Traits associated with treatment retention in a therapeutic community for substance dependence

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Traits Associated with Treatment Retention in a Therapeutic Community for Substance Dependence

Abstract

Purpose. The treatment of severe and chronic substance dependence is challenged by high rates of treatment attrition, highlighting the need to identify factors that hinder treatment retention. **Methodology.** The present study examined certain neurocognitive and personality traits in relation to treatment retention in a sample of 46 residents of an Australian Therapeutic Community (TC). The traits examined were previously found to be associated with problematic substance use in non-clinical samples and were also previously shown to differentiate TC clients from social drinkers. The hypothesis was thus that traits that appear to be risk factors for addictions are also likely to impact on TC retention. **Findings.** Group comparisons of those retained for more than the recommended 90 days versus those who left treatment prematurely showed that after controlling for the influence of depression, those who left treatment prematurely reported significantly higher levels of trait impulsivity, punishment sensitivity, and executive cognitive dysfunction. There was a very high rate of alexithymia in the sample (52%), but alexithymia status was unrelated to retention. **Originality.** Findings highlight the important roles of trait factors in TC treatment retention in addition to the motivational and interpersonal factors identified in previous work.

Keywords: Therapeutic Communities, substance dependence, retention, executive dysfunction, personality traits

1. Introduction

A common treatment modality in Australia for individuals with severe and persistent substance use disorders is the Therapeutic Community (TC), whereby long-term, abstinence-oriented treatment is delivered in an inpatient residential setting (De Leon, 2000). Research supports the effectiveness of TC treatment in reducing substance use and associated criminality, improving general health and psychological functioning, and increasing involvement in employment and education (Gowing, Cooke, Biven, & Watts, 2002). Outcome research indicates that the most consistent predictor of positive treatment outcomes in TC programs is the length of time spent in treatment (e.g., Greenfield et al., 2004; see review by Vanderplasschen et al., 2013). A minimum 90-day duration of client residence in the TC is reportedly optimal for client benefit (Baker et al., 2004; Messina, Wish, & Nemes, 2000; Putt, 2006). However, high rates of treatment attrition are common in TCs, especially during the early stages of treatment (Condelli & DeLeon, 1993). Identification of factors associated with treatment retention is thus likely to be crucial to improving outcomes and reducing the social and economic costs of substance dependence (Brorson, Ajo Arnevik, Rand-Hendriksen & Duckert, 2013).

A TC is a hierarchically structured environment designed to facilitate behaviour change in the context of community living, whereby the community is the primary therapeutic instrument (Adshead, 2015; DeLeon, 2000; Veale, Gilbert, Wheatley, & Naismith, 2015). The model is designed to provide the individual with a physically and psychologically safe environment in which they are supported in a holistic recovery. Basic needs (i.e., housing, meals, clothing, and medical care) are met, and the community structure aims to recreate the main characteristics of a prosocial and positive family environment, such as boundaries, routine, acceptance, and encouragement (DeLeon, 2000). Through constructive feedback from TC staff and peers, time in the TC is intended to provide the corrective emotional experiences required to enable the individual to develop self-understanding and self-esteem, and to acquire skills in adaptive and respectful interpersonal

functioning (Adshead, 2015; Warren, Hiance, Doogan, DeLeon, & Phillips, 2012) to facilitate the goal of long-term abstinence.

