community-Based Sample			Juvenile Justice Sample		
	n	*M* (*SD*)	Standardized Cronbach Coefficient Alpha	*n*	*M* (*SD*)	Standardized Cronbach Coefficient Alpha	*n*	*M* (*SD*)	Standardized Cronbach Coefficient Alpha
Item 18. You think of several different ways to solve a problem.	305	3.54 (1.09)	.76	192	3.70 (.98)	.77	113	3.27 (1.21)	.76
Item 23. You make good decisions.	305	3.16 (.98)	.81	192	3.16 (.97)	.83	113	3.18 (1.00)	.80
Item 33. You examine problems by looking at all the choices.	305	3.20 (1.13)	.76	192	3.30 (1.09)	.76	113	3.02 (1.19)	.78

[(R)]Denotes reverse-scored items.
[a]Scale reliability estimates calculated after removing items 21 and 26.

juvenile justice settings was below the desired .70 value. An examination of the item correlations revealed that two items from the decision making scale were negatively correlated with the total scale. Those items were removed. The remaining decision making items demonstrated improved internal consistency (α = .80).

An evaluation of Time 2 measures revealed that all measures met and exceeded the desirable alpha value cutoff except cold heartedness (see Table 6). Internal consistency for cold heartedness at Time 2 was acceptable for youth in community-based treatment, but did not meet criteria among youth in juvenile justice secure settings. In order to maintain the integrity of the measurement model, cold heartedness was retained in the hypothesized model, its internal consistency to be addressed as a study limitation. Time 3 measures for negative urgency, positive urgency, premeditation, and decision making all exceeded the cutoff for acceptable internal consistency (Table 7).

Correlation coefficients among measures indicated that power orientation and cold heartedness at Time 1 were significantly negatively correlated but not significantly correlated at Time 2 (see Table 8). Planning and decision making at Times 1, 2, and 3 were significantly correlated such that higher premeditation was related to higher decision making. Correlation coefficients suggested a moderate relationship between planning and decision making (Cohen, 1988). Significant moderate correlation coefficients were also estimated for Time 1 and Time 2

Table 6
Scale Reliability Values for Time 2 Measures

	Study Sample			Community-Based Sample			Juvenile Justice Sample		
Scale Items	*n*	*M (SD)*	Standardized Cronbach Coefficient Alpha	*n*	*M (SD)*	Standardized Cronbach Coefficient Alpha	*n*	*M (SD)*	Standardized Cronbach Coefficient Alpha
Negative Urgency	230		.81	119		.86	111		.71
Item 4	230	3.26 (1.11)	.79	119	3.42 (1.10)	.84	111	3.09 (1.09)	.67
Item 7	230	3.05 (1.04)	.78	119	3.18 (1.02)	.84	111	2.91 (1.05)	.66
Item 10	230	2.98 (.97)	.79	119	3.03 (1.02)	.83	111	2.92 (.92)	.69
Item 19	230	2.70 (1.08)	.81	119	2.92 (1.08)	.84	111	2.47 (1.03)	.74
Item 25	230	3.03 (1.07)	.76	119	3.24 (1.04)	.83	111	2.80 (1.06)	.62
Item 27	230	3.18 (1.08)	.77	119	3.43 (1.04)	.83	111	2.91 (1.07)	.66
Positive Urgency	231		.84	120		.88	111		.78
Item 9	231	2.67 (.99)	.83	120	2.75 (1.06)	.87	111	2.58 (.91)	.77
Item 11	231	2.67 (.99)	.83	120	2.72 (1.01)	.86	111	2.61 (.96)	.78
Item 17	231	2.69 (1.07)	.82	120	2.72 (1.05)	.86	111	2.66 (1.09)	.76
Item 29	231	2.65 (1.03)	.80	120	2.80 (1.03)	.85	111	2.50 (1.01)	.70
Item 31	231	2.59 (1.06)	.80	120	2.63 (1.09)	.85	111	2.55 (1.02)	.71
Item 33	231	2.77 (1.00)	.83	120	2.89 (1.05)	.87	111	2.64 (.93)	.77
Premeditation	232		.80	120		.80	112		.79
Item 2	232	3.63 (.87)	.79	120	3.66 (.86)	.81	112	3.60 (.90)	.75
Item 5	232	3.18 (1.02)	.77	120	3.18 (1.02)	.78	112	3.18 (1.03)	.75
Item 8	232	3.25 (.87)	.78	120	3.32 (.84)	.78	112	3.18 (.89)	.78
Item 12	232	3.40 (.98)	.75	120	3.40 (.99)	.73	112	3.40 (.96)	.76
Item 21	232	3.30 (1.00)	.76	120	3.28 (1.00)	77	112	3.31 (1.00)	.76
Item 32	232	3.35 (.95)	.75	120	3.36 (.95)	.75	112	3.34 (.94)	.76
Decision Making	238		.82	125		.84	113		.79
Item 3	238	3.69 (.96)	.83	125	3.69 (.96)	.83	113	3.70 (.96)	.75
Item 4	238	3.74 (.89)	.82	125	3.66 (.92)	.82	113	3.82 (.85)	.75
Item 13	238	3.60 (1.01)	.81	125	3.50 (1.11)	.81	113	3.72 (.87)	.78
Item 16	238	3.60 (.96)	.82	125	3.74 (.90)	.82	113	3.43 (1.00)	.76
Item 18	238	3.58 (.96)	.81	125	3.67 (.90)	.81	113	3.49 (1.01)	.75
Item 23	238	3.40 (1.01)	.83	125	3.34 (1.05)	.83	113	3.47 (.96)	.80
Item 33	238	3.33 (1.06)	.82	125	3.34 (1.04)	.82	113	3.31 (1.08)	.75
Power Orientation	201		.77	103		.75	107		.76
Item 20	201	3.06 (1.13)	.73	103	3.27 (1.14)	.69	107	2.86 (1.09)	.73
Item 22	201	3.45 (.96)	.80	103	3.66 (.83)	.78	107	3.24 (1.04)	.80
Item 24	201	2.77 (.99)	.73	103	2.99 (1.02)	.69	107	2.56 (.91)	.73
Item 28	201	2.93 (1.06)	.71	103	3.24 (1.00)	.69	107	2.63 (1.03)	.70
Item 29	201	2.95 (.97)	.73	103	3.14 (.97)	.70	107	2.77 (.95)	.72
Item 32	201	2.70 (.96)	.74	103	2.86 (1.03)	.73	107	2.55 (.87)	.71
Item 34	201	2.71 (1.07)	.75	103	2.81 (1.09)	.73	107	2.62 (1.05)	.71
Cold Heartedness	214		.67	105		.77	109		.51
Item 19	214	2.14 (.83)	.62	105	2.06 (.77)	.72	109	2.23 (.88)	.45
Item 23	214	2.49 (1.01)	.58	105	2.35 (.94)	.73	109	2.62 (1.05)	.33
Item 27	214	2.62 (.97)	.57	105	2.40 (.85)	.68	109	2.83 (1.04)	.40
Item 31	214	2.19 (.85)	.62	105	2.05 (.76)	.72	109	2.32 (.91)	.48
Item 35	214	2.79 (1.02)	.68	105	2.61 (1.01)	.77	109	2.97 (1.00)	.57
Personal Irresponsibility	217		.77	106		.76	106		78
Item 21	217	2.93 (1.13)	.76	106	3.04 (1.15)	.75	106	2.83 (1.11)	.77
Item 25	217	2.73 (1.06)	.72	106	2.81 (1.15)	.71	106	2.66 (.96)	.73
Item 26	217	2.53 (.99)	.71	106	2.71 (1.04)	.70	106	2.37 (.91)	.72
Item 30	217	2.92 (1.11)	.77	106	2.96 (1.15)	.76	106	2.88 (1.08)	.78
Item 33	217	2.18 (.98)	.72	106	2.09 (1.02)	.70	106	2.25 (.94)	.74
Item 36	217	2.19 (1.07)	.73	106	2.47 (1.10)	.72	106	2.51 (1.04)	.74

Table 7

Scale Reliability Values for Time 3 Measures

	Study Sample			Community-Based Treatment Set			Juvenile Justice Treatment Set		
Scale Items	*n*	*M (SD)*	Standardized Cronbach Coefficient Alpha	*n*	*M (SD)*	Standardized Cronbach Coefficient Alpha	*n*	*M (SD)*	Standardized Cronbach Coefficient Alpha
Negative Urgency	260		.81	150		.86	110		.70
Item 4	260	3.27 (1.09)	.78	150	3.30 (1.16)	.84	110	3.23 (.98)	.67
Item 7	260	2.88 (1.10)	.77	150	2.91 (1.15)	.83	110	2.84 (1.04)	.64
Item 10	260	2.88 (1.02)	.78	150	2.87 (1.02)	.83	110	2.90 (1.01)	.67
Item 19	260	2.63 (1.03)	.78	150	2.71 (1.04)	.83	110	2.52 (1.00)	.67
Item 25	260	3.01 (1.13)	.76	150	3.15 (1.14)	.81	110	2.82 (1.09)	.64
Item 27	260	2.96 (1.09)	.79	150	3.01 (1.16)	.85	110	2.89 (1.00)	.64
Positive Urgency	257		.87	147		.88	110		.87
Item 9	257	2.54 (.99)	.87	147	2.53 (1.02)	.87	110	2.55 (.95)	.86
Item 11	257	2.68 (1.05)	.84	147	2.78 (1.11)	.84	110	2.54 (.95)	.84
Item 17	257	2.64 (1.06)	.86	147	2.58 (1.12)	.85	110	2.72 (.99)	.86
Item 29	257	2.61 (1.02)	.86	147	2.60 (1.06)	.86	110	2.63 (.97)	.85
Item 31	257	2.64 (1.10)	.84	147	2.65 (1.16)	.84	110	2.63 (1.02)	.83
Item 33	257	2.70 (1.04)	.84	147	2.69 (1.08)	.86	110	2.73 (.99)	.82
Premeditation	259		.80	149		.80	110		.79
Item 2	259	3.53 (.94)	.76	149	3.65 (.94)	.75	110	3.45 (.91)	.76
Item 5	259	3.29 (1.03)	.77	149	3.40 (1.05)	.79	110	3.14 (.98)	.74
Item 8	259	2.26 (.96)	.80	149	3.28 (.94)	82	110	3.24 (.99)	.76
Item 12	259	3.41 (1.01)	.76	149	3.52 (.97)	.75	110	3.25 (1.04)	.77
Item 21	259	3.31 (1.07)	.76	149	3.42 (1.04)	.74	110	3.16 (1.10)	.78
Item 32	259	3.36 (1.03)	.76	149	3.45 (.99)	.75	110	3.23 (1.07)	.77
Decision Making	259		.81	151		.83	108		.77
Item 3	259	3.61 (1.00)	.77	151	3.60 (1.05)	.78	108	3.61 (.94)	.75
Item 4	259	3.83 (.87)	.79	151	3.86 (.92)	.81	108	3.78 (.81)	.75
Item 13	259	3.69 (1.01)	.76	151	3.77 (.95)	.77	108	3.56 (1.08)	.72
Item 16	259	3.53 (.98)	.77	151	3.57 (.99)	.80	108	3.46 (.97)	.73
Item 18	259	3.64 (.98)	.77	151	3.70 (1.02)	.79	108	3.55 (.92)	.75
Item 23	259	3.48 (.96)	.82	151	3.52 (.99)	.84	108	3.44 (.91)	.79
Item 33	259	3.44 (1.04)	.79	151	3.42 (1.07)	.82	108	3.48 (1.00)	.72

