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A time-series analysis of therapeutic alliance, interventions, and client's clinical status in an evidence-based single-case study: Evidence for establishing change mechanisms in psychotherapy

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Abstract
Objective: The goal of this study was to analyze the time-series of alliance, interventions, and client's post-sessions clinical status, to establish if alliance and adherence to cognitive-behavioral interventions preceded improvement in psychotherapy **Method:** A single-case study of a complete Cognitive-Behavioral treatment of a 27-year-old male diagnosed with Generalized Anxiety Disorder treatment was conducted. Alliance, adherence to cognitive-behavioral interventions, and client's therapeutic condition were assessed every two sessions during the entire treatment. **Results:** After controlling for the effect of autocorrelations, the transfer functions showed that alliance predicted client's clinical condition with a lag of two sessions throughout the entire treatment. However, the inverse relationship was not observed. **Conclusions:** Results support the hypothesis of a time-lagged association between alliance and subsequent client's changes in their clinical condition in single case of a cognitive-behavioral treatment.

Keywords: therapeutic alliance; interventions; mechanism of change; change; single-case

Introduction

Therapeutic alliance is considered to be a modest but robust predictor of psychotherapy outcome (Horvath, Del Re, Flückiger, & Symonds, 2011). Although this association has led to a conventional assumption that alliance has a causal effect on therapeutic change (Feeley, DeRubeis, & Gelfand, 1999), the nature of this relationship remains unclear (Barber, 2009).

Most of the studies in this topic have measured alliance in only one moment after the initiation of therapy and then have correlated the alliance scores with changes produced from the beginning to the end of therapy. With this methodology, an amount of change supposedly predicted by alliance may have occurred before alliance was assessed, with the early changes having a causal effect on the relationship (Klein et al., 2003). In order to determine the alliance as having a causal effect on outcome, the symptomatic improvement must appear after the alliance assessment, and the reverse causation, led by prior changes, must be statistically controlled (Crits-Christoph, Connolly Gibbons, & Mukherjee, 2013).

During the 1990s, several studies tried to address this issue, without finding a significant association between early alliance and outcome, when prior improvements were controlled and even finding that alliance's strength was significantly predicted by early symptomatic changes (DeRubeis & Feeley, 1990; Feeley et al., 1999). Falkenström, Granström, and Holmqvist (2013) pointed out that most of these studies used methods developed to analyze between-clients effects. These effects cannot be assumed as evidence that an improvement of alliance in a given client would predict an eventual improvement in his outcome, a within-subject effect hypothesis. To gather evidence to support this hypothesis, a more idiographic perspective is needed, focusing in single

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subject's time variations in process and outcome variables (Tschacher & Ramseyer, 2009).

In the last 15 years, several studies introduced time-series methods to explore alliance–outcome relationship controlling the eventual effect of prior symptomatic changes. Most of them were based on mixed lineal models. These models, where the covariates may include both random and fixed effects, are suitable for data where the assumptions of independency or homoscedasticity are violated. Thus, they are applicable in repeated-measures studies where correlations among the residuals are expected allowing to analyze within-client effects. Other studies used autoregressive models to analyze alliance–outcome time-series. In these models, variables are regressed on themselves at early measures. Once autoregressive structures are identified, cross-lagged effects might be established among variables.

Based on these two main strategies, some studies observed that alliance predicted subsequent change even when prior symptomatic reductions were controlled for (Accurso et al., 2015; Klein et al., 2003; Zilcha-Mano, Dinger, McCarthy, & Barber, 2013). However, except for Zilcha-Mano et al. (2013), all of them only reported between-subjects effects. Other studies that explored specifically within-subjects effects found evidences of an inverse relationship (Strunk, Brotman, & DeRubeis, 2010) or a reciprocal model effect between the variables (Crits-Christoph, Gibbons, Hamilton, Ring-Kurtz, & Gallop, 2011; Falkenström et al., 2013; Ramseyer, Kupper, Caspar, Znoj, & Tschacher, 2014).

Research on the dependability of alliance assessments suggested at least four measures of alliance for a reliable assessment of the construct (Crits-Christoph et al., 2011). Nevertheless, except for Accurso et al. (2015) and Zilcha-Mano et al. (2013), most of the papers that found an association between alliance and outcome used less than four measures. Besides, the studies in this topic focused on clients with anxiety disorders are limited (Crits-Christoph et al., 2013).

Some process–outcome studies have also concentrated on analyzing the effects of psychotherapy interventions. Although there is an implicit presupposition that therapist's adherence to interventions of their theoretical framework is strongly related to outcome (Barber, 2009), in the last meta-analysis on this topic, Webb, DeRubeis, and Barber (2010) found that adherence and competence effect sizes were not significantly different from zero. Nevertheless, in Cognitive-Behavioral Therapy (CBT), some individual studies have found significant associations between adherence and outcome (DeRubeis & Feeley, 1990; Feeley et al., 1999; Strunk et al., 2010). Additionally, interactions between adherence

and results, moderated by alliance levels have been reported (Owen, Hilsenroth, & Rodolfa, 2013).

The study of interventions as a mechanism of change has presented the same limitations as the research on the role of alliance in outcome. A reverse causation may explain the significant associations among the variables in most of the research presented above.

In the last years, some isolated efforts have been made to determine interventions' causal role on outcome. Based on an experimental setting, Høglend et al. (2011) found that the use of transference interpretations was related to improvement within the context of a weak therapeutic alliance. Boswell, Anderson, and Barlow (2014), using time-series analysis, reported that the CBT intervention modules were related to therapeutic changes. Ramseyer et al. (2014), applying Time-Series Panel Analysis, found that a higher stability in the use of clarification and mastery interventions (but not the dosage of use) was related to changes.