Many studies have examined risk factors for dropout from addiction treatments in general (see review by Brorson et al., 2013); a much smaller subset of these studies have examined factors influencing TC treatment outcomes specifically, and the results have been mixed (Vanderplasschen et al., 2013). Despite the research to date, there remains a dearth of consistent findings on factors pertaining to TC client retention, particularly when it comes to the potential influences of client traits. In their review, Brorson et al. concluded that, across a wide variety of treatment methods (including inpatient and outpatient treatment modalities), cognitive deficits related to prefrontal cortex dysfunction and psychiatric comorbidity were the only client factors (other than younger age) that were consistently associated with early treatment dropout. Psychiatric comorbidity has often been linked to poor retention, with more severe psychiatric comorbidity associated with higher rates of both attrition and relapse (e.g., Gonzalez-Saiz, Vergara-Moragues, Verdejo-Garcıa, Fernandez-Calderon & Lozano, 2014; Putt, 2006). This relationship likely reflects cognitive and social impairments associated with severe mental illness, which can present obstacles to the successful implementation of cognitive-behavioural or other common modes of therapy for addictions, as well as the fact that the primary focus of TC treatment is substance dependence. Further, cognitive impairments associated with such illnesses, and even medications with sedating effects, may impact on understanding and responding appropriately to tests such as those administered in this study. The present study thus excluded TC clients with diagnoses of psychotic illness for these reasons, and likewise for neurological diagnoses including past TBI. However, comorbid diagnoses such as depression, anxiety and ADHD are common enough among TC clients that excluding such clients would have severely and unrealistically limited the accessible pool of potential participants, hence such clients were retained. Depression is the most frequent comorbid disorder (Putt, 2006) and is particularly common during early abstinence, with high levels of depression often linked to early dropout from addiction treatment (Tate et al., 2011). The influence

of comorbid depression was thus controlled in the present study through covariate analysis, as the potential influences of specific personality and neurocognitive factors were the focus of the research.

Lyvers, Hinton, Edwards and Thorberg (2014) investigated the personality and neurocognitive traits that differentiated a sample of TC clients (n = 100) from a control sample of social drinkers (n = 107). The traits examined were those presumed to reflect the functioning of brain systems implicated in addictions (e.g., Hagen et al., 2016; Lyvers, 2000; Spinella, 2003) and which have been linked to risky substance use or addiction in previous studies (Brorson et al., 2013; Dawe, Gullo & Loxton, 2004; Lyvers, Duff, Basch & Edwards, 2012; Thorberg, Young, Sullivan & Lyvers, 2009). The traits included impulsivity, executive dysfunction (i.e., deficiencies in working memory, planning, inhibition, and cognitive flexibility), sensitivity to reward and punishment, and alexithymia, the latter defined as a difficulty identifying and describing feelings as well as an externally oriented thinking style. Results indicated that the TC client sample reported significantly higher impulsivity, reward sensitivity, punishment sensitivity, and executive dysfunction, after controlling for variance in demographic variables and prior head injury, when compared to the control group. The TC sample also had twice as many participants scoring above the cut-off for alexithymia on the Toronto Alexithymia Scale (TAS-20; Bagby, Parker & Taylor, 1994), and reported elevated levels of negative mood including depression. Given the potential importance of client traits in relation to treatment retention, the current study represented an extension on this study, hypothesizing that traits that appear to be risk factors for addictions are also likely to impact on treatment retention. The aim was therefore to evaluate the potential association of specific trait measures, obtained between 14 and 21 days post-admission, with TC treatment retention of 90 days or more.

Alexithymia refers to difficulty in identifying and describing feelings and in discriminating between emotional feelings and somatic sensations, as well as an externally oriented or concrete thinking style (Taylor, 2000). Both alexithymia and negative moods are prevalent among clients

undergoing treatment for substance disorders (Lyvers et al., 2014; Thorberg, Young, Sullivan & Lyvers, 2009). In non-clinical samples, alexithymia is associated with heavier use of drugs such as alcohol (Lyvers, Onuoha, Thorberg & Samios, 2012), cannabis (Lyvers, Jamieson, & Thorberg, 2013), and even caffeine (Lyvers, Duric & Thorberg, 2014). Social drinkers with alexithymia are more likely to report drinking alcohol to cope with negative moods (Bruce, Curren, & Williams, 2012; Lyvers, Hasking, Albrecht, & Thorberg, 2012; Thorberg et al., 2009). Self-medication and/or poor interceptive awareness may account for the heightened risk of problematic substance use among those with alexithymia, although the nature of this link is not clear. Clients in treatment for alcohol use disorder (AUD) who are alexithymic have been reported to experience stronger alcohol craving and show poorer outpatient treatment outcomes compared to non-alexithymic AUD clients (Thorberg et al., 2009, 2011). On the other hand, a recent investigation of alexithymia in relation to TC client dropout in a sample of 55 TC clients aged 17-24 years (Parolin et al., 2018) found that alexithymia - as measured by the widely used Toronto Alexithymia Scale 20 (TAS-20; Bagby, Parker & Taylor, 1994) – was unrelated to TC dropout after one year; this was consistent with previous work reviewed by these authors, such that alexithymia was reportedly related to dropout from outpatient treatments in some studies but not from the inpatient treatment studies cited. In contrast to their results for the TAS-20, observer ratings of alexithymia were associated with relapse rates for males but not for females. The authors noted that research to date on alexithymia in the context of addiction treatment outcomes has varied substantially in terms of treatment modalities, sample characteristics and methodological factors, all of which are likely to have contributed to the heterogeneity of findings. These authors also suggested that when a relationship is found between alexithymia and treatment outcome, it may simply reflect the strong association between alexithymia and depression - the influence of which was (as noted earlier) controlled as a covariate in the present investigation.