Table 8

Correlations among Age, Drug Use, Time in Treatment, and Assessment Measures

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Age	1.00																				
2. Drug Use	0.11	1.00																			
3. Time in Treatment 1	-0.09	0.05	1.00																		
4. Time in Treatment 2	-0.05	-0.09	0.05	1.00																	
5. Time in Treatment 3	-0.06	-0.06	-0.08	.43***	1.00																
Criminal Thinking Indicators																					
6. Cold Heartedness Time 1	-0.05	0.01	-.19**	0.02	-0.10	1.00															
7. Cold Heartedness Time 2	0.07	-0.07	-0.04	0.03	0.01	.41***	1.00														
8. Power Orientation Time 1	-0.02	.24***	.12*	-0.02	-0.04	-.30***	-0.03	1.00													
9. Power Orientation Time 2	-0.08	.19*	0.04	-0.03	0.05	-0.09	-0.12	.33***	1.00												
Planning Indicators																					
10. Decision Making Time 1	0.06	-0.09	0.05	-0.13	-0.04	-.49***	-.31***	0.03	-0.05	1.00											
11. Decision Making Time 2	0.04	-0.05	0.01	0.11	-0.02	-.37***	-.50***	-0.05	-.14*	.54***	1.00										
12. Decision Making Time 3	0.08	0.06	0.02	-0.07	-0.03	-.31***	-.35***	-.16*	-.16*	.51***	.56***	1.00									
13. Premeditation Time 1	.12*	-.19**	0.10	-0.07	-0.10	-.36***	-0.08	-0.06	-.20**	.63***	.39***	.40***	1.00								
14. Premeditation Time 2	0.06	-.16*	0.06	0.10	-0.07	-0.14	-.32***	-.19*	-.19**	.37***	.56***	.45***	.37***	1.00							
15. Premeditation Time 3	-0.01	0.06	0.07	-0.02	0.04	-.20**	-.39***	-0.13	-0.08	.40***	.36***	.61***	.34***	.42***	1.00						
Urgency Indicators																					
16. Negative Urgency Time 1	0.06	.21***	-0.01	0.04	0.08	-.35***	-.15*	.45***	.16*	0.09	0.11	-0.02	0.10	-0.07	-0.01	1.00					
17. Negative Urgency Time 2	-0.02	.14*	-0.04	.14*	0.07	-0.12	-.20**	.22**	.49***	-0.05	0.02	-0.12	-.15*	0.02	-0.02	.40***	1.00				
18. Negative Urgency Time 3	-0.05	.15*	-0.12	0.00	0.02	-0.04	-0.11	.25***	.52***	-.15*	-0.09	-.21***	-.22***	-.26***	-0.09	.44***	.55***	1.00			
19. Positive Urgency Time 1	-0.02	.26***	-0.03	-0.01	0.01	-.20***	-0.02	.39***	.16*	-0.02	-0.04	-0.09	0.02	-0.12	0.00	.64***	.26***	.37***	1.00		
20. Positive Urgency Time 2	0.00	.16*	-0.08	0.03	0.12	-0.04	-0.06	.20**	.50***	-.18*	-0.12	-.15*	-.20**	-0.08	-0.04	.32***	.67***	.55***	.36***	1.00	
21. Positive Urgency Time 3	-0.07	0.07	-0.07	-0.02	0.04	0.02	-0.07	.19**	.49***	-.24***	-.18*	-.33***	-.26***	-.21**	-.18**	.24***	.40***	.70***	.33***	.59***	1.00

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

measures of negative and positive urgency. The relationship between Time 3 measures of negative and positive urgency was strong. For each variable, values at Times 1 and 2 were significantly correlated, and values for Times 1, 2, and 3 for decision making, premeditation, negative urgency, and positive urgency were significantly correlated. The hypothesized measurement model was adjusted such that the criminal thinking latent variables represented only cold heartedness and power orientation measures because of the poor internal consistency of the personal irresponsibility measure. This initial model was tested using the robust maximum likelihood estimator with MPlus 7 software, but results were not able to be computed. Because the internal consistency of the Time 2 cold heartedness measure was low and Time 2 cold heartedness and power orientation measures were not significantly correlated, the model was re-estimated with cold heartedness and power orientation at Times 1 and 2 specified as separate, observed measures (see Figure 4; Model 1). Results indicated that the RMSEA was

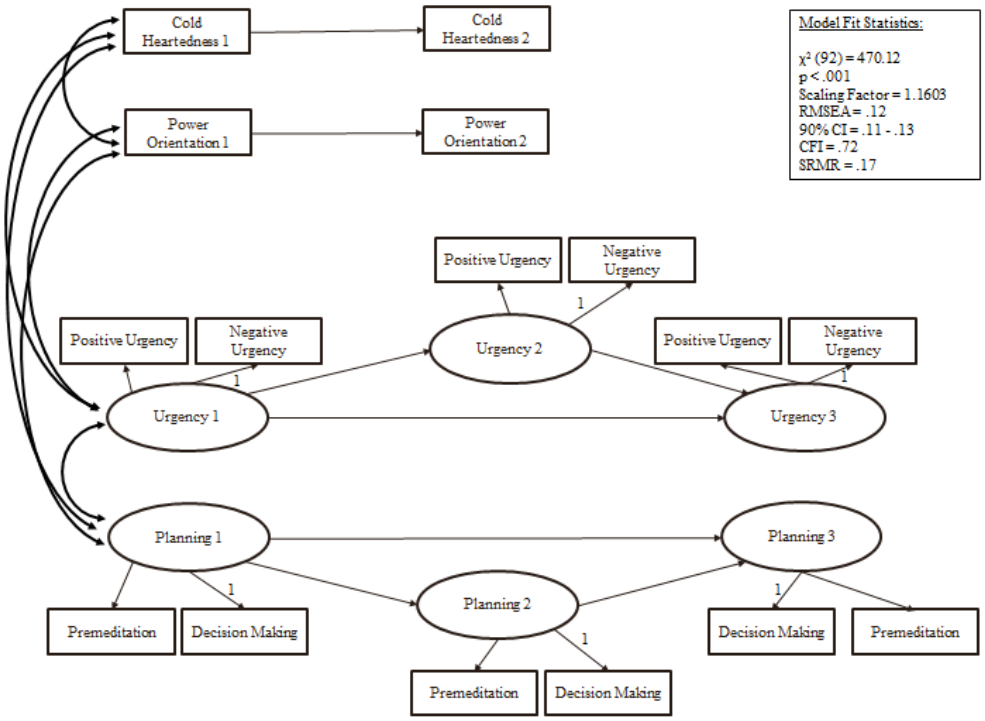

Figure 4. The measurement model was respecified with criminal thinking measures estimated as separate variables (Measurement Model 1).

higher than the desired .05 cutoff (RMSEA = .13), the upper 90% confidence interval was greater than the desired value (less than .10) at .13, the CFI indicated that only 72% of the variance-covariance was accounted for, and the SRMR exceeded the desired .05 cutoff at .17. Overall, the model was not an acceptable fit to the data. Standardized parameter estimates indicated that the factor loadings were statistically significant and within an acceptable range (at or above .70) with the exception of premeditation at Time 2 (see Table 9). The urgency latent variable at Times 1, 2, and 3 explained 68%, 57%, and 73% of the variance of negative urgency, and 60%, 78%, and 64% of positive urgency at Times 1, 2, and 3 respectively. The planning latent variable at Times 1, 2, and 3 explained 78%, 74%, and 80% of the variance of decision making and 48%, 49%, and 44% of the variance in premeditation at Times 1, 2, and 3 respectively. Time 1 planning, urgency, cold heartedness, and power orientation were significantly related to their respective Time 2 repeated measures. Similarly, urgency and planning at Time 2 were significantly related to their respective Time 3 measures, but Time 1 urgency and planning were not significantly related directly to their respective Time 3 measures. Twenty-four percent of the variance of Time 2 urgency was explained by Time 1 urgency, and 53% of the variance in Time 2 planning was explained by Time 1 planning. Controlling for these effects, 42% of the variance of Time 3 urgency, and 52% of the variance of Time 3 planning was explained by Time 2 urgency and Time 2 planning respectively.

Based on modification indices, the model was respecified to allow planning Time 1 and cold heartedness Time 1 to correlate (Model 2). This model was a significantly better fit to the data based on the Satorra-Bentler chi-square difference test, but was still an inadequate fit to the data. Further respecifications included allowing Time 2 power orientation and Time 2 urgency errors to correlate (Model 3), allowing Time 2 cold heartedness and Time 2 planning errors to correlate (Model 4), correlating power orientation at Time 1 with urgency at Time 1 (Model 5), and regressing urgency at Time 2 on planning at Time 1 (Model 6).

Table 9

Measurement Model 1 Unstandardized and Standardized Estimates

	Unstandardized		Standardized	
Measure	Estimate	*SE*	Estimate	*SE*
Factor Loadings				
Urgency Time 1 by				
Negative Urgency Time 1	1.00	.00	.83	.09
Positive Urgency Time 1	.83***	.17	.77	.08
Planning Time 1 by				
Decision Making Time 1	1.00	.00	.89	.05
Premeditation Time 1	.83***	.10	.70	.05
Urgency Time 2 by				
Negative Urgency Time 2	1.00	.00	.75	.08
Positive Urgency Time 2	1.23***	23	.88	.07
Planning Time 2 by				
Decision Making Time 2	1.00	.00	.86	.05
Premeditation Time 2	.84***	.11	.70	.06
Urgency Time 3 by				
Negative Urgency Time 3	1.00	.00	.85	.05
Positive Urgency Time 3	1.02***	.14	.80	.06
Planning Time 3 by				
Decision Making Time 3	1.00	.00	.90	.05
Premeditation Time 3	.86***	.12	.66	.06
Direct Effects				
Urgency Time 3 on				
Urgency Time 2	.50**	.15	.45	.12
Urgency Time 1	.28**	.10	.30	.10
Urgency Time 2 on				
Urgency Time 1	.41***	.12	.49	.11
Planning Time 3 on				
Planning Time 2	.49**	.19	.51	.18
Planning Time 1	.22	.12	.26	.15
Planning Time 2 on				
Planning Time 1	.64***	.10	.73	.07
Cold Heartedness Time 2 on				
Cold Heartedness Time 1	.34***	.06	.40	.07
Power Orientation Time 2 on				
Power Orientation Time 1	.38***	.08	.36	.08
Correlations				
Planning Time 1 with				
Urgency Time 1	.04	5.29	.001	.12
Error Correlations				
Planning Time 3 with				
Urgency Time 3	-5.20*	2.59	-.29	.14

Measure	Unstandardized Estimate	Unstandardized *SE*	Standardized Estimate	Standardized *SE*
Cold Heartedness Time 2 with				
Urgency Time 3	-3.02	2.55	-.11	.09
Planning Time 3	-4.99	2.54	-.23	.11
Power Orientation Time 2	-6.16	3.17	-.16	.08
Power Orientation Time 2 with				
Urgency Time 3	17.59***	4.44	.55	.09
Planning Time 3	-2.60	2.69	-.10	.10

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

Each respecified model was a significantly better fit to the data than the previous, and made conceptual sense (see Table 10). The final model was specified by removing effects that were not statistically significant, resulting in a model that did not meet all of the desired criteria for a good fit to the data, but did meet criteria for an adequate fit to the data (Hu & Bentler, 1995; see Figure 5). The factor loadings remained stable through each respecification. The standardized loading for premeditation at Time 3 was slightly below the desired range at .67 with an R^2 value at .45 (see Table 11). Each standardized unit increase in Time 1 urgency significantly predicted a .58 unit increase in Time 2 urgency. Likewise, each standardized unit increase in Time 2 urgency significantly predicted a .80 increase in Time 3 urgency. Each standardized unit increase in planning at Time 1 was also significantly associated with a .24 unit decrease in Time 2 urgency. In standardized units, each unit increase in Time 1 planning was associated with a .76 unit increase in planning at Time 2, and each unit increase in Time 2 planning was associated with .81 unit increase in Time 3 planning. Higher cold heartedness at Time 1 was associated with higher cold heartedness at Time 2, and higher power orientation was associated with higher power orientation at Time 2.