Aims and Rationale of the Study

The general picture presented above indicates the importance of continuing to explore the relationships among interventions, alliance, and the evolution of client's clinical status to enrich the conceptualization of the links among these components.

This research was an effort in this direction and aimed to analyze how adherence to psychotherapy interventions and alliance are related to client's clinical status by conducting a time-series analysis of these variables in a single case of a complete non-manualized CBT. We were especially interested in determining whether the alliance and interventions adherence could predict subsequent scores in client's clinical condition or if the opposite effect would occur.

Although case studies have a large history in the development and validation of clinical theories, their scientific potential has been unappreciated lately. This was mainly due to threats to internal validity associated with the use of anecdotal and nonsystematic records (Kazdin, 2002), and the impossibility of conducting conventional statistical methods due to the violation of the independence of the observations assumption (Borckardt et al., 2008). In this research, we conducted a single-case study where we applied methodological strategies proposed to address these two issues. Firstly, to control threats to internal validity, the study was designed according to the American Psychological Association (n.d.) criteria for evidence-based case studies. Secondly, for data analysis, we used Autoregressive Integrated Moving Average Models (ARIMA; Box & Jenkins, 1976), one of the statistical methods that has been designed for evaluating the evolution of variables that display a

dependency due to autocorrelations. We consider that by adjusting these features, case studies can be a source of substantial empirical findings with great impact on clinical practice (Kazdin, 2002).

We have not found previous research that analyzed in a systematized single-case study how alliance, interventions adherence, and client's post-sessions clinical status are related during a complete treatment and using ARIMA. Although ARIMA have been used in prior healthcare studies (Chew, Doraisingham, Ling, Kumarasinghe, & Lee, 1998), we have only found one research that applied this particular methodology in a single case for psychotherapy research (Boswell et al., 2014). In that study, the authors analyzed the influence of modules of interventions and not adherence to specific interventions. Although there have been studies that used autoregressive methods to explore the association between alliance and outcome (Accurso et al., 2015; Zilcha-Mano et al., 2013), we have not found papers that used ARIMA for that purpose. In this sense, we consider that this paper could represent a statistical contribution for further research, regarding the study of alliance-change and interventions-change relationships.

This research seeks to analyze the relationships between the variables addressing as well some of the limitations pointed out in process–outcome research literature. We included more than the four measurements suggested for a reliable assessment of alliance (Crits-Christoph et al., 2011), and explored within-subject effects instead of between-subjects effects (Falkenström et al., 2013). The study is focused on a client diagnosed with an anxiety disorder, a population underrepresented in prior alliance–outcome studies (Crits-Christoph et al., 2013).

The main hypotheses of the study were: (1a) Alliance prior scores would predict subsequent scores (i.e., alliance would present an auto-regressive structure); (1b) Prior levels of CBT interventions adherence would predict the subsequent levels; (1c) Client's clinical status prior scores would predict the subsequent ones; (2a) Alliance would predict subsequent scores in client's clinical status; (2b) CBT interventions adherence would predict subsequent scores in client's clinical status; (3a) Client's clinical status would not predict subsequent scores in alliance; and (3b) Client's clinical status would not predict subsequent scores in CBT interventions.

Methods

Participants

Client. When treatment started, Cristobal (pseudonym) was a 27-year-old, single, middle-class, Argentinian man who lived alone in Buenos Aires. He was studying engineering and working as a computer system administrator. He sought therapy because of excessive anxiety and worry related to a wide range of situations (academic, labor, interpersonal) and difficulties in managing that anxiety. These worries made the client avoid certain situations, such as using public transportation, reducing the client's interpersonal functioning and self-worth. The client also had difficulties with sleeping and concentrating, muscle aches, fidgeting, and irritability.

The therapist diagnosed the client, using her clinical observations in the initial interviews, with Generalized Anxiety Disorder (GAD), based on the criteria of the revised fourth edition of the *Diagnostic and statistical manual of mental disorders* (DSM-IV-TR; American Psychiatric Association, 2001).

Therapist. The therapist was a 29-year-old, single, Argentinian female. Once treatment started, she had already completed 5 years of clinical training at a public hospital with a CBT specialization. The therapist described her orientation as Cognitive-Behavioral.

Treatment

Once Cristobal was referred to the therapist, an interview was conducted where the client signed a consent form for participating in this study, and the therapist explored the client's reason for consultation and baseline characteristics. Both the exploration and the diagnosis processes were conducted in a natural setting, as the therapist usually does in her practice. Setting of the treatment was the therapist´s private practice office.

The treatment was a CBT non-manualized therapy, primarily based on Wells (2006) Metacognitive Model for GAD therapy. The therapist was trained in this model for GAD during her postgraduate specialization training for CBT at the Universidad de Buenos Aires, Argentina. After case formulation, the socialization of treatment, and the use of specific interventions for the identification of worries, treatment was mainly focused on dysfunctional beliefs (both positive and negative) related to worry. Additionally, the therapist integrated strategies from other cognitive models for GAD treatment, as she usually does in her private practice.

The therapy consisted of 47 sessions with a once a week frequency. The therapist, based on therapist clinical judgment of client recovery, proposed treatment termination and client agreed.