According to Dawe, Gullo and Loxton (2004), there are two distinct forms of trait impulsivity relevant to substance use: reward sensitivity and rash impulsiveness. Sensitivity to

reward is presumed to reflect the functioning of the dopaminergic Behavioral Activation System - which promotes approach to stimuli perceived as rewarding - in Gray's (1987) theory of motivation, and according to Dawe et al. promotes onset of regular substance use for pleasure. By contrast, rash impulsiveness, or the tendency to act quickly without forethought, reflects executive dysfunction, which is said to maintain compulsive use in addictions. According to Dawe et al., sensitivity to reward can be indexed by the corresponding scale of the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia, Ávila, Moltó & Caseras, 2001), whereas rash impulsiveness can be indexed by the Barratt Impulsiveness Scale (BIS-11; Patton et al., 1995) as also described in a recent review (Stanford et al., 2009). The paradigm proposed by Dawe et al. has been recently supported in relation to alcohol and illicit substance use in both clinical (Lyvers et al., 2014) and non-clinical samples (Lyvers et al., 2012). In contrast to reward sensitivity, the other brain motivational system proposed by Gray (1987) – the Behavioral Inhibition System – is proposed to underlie sensitivity to punishment, a trait manifested by the tendency to vigilantly avoid unpleasant or aversive stimuli and situations. High punishment sensitivity has been reported in problematic drinkers (Loxton & Dawe, 2001) as well as in the TC clients assessed by Lyvers et al. (2014), who (as noted earlier) also showed elevated levels of impulsivity, executive dysfunction and alexithymia compared to controls. All of these client factors were thus examined in relation to TC treatment retention in the present investigation. To reiterate, the primary research question of the present study was: can these reported differences between TC clients and community controls on specific personality and neurocognitive traits likewise differentiate early TC dropouts from those retained in treatment after 90 days? In other words, are characteristics that appear to predispose to addictions also relevant to the issue of early TC dropout?

Given previous evidence that TC retention should be for at least 90 days to show clear benefits (Baker et al., 2004; Messina et al., 2000), the present study compared clients who dropped out earlier than 90 days to those who were retained in the TC for more than 90 days on the trait variables of interest. Based on previous research and theory, alexithymia, impulsivity, executive

dysfunction and sensitivity to punishment were expected to be elevated among those who dropped out before 90 days compared to those clients who remained in the TC for more than 90 days, after controlling for self-reported depressed mood. As sensitivity to reward is theoretically implicated in the onset of regular substance use, but not the maintenance of or relapse to addiction (Dawe et al., 2004), no specific prediction was made concerning this variable.

2. Material and Methods

2.1. Participants

Participants were recruited via the distribution of flyers describing the research project during weekly group psychoeducation sessions at a 40-bed, open-ended, in-patient residential TC in southeast Queensland, Australia. The flyers requested volunteers aged between 18 – 40 years with a diagnosis of substance dependence. Inclusion criteria were such that only residents within the 14 – 21 day post-intake period were eligible for participation, thereby precluding the influence of detoxification or acute withdrawal on responding. Potential participants with a diagnosed psychotic or neurological illness were excluded for reasons described earlier. Participants were required to provide written informed consent prior to participation, and were advised they were free to withdraw from the study at any time without penalty. As an incentive for participation, a $40 gift voucher was offered to each participant. Ethical approval was obtained from the local ethics committee prior to the commencement of data collection.