Planning and cold heartedness were significantly correlated at Time 1 such that higher cold heartedness was associated with lower planning. Higher cold heartedness at Time 1 was also significantly associated with lower urgency and power orientation at Time 1. Higher power

Table 10

Measurement Model Analysis Respecification Steps and Satorra-Bentler Chi-Square Difference Test Results

Model	χ^2_M	df_M	Scaling Factor	χ^2_D	df_D	RMSEA (90% CI)	CFI	SRMR
Hypothesized Model[a]								
Model 1 (Single Indicators of cold heartedness and power orientation at Times 1 and 2 included)	470.12***	92	1.1603			.12 (.11-.13)	.72	.17
Model 2 (Planning 1 with Cold Heartedness 1)	388.70***	91	1.1471	42.18***	2.36	.10 (.09-.11)	.78	.15
Model 3 (Power Orientation 2 with Urgency 2)	316.77***	90	1.1590	1034.65***	.08	.09 (.08-.10)	.83	.13
Model 4 (Cold Heartedness 2 with Planning 2)	271.64***	89	1.1526	31.27***	1.73	.08 (.07-.09)	.86	.13
Model 5 (Power Orientation 1 with Urgency 1)	204.87***	86	1.1503	63.55***	1.22	.06 (.05-.07)	.92	.10
Model 6 (Urgency 2 on Planning 1)	187.85***	85	1.1513	18.20***	1.07	.06 (.05-.07)	.93	.08
Final Model (Remove Non-Significant Effects)	193.32***	92	1.1793	-7.71*	1.52	.06 (.05-.07)	.93	.08

[a]Unable to be estimated.

*$p < .05$. ***$p < .001$.

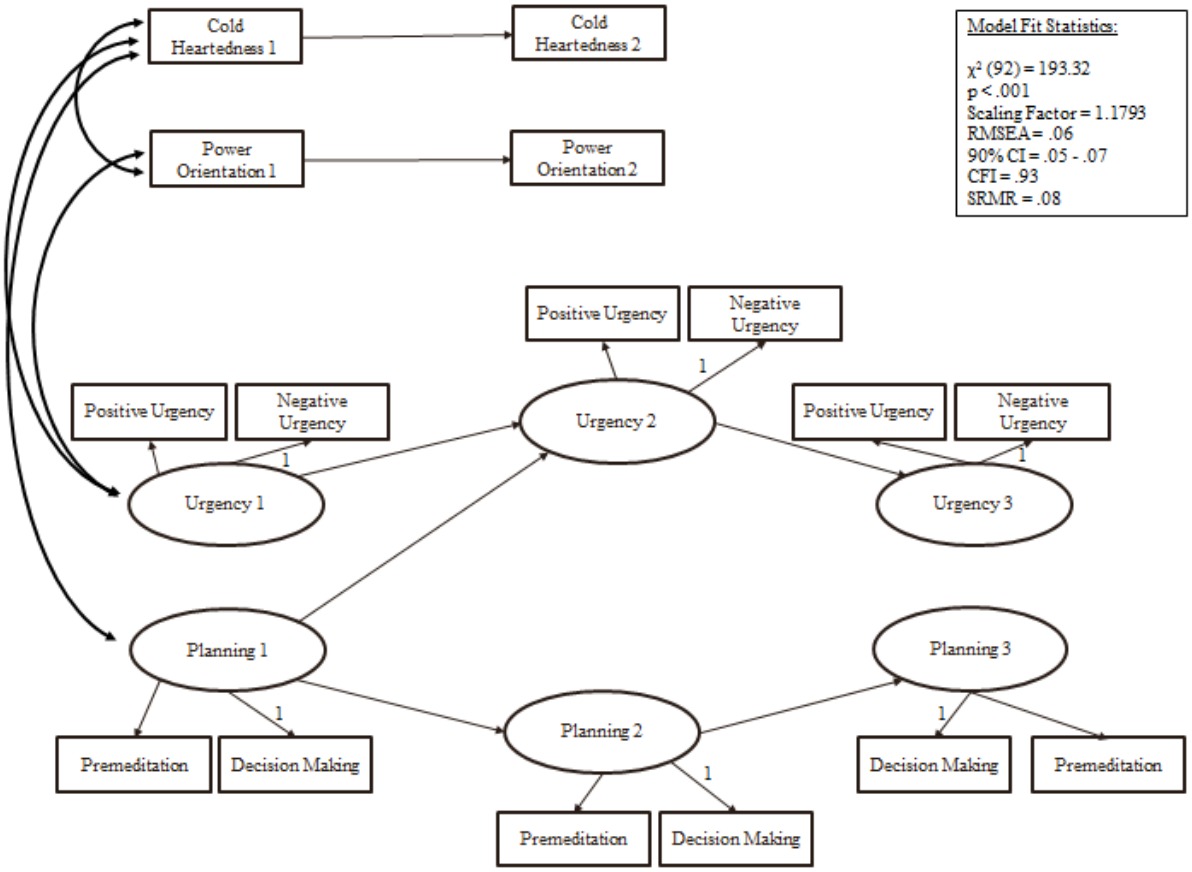

Figure 5. The final measurement model was respecified by including a direct effect from planning Time 1 to urgency Time 1, and by removing effects that were not statistically significant. The model was an adequate fit to the data.

Table 11

Measurement Model Final Model Unstandardized and Standardized Estimates

	Unstandardized		Standardized	
Measure	Estimate	*SE*	Estimate	*SE*
Factor Loadings				
Urgency Time 1 by				
Negative Urgency Time 1	1.00	.00	.89	.04
Positive Urgency Time 1	.72***	.07	.73	.04
Planning Time 1 by				
Decision Making Time 1	1.00	.00	.85	.03
Premeditation Time 1	.91***	.08	.74	.04
Urgency Time 2 by				
Negative Urgency Time 2	1.00	.00	.79	.04
Positive Urgency Time 2	1.07***	.10	.85	.04
Planning Time 2 by				
Decision Making Time 2	1.00	.00	.83	.04
Premeditation Time 2	.81***	.08	.67	.06
Urgency Time 3 by				
Negative Urgency Time 3	1.00	.00	.87	.04
Positive Urgency Time 3	.97***	.10	.80	.04
Planning Time 3 by				
Decision Making Time 3	1.00	.00	.88	.04
Premeditation Time 3	.88***	.11	.71	.06
Direct Effects				
Urgency Time 3 on				
Urgency Time 2	.87***	.11	.80	.05
Urgency Time 2 on				
Urgency Time 1	.49***	.07	.58	.07
Planning Time 1	-.24***	.06	-.25	.07
Planning Time 3 on				
Planning Time 2	.85***	.09	.81	.05
Planning Time 2 on				
Planning Time 1	.66***	.08	.76	.05
Cold Heartedness Time 2 on				
Cold Heartedness Time 1	.37***	.05	.43	0.05
Power Orientation Time 2 on				
Power Orientation Time 1	.38***	.07	.36	.07
Correlations				
Urgency Time 1 with				
Planning Time 1	.00	.00	.00	.00
Power Orientation Time 1	25.602***	4.28	.52	0.07
Planning Time 1 with				
Cold Heartedness Time 1	-26.34***	3.73	-.56	.05
Power Orientation Time 1	.00	.00	.00	.00
Cold Heartedness Time 1 with				
Power Orientation Time 1	-15.72***	3.35	-.32	.05
Urgency Time 1	-17.85***	4.09	-.33	.06
Error Correlations				
Urgency Time 3 with				
Planning Time 3	.00	.00	.00	.00
Cold Heartedness Time 2 with				
Planning Time 2	-15.05***	2.78	-.70	.08
Planning Time 3	.00	.00	.00	.00
Urgency Time 3	-5.06*	2.10	-.21	.09

Measure	Unstandardized Estimate	Unstandardized *SE*	Standardized Estimate	Standardized *SE*
Power Orientation Time 2 with				
Urgency Time 2	20.31***	3.37	.65	.07
Urgency Time 3	7.81**	2.92	.29	.09
Planning Time 3	.00	.00	.00	.00
Cold Heartedness Time 2	-5.701*	2.39	-.15	.06

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

orientation at Time 1 was associated with higher urgency at Time 1. The error term for Time 2 power orientation was significantly associated with the error terms of urgency Times 2 and 3 and cold heartedness at Time 2. The error term of cold heartedness at Time 2 was associated with the error terms of planning Time 2 and urgency Time 3.

Explained variance for each endogenous variable was also computed. Forty percent of the variance of urgency Time 2 was explained by urgency Time 1 and planning Time 1. Sixty-three percent of the variance in urgency Time 3 was explained by the effect of urgency Time 2 on urgency Time 3, the effect of urgency Time 1 on urgency Time 2, and the effect of planning Time 1 on urgency Time 2. Planning Time 1 explained 57% of the variance in planning Time 2. Sixty-six percent of the variance in planning Time 3 was explained by the effect of planning Time 1 on planning Time 2 and the effect of planning Time 2 on Planning Time 3. Only 18% of the variance in cold heartedness Time 2 was explained by cold heartedness at Time 1, and 13% of the Time 2 power orientation variance was explained by Time 1 power orientation. The urgency latent variables at Times 1, 2, and 3 explained 79%, 62%, and 76% of the variance in negative urgency, and 83%, 72%, and 64% of the variance in positive urgency at Times 1, 2, and 3 respectively. The planning latent variables at Times 1, 2, and 3 explained 73%, 69%, and 78% of the variance in decision making and 55%, 45%, and 50% of the variance in premeditation at Times 1, 2, and 3 respectively.

