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Only Connect: The Working Alliance in Computer-Based Cognitive Behavioral Therapy

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Abstract

The limited role of therapists in some technology-based interventions raises questions as to whether clients may develop a ‘working alliance’ with the program, and the impact on relationships with a therapist and/or treatment outcomes. In this study, the Working Alliance Inventory (WAI), and an adapted version for technology-based interventions (WAI-Tech), were administered within a subsample ($n = 66$) of cocaine-dependent individuals participating in a randomized trial evaluating the efficacy of Computer-Based Training for Cognitive Behavioral Therapy (CBT4CBT) as an adjunct to treatment as usual (TAU). Results suggest the WAI-Tech has relatively similar psychometric characteristics as the standard WAI; however the ‘bond’ subscale scores were lower on the WAI-Tech [$F(1,52) = 5.78, p < .05$]. Scores on the WAI-Tech were not associated with cocaine use outcomes, whereas total scores on the WAI for those assigned to TAU were associated with the percentage of days abstinent from cocaine ($r = .43, p < .05$). There was little evidence that adding a technology-based intervention adversely affected the working alliance with a therapist in this sample. These preliminary findings suggest some concepts of working alliance may apply to computer-based CBT, yet the function of the alliance may be different in technology-based interventions than in face-to-face psychotherapies.

Keywords

Working Alliance; Therapeutic Alliance; Technology-Based Interventions; Substance Use Treatment; CBT4CBT

INTRODUCTION

Multiple challenges to dissemination of evidence-based therapies, such as cognitive behavioral therapy (CBT), have spurred development of numerous technology-based interventions (see reviews, Cuijpers et al., 2009; Kaltenthaler et al., 2006; Marks et al., 2009; Richardson, Stallard, & Velleman, 2010; Spek et al., 2007). Technology-based interventions offer many potential benefits, such as providing broader access to empirically supported

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treatments, consistency in treatment delivery (i.e., increased fidelity), decreasing the demands on clinician time and clinic resources, and cost effectiveness (Carroll & Rounsaville, 2010; Marks & Cavanagh, 2009; Marsch & Dallery, 2012). For the treatment of substance use disorders, many technology-based interventions have demonstrated positive treatment outcomes (e.g., Bickel, Marsch, Buchhalter, & Badger, 2008; Budney et al., 2011; Carroll et al., 2008; Gustafson et al., 2011; Hester, Delaney, & Campbell, 2011; Ondersma, Chase, Sviki, & Schuster, 2005). However, there has been relatively little research regarding how these technology-based interventions may lead to changes in substance use (i.e., mediators/mechanisms of action), the extent to which findings regarding active ingredients of the parent therapy pertain to the technology-based intervention, and what treatment factors are predictive of better outcomes.

In traditional clinician-delivered interventions, the working alliance (also referred to as the therapeutic alliance) is one of the most consistent predictors of positive treatment outcomes (Horvath, Del Re, Fluckiger, & Symonds, 2011; Martin, Garske, & Davis, 2000). In the treatment of substance use disorders, a positive working alliance early in treatment has been associated with greater engagement, retention, and early improvements in substance use (Gibbons et al., 2010; Ilgen, McKellar, Moos, & Finney, 2006; Meier, Barrowclough, & Donmall, 2005; Meier, Donmall, McElduff, Barrowclough, & Heller, 2006). However, the relationship between alliance and outcome is complex, as reports of the robustness of the alliance as a predictor of treatment outcomes has been somewhat mixed after accounting for prior symptom change (e.g., Barber, Connolly, Crits-Christoph, Gladis, & Siqueland, 2000; Falkenstrom, Granstrom, & Holmqvist, 2014; Strunk, Brotman, & DeRubeis, 2010; Webb et al., 2011). Furthermore, several studies have found that therapist variability in the alliance (i.e. variability between therapists) rather than patient variability (i.e., variability within therapists), more strongly relates to treatment outcomes (Baldwin, Wampold, & Imel, 2007; Crits-Christoph et al., 2009). Although there is some disagreement regarding the magnitude of therapist effects, multilevel models applied to clinical trial data have shown that 5–10% of the total variability in outcomes is attributable to between-therapists differences (Crits-Christoph et al., 1991; Elkin, Falconnier, Martinovich, & Mahoney, 2006; Kim, Wampold, & Bolt, 2006). Because many technology-based interventions significantly alter the role of the therapist (with treatment implemented either independently from the therapist or significantly reduced amount of therapist contact), it is unclear how this change in delivery might affect important treatment processes such as the working alliance.