From the initial sample of 66 clients, after removing 6 cases diagnosed with schizophrenia, 12 cases with neurological conditions or history of TBI, and 2 cases outside the specified age range, the final sample of 46 clients (30 males, 16 females) aged 19-36 years (M = 26.26 years, SD = 4.57) was obtained. Of the 46 clients, 30 (65%) were primarily being treated for dependence on methamphetamine, 11 (24%) for alcohol, 2 (4%) for cannabis, 2 (4%) for heroin, and 1 (2%) for cocaine. There were 27 clients who were retained in treatment for more than 90 days (range = 95 to 304 days) and 19 clients who dropped out of the TC before 90 days (range = 17 to 69 days).

2.2. Materials

2.2.1. Demographics and Screening Questionnaire. A demographics and screening questionnaire was used to obtain participants' age, gender, education and employment history, days since admission, mental health status, neurological status or history of TBI, and details regarding previous substance use (e.g., principle drug of concern, mode of consumption, age at onset).

2.2.2. Barratt Impulsiveness Scale (BIS-11; Patton et al., 1995). The BIS-11 is a 30-item self-report instrument designed to measure rash (as opposed to reward-driven) impulsiveness. Using a 4-point Likert type scale, respondents rate items such as 'I do things without thinking' from 1 (rarely / never) to 4 (almost always / always). Total scores range from 30 to 120, with higher total scores indicating greater impulsiveness. The instrument has demonstrated high temporal stability (Patton et al., 1995), as well as convergent validity with neuropsychological measures that show sensitivity to prefrontal cortex dysfunction (Spinella, 2004). In the present study the alpha reliability index was .83.

2.2.3. Frontal Systems Behavior Scale (FrSBe; Grace & Malloy, 2001). The FrSBe is a 46-item self-report measure designed to identify behavioural disturbances associated with frontal lobe damage in individuals aged between 18 and 95 years. The FrSBe has three subscales measuring neurobiological traits relating to dysfunction in three corresponding prefrontal systems: the anterior cingulate (14-item Apathy subscale), orbitofrontal cortex (15-item Disinhibition subscale), and the dorsolateral prefrontal cortex (17-item Executive Dysfunction subscale). The measure is designed to assess changes in behaviour following traumatic brain injury (TBI) by obtaining pre and post-injury ratings. Using a five-point Likert scale, respondents rate items such as "Repeat certain actions or get stuck on certain ideas" (Executive Dysfunction item) from (1) almost never to (5) almost always, with higher scores reflective of greater levels of impairment. In the current study, only ratings of current behavioural functioning were obtained, as in previous research carried out with substance dependent populations without a history of TBI (e.g., Lyvers et al., 2012). The measure has demonstrated excellent internal consistency and temporal stability in clinical and non-clinical samples (Grace, Stout, & Malloy, 1999; Velligan, Ritch, Sui, Di Cocco, & Huntzinger, 2002) and

the instrument has been shown to correlate with objective measures of executive dysfunction (Norton, Malloy, & Salloway, 2001). The Executive Dysfunction subscale was the measure of interest for the purposes of the present study given the purported role of this crucial self-regulation construct in addiction as well as relapse (e.g., Hagen et al., 2016; Lyvers, 2000; Spinella, 2003). In the present study the alpha reliability index for Executive Dysfunction was .72.

2.2.4. Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia et al., 2001). The SPSRQ is a 48-item measure comprised of two 24-item subscales, Sensitivity to Punishment (SP) and Sensitivity to Reward (SR). The instrument provides a measure of individual differences in approach (SR) and avoidance (SP) behaviour in response to prospective reinforcement or punishment, respectively. Respondents either endorse or deny items such as "Does the good prospect of obtaining money motivate you strongly to do some things?" Scores for each subscale are obtained by totalling the number of items endorsed, with higher scores indicative of greater SR or SP. Drawing from Gray's (1987) Reinforcement Sensitivity Theory (RST), the SR scale was developed to assess the influence of the Behavioural Activation System on behaviour, whereas the SP scale was developed to assess the influence of the Behavioural Inhibition System. Research supports the reliability and validity of the SPSRQ as a measure of the two behavioural systems proposed by RST (Loxton & Dawe, 2001), and the instrument has demonstrated good internal consistency, test–retest reliability, and convergent, construct and discriminant validity (Torrubia et al., 2001). In the present study the alpha reliability index was .66 for SR and .88 for SP.