Measures

The variables explored were measured by different sources to reduce participants' burden and to prevent common rater's effects bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

Therapeutic alliance. Alliance was measured by the Argentine Adaptation of the Working Alliance Inventory—Counselors Form (WAI; Waizmann & Roussos, 2011) completed by the therapist. The WAI is a 36-item measure that assesses alliance in three dimensions: Bond, Tasks, and Goals. The Argentine adaptation of the WAI has demonstrated adequate psychometric properties with evidences of internal consistency and convergent and discriminant validity (Gomez Penedo, Waizmann, & Roussos, 2015; Waizmann & Roussos, 2011).

Cognitive-behavioral interventions. Interventions were assessed by the Argentine version of the Comparative Psychotherapy Process Scale (CPPS-A) using external raters. CPPS is a general assessment of the psychotherapy process to analyze therapist activity during sessions (Hilsenroth, Blagys, Ackerman, Bonge, & Blais, 2005). The instrument has 20 items rated on a 7-point Likert scale (0 = not at all characteristic; 6 = extremely characteristic). Ten items describe CBT interventions, and the other 10 items describe Psychodynamic-Interpersonal (PI) interventions. Each item represents interventions that are prescribed by one framework and proscribed by the other, forming a pool of unique interventions for each framework.

The original instrument has shown adequate internal consistency and inter-rater reliability (Hilsenroth et al., 2005). In Argentina, the CPPS-A has also shown adequate internal consistency (CBT subscale α = .93) and evidence of construct validity, presenting a two-factor solution (Gomez Penedo, Barrientos, Martinez, & Roussos, 2015). In this research, we only used the CBT subscale for the analysis of the interventions, although PI subscale was also assessed. Influences of non-CBT interventions were not controlled for.

Although CPPS includes a generic compendium of CBT techniques not specifically designed for GAD, most of them are consistent with CBT proposed for this disorder (Roemer, Orsillo, & Barlow, 2002) or with basic principles that are expected in every CBT (Beck, 2011).

Evolution of client's clinical status. Symptomatic status was measured by the Argentine adaptation of the Symptom CheckList-90-Revised (SCL-90; Casullo & Perez, 1999/2008; Derogatis, 1994) rated by the client. This measure is a 90-item, self-report questionnaire rated on a 5-point Likert scale that assesses psychological distress in nine symptomatic subscales and in a general index. The adaptation used presented a high internal consistency (α = .96; Sanchez & Ledesma, 2009). Although SCL-90 has not been developed as a process measure, it has been shown as a stable measurement with adequate test–retest correlation coefficients (Derogatis, 1983).

The evolution of the client therapeutic status was measured by the Spanish version of Outcome Questionnaire.45 (OQ.45; Lambert et al., 1996) adapted by Von Bergen and De la Parra (2002) in Chile, rated by the client. The OQ.45 is a 45-item, self-report questionnaire, on a 5-point Likert scale, to measure client distress in symptoms, social role performance, and interpersonal relations. In Argentina, the questionnaire showed good internal consistency (α = .92), test–restest reliability (r = .864), concurrent validity and sensitivity to change (Maristany & Fernandez-Alvarez, n.d.).

We used both OQ.45 and SCL-90 in order to have two different measures of client's clinical status. Although in this study they had a strong correlation (r = .83), they present clinical differences. SCL-90 measures psychological symptoms' intensity in nine specific symptomatic areas (such as depression or anxiety). Instead, OQ.45 analyzes symptomatic distress only in a generic sense. On the other hand, OQ.45 incorporates an assessment of social role performance, an important dimension to evaluate client's clinical status that is not evaluated in SCL-90.

Procedures

This study was conducted with the approval of the Internal Review Board from the Universidad de Buenos Aires. Client's data were codified to safeguard his confidentiality.

At the initial interview, the client provided an informed written consent for participating in the study. Once the interview finished, Cristobal was asked to complete the SCL-90 and the OQ.45 as baseline measures. At the next appointment, treatment was initiated, counting as the first session. The administration of SCL-90 and OQ.45 was repeated after the first session and every two sessions during the whole treatment. After the last session, both questionnaires were again assessed (Post-test). WAI began to be assessed after the third session and then every two sessions, since literature suggests that alliance is established from the third session onwards (Kokotovic & Tracey, 1990). The 47 sessions of the treatment were audio-recorded. One of

every two sessions were transcribed verbatim and analyzed using the CBT subscale of the CPPS-A rater form. Two undergraduate students classified the interventions. After training, both raters classified the same two sessions with an intraclass correlation coefficient (ICC (2,1)) of .65, which represent a "good" agreement level (Fleiss, 1981). Once training was finished, the 24 sessions were randomly assigned to raters. Agreement was again checked in the middle and at the end of the analysis, with an ICC (2,1) of .70 between the raters in all the common sessions.

Data Analysis

Clinical significance calculation. For the OQ.45 Total Score, we used the reliable change (RC) index and cut-off point (CP) calculated by Maristany and Fernandez-Alvarez (n.d.) for Argentine population (CP = 1.11 and RC = 0.35). For the SCL-90 GSI, we calculated the CP (0.64) and RC (0.88), using the formula *c* of Jacobson and Truax (1991), based on data from the Argentine functional (Casullo & Perez, 1999/2008) and dysfunctional populations (Sanchez & Ledesma, 2009), and test–retest coefficients of the original measure (Derogatis, 1994).