Structural Models. The final measurement model was used to respecify the model testing hypothesis 1, which predicted that cognitive measures would change over time. The planned covariates (drug use and time in treatment) and covariates identified in preliminary analyses (ethnicity, race, and age) were included in the initial model (see Figure 6; Table 12). As

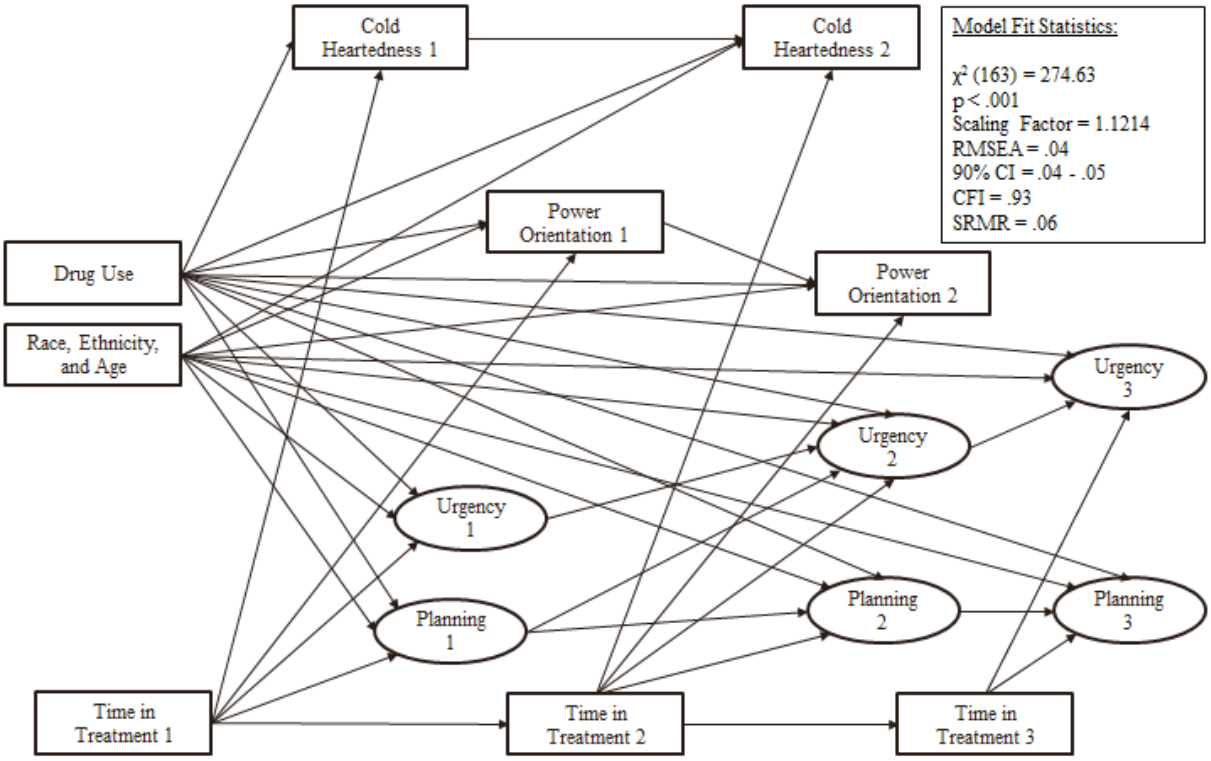

Figure 6. The model for hypothesis 1 was respecified using the final measurement model (Hypothesis 1 Model 0). The model was an adequate fit to the data.

expected, due to the large sample size, the chi square value was significant. Because the model was an adequate fit to the data, the final model reflected only the removal of effects that were not statistically significant (see Figure 7). This respecification was not a significantly better fit to the data at a .05 level based on the Satorra-Bentler difference test. The factor loadings for the latent variables were similar to those in the final measurement model, and the repeated measures effects remained significant (see Table 13). Planning at Time 1 was significantly associated with Urgency at Time 2 as in the final measurement model.

Table 12

Hypothesis 1: Hypothesized Model Unstandardized and Standardized Estimates

	Unstandardized		Standardized	
Measure	Estimate	*SE*	Estimate	*SE*
Factor Loadings				
Urgency Time 1 by				
Negative Urgency Time 1	1.00	.00	.87	.04
Positive Urgency Time 1	.75***	.07	.74	.04
Planning Time 1 by				
Decision Making Time 1	1.00	.00	.85	.04
Premeditation Time 1	.91***	.09	.74	.04
Urgency Time 2 by				
Negative Urgency Time 2	1.00	.00	.80	.04
Positive Urgency Time 2	1.05***	.10	.84	.04
Planning Time 2 by				
Decision Making Time 2	1.00	.00	.82	.04
Premeditation Time 2	.83***	.09	.68	.05
Urgency Time 3 by				
Negative Urgency Time 3	1.00	.00	.86	.04
Positive Urgency Time 3	.99***	.10	.81	.04
Planning Time 3 by				
Decision Making Time 3	1.00	.00	.88	.04
Premeditation Time 3	.89***	.11	.71	.06
Direct Effects				
Urgency Time 3 on				
Urgency Time 2	.86***	.11	.80	.05
Time in Treatment 3	-.01	.04	-.01	.05
Drug Use	.04	.06	.05	.07
Ethnicity	-.43	.88	-.03	.07
Race	1.24	.94	.08	.06
Age	-.22	.30	-.04	.05
Urgency Time 2 on				
Urgency Time 1	.51***	.08	.58	.07
Planning Time 1	-.25***	.07	-.26	.07
Time in Treatment 2	.07	.05	.09	.06
Drug Use	-.05	.06	-.06	.07
Ethnicity	.52	.93	.04	.07
Race	-1.04	1.10	-.07	.07
Age	-.19	.30	-.03	.06
Urgency Time 1 on				
Time in Treatment 1	-.05	.06	-.05	.05
Drug Use	.20**	.07	.22	.08
Ethnicity	-.33	1.04	-.02	.07
Race	-1.63	1.26	-.10	.07
Age	-.11	.36	-.02	.06

Measure	Unstandardized Estimate	Unstandardized *SE*	Standardized Estimate	Standardized *SE*
Planning Time 3 on				
Planning Time 2	.88***	.09	.84	.04
Time in Treatment 3	.06	.04	.09	.07
Drug Use	.15**	.05	.20	.07
Ethnicity	-.58	.86	-.05	.07
Race	-.05	.90	-.003	.06
Age	-.22	.29	-.04	.06
Planning Time 2 on				
Planning Time 1	.65***	.08	.75	.05
Time in Treatment 2	.07†	.04	.10	.06
Drug Use	-.03	.05	-.05	.06
Ethnicity	.77	.80	.07	.07
Race	-.02	.94	-.002	.07
Age	.41	.29	.09	.06
Planning Time 1 on				
Time in Treatment 1	.08	.06	.08	.06
Drug Use	-.14**	.05	-.17	.06
Ethnicity	-.10	.90	-.01	.07
Race	-.60	1.10	-.04	.07
Age	.65†	.36	.12	.06
Cold Heartedness Time 2 on				
Cold Heartedness Time 1	.36***	.05	.41	.05
Time in Treatment 2	.002	.04	.003	.05
Drug Use	-.04	.05	-.04	.06
Ethnicity	-1.10	.84	-.09	.07
Race	.14	.94	.01	.06
Age	.34	.32	.06	.06
Cold Heartedness Time 1 on				
Time in Treatment 1	-.22***	.06	-.19	.05
Drug Use	.09†	0.05	.09	.05
Ethnicity	.12	.88	.01	.06
Race	3.92***	1.12	.22	.06
Age	-.45	.35	-.07	.05
Power Orientation Time 2 on				
Power Orientation Time 1	.36***	.08	.34	.07
Time in Treatment 2	.003	.06	.004	.06
Drug Use	.06	.06	.07	.07
Ethnicity	2.05*	4	.14	.07
Race	.72	1.14	.04	.07
Age	-.36	.33	-.06	.05

Measure	Unstandardized Estimate	Unstandardized *SE*	Standardized Estimate	Standardized *SE*
Power Orientation Time 1 on				
Time in Treatment 1	.11†	.06	.10	.06
Drug Use	.19***	.05	.22	.06
Ethnicity	.86	.86	.06	.06
Race	-.09	1.01	-.01	.06
Age	-.41	.32	-.07	.05
Time in Treatment 2 on				
Time in Treatment 1	.02	.10	.02	.08
Time in Treatment 3 on				
Time in Treatment 2	.11	.12	.09	.10
Error Correlations				
Urgency Time 1 with				
Planning Time 1	.00	.00	.00	.00
Urgency Time 3 with				
Planning Time 3	.00	.00	.00	.00
Planning Time 1 with				
Cold Heartedness Time 1	-23.85***	3.60	-.54	.05
Cold Heartedness Time 1 with				
Urgency Time 1	-16.64***	3.76	-.35	0.07
Power Orientation Time 1	-14.12***	2.97	-.31	0.05
Cold Heartedness Time 2 with				
Urgency Time 3	-4.68*	2.00	-.20	.08
Planning Time 2	-14.50***	2.71	-.71	.08
Planning Time 3	.00	.00	.00	.00
Power Orientation Time 1 with				
Urgency Time 1	22.62***	4.03	.51	.07
Planning Time 1	.00	.00	.00	.00
Power Orientation Time 2 with				
Urgency Time 2	20.17***	3.34	.66	.07
Urgency Time 3	7.15*	2.81	.28	.09
Planning Time 3	.00	.00	.00	.00
Cold Heartedness Time 2	-4.61*	2.22	-.12	.06