2.2.5. Toronto Alexithymia Scale (TAS-20; Bagby et al., 1994). The TAS-20 is a 20-item self-report measure designed to assess alexithymia, which refers to difficulty identifying feelings, difficulty describing feelings and an externally oriented thinking style. Using a 5-point Likert scale, respondents rate items such as "I have feelings that I can't quite identify" from 1 (strongly agree) to 5 (strongly disagree). Total scores can range from 20 to 100. Cut-off scores have been empirically derived for the TAS-20, whereby a score equal to or greater than 61 is indicative of alexithymia, whereas scores equal to or less than 51 indicate no alexithymia, and scores in between suggest

borderline or possible alexithymia (Bagby, Taylor & Parker, 1994). Research has supported the validity and reliability of the TAS-20 (Bagby, Taylor, Quilty, & Parker, 2007; Thorberg et al., 2010). In the present study the alpha reliability index of the TAS-20 was .88.

2.2.6. Depression, Anxiety, and Stress Scales (DASS-21; Lovibond & Lovibond, 1995). The DASS-21 is a 21 item self-report measure comprised of three subscales measuring the subjective experience of depression, anxiety, and stress over the previous week. Using a four point Likert scale, respondents rate items such as "I felt that I had nothing to look forward to" (Depression item) from (0) did not apply to me at all, to (4) applied to me very much or most of the time, with higher subscale scores reflective of greater subjective depression, anxiety, and stress. Examinations of the psychometric properties of the DASS-21 yielded internal consistency in the acceptable to excellent range, and the construct and concurrent validity of the measure were confirmed by Antony, Bieling, Cox, Enns, and Swinson (1998). The DASS-21 Depression scale was used in the present study to control for the relationship between depressed mood and retention (Tate et al., 2011). In the present study the alpha reliability index of the Depression scale was .95.

2.3. Procedure

Participants were tested individually in a private consultation room within the TC. Following receipt of informed consent, participants completed the pencil and paper demographics and screening questionnaire followed by the self-report measures in a pre-determined order. Upon completion of all tasks participants were given their $40 gift card and thanked for their participation. Retention data were subsequently obtained via follow-up with the TC.

3. Results

Alexithymia and Treatment Retention. Based on TAS-20 scoring criteria (Bagby et al., 1994), 24 of the 46 participants (52%) were identified as having alexithymia, a rate considerably higher than the 5-13% rate of alexithymia in the general population (Franz et al., 2008; Mattila, Salminen, Nummi & Joukamaa, 2006) but in accordance with previous research in addict samples (Thorberg et al., 2009). Chi-square test revealed no relationship between alexithymia and gender, *p*

= .15, nor between TC retention group (less than 90 days versus 90 days or more) and gender, p = .40. According to t-test, retention groups did not differ in age, p = .70. Of the 19 who dropped out of treatment before 90 days, 12 (63%) were identified as alexithymic by TAS-20 cut-off, whereas of the 27 who remained in treatment for at least 90 days, 12 (44%) were identified as alexithymic, a nonsignificant association, p = .21. This result was contrary to predictions, but perhaps unsurprising given that over half of the overall sample met the TAS-20 criterion for alexithymia. In any case there was no evidence for an influence of alexithymia on treatment retention in this sample (treating alexithymia scores as a continuous variable also yielded a nonsignificant group difference, p = .95). Results for alexithymia were thus entirely in line with the recent report of Parolin et al. (2018) that alexithymia as measured by the TAS-20 was unrelated to TC treatment retention.