As an emerging area of research, there are few studies that specifically address the concept of a working alliance in technology-based interventions. Of those that have examined the working alliance within this context, the predominant focus has been on the alliance with a *clinician* guiding or providing the technology-based intervention, rather than a working alliance with the technology-based program itself. Most studies indicate alliance ratings with a clinician/therapist guiding/providing the technology-based intervention are in line with ratings found in face-to-face therapies (Andersson et al., 2012; Cook & Doyle, 2002; Kay-Lambkin, Baker, Lewin, & Carr, 2011; Knaevelsrud & Maercker, 2007; Preschl, Maercker, & Wagner, 2011; Socala et al., 2012). However, a pilot study explored participants' alliance ratings with a computerized CBT package for depression using a modified version of the Agnew Relationship Measure (Agnew-Davies, Stiles, Hardy, Barkham, & Shapiro, 1998),

with the word “package” replacing “therapist” in the original scale, and found participants’ average ratings of alliance with the package were above the neutral midpoint, suggesting a positive relationship (Ormrod, Kennedy, Scott, & Cavanagh, 2010). Also, although significant decreases in depression were found after receiving the computerized CBT package, these outcomes were not related to the alliance with the computerized package (Ormrod et al., 2010). These were some of the first known reported results regarding a potential alliance with a computerized CBT program, as well as its relation to treatment outcomes, yet the study was limited by a small sample (n=16) and did not include a comparison condition.

Overall, relatively little is known about whether the concept of the working alliance is relevant to technology-based interventions, how this potential alliance may affect the relationship with a therapist, and whether it influences outcome in a manner similar to that of traditional therapist-client working alliance. There have been reports that some clients do describe a form of relationship with computerized interventions (Bickmore, Gruber, & Picard, 2005; Bickmore, Caruso, Clough-Gorr, & Heeren, 2005; Kaplan, Farzanfar, & Friedman, 2003; Ormrod et al., 2010). For example, Bickmore, Gruber, & Picard (2005) reported a computerized intervention for physical activity adoption that included a ‘relational agent’ (e.g., animated computer character that simulated face-to-face conversation using social-emotional behaviors) produced higher working alliance ratings than a comparison intervention without the relational qualities. Furthermore, results of qualitative interviews from participants engaged in a telephone-based health behavior intervention indicated users described the system in ways indicative of having a personal relationship with it (e.g., “friend”, “helper”, “mentor”) (Kaplan, Farzanfar, & Friedman, 2003). While these findings suggest clients may develop some form of working alliance with technology-based interventions, the nature of the alliance and how it may differ from traditional features of a working alliance is relatively unexplored.

To investigate this concept, we adapted a widely-used and well validated measure of the working alliance (WAI; Horvath & Greenberg, 1989) and implemented it in the context of a randomized trial evaluating the effectiveness of Computer-Based Training for Cognitive Behavioral Therapy (CBT4CBT; Carroll, Kiluk, Nich, Gordon, et al., 2014). The purpose of the present study was to: (1) provide a preliminary psychometric evaluation of the newly adapted version of the WAI designed to measure the alliance with a technology-based intervention (WAI-Tech), including reliability and construct validity; (2) to evaluate the extent to which using a technology-based intervention as an adjunct to standard treatment might affect participants’ reported alliance with their clinicians; and (3) explore the contribution of a working alliance with a technology-based intervention to substance use treatment outcomes, such as treatment retention and frequency of substance use.

METHODS

Overview of the study: Treatments, participants, and assessment schedule

As described in detail in the main study report (Carroll, Kiluk, Nich, Gordon, et al., 2014), 101 cocaine-dependent individuals enrolled in an outpatient methadone program were randomized to one of two treatment conditions for a period of 8-weeks: (1) standard

methadone maintenance ('treatment as usual', TAU) or, (2) TAU plus CBT4CBT. The TAU condition consisted of daily methadone maintenance along with weekly group and/or individual sessions with a substance use counselor. Those randomized to the CBT4CBT condition were also provided with weekly access to the computer program in a small private room within the clinic. Briefly, CBT4CBT (Carroll et al., 2008; Carroll et al., 2009) is a computer-based version of CBT for substance use disorders (Carroll, 1998) that uses videos, games, cartoons, and interactive exercises to teach CBT concepts and coping skills in an engaging manner. It includes 7 'modules' that cover a specific CBT skill/topic area, with each module taking approximately 45 minutes to complete. It is highly user-friendly, requires no previous experience with computers and no reading skills, as all material presented in text is read aloud by a narrator. A research staff member guided participants through their initial use of the CBT4CBT program and was available to answer questions each time participants accessed the program. Participants were assessed before treatment, twice weekly during treatment, and at the 8-week treatment termination point, as well as at several time points following treatment termination (1-, 3-, and 6-months after termination). Post-treatment interviews were obtained from 98 of the 101 individuals randomized (97%); complete follow-up data were available for 93 of those randomized (92%).

Individuals were eligible who met criteria for current (past 30 days) cocaine dependence. Individuals were excluded only if (1) they failed to meet Diagnostic and Statistical Manual – Fourth Edition (DSM-IV; American Psychiatric Association, 1994) criteria for current cocaine dependence, (2) had an untreated/unstabilized psychotic disorder or had current suicidal/homicidal ideation such that more intensive treatment was needed, or (3) could not read at a 6th grade level in order to provide written informed consent and complete study assessments. All participants provided informed consent and the procedures followed were in accord with the standards of the Yale University School of Medicine Human Investigations Committee.