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

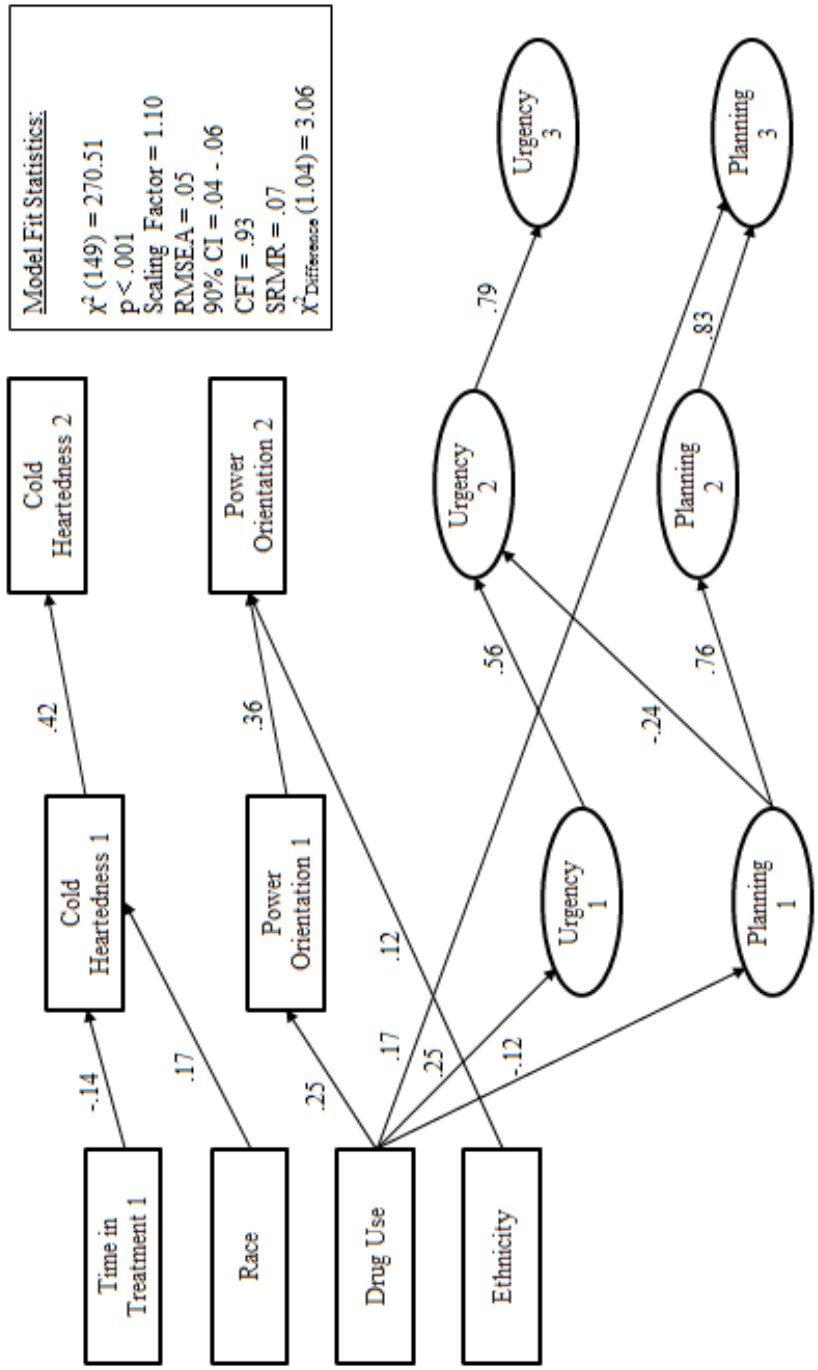

Figure 7. The final model for hypothesis 1 was respecified by removing the effects that were not statistically significant. The model was an adequate fit to the data. Standardized estimates are shown.

Table 13

Hypothesis 1: Final Model Unstandardized and Standardized Estimates

	Unstandardized		Standardized	
Measure	Estimate	*SE*	Estimate	*SE*
Factor Loadings				
Urgency Time 1 by				
Negative Urgency Time 1	1.00	.00	.88	.04
Positive Urgency Time 1	.74***	.07	.74	.04
Planning Time 1 by				
Decision Making Time 1	1.00	.00	.85	.04
Premeditation Time 1	.91***	.08	.74	.04
Urgency Time 2 by				
Negative Urgency Time 2	1.00	.00	.78	.05
Positive Urgency Time 2	1.10***	.11	.86	.04
Planning Time 2 by				
Decision Making Time 2	1.00	.00	.83	.04
Premeditation Time 2	.82***	.09	.68	.06
Urgency Time 3 by				
Negative Urgency Time 3	1.00	.00	.86	.04
Positive Urgency Time 3	.99***	.10	.81	.04
Planning Time 3 by				
Decision Making Time 3	1.00	.00	.88	.04
Premeditation Time 3	.89***	.11	.71	.06
Direct Effects				
Urgency Time 3 on				
Urgency Time 2	.87***	.11	.79	.05
Urgency Time 2 on				
Urgency Time 1	.47***	.08	.56	.07
Planning Time 1	-.23***	.06	-.24	.07
Urgency Time 1 on				
Drug Use	.23***	.06	.25	.07
Planning Time 3 on				
Planning Time 2	.87***	.09	.83	.04
Drug Use	.12**	.04	.17	.06
Planning Time 2 on				
Planning Time 1	.67***	.08	.76	.05
Planning Time 1 on				
Drug Use	-.09*	.04	-.12	.05
Cold Heartedness Time 2 on				
Cold Heartedness Time 1	.37***	.05	.42	.05
Cold Heartedness Time 1 on				
Time in Treatment 1	-.16***	.05	-.14	.04
Race	2.94***	.84	.17	.05

Measure	Unstandardized Estimate	Unstandardized *SE*	Standardized Estimate	Standardized *SE*
Power Orientation Time 2 on				
Power Orientation Time 1	.38***	.07	.36	.07
Ethnicity	1.73*	.70	.12	.05
Power Orientation Time 1 on				
Drug Use	.22***	.05	.25	.05
Error Correlations				
Urgency Time 1 with				
Planning Time 1	.00	.00	.00	.00
Urgency Time 3 with				
Planning Time 3	.00	.00	.00	.00
Planning Time 1 with				
Cold Heartedness Time 1	-24.57***	3.69	-.55	05
Cold Heartedness Time 1 with				
Urgency Time 1	-16.71***	3.80	-.34	.07
Power Orientation Time 1	-14.22***	3.02	-.31	.05
Cold Heartedness Time 2 with				
Urgency Time 3	-5.15*	2.11	-.22	.09
Planning Time 2	-14.84***	2.77	-.69	.08
Planning Time 3	.00	.00	.00	.00
Power Orientation Time 1 with				
Urgency Time 1	22.61***	4.06	.49	.07
Planning Time 1	.00	.00	.00	.00
Power Orientation Time 2 with				
Urgency Time 2	19.77***	3.36	.64	.07
Urgency Time 3	8.07**	2.86	.31	.09
Planning Time 3	.00	.00	.00	.00
Cold Heartedness Time 2	-5.33*	2.35	-.14	.06

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Results from the final model indicated that there were significant relationships between Time 1 and 2 measures, as well as between Time 2 and 3 urgency and planning measures. Parameter estimates indicated that, controlling for the effect of drug use on urgency at Time 1, for every unit increase in Time 1 urgency, Time 2 urgency increased by .47 units. In other words, at a score of 0 for Time 1 urgency, the predicted Time 2 urgency scores was .47 (.56 standardized). Controlling for the effect of Time 1 urgency on Time 2 urgency and the effect of drug use on planning and Time 1 urgency, every unit increase in planning at Time 1 was associated with a .23 unit decrease in Time 2 urgency. This can also be interpreted as a

reduction in change from urgency Time 1 to urgency Time 2. These effects accounted for 38% of the variance of Time 2 urgency. Given a score of 0 on Time 2 urgency, controlling for Time 1 urgency and Time 1 planning, the expected Time 3 urgency score was .87 (.79 standardized). Sixty-three percent of the variance of Time 3 urgency was explained. Planning also increased from Time 1 to Time 2, explaining 58% of the variance of planning Time 2, and from Time 2 to Time 3, explaining 70% of the variance for planning at Time 3. Controlling for the effect of drug use on Planning at Time 1, for every unit increase in Time 1 planning, a .67 unit increase was expected for Time 2 planning. Controlling for the effect of drug use on Time 1 planning and the effect of Time 1 planning on Time 2 planning, for every unit increase in Time 2 planning, a .87 unit increase was expected for Time 3 planning. Increases were also expected for cold heartedness and power orientation. Controlling for the effect of time in treatment 1 and race on cold heartedness Time 1, for every unit increase in cold heartedness Time 1, there was a .37 unit increase expected for Time 2 cold heartedness. Eighteen percent of the variance of cold heartedness Time 2 was explained. Controlling for the effect of drug use on power orientation Time 1, for every unit increase in power orientation Time 1, a .38 unit increase in power orientation Time 2 was expected, explaining 15% of Time 2 power orientation variance.

Several covariates were significantly associated with variables in the structural model. Using standardized estimates, for every unit increase in drug use, there was a .17 unit increase in Planning Time 3, a .25 unit increase in urgency at Time 1, a .25 unit increase in power orientation at Time 1, and a .12 unit decrease in planning at Time 1. Controlling for power orientation at Time 1, Hispanic youth reported greater Time 2 power orientation. Race was significantly associated with cold heartedness at Time 1 such that Black/African American youth reported higher cold heartedness. Cold heartedness at Time 1 decreased by .14 units for every additional day a youth was in treatment from intake to the initial assessment administration. All effects also controlled for the correlations among exogenous variables and relationships among Time 1 measure error terms (cold heartedness with planning, urgency, and power orientation; and power orientation with urgency).

Urgency latent variables at Times 1, 2, and 3 accounted for 76%, 64%, and 75% of negative urgency variables and 55%, 71%, and 65% of Time 3 positive urgency variance at Times 1, 2, and 3 respectively. Planning latent variables at Times 1, 2, and 3 accounted for 73%, 68%, and 77% of decision making variables and 55%, 47%, and 50% of Time 3 premeditation variance at Times 1, 2, and 3 respectively.

The model testing hypothesis 2 (youth in community-based treatment settings would report lower criminal thinking, lower urgency, and higher planning) was not tested because it was not an identified model. Measurement models with only 2 latent variables must include at least 1 latent variable with 3 or more indicators to be identified (Kline, 2011). Thus, the model testing hypothesis 3 was specified next. The initial model testing hypothesis 3 was respecified using the final measurement model and by including effects of the covariates (drug use, time in treatment, ethnicity, race, and age) and the effects of treatment setting (community-based set = 0; see Figure 8; Table 14). The model was an adequate fit to the data with good RMSEA (.04) and upper 90% CI (.05) values, and adequate CFI (.93) and SRMR (.06) values. The chi-square value was significant as expected. The final model (where non-statistically significant effects were removed) was also an adequate fit (see Figure 9) but not a significant improvement over the hypothesized model.

The measurement model retained similar factor loadings and the repeated measures retained significant effects (see Table 15). Urgency latent variables at Times 1, 2, and 3 accounted for 77%, 64%, and 74% of negative urgency variables and 55%, 72%, and 65% of positive urgency variance at Times 1, 2, and 3 respectively. Planning latent variables at Times 1, 2, and 3 accounted for 72%, 69%, and 78% of decision making variables and 55%, 46%, and 50% of Time 3 premeditation variance at Times 1, 2, and 3 respectively. Controlling for the effect of drug use on urgency at Time 1, for each unit increase in urgency Time 1, a .47 unit increase was expected for urgency at Time 2. Thirty-nine percent of the variance in urgency Time 2 was explained. Controlling for the effect of drug use on urgency Time 1 and the effect of urgency Time 1 on urgency Time 2, each unit increase in urgency Time 2 was associated with a

.86 unit increase in urgency Time 3. Sixty-three percent of urgency Time 3 variance was explained. Controlling for the direct effects of treatment setting, drug use, and age on planning at Time 1, each unit increase in planning at Time 1 was associated with a .68 unit increase in planning at Time 2, accounting for 58% of the variance for Time 2 planning. Controlling for the effect of treatment setting, drug use, and age on planning Time 1, and the effect of planning Time 1 on planning Time 2, each unit increase in planning at Time 2 was associated with a .86 unit increase in planning Time 3. Sixty-nine percent of the variance at planning Time 3 was explained. Controlling for the effect of drug use on urgency Time 1 and planning Time 1, the effect of treatment setting on planning Time 1, and the effect of urgency Time 1 on urgency Time 2, higher planning at Time 1 predicted lower urgency at Time 2. In other words, higher planning scores predicted a lower increase in urgency from Time 1 to Time 2. Higher drug use at Time 1 was associated with higher Time 3 planning (controlling for planning Times 1 and 2), higher Time 1 urgency, lower Time 1 planning, and higher Time 1 power orientation.