ARIMA. Most statistical methods assume that the observations form a set of random data that are independent. In these cases, the order of the observations is not relevant. In single cases, the data correspond to a sequence of observations that conform a time-series (Borckardt et al., 2008). Thus, the order of observations is fundamental and the observations depend on each other, violating the assumption of independence (Borckardt et al., 2008). Therefore, specific statistical models have been developed to collect and draw on the dependence between observations that were temporally ordered, such as the autoregressive models (Borckardt et al., 2008). Within these models, ARIMA are specific statistical methods developed to identify autocorrelations (AR) of given variables and time-lagged associations among them (Box & Jenkins, 1976). The most important instruments in ARIMA are the AR coefficients that measure the lineal association among the observations of a variable separated by time periods (k). These coefficients provide the information on how the observations are related, allowing us to identify the ARIMA model that best fits the data. ARIMA model is designed to analyze information that presents a certain degree of homogeneity. Stationarity, one of the main assumptions of time-series models, was evaluated in all the cases for all the variables and there were no evidences of its violations in data. Another of the assumptions of

ARIMA is that the intervals of assessments are constant. From the perspective of the continuity of the sessions, the measurement moments of this study (one every two sessions) meet the assumption of uniform measurement intervals.

To observe if the variables presented an AR structure, ARIMAs were conducted in: (a) *WAI Total score*; (b) *CPPS CBT subscale*; (c) *OQ.45 total score*; and (d) *SCL-90 GSI*. Although a minimum of 50 observations is usually established for ARIMA, this is worth it when there are evidences of stationarity (Box & Tiao, 1975); in a case where there is no such evidence, a minimum of 4 observations per parameter estimated should be sufficient (Simonton, 1977). We calculated the individual functions of AR and partial autocorrelation (PA) in each time-series to analyze the feasibility of fitting an ARIMA model. To identify the specific features of the models, we analyzed the charts of ARs and Pas. In the cases where it was possible, we also calculated the type of model adjusted, the indicators of goodness of fit, and the estimators.

Transfer functions. The transfer functions analyze the potential joint modeling of a series of two or more variables in order to evaluate the existence of causal temporal relationships (Wei, 2006). In order to analyze the relationships among the variables, they need to have previously fit to an AR model. The functions of cross-correlations are the indicators of the power and directionality of the association among the variables (Wei, 2006).

Although both ARIMA and transfer functions were developed for econometrics, they have been previously used in psychotherapy process–outcome single-case studies as in the work by Boswell et al. (2014) above quoted. The organization and presentation of the ARIMA and the transfer model results in this study were partially based on that prior paper.

For the ARIMA and transfer function models, we used the software SAS version 9.2. In this study, we only present the ARIMA models that were statistically significant.

Results

Alliance Evolution (Hypothesis 1a)

Alliance was moderate at session 3 (WAI *M* = 4.47), presenting a slight growing trend over time (Figure 1). During the entire treatment, alliance presented higher means (WAI *M* = 5.52, *SD* = .45). The highest level in alliance was presented in the last session (WAI *M* = 6.27).
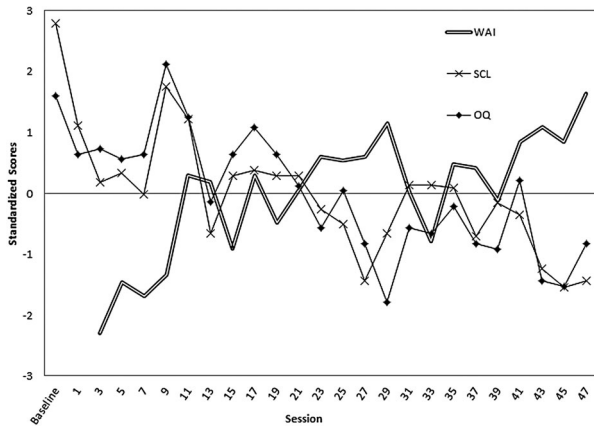
Figure 1. Times-series of alliance and change during treatment (p. 13).

The ARIMA models used showed that the time-series of alliance fit an autoregressive model of order 1 (AR1), presenting a significant autoregressive coefficient at Lag 1 (AR1 = .74; Variance of innovation (VI) = 166.91; $p < .0001$), which means that a given observation depended on the immediately prior observation (Table I). We present the equation in Table I. The AR and PA functions supported the feasibility of fitting a model with these features, with both cases being higher than the confidence interval (Appendix 1). After Lag 1, AR present an exponential reduction while the PA present an abrupt reduction, two important requirements for identifying an AR1 autoregressive model. No atypical values were detected. Box-Ljung tests indicated satisfactory adjustments for the models ($X^2 = 16.21$, $p = .06$).

The three individual subscales of WAI were also tested, but have not fitted ARIMA models.

CBT Interventions Adherence Evolution (Hypothesis 1b)

In the first three observations, the mean from the CBT subscale ($M = 1.76$, $SD = .32$) was slightly lower than in the entire therapy ($M = 2.02$, SD = .64). The mean from the PI subscale during treatment was lower than the CBT subscale ($M = 1.60$, $SD = .31$) as expected.

CPPS CBT subscale data did not fit an autoregressive model. Neither any of the Ars (AR at Lag 1 = .20, $SE = .20$, CI [−0.41, 0.41]) nor any of the Pas (CBT PA at Lag 1 = .20, CI = [−0.40, 0.40]) reached the established confidence interval. The AR and PA graphs confirmed the impossibility of fitting an AR1 model. CBT subscale data did not fit any other ARIMA model.

Client's Clinical Status Evolution (Hypothesis 1c)

Cristobal's baseline OQ.45 total score was 1.68, while baseline SCL-90 GSI was 1.34, both being above the clinical significance CP. The evolution of the two time-series of client's condition resulted in a slight reduction trend during treatment (Figure 1). It should be noted that in both instruments, a reduction represents client improvement.