The Substance Use Calendar (Carroll et al., 2004) was used to assess substance use, which is a calendar-based assessment of self-reported substance use similar to the Timeline Follow Back (Fals-Stewart, O'Farrell, Freitas, McFarlin, & Rutigliano, 2000; Sobell & Sobell, 1992). Participant self-reports of drug use/abstinence were verified through urine toxicology screens that were obtained at every assessment visit. Rates of discordance between participant self-report and urine toxicology result (i.e., urine result positive for cocaine, yet participant denied cocaine use during the previous 3-day period) were fairly low (12% of the 875 urine specimens collected).

Results from the main study evaluating the efficacy of CBT4CBT indicated participants assigned to the CBT4CBT condition (N=47) demonstrated better cocaine use treatment outcomes than those assigned to TAU only (N=54) (Carroll, Kiluk, Nich, Gordon, et al., 2014). Specifically, those assigned to CBT4CBT were significantly more likely to achieve 3 or more consecutive weeks of abstinence from cocaine (36% compared to 17%; $p<.05$), and also demonstrated a greater reduction in the frequency of cocaine use over the course of treatment and through a 6-month follow-up period compared to those assigned to TAU only. These results replicated initial findings regarding the efficacy and durability of CBT4CBT as

an add-on to standard treatment at reducing rates of drug use compared to standard treatment only (Carroll et al., 2008; Carroll, Kiluk, Nich, Gordon, et al., 2014; Carroll et al., 2009).

Development of the WAI-Tech

The Working Alliance Inventory (WAI; Horvath & Greenberg, 1989) was selected as the starting point for the development of an instrument evaluating the working alliance in technology-based interventions, as it (1) is a widely used measure with very strong psychometric properties (Horvath & Greenberg, 1986; Horvath & Symonds, 1991; Tichenor & Hill, 1989; Tracey & Kokotovic, 1989), (2) has been shown to predict outcome in a variety of populations, including substance users (Cecero, Fenton, Nich, Frankforter, & Carroll, 2001; Connors, Carroll, DiClemente, Longabaugh, & Donovan, 1997; Connors, DiClemente, Derman, Kadden, & Carroll, 2000; Fenton, Cecero, Nich, Frankforter, & Carroll, 2001), and (3) reflects the broad conceptualization of the alliance that is consistent with Bordin's pantheoretical definition (Bordin, 1979).

The WAI is a 36-item paper-pencil instrument designed to measure the level of alliance between client and therapist along three dimensions: Task (12 items), Bond (12 items), and Goal (12 items). The task subscale indicates how responsive the therapist was to the client's focus or need. The goals subscale refers to the extent to which goals were important, mutual, and capable of being accomplished. The bonds subscale refers to the degree of mutual liking and attachment as assessed through such means as tone of voice, empathy, and comfort in exploring intimate issues. The client version contains items including a blank space for participants to mentally insert the name of their therapist (e.g., "*It seems as if _____ and I understand each other.*") Participants rate their responses using a 7-point scale (1 = "*never*" to 7 = "*always*"). The WAI yields three 12-item subscale scores (Task, Bond, Goal) and one overall score (Total). All participants in this study completed the WAI (client version) reflecting their relationship with their substance use counselor at the treatment facility, following session 2, 4, and 8 during the 8-week course of treatment.

The Working Alliance Inventory for Technology-Based Interventions (WAI-Tech) was based closely on the WAI, including a parallel set of 36 items and using the 7-point rating scale with identical anchors. The majority of items were not changed from the original WAI; the major difference was that participants were instructed to insert the name of the computer program in the blanks: e.g., "I am confident in the CBT4CBT program's ability to help me". Several items, most often those from the bond scale, were reworded to preserve comprehension while retaining intent as much as possible. For example, "I believe _____ is genuinely concerned with my welfare" was changed to "I believe _____ is genuinely relevant to my wellbeing". Instructions specified that items referred to the computer program only, not the computer itself, or the research team. Only those participants assigned to the CBT4CBT condition completed the WAI-Tech following session 2, 4, and 8 with the computer.

Evaluation of Treatment

Upon completion of the 8-week treatment period, all randomized participants completed a 10-item self-report questionnaire rating their satisfaction (5-point scale from "*very*

dissatisfied” to “*very satisfied*”) with the type of treatment received, satisfaction with their counselor, how much they have changed during treatment (5-point scale from “*I’m much worse*” to “*I’m much better*”), and how much they attributed changes in functioning to the treatment received (5-point scale from “*definitely not related*” to “*definitely related*”).

Those assigned to CBT4CBT also completed an assessment of their satisfaction with and experience of the program using a scale developed previously (Carroll et al., 2008). This scale consisted of 24 items assessing the participants’ impression of various aspects of the CBT4CBT program. (e.g., I like the narrator for this program; I can relate to the characters in the videos). These were scored using a similar 7-point scale using the same anchors as the WAI.

