Addiction (1998) 93(9), 1313–1333

RESEARCH REPORT

Network support for drinking, Alcoholics Anonymous and long-term matching effects

RICHARD LONGABAUGH[1], PHILIP W. WIRTZ[2], ALLEN ZWEBEN[3] & ROBERT L. STOUT[4]

[1]*Brown University, Center for Alcohol & Addiction Studies, Providence, RI,* [2]*George Washington University, Washington, DC,* [3]*University of Wisconsin-Milwaukee, Center for Addiction & Behavioral Health Research, Milwaukee, WI,* [4]*Brown University and Butler Hospital, Center for Alcohol & Addiction Studies, Providence, RI, USA*

Abstract

Aims. *(1) To examine the matching hypothesis that Twelve Step Facilitation Therapy (TSF) is more effective than Motivational Enhancement Therapy (MET) for alcohol-dependent clients with networks highly supportive of drinking 3 years following treatment; (2) to test a causal chain providing the rationale for this effect.* **Design**. *Outpatients were re-interviewed 3 years following treatment. ANCOVAs tested the matching hypothesis.* **Setting**. *Outpatients from five clinical research units distributed across the United States.* Participants: *Eight hundred and six alcohol-dependent clients.* **Intervention**. *Clients were randomly assigned to one of three 12-week, manually-guided, individual treatments: TSF, MET or Cognitive Behavioral Coping Skills Therapy (CBT).* **Measurements**. *Network support for drinking prior to treatment, Alcoholics Anonymous (AA) involvement during and following treatment, percentage of days abstinent and drinks per drinking day during months 37–39.* **Findings**. *(1) The a priori matching hypothesis that TSF is more effective than MET for clients with networks supportive of drinking was supported at the 3 year follow-up; (2) AA involvement was a partial mediator of this effect; clients with networks supportive of drinking assigned to TSF were more likely to be involved in AA; AA involvement was associated with better 3-year drinking outcomes for such clients.* **Conclusions**. *(1) In the long-term TSF may be the treatment of choice for alcohol-dependent clients with networks supportive of drinking; (2) involvement in AA should be given special consideration for clients with networks supportive of drinking, irrespective of the therapy they will receive.*

Introduction

Once support for drinking is differentiated from general support, (Longabaugh & Beattie, 1985, 1986) it has been found to be a consistent negative prognostic indicator of drinking outcomes for treatment-seeking clients (Havassy, Hall & Wasserman, 1991; Beattie, Longabaugh & Fava, 1992; Longabaugh *et al.*, 1993; Beattie & Longabaugh, 1997; Project MATCH Research Group, 1997a). Given this prognostic effect, an important question is whether treatments can be developed that will

Correspondence to: Richard Longabaugh EdD, Brown University, Center for Alcohol & Addiction Studies, Box G-BH, Providence, RI 02912, USA.

Submitted 25th November 1997; initial review completed 20th January 1998; final version accepted 27th March 1998.

0965–2140/98/091313–21 $9.50

Carfax Publishing Limited

decrease social support for drinking, and by doing so decrease drinking. Our previous research has shown that clients varying in alcohol-specific support from their social networks (i.e. those people who are important to them and with whom they have regular contact) will differ in their drinking outcomes as a function of treatment emphasis on interpersonal relationships. A treatment having goals of enhancing primary relationships and decreasing support for drinking will be differentially effective as a function of amount of treatment, client investment in their social network and the support of this network for abstinence (Longabaugh *et al.*, 1995).

In Project MATCH Twelve Step Facilitation (TSF) treatment, with its aim of involving the client in Alcoholics Anonymous (AA) (Nowinski, Baker & Carroll, 1992), was conceptualized as a relationship-based intervention that would increase alcohol-specific support for the client. Involvement in AA would expose the client to a network of people who have a goal of maintaining abstinence and who support one another in achieving and maintaining this goal. Thus, the AA fellowship would serve as a reference or support group to buffer the person from the negative effects of a network supportive of drinking. In contrast, AA involvement was not an important aim of Motivational Enhancement Therapy (MET; Miller *et al.*, 1992) in Project MATCH. Rather, MET therapists were instructed to support a goal of AA involvement if selected by the client, but were not to initiate a discussion of this topic themselves.

Hypothesis 1: matching TSF vs. MET × network support for drinking

We therefore hypothesized that network support for drinking would interact with treatment such that the relationship between support and outcome would be stronger for TSF than for MET clients.