At the treatment's termination, Cristobal presented an OQ.45 total score of 1.06 and a GSI in SCL-90 of 0.38. The final outcome in both measures represented a clinically significant change.

The ARIMAs conducted showed that both series (OQ.45 and SCL-90 scores) fit an autoregressive model (Table I), with a significant autoregressive coefficient at Lag 1 (OQ.45's AR1 = .65; VI = 81.58; $p < .0001$; SCL-90's AR1 = .72; VI = 274.98; $p < .0001$). The AR and PA functions (Appendix 1) indicated the viability of fitting a model with these characteristics. With the correlations in both cases surpassing the confidence interval established at Lag 1, the ARs present an exponential reduction and the Pas, an abrupt reduction after Lag 1 (Appendix 1). In Table I, we present the equation to predict further scores of OQ.45 and SCL-90 by previous measures.

No atypical values were detected and the Box-Ljung tests indicated that the adjustments of the

Table I. Autoregressive and transfer function models adjusted (p. 13).

Model	Variables	Equation of the model	Parameter	VI	AIC
AR1	WAI	WAI (t) = 50.57 + .74*WAI $(t–1)$	.74*	166.91	185.68
AR1	OQ	OQ (t) = 19.84 + .65*OQ $(t–1)$	.65*	81.58	183.47
AR1	SCL	SCL (t) = 18.47 + .72*SCL $(t–1)$	.72*	274.98	214.01
TM	WAI–OQ	OQ(t) = 162.88 − .54*WAI $(t − 1)$ + $a(t)$	−.54*	56.66	153.15
TM	WAI–SCL	SCL(t) = 211.30 − .76*WAI $(t − 1)$ + $a(t)$	−.76*	141.41	173.27

Note: In the autoregressive model, the parameters reported are AR1 while in the transfer models, they are Lambda parameters; AR1, autoregressive model at lag 1; TM, transfer model; VI, variance of innovation; AIC, Akaike's information criterion; WAI, Working Alliance Inventory total score; OQ, Outcome Questionnaire 45 total score; and SCL, Symptom Check List 90 general severe index.
*Parameter is significant at a $p < .0001$ level.

models are satisfactory (OQ X^2 = 8.61, p = .12; SCL X^2 = 8.03, p = .15).

Although the assumption of stationarity was evaluated in all the cases for all the variables and there were no evidences of its violations, in the particular case of OQ.45 scores, the AR function appears to descend more slowly than would be expected. However, the result of the PA suggests us fitting an AR1 model. Additionally, the estimator of the autoregressive parameter is not near 1, which is an indicator of possible violation of the hypothesis of stationarity. These facts plus the already mentioned Box-Ljung statistics applied in the residuals of the ARs support the validity of the model.

The changes observed in both measures reflected the client's narrative. In Appendix 2, we present a verbatim transcription of an excerpt from the 33rd session. In that session, the client started exhibiting specific changes related to the reasons for consultation, which resulted in the greatest change in SCL-90 and the second greatest change in OQ.45 in the entire treatment.

Alliance and Client's Clinical Status Relationship (Hypotheses 2a and 3a)

Transfer functions analyses were conducted to evaluate the existence of temporal relationships between alliance and client's clinical status. Two models were created, one including the WAI and SCL-90's series, and the other with the WAI and OQ.45's series. Cross-correlations with previous filtering of the AR1 models were conducted for both cases.

Small contemporaneous correlations were found between WAI and OQ.45 (r = −.167) and between WAI and SCL-90 (r = −.070). As shown in

Figure 2, the strongest correlations in both relationships were the ones corresponding to Lag 1 (WAI—OQ.45 r = −.389; WAI—SCL-90 r = −.446), indicating that the correlation in both sets of series presented a lag of one measure in WAI. The cross-correlations indicated what model could be tested and how it could be interpreted. The fact that a cross-correlation does not exceed the confidence interval established does not mean that the data could not fit a transfer function model. In both cases, WAI cross-correlates with Lag 1, and the SCL-90 and OQ.45 were the strongest cross-correlations and the only ones that exceeded or were near the confidence interval limit. While the WAI—SCL-90 cross-correlation exceeded this confidence interval (95%), the WAI—OQ.45 narrowly did not. However, as presented in Table I, both times-series fitted transfer function models, presenting statistically significant parameters (WAI-OQ.45's Lambda parameter (LP) = −.54*, VI = 56.66; p < .0001; WAI-SCL-90's LP = −.76*, VI = 141.41; p < .0001). These models were due to the cross-correlations, meaning that the alliance score in a given session significantly predicted scores in the OQ.45 and SCL-90 at the subsequent moment of observation (two sessions after) throughout all of the treatment observations (formulas are presented in Table I). Nevertheless, as the cross-correlations between WAI and both client's status measures (OQ.45 and SCL-90) with Lag 1 were not significant and far from the confidence interval limit, the scores of client's status measures could not significantly predict subsequent alliance scores.