Statistical Analyses

Participants assigned to the CBT4CBT condition who completed the WAI-Tech were compared to participants assigned to TAU who completed a WAI using Chi-square and Analysis of Variance (ANOVA) to evaluate differences according to demographic characteristics and baseline substance use severity. Cronbach’s alpha was used to evaluate the internal consistency of the WAI-Tech Total and subscale scores. These were compared to Cronbach’s alpha for the standard WAI. To evaluate construct validity, Pearson product moment correlations were calculated between WAI and WAI-Tech at each time point, as well as with participant ratings of satisfaction with the CBT4CBT program and with treatment. ANOVAs were used to compare mean scores for the WAI-Tech and WAI at each time point. Random effects regressions were used to explore the stability of WAI-Tech scores over time, and whether there was differential change compared to the WAI. Lastly, correlations were used to explore the relationship between the WAI-Tech and several common substance use treatment outcomes (Carroll, Kiluk, Nich, DeVito, et al., 2014; Donovan et al., 2012), such as the days retained in treatment, the percentage of days of self-reported abstinence from cocaine, the percentage of cocaine negative urine samples submitted, and whether the participant achieved at least 21- consecutive days of cocaine abstinence. Multiple regression and structural equation modeling (SEM) were used to further explore the relationship between WAI-Tech and treatment outcomes.

RESULTS

Participants

Of the 47 participants assigned to the CBT4CBT condition, 34 completed the WAI-Tech at least once (development and implementation of the WAI-Tech began after the trial initiated enrollment). Table 1 displays the demographic and baseline characteristics of these participants. There were no baseline differences between those assigned to CBT4CBT who completed the WAI-Tech and those assigned to TAU who completed a WAI ($n = 32$). The sample of participants who completed the WAI-Tech consisted of an equal number of males and females (50% each), mostly Caucasian (56%), never married (85%), and with an average age of 43.4 ($SD = 9.6$). The majority completed high school (74%), were unemployed (97%), and were receiving public assistance (77%). Most (71%) reported using

a computer regularly. The average number of days of cocaine use during the month prior to treatment entry was 15.2 ($SD = 9.2$).

There were no significant differences in terms of treatment utilization in the main trial for those assigned to CBT4CBT compared to TAU within this subsample of participants included in the current study. The number of individual treatment sessions attended were comparable across conditions (CBT4CBT: $M = 3.6$, $sd = 2.0$; TAU: $M = 4.2$, $sd = 3.4$; $F(1,55) = 0.51$, $p = ns$), as were the number of group treatment sessions attended (CBT4CBT: $M = 7.1$, $sd = 9.6$; TAU: $M = 9.2$, $sd = 16.8$; $F(1,55) = 0.32$, $p = ns$). Those assigned to the CBT4CBT condition also completed an average of 5.5 ($sd = 2.3$) modules in the program. Also, there were no differences in terms of treatment completion within this subsample, as 82% of those assigned to CBT4CBT and 84% of those assigned to TAU completed treatment. These rates were comparable to those in the main study report (Carroll, Kiluk, Nich, Gordon, et al., 2014).

Of the 34 participants who completed the WAI-Tech at session 2, 27 (79%) completed it again at session 4, and 21 (62%) completed it again at session 8. Of the 32 participants assigned to TAU who completed the WAI at session 2, all (100%) completed it again at session 4, and 29 (91%) completed it again at session 8. Scores on the WAI-Tech or WAI at session 2 or 4 did not significantly differ between treatment completers or non-completers (no data was available for WAI-Tech or WAI at session 8 for treatment non-completers). There were also no significant differences in responses on the treatment evaluation measure between treatment completers and non-completers.

Psychometric evaluation of the WAI-Tech

Internal consistency of the WAI-Tech Total scale at session 2 ($n = 34$) was excellent (Cronbach's $\alpha = .92$), with each of the subscales considered to have good internal consistency (Task $\alpha = .84$; Bond $\alpha = .78$; Goal $\alpha = .75$). These were comparable to Cronbach's alpha coefficients for the CBT4CBT participants' WAI Total scale at session 2 ($n = 34$; $\alpha = .94$), and subscales (Task $\alpha = .86$; Bond $\alpha = .89$; Goal $\alpha = .86$), as well as the TAU participants' WAI Total scale at session 2 ($n = 31$; $\alpha = .95$), and subscales (Task $\alpha = .86$; Bond $\alpha = .85$; Goal $\alpha = .86$). In terms of the strength of relationship between the WAI-Tech and WAI total and corresponding subscales within the CBT4CBT sample ($n = 34$), there were strong positive correlations at session 2 (r ranged from .52 to .65, $p < .01$), with the lowest magnitude between the corresponding bond subscales ($r = .52$). At session 4, the total scale and subscales scores between WAI and WAI-Tech remained significant, although slightly lower magnitude (r ranged from .48 to .53, $p < .01$), however the bond subscales of these two measures were no longer correlated at session 4 ($r = .28$, $p = ns$). At session 8, again the bond subscales were not correlated ($r = .23$, $p = ns$), whereas the other subscales and total scale were positively correlated (r ranged from .51 to .63, $p < .01$).