Figure 1 portrays this hypothesis where it can be seen that, as network support for drinking increases, the difference between MET and TSF becomes greater. If the difference in slopes between these two treatments is statistically significant, an interaction effect is observed. If clients are found to differ significantly in their outcomes at one end of the continuum but not the other (as we have hypothesized in Fig. 1) then the interaction effect is considered to be ordinal (as opposed to an effect where clients are found to be significantly different from one another in opposite directions at the two ends of the attribute, in which case the interaction effect would be considered to be "disordinal").

Figure 1 also portrays an expected negative prognostic effect of network support for drinking, such that clients with networks more supportive of their drinking are more likely to have poorer drinking outcomes. As can be seen from the figure, assignment to TSF was expected to diminish this negative prognostic effect significantly, thus producing the hypothesized interaction effect.

Hypothesis 2: AA involvement will mediate the TSF vs. MET × network support matching effect

The matching hypothesis was predicated upon the assumption that assignment to TSF would result in greater involvement in AA than assignment to MET. Meta-analyses of primarily correlational data suggests that participation in AA is beneficial to clients as an adjunct to their treatment or as aftercare. AA participation without involvement in treatment has not been demonstrated to be beneficial (Tonigan, Toscova & Miller, 1996b).

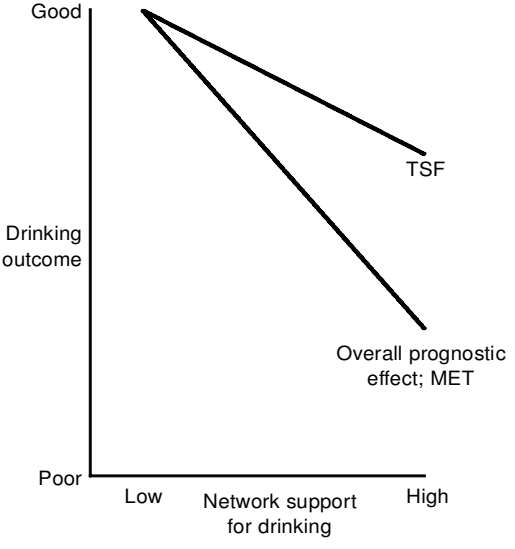

Figure 1. *Expected prognostic and matching effects on drinking outcomes as a function of network support for drinking and its interaction with treatment.*

Going a step further, we expected that involvement in AA would be differentially useful for clients, depending upon the extent of pre-treatment support for drinking in their social networks. For clients with high network support for drinking prior to treatment, AA involvement was expected to enhance their drinking outcomes. In contrast, for clients with networks already supportive of abstinence, AA involvement would be less influential. Thus, we hypothesized that AA involvement would be a mediator of the proposed matching effect.

The aims of the present paper are, first, to trace in detail the results of testing the network support for drinking matching hypothesis over the full period of study, and secondly to test a causal chain developed to account for the observed matching effect. (We report elsewhere the results of testing a CBT vs. MET × network support for drinking matching hypothesis, which was not supported (Longabaugh *et al.*, 1998.)

Methods

The overall research design and participant population of Project MATCH has been described in detail in previous publications, both in this journal (Project MATCH Research Group, 1997b) and elsewhere (Project MATCH Research Group, 1997a; Project MATCH Research Group, 1998a, 1998b). We therefore provide only a summary description here.

Clients were recruited at nine clinical research units (CRUs) affiliated with multiple treatment facilities. The study involved two independent arms of investigation, an outpatient arm and an aftercare arm. Every effort was made to keep the two arms as similar as possible. They involved identical randomization procedures, assessment instruments, treatment procedures, follow-up evaluations, matching hypotheses and analytical techniques. In the outpatient arm, however, clients were recruited directly from the community or from outpatient treatment centers. In the aftercare arm the treatments were offered to clients following completion of inpatient or intensive day hospital treatment.

One major difference between the two arms of study is that clients treated at the five outpatient CRUs participated in a 3-year follow-up. Given budgetary limitations, the outpatient setting was chosen over aftercare for this extended follow-up because of the current trend in which outpatient treatment has become the predominant treatment setting.

Additionally, treatment effects were thought more likely to occur where MATCH treatments were not confounded with previous, more intensive, treatment. Clients were re-contacted and interviewed in person. Many of the follow-up assessments that were used during the first year post-treatment were repeated at 3 years. These included a follow-up version of Form 90 (Miller & Del Boca, 1994; Miller, 1996), used to record self-reported estimates of the client's daily drinking during the 3 months prior to the 3-year follow-up (39 months from randomization and 36 months from planned treatment completion).