No atypical values were detected and Box-Ljung tests indicated that the adjustments of the models were satisfactory (SCL X^2 = 3.24, p = .77; OQ X^2 = 6.00, p = .42).
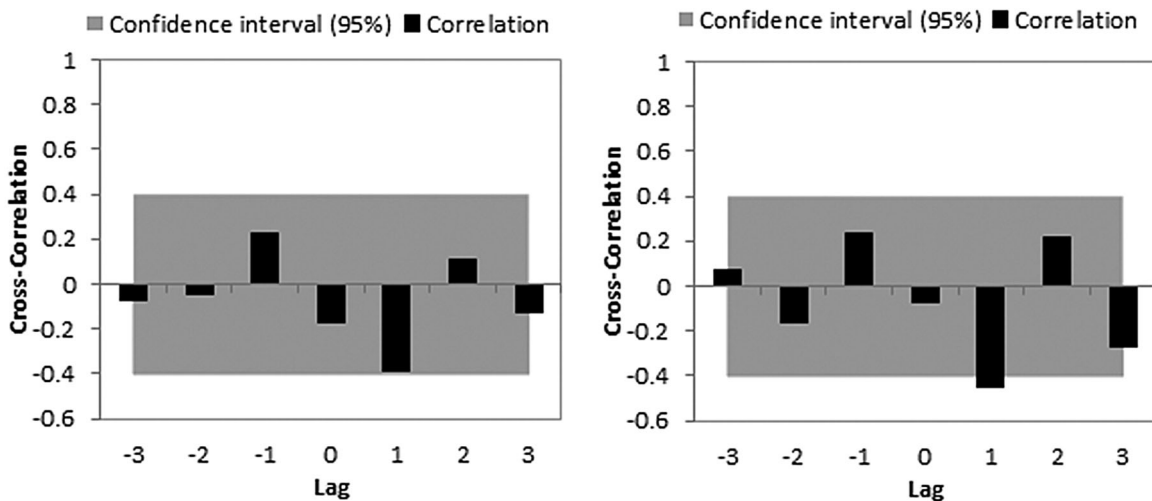

Figure 2. Cross-correlations between WAI and OQ and between WAI and SCL (p. 15).

CBT Intervention's Adherence and Client's Status Relationship (Hypotheses 2b and 3b)

Since the adherence to CBT interventions did not fit to an ARIMA model, transfer functions analysis to study the relationship with client's status evolution could not be conducted. Thus, in order to analyze the association of the variables, Pearson's correlations were calculated among them. CBT subscale total score correlated significantly with OQ.45 ($r = -.409$; $p = .046$) and SCL-90 ($r = -.442$; $p = .030$).

Discussion

The symptomatic and the outcome evolution showed that the treatment was successful, with the client presenting statistically and clinically significant changes (Jacobson & Truax, 1991).

The results supported Hypothesis 1a and 1c of the study, with the alliance and the client's clinical status time-series displaying an autoregressive structure with a Lag 1. Prior values of one of these variables enabled the prediction of future ones.

Hypothesis 1b of the study was not supported. The adherence to CBT interventions did not present an autoregressive structure. This finding contrasts with previous research that found a significant AR within mastery and clarification interventions (Ramseyer et al., 2014). The absence of an AR in our study could be due to the insufficient subscale variability observed in this research but also it could represent a lack of stability in the way interventions were provided by the therapist. Moreover, the fact that we could not fit a significant AR in CBT interventions did not allow us to state that they do not have an AR structure (assume the null hypothesis as true). We conducted Pearson's correlations to gather alternative evidence for Hypothesis 2b. Adherences to CBT interventions were significantly related to both OQ.45 and SCL-90. These contemporaneous correlations should be understood cautiously because they could be produced due to reverse causation or spurious relationships. The absence of an AR structure did not allow us to test Hypothesis 3b.

The theoretical debate about the nature of the relationship between alliance and change still remains open. Early studies that explored this topic have not fully established a timeline in which the nature of the relationship could be elucidated; they have not been able to control the possibility of a temporal confound in the study of the effects of alliance on change (Crits-Christoph et al., 2013). Later research started including time-series analysis with heterogeneous results that in some cases supported and in others refuted the hypothesis of a temporal precedence among the variables (Falkenström et al., 2013). Our

research tried to increase the knowledge in this controversial topic. The results of the transfer functions showed that alliance evolution was temporally related to client's clinical status with Lag 1 (i.e., Hypothesis 2a was supported). With a medium-sized effect, WAI scores significantly predicted OQ.45 ($r = .389$) and SCL-90 ($r = .464$) with a delay of a onetime of measure (Cohen, 1992). Additionally, an inverse relationship was not observed (Hypothesis 3a was supported). OQ.45 and SCL-90 could not predict either subsequent or contemporaneous WAI scores (Lag 0, r WAI-OQ $= .167$; r WAI-SCL $= -.070$). The support for Hypothesis 2a and 3a suggests that alliance evolution presented a cross-lagged association with subsequent client's condition throughout all of the treatment without the opposite directionality.

These results are in the same line with other studies that found a temporal precedence of alliance on change by time-series analysis (Accurso et al., 2015; Anker, Owen, Duncan, & Sparks, 2010; Klein et al., 2003; Zilcha-Mano et al., 2013). However, some differences among these studies and the research presented in this paper need to be highlighted.

First, none of the quoted papers was circumscribed to the study of clients with specific anxiety disorders. In this study, we presented evidence of a time-lagged association between alliance and outcome in a client with an anxiety disorder, specifically GAD. Compared with the treatment of other disorders, as major depression, where the interventions are orientated to reduce the burden as soon as possible, in CBT for anxiety disorders, some of the main interventions are focused on increasing client's levels of anxiety in the short term by exposing them to perceived threats to solve their condition (Roemer et al., 2002). A strong enough bond, and an agreement in therapy tasks and goals may be mandatory for clients to engage in treatment (Hayes, Hope, VanDyke, Richard, & Heimberg, 2007). The results of this paper provided preliminary evidence on the importance for clinicians to be aware of and monitor the levels of therapeutic alliance throughout the treatment of anxiety disorders, as GAD, in order to promote greater changes and prevent eventual dropout. Second, except for Accurso et al. (2015) and Zilcha-Mano et al. (2013), all of them used less than four measurements of alliance, which would represent a lack of a reliable measure of the construct (Crits-Christoph et al., 2011). Finally, unlike most previous research, focused on between-subjects effects, this study presented evidence of a within-subject effect (i.e., unidirectional cross-lagged association), between alliance and change through the completed treatment, consistent with Zilcha-Mano et al. (2013) findings.