Bivariate Correlations. Bivariate correlations among the dependent variables of the multivariate analysis of covariance (MANCOVA) reported below are shown in Table 1. As can be seen in the table, the covariate DASS-21 Depression was significantly positively correlated with all trait variables except SR. The BIS index of impulsivity, the Executive Dysfunction index from the FrSBe, and the SP index of punishment sensitivity were all significantly positively correlated with each other. By contrast the SR index of reward sensitivity was not significantly correlated with any other variable. No correlation approached .90, therefore the MANOVA assumption of no multicollinearity was not violated (Tabachnik & Fidell, 2014).

Group Comparison. A MANCOVA compared clients who dropped out of the TC before 90 days (n = 19) with those retained in the program for more than 90 days (n = 27) on BIS-11 impulsivity, FrSBe Executive Dysfunction, SP and SR while controlling for the influence of depressed mood as measured by the DASS-21 Depression scale. Box's M Test was nonsignificant (p = .32) as was Levene's Test for all dependent measures, thus satisfying assumptions. The multivariate effect of retention group was significant according to Pillai's Trace, $F(4, 40) = 2.72$, p = .04, partial eta squared = .21, observed power = .70, as was the multivariate effect of the covariate Depression, $F(4, 40) = 10.75$, $p < .0001$, partial eta squared = .52, observed power = 1. Consistent

with predictions, after controlling for Depression, univariate effects of retention group were significant for BIS-11 impulsivity, $F(1, 43) = 5.10$, $p = .03$, partial eta squared = .11, observed power = .60; FrSBe Executive Dysfunction, $F(1, 43) = 4.43$, $p = .04$, partial eta squared = .09, observed power = .54; and the SP scale of the SPSRQ, $F(1, 43) = 5.00$, $p = .03$, partial eta squared = .10, observed power = .59. There was no group difference on the SR scale of the SPSRQ, $F(1, 43) = .01$. As can be seen in Table 2, those who dropped out of the TC before 90 days scored significantly higher on impulsivity, executive dysfunction and punishment sensitivity than did those who remained in the TC for more than 90 days.

4. Discussion

According to theory, high reward sensitivity as indexed by the SR scale of the SPSRQ promotes onset of regular substance use, whereas rash impulsivity as indexed by the BIS-11 promotes maintenance of and relapse to addiction (Dawe et al., 2004). Consistent with that view, the current findings indicate that in the present TC client sample, higher BIS-11 scores were associated with dropping out of treatment before 90 days in a program where regular drug testing confirmed abstinence and a drug-positive test meant expulsion. High trait impulsivity is commonly interpreted as a behavioural sign of prefrontal cortex dysfunction (e.g., Brorson et al., 2013; Lyvers, 2000); there has been considerable discussion as to the degree to which impulsivity and perhaps other signs of executive deficit in addicts may reflect pre-drug characteristics versus drug-induced alterations of motivational brain circuits, with brain imaging and other neurobiological evidence often interpreted as supporting the latter view in recent years (e.g., Koob & Volkow, 2016; Volkow & Morales, 2015). In contrast to the present findings for the BIS-11, the SR form of impulsivity was not related to retention in the present sample; instead, higher scores on the other SPSRQ measure, SP - an index of Gray's (1987) Behavioural Inhibition System - were significantly associated with early dropout, consistent with the hypothesized role of punishment sensitivity in the maintenance of addictions (Staiger, Kambouropoulos & Dawe, 2007).