Three-year outpatient sample

The study population for the present report is limited to the outpatient sample participating in the 3-year follow-up (Project MATCH Research Group, 1998b). The total number of outpatient clients, and therefore the possible number of clients that could have been assessed at 39 months, was 952. Of these, 806 (84.7%) were successfully followed-up at 39 months and provided the complete outcome data needed for the present analyses. Treating all missing cases as a single group, no differences were found on either of the Project MATCH primary outcome variables, percentage of days abstinent or drinks per drinking day, either at intake or at months 10–12 following the end of treatment (the last period of observation during the 1-year follow-up).

The average age of this outpatient sample of 806 was 38.6 years; 28% were female, 43% were currently married or cohabiting; 80% were white; and 69% were employed. Ninety-six per cent met criteria for alcohol dependence as assessed by the Structured Clinical Interview for DSM-III-R (Spitzer & Williams, 1985). Thirty-three per cent had one or more life-time Axis I non-substance diagnoses. Analyses conducted of the 806 clients who completed the 37–39-month interview indicated that they were representative of the full original outpatient sample (Project MATCH Research Group, 1998b).

Treatments

The three treatments are described in detailed treatment manuals: Cognitive Behavioral Therapy (CBT; Kadden *et al.*, 1992); MET (Miller

et al., 1992); and TSF (Nowinski *et al.*, 1992). They were delivered as individual therapy over a 12-week period. CBT and TSF involved 12 weekly sessions, and MET involved four sessions (in weeks 1, 2, 6 and 12).

Treatments differed from one another in a number of ways (Donovan *et al.*, 1994). CBT was based on social learning theory and viewed drinking behavior as functionally related to major problems in an individual's life, with emphasis placed on overcoming skills deficits and increasing ability to cope with situations that commonly precipitate relapse. TSF was grounded in the concept of alcoholism as a spiritual and medical disease with stated objectives of fostering acceptance of the disease of alcoholism, developing a commitment to participate in AA, and beginning to work through the 12 steps. MET was based on principles of motivational psychology and focused on producing internally motivated change. This treatment employed motivational strategies to mobilize the individual's own resources.

Analyses of session videotapes indicated that treatments were implemented as intended, highly discriminable from one another, and comparable regarding non-specific dimensions such as therapist skillfulness (Carroll *et al.*, 1998). Outpatient clients attended 68% of scheduled sessions overall. MET clients attended a greater proportion (82%) of their available four scheduled sessions than either CBT (69%) or TSF (63%) clients attended of their available 12 scheduled sessions.

Alcohol consumption

Primary measures of drinking outcome were percentage of days abstinent and drinks per drinking day. Percentage of days abstinent provided a measure of drinking frequency. Drinks per drinking day constituted a measure of drinking intensity (Babor *et al.*, 1994). Drinking was summarized on a monthly basis; if a person was abstinent during a given month, his or her score on the drinks per drinking day variable was zero. To reduce variable skewness an arcsin transformation was used for percentage of days abstinent and a square root transformation for drinks per drinking day.

During the initial 15-month period following treatment initiation, secondary measures of drinking outcome included time to first drink, time to first heavy drinking day (Six or more drinks) and time to first three successive heavy drinking days. Drinking behavior during months 37–39 was measured solely by percentage of days abstinent and drinks per drinking day.

Network support for drinking

Network support for drinking was measured prior to treatment using the Important People and Activities instrument (IPA; Clifford & Longabaugh, 1991). The IPA is a structured interview that asks the client to identify important people in his or her network with whom he/she has had frequent contact within the past 6 months. In Project MATCH the client could identify up to 12 people over the age of 12 years. For each person so identified, the client is asked to characterize the relationship (e.g. spouse, brother, friend, co-worker), along with the duration of the relationship and the frequency of contact with the person. The client is also asked to assess the drinking behavior of each person: how often the person drinks, how much the person drinks on a maximum drinking day, and the person's overall drinking status (e.g. heavy drinker, moderate drinker, abstainer). Finally the client is asked to select from this network the four people who are most important. For these four people the client rates their importance (from totally important to unimportant), how much the client likes the person (totally like to dislike), and how the person behaves in relation to the client's drinking and not drinking: is the person supportive of drinking, accepting, neutral, non-supportive, or non-accepting? Is the person supportive of the client's not drinking, accepting, neutral, non-supportive or non-accepting?

The interview takes 20–30 minutes to administer. A summary measure of alcohol-specific network support derived from this instrument has been found previously to be prognostic of post-treatment drinking outcome at 1-year follow-up (Longabaugh *et al.*, 1993). As used in Project MATCH, the IPA was found to have test–retest reliability over a 2–3-day period. With a heterogeneous sample of 70 heavy drinkers and clients who had received alcohol treatment, the summary index of overall support for drinking operationalized for the present study had a Shrout–Fleiss (1979) intraclass correlation of 0.80 and a product moment correlation of 0.95.