Examination of descriptive statistics and frequencies for each of the WAI-Tech item ratings revealed that most clients viewed the CBT4CBT program positively. The negatively framed items had the lowest mean ratings, suggesting disagreement with a negative view of the program (e.g., item 7 – “I find what I am doing in these session confusing”: $M = 1.56$, $sd = 0.79$), whereas the positively framed items had the highest mean ratings (e.g., item 26 – “I

trust what the CBT4CBT program is doing for me”: $M = 5.56$, $sd = 1.08$). Correlations of WAI-Tech scores and some of the additional items reflecting clients’ impression of the CBT4CBT program were consistent, indicating reasonable construct validity. For instance, the item “I can really relate to the characters in this program” was positively correlated with WAI-Tech scores (r ranged from .61 to .76, $p < .001$). The item, “I like the narrator in this computer program” was positively correlated with WAI-Tech bond subscale ($r = .47$, $p < .01$), more so than the task ($r = .34$, $p < .05$) or goal ($r = .29$, $p = ns$). Negatively framed items had a strong negative correlation with WAI-Tech scores. For example, the item “I find this computer program boring” was negatively correlated with the WAI-Tech scores (r ranged from $-.54$ to $-.68$, $p < .001$).

Participants’ rating of satisfaction with their substance use counselor was correlated with WAI-Tech total, task, and goal scores at session 4 (r ranged from .42 to .47, $p < .05$), and the task subscale at session 8 ($r = .44$, $p < .05$). This indicates that higher alliance scores on the WAI-Tech at those time points were associated with higher ratings of clients’ satisfaction with their counselor. However, the WAI-Tech bond subscale was not significantly related to participants’ satisfaction with their counselor at any time point. Clients’ ratings of alliance with their counselor on the WAI (for those assigned to CBT4CBT) were positively correlated with their ratings of satisfaction with their counselor, but only early in treatment (session 2 total, task, goal, and bond r ranged from .54 to .59, $p < .01$). Session 8 alliance ratings were not correlated with ratings of satisfaction with a counselor. This pattern was similar to that for clients assigned to TAU – earlier alliance ratings (session 2 and 4) were positively correlated with client satisfaction with their counselor (ranging from $r = .51$, $p < .01$, to $r = .38$, $p < .05$). Neither versions of the WAI were correlated with clients’ rating of satisfaction with treatment.

Stability of scores over time

Mean scores for the Total scale and subscales at each time point for both the WAI-Tech and WAI (CBT4CBT group only) are presented in Table 2. Overall, scores for the Total scale and subscale were not significantly different across the WAI versions, with the exception of the *bond* subscale at session 4 [$F(1,52) = 5.78$, $p < .05$]. Scores on the WAI-Tech bond subscale were lower than the WAI at all time points, however only the session 4 difference was statistically significant (WAI-Tech: $M = 5.15$, $SD = 0.76$; WAI: $M = 5.71$, $SD = 0.92$). There were no differences between WAI total or subscale scores across treatment conditions (CBT4CBT vs. TAU; data not displayed) at any time point, suggesting that inclusion of the computerized CBT component of the treatment did not significantly adversely affect the relationship with the counselor.

Random effects regression evaluating change over time on the subscale mean scores between the WAI-Tech and WAI using all available data for those assigned to CBT4CBT, revealed a trend toward a time effect for the total score [$F(1,136) = 2.92$, $p < .10$], but no group or group by time interaction. The total scores appeared to decrease slightly over time for both WAI versions, however this seems to be due to the decrease in bond subscale scores over time rather than changes on the task or goal subscales. On the bond subscale, results indicated a significant time effect [$F(1,138) = 6.79$, $p < .01$] and a trend toward a group

effect [$F(1,129) = 3.12, p < .10$], yet no group by time interaction. Specifically, the bond subscale scores were slightly lower overall on the WAI-Tech compared to the WAI, and also significantly decreased over time for both versions, but they did not differentially change over time. There were no group, time, or group by time interactions for the task or goal subscales, suggesting relatively stable scores on these subscales for both the WAI and WAI-Tech over time.

Relationships of WAI-Tech to Treatment Process and Outcomes

Correlations between the scales of the WAI versions at session 2 and several cocaine treatment outcome measures are displayed in Table 3. There were few significant relationships between the WAI-Tech and treatment outcome measures: the goal subscale was positively correlated with the percentage of days abstinent from cocaine ($r = .41, p < .05$), indicating higher ratings of perceived common goals with the computer program was associated with a greater percentage of days abstinent from cocaine during the treatment period. Because there were several significant relationships between baseline cocaine use characteristics (e.g., days of cocaine use prior to treatment entry) and treatment outcome measures (Carroll, Kiluk, Nich, Gordon, et al., 2014), the relationship between WAI-Tech scores at session 2 and percentage of cocaine use during treatment was no longer significant after controlling for these characteristics in multiple regression. Also, Structural Equation Modeling (SEM) to evaluate the association between WAI-Tech scores at the end of treatment (i.e., session 8) and cocaine use across the follow-up period (6-months following end of treatment) did not reveal any significant relationships.

This pattern of relationships with treatment outcomes was similar to the ones found for the WAI among participants assigned to the CBT4CBT condition - the WAI in this group of participants had few relationships with treatment outcomes. However, among participants assigned to TAU, the WAI had several significant relationships with cocaine use outcomes. For instance, the WAI was positively associated with the percentage of days abstinent from cocaine use during treatment [total score ($r = .43, p < .05$), task ($r = .40, p < .05$), bond ($r = .45, p < .01$), goal ($r = .39, p < .05$)]. These positive correlations indicate higher client ratings of the working alliance with their counselor were associated with a greater percentage of days abstinent from cocaine during the treatment period.