Although between-subjects effects are predominant in psychotherapy research, psychotherapy is intrinsically a within-subject phenomenon (Tschacher & Ramseyer, 2009). Therapists evaluate their own practice effectiveness by idiographic information and client's temporal evolution during therapy (Ramseyer et al., 2014). An analysis as the one conducted in this study may represent an additional contribution to foster a more idiographic perspective in quantitative psychotherapy process–outcome research (Falkenström et al., 2013; Tschacher & Ramseyer, 2009). This perspective may produce knowledge that would be more in line with clinical perspectives and interests, facilitating the approach of clinicians to research, and dealing with the well-known gap between research and practice.

Furthermore, the time-lagged association observed between alliance and change may be considered an approximation to a causal relationship (Tschacher & Ramseyer, 2009). Although temporal precedence has been considered a fundamental requirement in determining mechanisms of change (Feeley et al., 1999), it is a first step that should be cautiously interpreted due to the possible influence of third variables that may produce a spurious relationship (Tschacher & Ramseyer, 2009).

The results of this paper contrast with other studies that analyze within-subject effects and found a bidirectional relationship between alliance and change (Crits-Christoph et al., 2011; Falkenström et al., 2013; Ramseyer et al., 2014).

In synthesis, the most important clinical implication of the results of this study is that they suggest that the construction of stronger relationships, based on a positive bond and agreement in therapy tasks and goals, favors the client's subsequent improvement. However, the interpretation of the results should be circumscribed to the within-case associations among alliance and the evolution of outcome during therapy and should not be confused with the final outcome. The association among the variables may be independent from the client's eventual outcome. Additionally, the results help to position therapeutic alliance and its effects in a therapeutic framework such as CBT where, in some cases, the effects of alliance have been underestimated (Barber, Connolly, Crits-Christoph, Gladis, & Siqueland, 2000).

Limitations and Future Directions

Single cases present intrinsic difficulties in generalization and external validity (Kazdin, 2002); however, they have the potential of demonstrating the existence of a phenomenon. In this study, the findings show that the establishment of systematic temporal precedence of alliance on change within a CBT for a client with GAD is viable, without finding the opposite relationship. For generalization purposes, further studies focused on within-subject effects in CBT for clients with anxiety disorders will be necessary. It should be noticed that the Lag 1 observed represents a time line of two sessions, meaning that the results do not establish an immediate temporal precedence among alliance and outcome measures. This does not mean that the eventual effect of the alliance on outcome measures is retarded and emerged two sessions later. Alliance could affect client's condition in the next session, and that improvement correlated to outcome after the subsequent. Nevertheless, this study did not gather evidence to test that hypothesis.

All the instruments used in the study are relatively long scales. The measurement points were selected every two sessions to reduce the annoyance to the participants. The length of this treatment allowed conducting an ARIMA, but in many CBTs, their short-term nature would limit that possibility. Methods developed for ecological repeated-measures studies that suggest using briefer scales (e.g., three items per variable) but with a higher frequency of assessments (e.g., daily) may be an alternative to increase the statistical power and reduce the time spent to complete the measures (Shiffman, Stone, & Hufford, 2008).

The fact that we used a generic instrument to study only CBT technique adherence is also a limitation of the study. Further research may incorporate specific measures for GAD manualized treatments and instruments that explore the timing and competence of the interventions used.

Another limitation of the study was related to alliance's initial assessment moment. As literature suggests that alliance is established from the third session onwards (Kokotovic & Tracey, 1990), we started measuring alliance after the third session of treatment. The inclusion of a measure of alliance after the first session might have modified the observed models. Thus, the association among the variables and the temporal precedence of WAI scores on SCL-90 and OQ.45 should be circumscribed to the moments that the time-series represents (between the 3rd and the 47th session). In order to enrich these interpretations, it would be fundamental to incorporate how alliance is built in the initial stages of therapy, analyzing alliance negotiation between client and therapist in the first sessions of treatment and its relationship to both outcome, and alliance–outcome association.

The AR model used in this research might be limited because it predicts the score in a given

session only by the score in the previous one. CBT for GAD is a treatment integrated by separated therapeutic phases with different main interventions. Interventions adherence evolution may be better described by AR models that explicitly incorporate the different intervention moments as dummy variables (Box & Tiao, 1975). Another option would be to study the influence of modules of interventions (i.e., sets of sessions) on change, instead of adherence scores in single sessions (Boswell et al., 2014). Moreover, particular contingencies of the case studied may have undermined the stability of the adherence to CBT interventions. The already-mentioned Time-series panel analysis is an interesting alternative since it analyzes individual trajectories and then fits models for an entire sample (Ramseyer et al., 2014; Tschacher & Ramseyer, 2009). Hence, this method limited the influences of specific features of single cases that may modify the relationships between the variables.