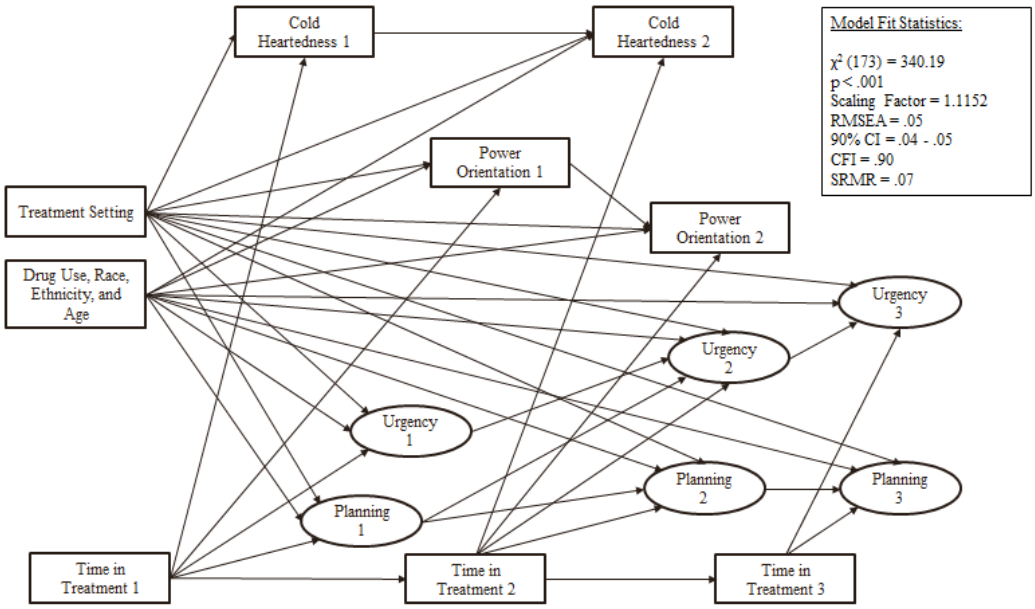

Figure 8. The model for hypothesis 3 was respecified using the final measurement model. The model was an adequate fit to the data.

Table 14

Hypothesis 3: Hypothesized Model Unstandardized and Standardized Estimates

	Unstandardized		Standardized	
Measure	Estimate	*SE*	Estimate	*SE*
Factor Loadings				
Urgency Time 1 by				
Negative Urgency Time 1	1.00	.00	.87	.04
Positive Urgency Time 1	.75***	.07	.74	.04
Planning Time 1 by				
Decision Making Time 1	1.00	.00	.85	.04
Premeditation Time 1	.92***	.09	.75	.04
Urgency Time 2 by				
Negative Urgency Time 2	1.00	.00	.80	.04
Positive Urgency Time 2	1.04***	.10	.84	.04
Planning Time 2 by				
Decision Making Time 2	1.00	.00	.83	.04
Premeditation Time 2	.82***	.09	.68	.06
Urgency Time 3 by				
Negative Urgency Time 3	1.00	.00	.86	.04
Positive Urgency Time 3	1.00***	.11	.81	.04
Planning Time 3 by				
Decision Making Time 3	1.00	.00	.88	.04
Premeditation Time 3	.89***	.11	.71	.06
Direct Effects				
Urgency Time 3 on				
Urgency Time 2	.86***	.11	.80	.05
Time in Treatment 3	.01	.04	.02	.05
Drug Use	.05	.06	.06	.07
Ethnicity	.08	.92	.01	.07
Race	1.03	.96	.07	.06
Age	-.29	.31	-.05	.05
Treatment Setting	1.07	.92	.08	.07
Urgency Time 2 on				
Urgency Time 1	.51***	.08	.58	.07
Planning Time 1	-.25***	.07	-.26	.07
Time in Treatment 2	.07	.05	.09	.06
Drug Use	-.07	.06	-.09	.07
Ethnicity	-.40	.97	-.03	.08
Race	-.45	1.12	-.03	.08
Age	-.03	.31	-.01	.06
Treatment Setting	-2.29*	1.02	-.18	.08

Measure	Unstandardized Estimate	Unstandardized *SE*	Standardized Estimate	Standardized *SE*
Urgency Time 1 on				
Time in Treatment 1	-.05	.06	-.05	.05
Drug Use	.20**	.08	.22	.09
Ethnicity	-.34	1.08	-.02	.08
Race	-1.61	1.31	-.09	.08
Age	-.11	.37	-.02	.06
Treatment Setting	-.05	1.11	-.003	.07
Planning Time 3 on				
Planning Time 2	.87***	.09	.84	.04
Time in Treatment 3	.06	.04	.09	.07
Drug Use	.14**	.05	.18	.06
Ethnicity	-.90	.97	-.08	.08
Race	.13	.90	.01	.06
Age	-.17	.29	-.03	.06
Treatment Setting	-.75	.87	-.06	.07
Planning Time 2 on				
Planning Time 1	.66***	.08	.75	.04
Time in Treatment 2	.07†	.04	.10	.06
Drug Use	-.02	.05	-.03	.06
Ethnicity	1.25	.89	.11	.08
Race	-.31	.97	-.02	.07
Age	.33	.30	.07	.06
Treatment Setting	1.12	.90	.09	.08
Planning Time 1 on				
Time in Treatment 1	.07	.06	.07	.06
Drug Use	-.16**	.05	-.19	.06
Ethnicity	-.89	.92	-.07	.07
Race	-.15	1.15	-.01	.08
Age	.79*	.37	.14	.07
Treatment Setting	-2.09*	1.02	-.16	.08
Cold Heartedness Time 2 on				
Cold Heartedness Time 1	.35***	.05	.41	.05
Time in Treatment 2	.002	.04	.002	.05
Drug Use	-.02	.05	-.02	.06
Ethnicity	-.11	.95	-.01	.08
Race	-.39	.95	-.03	.06
Age	.20	.32	.04	.06
Treatment Setting	2.20*	.94	.16	.07

Measure	Unstandardized Estimate	Unstandardized *SE*	Standardized Estimate	Standardized *SE*
Cold Heartedness Time 1 on				
Time in Treatment 1	-.22***	.06	-.19	.05
Drug Use	.09†	.05	.10	05
Ethnicity	.28	.90	.02	.06
Race	3.80**	1.19	.22	.06
Age	-.48	.37	-.08	.06
Treatment Setting	.49	1.05	.03	.07
Power Orientation Time 2 on				
Power Orientation Time 1	.35***	.07	.34	.07
Time in Treatment 2	.01	.06	.01	.06
Drug Use	.03	.06	.04	.07
Ethnicity	.39	1.06	.03	.07
Race	1.72	1.16	.10	.07
Age	-.12	.34	-.02	.06
Treatment Setting	-3.79**	1.15	-.25	.08
Power Orientation Time 1 on				
Time in Treatment 1	.11†	.06	.10	.06
Drug Use	.19***	.05	.22	.06
Ethnicity	.99	.94	.07	.07
Race	-.13	1.04	-.01	.06
Age	-.43	.33	-.07	.06
Treatment Setting	.27	.97	.02	.07
Time in Treatment 2 on				
Time in Treatment 1	.02	.10	.02	.08
Time in Treatment 3 on				
Time in Treatment 2	.10	.12	.09	.10
Error Correlations				
Urgency Time 1 with				
Planning Time 1	.00	.00	.00	.00
Urgency Time 3 with				
Planning Time 3	.00	.00	.00	.00
Planning Time 1 with				
Cold Heartedness Time 1	-23.51***	3.63	-.54	.05
Cold Heartedness Time 1 with				
Urgency Time 1	-16.60***	3.77	-.35	.07
Power Orientation Time 1	-14.11***	2.95	-.31	.05
Cold Heartedness Time 2 with				
Urgency Time 3	-4.58*	1.97	-.20	.09
Planning Time 2	-14.44***	2.69	-.71	.08
Planning Time 3	.00	.00	.00	.00

Measure	Unstandardized Estimate	Unstandardized *SE*	Standardized Estimate	Standardized *SE*
Power Orientation Time 1 with				
Urgency Time 1	22.56***	4.03	.51	.07
Planning Time 1	.00	.00	.00	.00
Power Orientation Time 2 with				
Urgency Time 2	19.04***	3.19	.65	.07
Urgency Time 3	7.28**	2.79	.29	.09
Planning Time 3	.00	.00	.00	.00
Cold Heartedness Time 2	-3.54	2.25	-.10	.06

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

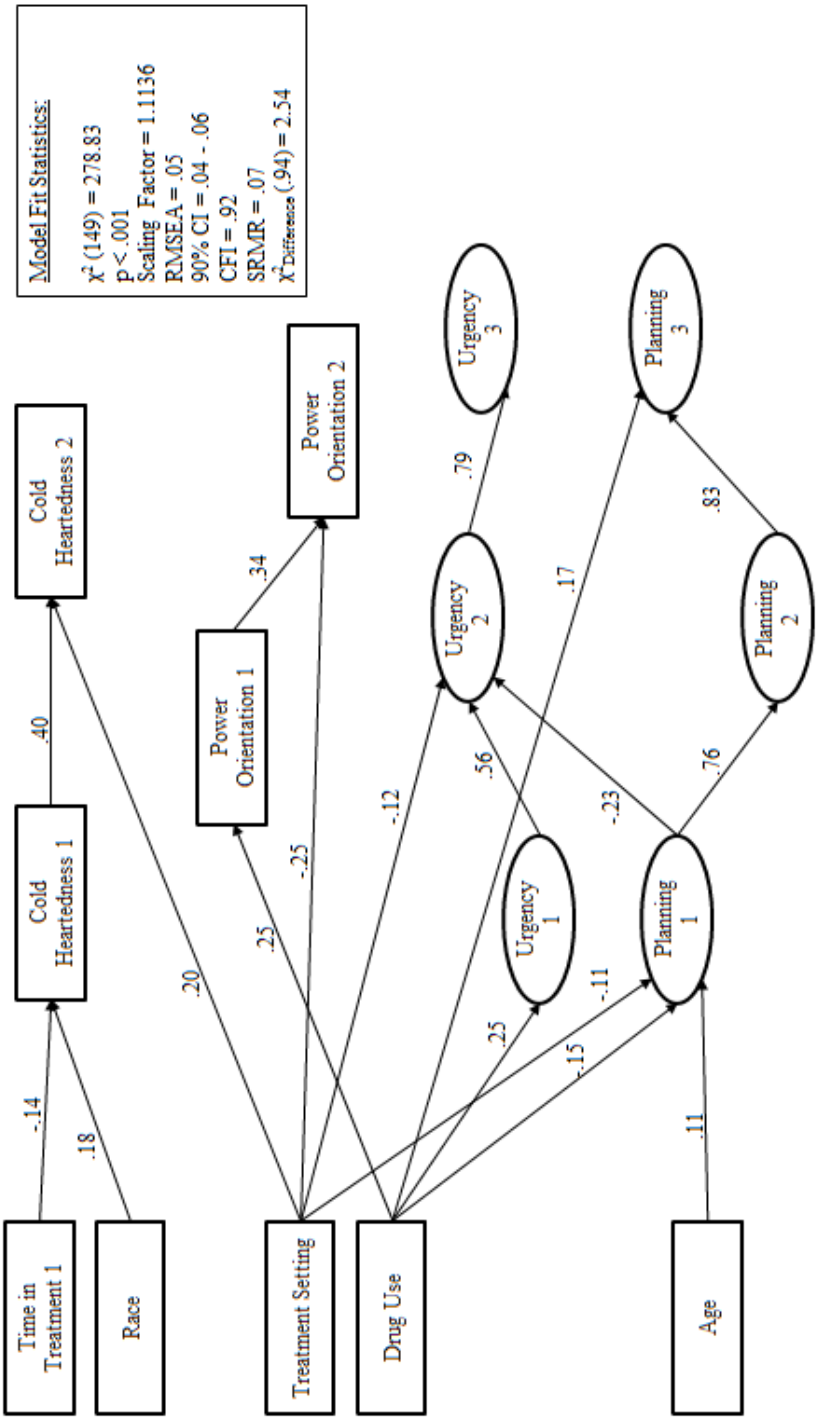

Figure 9. The final model for hypothesis 3 was respecified by removing the effects that were not statistically significant. The model was an adequate fit to the data. Standardized estimates are shown.