In terms of treatment process, the goal and bond subscales for the WAI-Tech at session 4 were positively correlated with the number of CBT4CBT modules completed ($r = .39, p < .05$, and $r = .38, p < .05$, respectively), indicating a greater goal and bond alliance was associated with the completion of more CBT4CBT modules. WAI-Tech scores were not significantly correlated with the number of individual sessions with a substance use counselor during the study. Also, although WAI-Tech scores were not related to the participants' rating of their satisfaction with the treatment received, they were related to the participants' attribution of change. For instance, higher participant ratings on the item "In your opinion, do you believe that whether you're worse, unchanged, or better (compared to when you began treatment) is related to the treatment received?" were associated with higher scores on the WAI-Tech at session 4: [total score ($r = .39, p < .05$), bond ($r = .47, p < .05$), goal ($r = .48, p < .05$)], and at session 8: [total score ($r = .55, p < .01$), task ($r = .50, p < .05$),

bond ($r = .61, p < .01$), goal ($r = .42, p < .05$)]. Participant ratings on this item were not correlated with the WAI for those assigned to CBT4CBT, however they were correlated with the WAI for those assigned to TAU: [session 2 total score ($r = .34, p < .05$), bond ($r = .36, p < .05$), task ($r = .41, p < .05$)], and [session 8 total score ($r = .51, p < .01$), bond ($r = .56, p < .01$), goal ($r = .45, p < .05$), task ($r = .49, p < .01$)].

DISCUSSION

This study explored the level of working alliance between clients and technology-based interventions using a newly adapted version of the Working Alliance Inventory for Technology-based interventions (WAI-Tech) administered to cocaine dependent individuals enrolled in a randomized trial of CBT4CBT (Carroll, Kiluk, Nich, Gordon, et al., 2014). Overall, the WAI-Tech appeared to have similar psychometric characteristics as the standard WAI in terms of internal consistency, mean scores, and stability over time. Not surprisingly, the ‘bond’ subscale of the WAI-Tech was consistently lower than the other subscales and decreased over time, although this score also decreased over time for the WAI as well. Clients’ alliance with the computer program did not negatively affect the alliance with their counselor, as some higher WAI-Tech scores were associated with higher ratings of satisfaction with counselor. The most noteworthy finding was that scores on the WAI-Tech had no significant relationship with cocaine use treatment outcomes, whereas scores on the WAI for those not receiving the computerized intervention were consistently related to the percentage of days abstinent from cocaine.

This is one of the first evaluations of a working alliance assessment developed specifically to measure the relationship between the client and a technology-based intervention. Others have measured the alliance with a therapist/clinician who provided online counseling (Andersson et al., 2012; Holmes & Foster, 2012; Sucala et al., 2012), or provided brief check-ins in accordance with a computer-assisted treatment (e.g., Kay-Lambkin et al., 2011). Those that have measured a working alliance with a specific technology-based intervention did not include an evaluation of the psychometric characteristics of the adapted measure (Bickmore, Gruber, & Picard, 2005; Ormrod et al., 2010). Our adaptation of the established WAI (Horvath & Greenberg, 1989) was designed to measure the nature of the alliance that clients may form with a computer-based program, rather than with a live person, and was not to be confused with thoughts/feelings regarding the computer itself. This is a complex construct, as many technology-based interventions include no therapeutic interaction with a therapist/counselor, potentially removing this consistently strong treatment component from the intervention. Regarding the questions of the extent to which clients may form an alliance with a computer-based CBT program, and whether this alliance contributes to outcomes in the same manner as with a therapist-delivered psychotherapy, our preliminary findings are mixed.

Overall, results indicated the WAI-Tech appeared to retain the psychometric characteristics of the WAI, with the exception of the bond subscale. Internal consistency estimates were lower for this subscale on the WAI-Tech (although still within an acceptable range). In terms of relationships with clients’ rating of satisfaction with their counselor, scores on the WAI-Tech were largely not correlated (with the exception of the task, goal, and total scores

following session 4). Clients' levels of alliance with their counselor (as measured on WAI) were positively correlated with their ratings of satisfaction with their counselor, as expected. Taken together, this suggests that clients' satisfaction with their counselor is not negatively impacted by whether they are also receiving a computer-based treatment in addition to standard outpatient counseling, nor by any potential alliance with the computer-based treatment. Interestingly, clients' levels of alliance with either the computer-based CBT program, or their counselor, was not related to their ratings of satisfaction with treatment. This was true across treatment conditions for reasons that are unclear.

When comparing scores across WAI versions, the bond subscale of the WAI-Tech continued to be the outlier relative to the task and bond scales. Mean scores were consistently lower for the bond subscale on the WAI-Tech compared to the WAI, but differences were only significant at session 4. The other subscale scores were not significantly different across versions at each time point. This makes intuitive sense, as the 'bond' concept of the working alliance refers to the personal attachment between client and therapist, and includes issues such as mutual trust, acceptance, and confidence, whereas the 'tasks' concept refers to perception of therapeutic tasks as relevant and efficacious, and the 'goals' concept refers to the agreement regarding the outcome of the intervention (Bordin, 1979). Thus, clients may agree with the relevance and outcomes of the therapeutic tasks within a technology-delivered intervention as much as when delivered by a therapist, yet they may not develop the same level of trust and acceptance with a computer/technology-based program as they would with a therapist in-person or online.