Although a previous study indicated that the link between alexithymia and problematic drinking was mediated by SP in a community sample (Lyvers, Hasking, Albrecht & Thorberg, 2012), in the present study alexithymia as measured by TAS-20 was unrelated to TC retention. This may have been due to a ceiling effect given that the overall rate of alexithymia in the present sample of TC clients was much higher than the typical reported rates in the general population, and even higher than in the TC sample in the Lyvers et al. (2014) study. Nevertheless it was roughly in line with other findings of high rates of alexithymia in clinical samples of clients in treatment for AUD (Cruise & Becerra, 2018; Thorberg et al., 2009). In any case, the failure of alexithymia as measured by TAS-20 to show any relationship to TC treatment retention in the present study - after controlling for depression, which is commonly associated with alexithymia - was consistent with the recent findings of Parolin et al. (2018) discussed earlier. Finally, FrSBe Executive Dysfunction scores were significantly higher among early dropouts than among those retained in the TC for more than 90 days, consistent with predictions. Addiction is hypothesized to stem from relative deficits in top-down executive control or self-regulation, enabling hyperactive bottom-up influences such as drives and habits to dominate behaviour (Bechara, 2005; Bickel & Yi, 2008; Koob & Volkow, 2016; Lyvers, 2000; Spinella, 2003; Volkow & Morales, 2015), thus from a neurobiological perspective executive dysfunction is crucially implicated in addiction and relapse (Hagen et al., 2016) irrespective of whether the associated deficits predated onset of drug use or reflect chronic drug-induced changes in brain motivational circuitry (some combination of both seems most plausible given the evidence to date). In either case, executive cognitive deficits in attention, inhibition and abstract thinking, as well as associated behavioural manifestations such as impulsivity, are likely to interfere with the successful implementation of cognitive-behavioural or other common modes of therapy for addictions (Brorson et al., 2013).

The present study had several limitations. The age range was restricted to 18-40 in order to reduce potential age-related cohort effects, but this necessarily limits the generalizability of the findings to relatively younger TC clients. The final sample size of 46 was less than planned but

reflected the strict participation criteria and temporal limitations of this study. TC clients had to be recruited within a one week period, two weeks after entry into the program, and were followed up for nearly one year. Despite the less than ideal sample size, no statistical assumptions were violated and the reliability indices of the scales completed by clients ranged from acceptable to excellent in this sample. Another limitation concerns the proximal causes of participant dropout. Such cases cannot necessarily be assumed to reflect relapses to substance abuse as clients could be expelled from the TC for violations of TC rules, such as leaving the residence without a chaperone, or for smoking indoors. Clients may also voluntarily leave the program for personal reasons unrelated to relapse, and some may maintain abstinence and thus be considered "successes" (see Aslan, 2015). Retention was thus extremely variable (17 to 304 days) and present findings cannot be interpreted in terms of relapse (data for which were unavailable), but pertain only to retention rates of less than versus more than the recommended 90 days. Nevertheless the findings of the present study are certainly consistent with both theoretical understanding and past research findings on the roles of trait factors in addiction. Future studies in larger samples should aim to replicate these findings and investigate potential underlying mechanisms of the indicated relationships in order to expand our understanding of the links between client factors and TC treatment retention. Such information might potentially be used to better tailor treatments to individual client needs, such as neurocognitive training to improve deficiencies of executive cognition and inhibitory control (Bickel, Yi, Landes, Hill & Baxter, 2011; Manning, Verdejo-Garcia & Lubman, 2017; Marceau, Berry, Lunn, Kelly & Solowij, 2017). Future research should also aim to gather information on the causes of client drop-out where possible, and most importantly whether such clients relapsed. A comprehensive understanding of the myriad factors influencing treatment retention may ultimately lead to more tailored treatment targets and better outcomes of TC programs.

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Table 1

Correlations among MANCOVA Variables

Variable	*1*	*2*	*3*	*4*	*5*
1. Depression	-				
2. Impulsivity	.47**	-			
3. ExecDys	.35*	.74**	-		
4. SP	.59**	.40**	.58**	-	
5. SR	-.07	.23	.27	.18	-

Note. ExecDys = Executive Dysfunction; SP = Sensitivity to Punishment; SR = Sensitivity to Reward.
* $p < .05$ ** $p < .01$

Table 2.

Means and Standard Deviations on BIS-11 Impulsivity, FrSBe Executive Dysfunction, and SPSRQ Reward Sensitivity (SR) and Punishment Sensitivity (SP) scores for Clients in a Therapeutic Community who dropped out of Treatment before 90 days versus Clients who Remained in Treatment for more than 90 Days.

	< 90 Days in TC		> 90 Days in TC	
	M	*SD*	*M*	*SD*
Impulsivity*	87.37	10.76	78.67	11.97
Executive Dysfunction*	52.21	7.32	45.63	10.40
Reward Sensitivity	15.58	4.40	15.74	3.27
Punishment Sensitivity*	16.84	4.06	12.99	5.89

* $p < .05$ in MANCOVA