The lack of an AR in CBT adherence also did not allow us to study the relationship of alliance, interventions, and change in a whole interactional model. Future research focused on studying the interactions and joint contribution of these variables to outcome could produce meaningful knowledge for clinical practice (Castonguay, 2013). Additionally, including baseline client characteristics in these models may represent a useful contribution to tailored treatments (from a relational and technical perspective) based on clients' singularities (Castonguay, 2013).
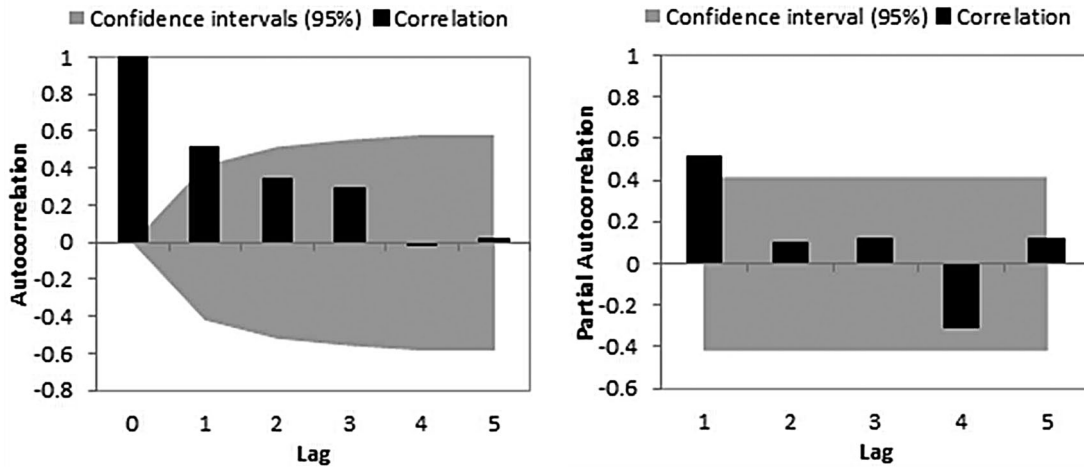
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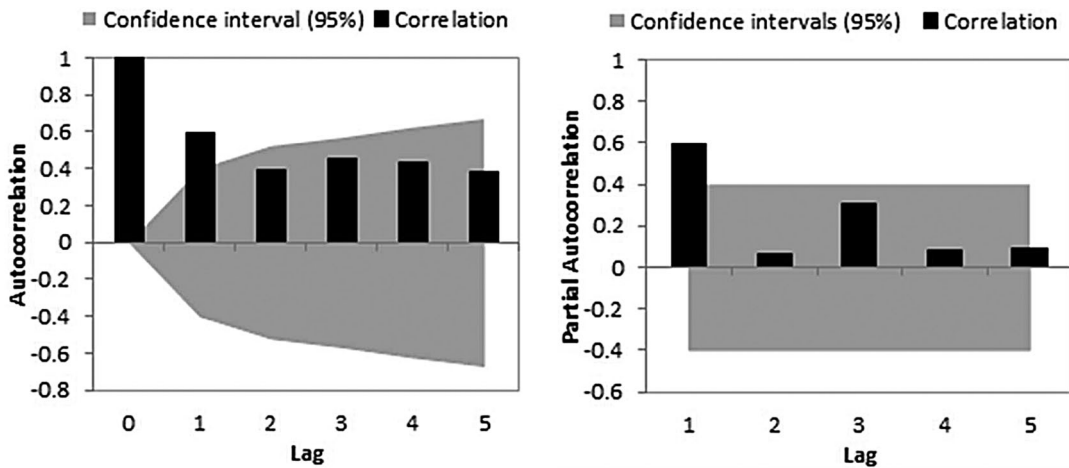
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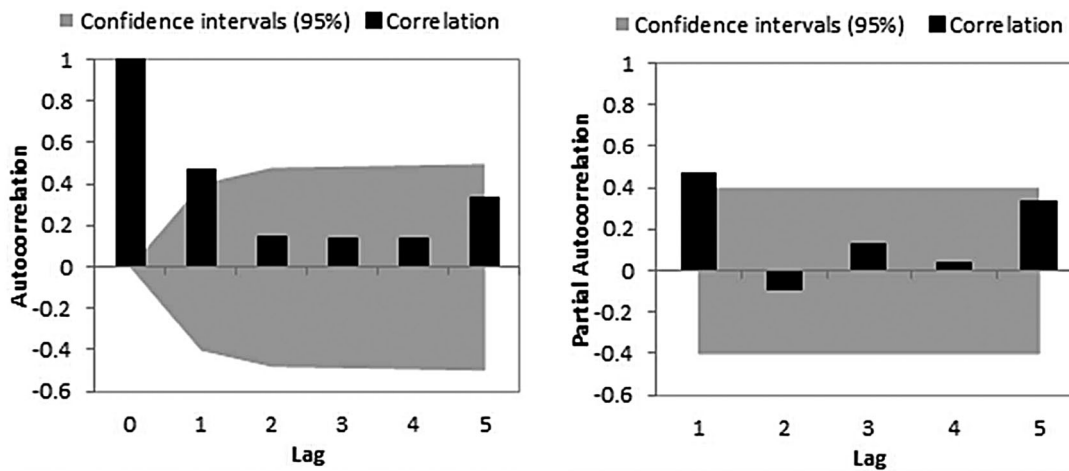**Appendix 1. AR and PAs Functions of WAI, OQ.45 and SCL-90**

a) Autocorrelation (left) and Partial Autocorrelation (right) functions of WAI.

b) Autocorrelation (left) and Partial Autocorrelation (right) functions of OQ.45.

c) Autocorrelation (left) and Partial Autocorrelation (right) functions of SCL-90.