Table 15

Hypothesis 3: Final Model Unstandardized and Standardized Estimates

	Unstandardized		Standardized	
Measure	Estimate	*SE*	Estimate	*SE*
Factor Loadings				
Urgency Time 1 by				
Negative Urgency Time 1	1.00	.00	.88	.04
Positive Urgency Time 1	.74***	.07	.74	.04
Planning Time 1 by				
Decision Making Time 1	1.00	.00	.85	.04
Premeditation Time 1	.92***	.09	.74	.04
Urgency Time 2 by				
Negative Urgency Time 2	1.00	.00	.79	.05
Positive Urgency Time 2	1.07***	.10	.85	.04
Planning Time 2 by				
Decision Making Time 2	1.00	.00	.83	.04
Premeditation Time 2	.81***	.09	.67	.06
Urgency Time 3 by				
Negative Urgency Time 3	1.00	.00	.86	.04
Positive Urgency Time 3	.99***	.10	.81	.04
Planning Time 3 by				
Decision Making Time 3	1.00	.00	.88	.04
Premeditation Time 3	.88***	.11	.71	.06
Direct Effects				
Urgency Time 3 on				
Urgency Time 2	.86***	.11	.79	.05
Urgency Time 2 on				
Urgency Time 1	.47***	.07	.56	.07
Planning Time 1	-.22**	.06	-.23	.07
Treatment Setting	-1.52*	.77	-.12	.06
Urgency Time 1 on				
Drug Use	.23***	.06	.25	.07
Planning Time 3 on				
Planning Time 2	.86***	.09	.83	.04
Planning Time 2 on				
Planning Time 1	.68***	.08	.76	.05
Planning Time 3 on				
Drug Use	.13**	.04	.17	.06
Planning Time 1 on				
Drug Use	-.12**	.04	-.15	.06
Age	.60†	.34	.11	.06
Treatment Setting	-1.49*	.74	-.11	06
Cold Heartedness Time 2 on				
Cold Heartedness Time 1	.35***	.06	.40	.06
Treatment Setting	2.62***	.65	.20	.05

Measure	Unstandardized Estimate	Unstandardized *SE*	Standardized Estimate	Standardized *SE*
Cold Heartedness Time 1 on				
Time in Treatment 1	-.16***	.05	-.14	.04
Race	3.16***	.88	.18	.05
Power Orientation Time 2 on				
Power Orientation Time 1	.36***	.07	.34	.07
Treatment Setting	-3.71***	.82	-.25	.05
Power Orientation Time 1 on				
Drug Use	.22***	.05	.25	.05
Error Correlations				
Urgency Time 1 with				
Planning Time 1	.00	.00	.00	.00
Urgency Time 3 with				
Planning Time 3	.00	.00	.00	.00
Planning Time 1 with				
Cold Heartedness Time 1	-23.95***	3.71	-.54	.05
Cold Heartedness Time 1 with				
Urgency Time 1	-16.76***	3.81	-.34	.06
Power Orientation Time 1	-14.13***	3.02	-.31	.05
Cold Heartedness Time 2 with				
Urgency Time 3	-3.31†	1.73	-.15	.08
Planning Time 2	-13.57***	2.61	-.66	.08
Planning Time 3	.00	.00	.00	.00
Power Orientation Time 1 with				
Urgency Time 1	22.60***	4.06	.49	.07
Planning Time 1	.00	.00	.00	.00
Power Orientation Time 2 with				
Urgency Time 2	19.03***	3.36	.63	.07
Urgency Time 3	7.64**	2.82	.30	.09
Planning Time 3	.00	.00	.00	.00
Cold Heartedness Time 2	.00	.00	.00	.00

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Several direct effects of covariates were also retained in the final model. Each 1 year increase in age was marginally associated with a .60 unit increase in planning Time 1. Like in the model testing hypothesis 1, Black/African American youth reported higher Time 1 cold heartedness than non-Black/African American youth. Unlike the hypothesis 1 model, ethnicity was not significantly related to power orientation. For every additional day between intake and Time 1 assessment administration, cold heartedness at Time 1 decreased by .14 units.

Treatment setting was significantly related to several endogenous variables. Youth in the juvenile justice secure settings reported lower planning at Time 1, higher cold heartedness at Time 2 (controlling for cold heartedness at Time 1), lower power orientation at Time 2 (controlling for power orientation at Time 1), and lower urgency at Time 2 (controlling for urgency at Time 1).

Discussion

Although cognitive functioning in specific areas (e.g., urgency, planning, and criminal thinking) is an important clinical target for improving substance abuse treatment for youth (Bickel, Christensen, & Marsch, 2011; Bickel & Yi, 2008; Brady, Gray, & Tolliver, 2011; Sofuoglu, Sugarman, & Carroll, 2010), studies examining change in specific areas during treatment are uncommon and their findings are inconsistent. Likewise, although research indicates that youth in juvenile justice-based treatment settings may face more cognitive challenges (Bartol & Bartol, 2005; Walters, 2014; Wasserman et al., 2003), few studies examine the differences in cognitive functioning between youth in community-based and juvenile justice-based settings. This study was novel in that it proposed an examination of cognition in standard residential treatment with an emphasis on the differences between adolescents in community-based treatment and those in treatment in secure legal settings.

Results from preliminary analyses indicated that the samples of youth in community-based residential and juvenile justice secure settings differed on several background characteristics. There was a greater proportion of Black youth in juvenile justice settings compared to community-based settings. This is consistent with multiple studies indicating that Black youth are overrepresented in juvenile justice systems, especially in detention facilities (Hsia, Bridges, & McHale, 2004; Nicholson-Crotty, Birchmeier, & Valentine, 2009; Wordes & Jones, 1998). In addition, a greater proportion of youth identified their ethnicity to be Hispanic in the community-based settings, which was likely related to geographic regional differences in ethnicity between the samples (e.g., Southwestern area samples compared with Mid-western). Youth in juvenile justice settings were significantly older regardless of ethnicity or race, and

Black and Hispanic youth tended to be younger regardless of treatment setting. Youth in juvenile justice settings were less likely to report marijuana as the substance that has caused them the most problems compared to youth in community-based treatment. Juvenile justice youth also reported less drug use occurring in the 12 months immediately prior to treatment admission than youth in community-based settings. This, however, may reflect the fact that many youth in juvenile justice settings have been detained for some or all of the 12 months prior to entering treatment. Youth in both settings reported similar levels of previous substance abuse treatment.

Structural equation model results provided partial support for hypothesis 1 (criminal thinking, urgency, and planning would improve over time). Inconsistent with expectations, findings indicated that urgency (impulsivity when experiencing extreme emotions) and criminal thinking did not improve over time. Deliberative decision making, however, did improve during treatment as expected. This is consistent with studies demonstrating that decision making skills get better during treatment (Dingwall, Maruf, Fredrickson, & Cairney, 2011; Knight, Dansereau, Becan, Rowan, & Flynn, in press). Interestingly, levels of planning at intake seemed to play a protective role for urgency. Better deliberative thinking attenuated the increase in urgency from intake to Time 2.

Hypothesis 2 stated that youth in community-based treatment settings would report lower criminal thinking and urgency, and better planning than youth in juvenile justice-secure settings. Removal of the criminal thinking latent variable from the measurement model prevented a direct test of the impact of treatment setting on only Time 1 measures. However, the expected relationships were also specified as a part of the hypothesis 3 model, providing an indirect test for hypothesis 2. Those data suggested that youth in juvenile justice settings reported similar levels of urgency and criminal thinking at intake, which was inconsistent with expectations. In support of hypothesis 2, youth in community-based settings reported higher planning at intake.

Consistent with hypothesis 3 (youth in juvenile justice settings would report less positive changes over time), results indicated that youth in juvenile justice treatment settings reported a greater increase in cold heartedness compared to youth in community-based settings. In contrast to expectations, however, youth in juvenile justice settings reported smaller increases in power orientation and urgency. Findings suggest that youth in juvenile justice setting changed in a more positive (or less negative) direction than youth in community-based settings, even when controlling for the protective effect of deliberate decision making (favoring youth in the community-based facilities).

Study findings provide new information for scientific consideration. First, although research suggests that in adult samples criminal thinking decreases with treatment exposure (Henggeler, Clingempeel, Brondino, & Pickrel, 2002; Hser et al., 2001; Joe, Rowan-Szal, Greener, Simpson, & Vance, 2010; Rowan-Szal, Joe, Simpson, Greener, & Vance, 2009), results suggest that the opposite is true for youth. This increase could be related to the heavy influence that the social environment has on adolescents (Chein, Albert, O'Brien, Uckert, & Steinberg, 2011; Prinstein, Brechwald, & Cohen, 2011). For example, youth make riskier decisions (compared to adults) when they are surrounded by peers than when they are alone or with adults (Chein et al., 2011). Studies also show that being exposed to aggression and delinquency increases pro-aggression beliefs and aggressive and delinquent behaviors (Dodge, Bates, Pettit, & Valente, 1995; Dodge, Harnish, Lochman, Bates, & Pettit, 1997; Kirk & Hardy 2012; Megens & Weerman 2012; Molano, Jones, Brown, & Aber, 2013; Mrug & Windle 2010; Shukla & Wiesner 2013; Weiss, Dodge, Bates, & Pettit, 1992). Youth who observe repeated episodes of aggression report more favorable attitudes toward aggression, increased sensitivity to aggressive cues, and increased attribution biases (attributing aggressive intentions to neutral social situations; Dodge et al. 1995; Shahinfar, Kupersmidt, & Matza, 2001; Teisl & Cicchetti 2008; Weiss et al. 1992). Thus, an increase in cold heartedness and power orientation could be related to increased exposure to peers who lack empathy and value power and aggression.