However, the clients' ratings of perceived bond with CBT4CBT weren't particularly low, *per se*; mean ratings were above the neutral midpoint at all time points indicating a positive alliance, consistent with other reports of alliance with computerized CBT (Ormrod et al., 2010). Ratings of the bond alliance may depend in part on the 'relational' aspects of the technology-based intervention. Bickmore, Gruber, and Picard (2005) found higher ratings on bond subscales of an adapted WAI, with increases over time, when a technology-based intervention for exercise adoption included a 'relational agent' – a computer animated human that interacted with users in a simulated face-to-face conversation using both verbal (e.g., empathy, social dialogue, humor, etc.) and nonverbal behaviors (e.g., direct gaze, smiling, nodding, etc.) to establish and maintain a working alliance, compared to an intervention with a 'non-relational agent' - the same computer animated human who provided exercise advice without these more complex verbal and nonverbal behaviors. The CBT4CBT program in the current study included a human narrator who acted as a guide throughout the program (yet was only visible on some screen pages). This may have contributed to the reasonably high bond subscale scores in this sample, which were actually higher than the bond subscales scores reported by Bickmore, Gruber, and Picard (2005) for participants receiving a technology-based intervention with a 'relational agent'. Moreover, strong correlations between alliance ratings on the WAI-Tech and items indicating a positive impression of the narrator and characters in the computer-based CBT provide some support for the potential significance of 'relational' aspects of technology-based interventions for development of an alliance.

These data also suggest that WAI-Tech ratings were not strongly related to cocaine use outcomes during the treatment or follow-up period, which is consistent with reports in other areas indicating no relationship between treatment outcomes and alliance within technology-based interventions (Andersson et al., 2012; Bickmore, Gruber, & Picard, 2005; Knaevelsrud & Maercker, 2006; Ormrod et al., 2010; Preschl et al., 2011). Conversely, for those assigned to TAU, higher client-reported alliance with their therapist at several time points during the treatment period was associated with greater rates of abstinence from cocaine (i.e., greater percentage of days abstinent). This is consistent with most prior studies of the working alliance and outcome in substance abuse treatment (Joe, Simpson, Dansereau, & Rowan-Szal, 2001; Simpson, Joe, Rowan-Szal, & Greener, 1997). However, this was not true for the client-reported alliance with their therapist among participants in the CBT4CBT condition (who received both a therapist- and technology-delivered intervention). In other words, a stronger alliance with a therapist/counselor was related to less cocaine use during treatment, but not for those who also received the computer-based program in addition to treatment from their therapist. Moreover, a higher client-rated attribution that change was due to treatment received was associated with higher alliance scores on the WAI-Tech but not the WAI for those in the CBT4CBT condition (there was an association with the WAI for those receiving TAU only). Therefore, while the level of alliance with a technology-based intervention may be related to whether clients attribute change to the treatment received, it does not appear related to substance use the same way the level of alliance with a therapist/counselor in a face-to-face treatment is related.

Such interpretations should be approached with caution, given the number of limitations in this study. First, this preliminary evaluation of the WAI-Tech was limited by the small sample size, which precluded more advanced evaluation of the measure, such as factor analysis and/or item analysis. Also, the reduced sample of participants completing the WAI-Tech at all three time points further limited the potential analyses. That being said, correlations with the WAI and other indicators of satisfaction with the CBT4CBT program lend some reasonable construct validity, and the use of random effects regression analyses for evaluating scores over time minimized the effect of missing data. Second, the multiple correlation analyses conducted in this study potentially increased the likelihood of chance findings, which may suggest the need for a more conservative significance level to account for inflated Type I error rates. Using a significance level of $p < .01$, for instance, would slightly reduce the number of relationships interpreted as significant. However, the small sample size and moderate strength of the correlation coefficient values mitigate the potential for false positives at $p < .05$. Third, this study did not obtain WAI ratings from the clinicians, limiting the ability to separate the variability in WAI scores according to therapist variability and client variability (Baldwin et al., 2007; Crits-Christoph et al., 2009). Last, the sample in this study was drawn from a methadone-maintained population which limits the generalizability of the findings to other populations of substance users and other psychiatric disorders in general.

Taken together, the results of this study suggest that some aspects of the construct of a working alliance may apply to a computer-based CBT program, with clients forming a similar level of alliance with the goals and tasks of the computer program as they would with a live therapist. However, the nature of the 'bond' between a client and a technology-

based intervention is unclear. Clients' level of alliance with a technology-based intervention does not appear to affect their level of alliance with a therapist when a treatment includes both delivery formats, yet the alliance with a technology-based intervention may not have the same impact on treatment outcomes as it does in a therapist-delivered intervention. Therefore, the distinctive treatment ingredients (i.e., specific factors) of the intervention may be a more important contributor to outcomes for technology-based interventions, whereas the common treatment ingredients (i.e., therapist behaviors) may play a larger role in face-to-face therapeutic interventions. Future research should continue to explore the role of a working alliance for technology-based interventions that do not include a therapist component.

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HIGHLIGHTS

- We adapted the Working Alliance Inventory for Technology-based Interventions.
- We examined WAI-Tech within randomized trial of CBT4CBT for cocaine use.
- Levels of alliance with CBT4CBT program were similar to alliance with therapist.
- Alliance with computer-based program did not affect alliance with therapist.
- Alliance with computer-based program not associated with treatment outcomes.

Table 1

Demographic and baseline characteristics across groups

	CBT4CBT (n=34)	TAU (n=32)	Total (n=66)	χ^2 *
Categorical variables	n (%)	n (%)	n (%)	
Female	17 (50)	16 (50)	33 (50)	0
Race / Ethnicity				3.33
Caucasian	19 (55.9)	19 (59.9)	38 (57.6)	
African-American	13 (38.2)	8 (25)	21 (31.8)	
Hispanic	2 (5.9)	3 (9.4)	5 (7.6)	
Other	0	1 (3.1)	1 (1.5)	
Multiracial	0	1 (3.1)	1 (1.5)	
Completed High School	25 (73.5)	23 (71.9)	48 (72.7)	0.02
Never married/living alone	29 (85.3)	29 (90.6)	58 (87.9)	0.44
Unemployed	33 (97.1)	28 (87.5)	61 (92.4)	2.15
Referred by criminal justice system	7 (20.6)	7 (21.9)	14 (21.2)	0.02
On Public Assistance	26 (76.5)	26 (81.3)	52 (78.8)	0.23
Lifetime alcohol use disorder	27 (79.4)	25 (78.1)	52 (78.8)	0.02
Anti Social Personality Disorder	5 (14.7)	2 (6.3)	7 (10.6)	1.24
Use a computer regularly	24 (70.6)	21 (65.6)	45 (68.2)	0.19
Continuous variables	Mean (sd)	Mean (sd)	Mean (sd)	F
Age	43.4 (9.6)	41.2 (9.7)	42.3 (9.6)	0.83
Days paid for work in past 28	3.2 (6.0)	2.9 (6.9)	3.1 (6.4)	0.04
Days of cocaine use past 28	15.2 (9.2)	14.5 (9.1)	14.8 (9.1)	0.09
Days of heroin use past 28	1.6 (4.9)	2.6 (6.4)	2.1 (5.6)	0.59
Days of alcohol use, past 28	0.4 (0.5)	0.3 (0.5)	0.4 (0.5)	0.64
Age of first cocaine use	20.6 (5.2)	19.5 (4.8)	20.1 (5.0)	0.87
Years of regular cocaine use	11.9 (6.9)	10.5 (8.7)	11.2 (7.8)	0.47
Lifetime number of arrests	13.5 (15.4)	11.6 (17.7)	12.5 (16.4)	0.22
# Previous Outpatient Treatments	3.5 (4.1)	2.1 (2.1)	2.9 (3.4)	2.95
# Previous Inpatient Treatments	4.4 (7.2)	2.7 (3.3)	3.6 (5.7)	1.38

* all *p* values non-significant (>.05)

Table 2

WAI-Tech and WAI mean scores over time (CBT4CBT group only)

Session 2	WAI-Tech (n= 34)				WAI (n= 34)			
	mean	std	mean	std	mean	std	F	
task	5.75	0.82	5.65	1.08	5.65	1.08	0.21	
bond	5.37	0.78	5.60	1.30	5.60	1.30	0.78	
goal	5.52	0.75	5.64	1.03	5.64	1.03	0.30	
total	5.55	0.70	5.63	1.08	5.63	1.08	0.14	
Session 4 (n= 27)								
task	5.64	0.79	5.69	0.81	5.69	0.81	0.06	
bond	5.15	0.76	5.71	0.92	5.71	0.92	5.78*	
goal	5.55	0.69	5.68	0.78	5.68	0.78	0.42	
total	5.45	0.67	5.69	0.76	5.69	0.76	1.56	
Session 8 (n= 21)								
task	5.83	0.88	5.79	0.63	5.79	0.63	0.05	
bond	5.09	0.93	5.51	1.08	5.51	1.08	1.87	
goal	5.71	0.80	5.69	0.64	5.69	0.64	0.01	
total	5.55	0.82	5.66	0.67	5.66	0.67	0.25	

* $p < .05$

Table 3

Correlations of WAI at session 2 and treatment outcomes

Outcome measure	WAI-Tech (Session 2) (n = 34)			CBT4CBT WAI (Session 2) (n = 34)			TAU WAI (Session 2) (n = 32)		
	Task	Bond	Goal	Total	Task	Bond	Goal	Total	Total
Days in treatment	.06	.20	.02	.11	.16	.29	.14	.22	-.21
% Cocaine negative urines	-.02	.07	-.04	.01	.16	.27	.02	.17	.35*
% Days cocaine abstinent	.30	.09	.41*	.29	.24	.27	.15	.24	.43*
21 days of consecutive abstinence	.06	.06	.01	.05	.08	.24	-.10	.09	.23

* $p < .05$

** $p < .01$