Another possible explanation for the unexpected increase in criminal thinking during treatment is that cold heartedness and power orientation may be socially adaptive responses to being placed in a new environment with unfamiliar peers. Research suggests that adolescents are still developing critical social skills, such as the ability to take on the perspective of another individual, differentiate between facial expressions of emotions, and evaluate the intentions of others (Crone, 2013; Herba & Philips, 2004; Klapwijk, Peters, Vermeiren, & Lilieveld, 2013; McGivern, Andersen, Byrd, Mutter, & Reilly, 2002; Steinberg & Morris, 2001; Thomas, De Bellis, Graham, & LaBar, 2007; Wade, Lawrence, Mandy, & Skuse, 2006). With less developed social skills, a decreased emotional investment in unknown peers or an increased desire for control may be adaptive self-preservation behaviors, or may be related to behaviors associated with the establishment of a social hierarchy. Group dynamics theories (e.g., Corey, 2014; Yalom, 1970) suggest that conflict among new peers is common among groups attempting to establish a cooperative social environment. The treatment programs participating in this study employed an open-group format (newly enrolled youth were introduced into existing counseling groups regularly), so the constant introduction of new individuals to the social environment may have contributed to the constant need to protect the self (higher cold heartedness) or re-establish social status (higher power orientation).

Second, although deliberate thinking improved during treatment as expected, urgency did not decrease as expected. One possible explanation is that youth behave more impulsively in treatment because they have a peer audience (Chein, Albert, O'Brien, Uckert, & Steinberg, 2011). Thus, it is possible that increased urgency is a byproduct of increased peer interaction occurring within the treatment environment. However, the findings provide more support for another possible explanation – that improved planning also represents improved self-awareness, which accounts for increased urgency. Results suggest that youth reporting lower deliberate thinking at intake change more on urgency from Time 1 to Time 2. It is possible that improved decision making is also related to improved self-awareness. If this is the case, then an increase in urgency scores could reflect an increase in youths' capacity to recognize their feelings and

behaviors rather than changes in their behaviors themselves. In other words, better self-awareness may be related to more accurate self-assessment instead of worsening impulsivity. Perhaps youth who are more self-aware at intake do not experience noticeable improvements in insight. These youth would not be expected to demonstrate insight-related increases in urgency scores. Treatment research suggests that cognitive-behavioral interventions, such as those used by the participating treatment agencies, increase self-awareness and insight (DeVito et al., 2011; Konova, Moeller, & Goldstein, 2013; Potenza, Sofuoglu, Carroll, & Rounsaville, 2011; Westbrook et al., 2011; Wetherill & Tapert, 2013). Therefore, it is possible that self-awareness, along with planning, improved for youth in the study sample. This could also account for increased criminal thinking scores. If this is the case, higher criminal thinking and urgency scores would reflect more accurate self-assessments rather than increased criminal or impulsive behaviors, which would be a considered an accomplishment from a clinical perspective.

In further support of this alternative explanation, the relationships between age and planning, and treatment setting and planning are in the expected direction. This provides some validation for the planning measure. Older youth reported better decision-making, which is consistent with other studies (Klaczynski, 2001; Klaczynski, 2005; Klaczynski & Cottrell, 2004), and youth in juvenile justice settings reported less planning at intake, which is consistent with the hypotheses. Future studies may wish to examine the potential relationships between decision making, insight, urgency, and criminal thinking. Perhaps once self-awareness peaks, improvements in criminal thinking and urgency can be more readily observed.

Third, unexpected differences between youth in the community-based and juvenile justice secure treatment settings could reflect a difference in clinical targets between community-based and juvenile justice secure approaches. In addition to the possibility that an increase in cold heartedness could function as an adaptive response to unfamiliar social environments, it could also reflect a tendency for juvenile justice programs to encourage participants to confront each other's excuses and avoid sympathetic enabling behaviors (behaviors that serve as a buffer between an individual and the consequences of his behaviors). In addition, juvenile justice

settings may be inclined to spend more time identifying and reducing criminal thinking such as power orientation and impulsive behaviors such as urgency. Curricula used with criminal or juvenile justice clients often include learning modules that involve identifying and challenging these types of criminogenic patterns (e.g., The Change Companies, 2013; Federal Bureau of Prisons, 2012). This could explain the results that juvenile justice youth show less of an increase in power orientation and urgency compared to community-based youth. In contrast, enhancing self-awareness and decision making tend to be more universal goals among a variety of treatment approaches (e.g., family-based therapies; Baldwin, Christian, Berkeljon, Shadish, & Bean, 2012; Danzer, 2013; Henderson, Dakof, Greenbaum, & Liddle, 2010; Liddle, 2013; Rowe, Liddle, Dakof, & Henderson, 2009; Adolescent Community Reinforcement Approach; Dakof, Godley, & Smith, 2011; Godley et al., 2014; Godley, Smith, Meyers, & Godley, 2009), which may account for the similar increase in deliberate decision making among the two samples.

Overall, results support the idea that youth in both settings are capable of decision making improvements. Data indicating that juvenile justice youth engage in less deliberate decision making than youth in community-based settings suggest that youth in juvenile justice secure treatment may have a more urgent need for improvement in this area. Youth in both samples also reported increased impulsivity and criminal thinking, which implies that more attention is needed in these areas in both treatment settings. Further examination of the adaptive function of cold heartedness and power orientation and the differences between community-based and juvenile justice approaches may help enhance the treatment experiences for these youth. Without further clarity about the possible adaptive functions of cold heartedness and power orientation, findings do not necessarily lend themselves to a practical large-scale policy recommendation.

More research is needed to address the possible alternative explanations for these findings. For instance, it would be helpful to examine the connection and possible mediators between deliberate thinking and delinquency. Perhaps the impact of enhanced deliberate thinking on behavior change is related to adolescents' beliefs about delinquent behaviors. In this

case, better analytic thinking may not translate to behavior change until youth also have more adaptive beliefs about how to appropriately respond to the social environment (e.g., Crawley, Knight, Becan, & Flynn, in press). Findings suggest that the recommendations to increase focus on cognitive functioning (Bickel, Christensen, & Marsch, 2011; Bickel & Yi, 2008; Brady, Gray, & Tolliver, 2011; Sofuoglu, Sugarman, & Carroll, 2010) may be well-grounded. Further research is needed, however, to determine the best methods to assess these needs, which skills to target, in which order, and how an increased focus on cognitive skills might impact treatment-related outcomes (e.g., motivation, engagement, and delinquency). It may be that increasing decision making skills without restructuring underlying beliefs about delinquency could result in more methodical criminal thinking.

There are several potential limitations to note. First, the sample size for this study was relatively small. The general guide for powering structural models is 10 subjects per estimated parameter. The ratio in this study was approximately 3 to 1, thus the study was underpowered. Some effects that could have clinical significance may not have reached statistical significance. Also due to the small sample size, a more sensitive examination of the differences between youth in community-based and juvenile justice secure settings, such as a multi-group model, was not practical. In addition, a sizeable portion of the data was missing and needed to be imputed. Although the appropriate methods for handling missing data were used in this study, a larger sample with more complete data may provide more accurate estimations. Likewise, care should be taken when interpreting results concerning cold heartedness at Time 2. It should be taken into consideration that this measure was not internally reliable among youth in the juvenile justice group, and results could be skewed.

Second, it is important to note that data were self-reported measures of internal processes and behaviors. Although studies indicate that self-report data for adolescents are generally valid, there are still measurement error issues to consider (e.g., Crockett, Schulenberg, & Petersen, 1987). For example, data show that youth are more forthcoming about sensitive self-report data when using a computer to respond to survey items rather than paper assessments (Wright,

Aquilino, & Supple, 1998). Youth in community-based settings used computers to complete assessments, whereas youth in juvenile justice settings used paper assessments. It is possible that youth in community-based settings responded more truthfully. It is also possible that the accuracy of data about internal processes depends on an individual's insight (Mabe & West, 1982), which could also skew the results. Third, these models do not imply causality and have not been conducted among adults or youth in other types of treatment settings. The results may not generalize to other samples. Fourth, some researchers caution against the use of 2-indicator latent variables. Because one of the variables is used as a scaling factor, there is concern that a 2-indicator latent variable is only represented by one measure. Three or more indicators are generally preferred (Hair, Tatham, Anderson, & Black, 1998; Ho, 2006). Future studies should design measurement models that include 3 or more indicators representing each latent variable. Finally, because these data were not compared to a non-treatment-enrolled sample, the effects reported in the findings cannot be definitively attributed to the impact of treatment. For instance, it may be that youth who are not in treatment experience greater increases in criminal thinking compared to youth who are in treatment; however, without a control group, no conclusions about the effects of treatment can be made.

Conclusion

Understanding how cognition changes during treatment may help clarify the treatment process for adolescents and identify treatment needs specific to youth in different clinical settings. Based on these findings, youth in community-based and juvenile justice secure treatment settings differ on deliberate thinking and on the rate of change in cognitive processes over time. Furthermore, planning plays a role in perceived impulsivity during treatment. Overall, results imply that youth in community-based and juvenile justice secure settings have different treatment needs, and youth may benefit from an increased focus on cognitive skill-building; however, more research is needed to determine the best policy approach moving forward.

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VITA

Personal Background	Rachel Dawn Crawley Teague, Texas Daughter of Jerry Crawley, Sr. and Dona Crawley Married Richard Henry, Jr., June 19, 2010
Education	Bachelor of Science, Psychology, Sam Houston State University, Huntsville, 2004 Master of Arts, Professional Counseling, Amberton University, Garland, 2010 Master of Science, Experimental Psychology, Texas Christian University Fort Worth, 2013
Experience	Graduate Research Assistant, Institute of Behavioral Research, 2011-present
Professional Memberships	APA Graduate Student Affiliate

ABSTRACT

AN EXAMINATION OF COGNITIVE CHANGES AMONG YOUTH IN COMMUNITY-BASED AND JUVENILE JUSTICE SECURE RESIDENTIAL TREATMENT

by Rachel Dawn Crawley, Ph.D., 2015
Department of Psychology
Texas Christian University

Dissertation Advisors: Dr. Patrick M. Flynn, Institute of Behavioral Research Director, Professor, Saul B. Sells Chair of Psychology (dissertation committee chair)

Dr. Timothy M Barth, Professor, Department of Psychology

Dr. Naomi Ekas, Assistant Professor, Department of Psychology

Dr. Danica K. Knight, Senior Research Scientist, Institute of Behavioral Research

Dr. Sarah Tauber, Assistant Professor, Department of Psychology

Researchers recommend increasing clinical attention to cognitive skill development for substance abusing youth to improve treatment outcomes, but little is known about cognitive improvement during standard substance abuse treatment. Also, studies indicate that youth in juvenile justice treatment settings, compared to those in community-based settings, may be at a cognitive disadvantage, but few studies have compared their treatment needs. To address these gaps in the literature, this study hypothesized that (1) cognitive functioning (criminal thinking, urgency, and planning) would improve during treatment, (2) youth in community-based treatment settings would report better cognition than youth in juvenile justice secure treatment, and (3) youth in community-based settings would improve more than youth in juvenile justice secure treatment. Data were collected at 3 time points (intake, 35 days, and 90 days in treatment) from 359 youth in 8 community-based and 2 juvenile justice secure substance abuse treatment

programs. Hypotheses were tested by estimating repeated measures structural equation models. Results indicated that youth in both treatment settings showed improvements in decision making (planning) but unexpected increases in their criminal thinking and impulsivity in response to emotions (urgency). Youth in juvenile justice settings reported less planning at intake, a greater increase in cold heartedness, and a smaller increase in power orientation than youth in community-based settings. Findings imply that youth in juvenile justice settings have different treatment needs than those in community-based settings. More research is needed to determine the best policy approach moving forward.