Because the version of the IPA used in Project MATCH was revised to suit the purposes of this study, it was necessary to develop a new single measure of alcohol-specific support based on this modified instrument. The summary measure operationalized to test the alcohol-specific support matching hypotheses involved 11 indices, each standardized to have a mean of 0 and a standard deviation of 1. The values assigned to each index are summed to yield an overall measure of network support for drinking. Three indices focus on the client's emotional investment in their social network and eight focus on the network's support of the client's drinking. Table 1 lists the 11 indices and their operational definitions. The indices are correlated with one another in predicted directions, but the degree of association is quite modest. Thus, the overall index is a composite of a fairly heterogeneous set of indices reflecting various dimensions of network support for drinking. However, because of the trial-wide need to set the number of tests of each matching hypothesis to a minimum, this summary variable was utilized as the single measure of network support for drinking.

The client's baseline score was used to test the matching hypothesis in each arm of the study. In the aftercare arm, the hypothesis was tested for two periods of observation: during the planned 12 weeks of treatment, and during the 12 months following planned treatment completion (months 4–15). In the outpatient arm of study it was also possible to test the matching hypotheses at the 37–39-month period of observation.

Involvement in AA

One measure of involvement in AA is a simple measure of frequency of attendance. Elsewhere we have utilized this measure to test AA involvement as a mediator of the hypothesized matching effect by counting the number of sessions in which the client reported AA attendance during the 3-month treatment period and the 1 year following (Longabaugh *et al.*, 1998). AA attendance varied over time and with treatment group. During the 3 months of treatment, clients were averaging about three meetings per month across treatment groups, with those assigned to TSF having the highest rate, over six meetings per month, and those in CBT and MET averaging slightly more than one and two meetings per month, respectively. Following treatment, clients averaged about two meetings per month during the first year of follow-up, with TSF clients averaging about three meetings per month during this period, with CBT clients averaging under two meetings per month, and MET clients slightly more than two meetings per month. During months 37–39, the average participant was averaging just under one meeting per month. There was no longer a significant difference between the three treatment groups at this point, although TSF clients were still more frequent attendees than the other two groups.

Shortcomings in measuring commitment to AA simply by attendance have been noted elsewhere (Tonigan, Connors & Miller, 1996a). In order to develop a better measure of AA commitment, Tonigan *et al.* developed a self-report questionnaire describing AA involvement which samples both adherence to AA prescriptions for achieving sobriety and for conducting one's life, as well as the ways in which AA members relate to one another in supporting their abstinence. The AA Involvement scale (AAI) developed for Project MATCH consists of 13 items designed to measure participation in AA. The inventory includes some items pertaining to the AA program (e.g. step work) and others reflecting commitment to the AA fellowship. The AAI has good internal consistency and test–retest reliability (Tonigan, Connors & Miller, 1996a). To yield a single AAI score the three post-treatment administrations at 3, 9 and 15 months were averaged to measure AA involvement over the initial 15-month period of study (which included the 3 months of treatment and the 1 year of follow-up). This measure is the primary index of AA involvement used in the present analysis. However, to test the reliability of results reported in the present paper, the causal chain analysis was repeated using AA attendance as the index of AA involvement (Longabaugh *et al.*, 1998).

Data analytic procedures

As reported elsewhere, a hierarchical latent growth model (also known as a multi-level latent growth process, see Bryk & Raudenbush, 1987) was used to test separately for matching effects in each arm of study during treatment and the initial 12-month follow-up period (Project MATCH Research Group, 1997a). Latent growth analysis complements the classical general linear model approach by enabling the modeling of individual

Table 1. *Composite index of network support for drinking*

Investment in the identified network Information concerning the person's investment in his/her network is drawn from two sections of the IPA: the client's description of the overall network and of the four most important people in this network	
Number of people in the network*	Formed by taking the square root of the number of members listed in the overall network, which can range from 0 to 12. The number is squared to provide a more normal distribution
Amount of contact with one's network*	Formed by counting the number of members within the client's overall network with whom he/she has daily contact
Average importance of most important people*	Formed by computing the average value of "How important this person has been to you" among the people listed as most important
Support for drinking Information concerning support for the person's drinking is also drawn from two sections of the IPA, the client's description of their drinking behavior and status of their entire network, and of the reactions of the most important people to the client's drinking	
Drinking status of network members	Formed by multiplying the contact the client has with each member in the network by the drinking status ascribed to the network member by the client (ranging from abstainer or recovering alcoholic to heavy drinker), and averaging the drinking status across the network
Frequency with which network members drink	Formed by multiplying the frequency with which each person in the listed network drinks by the amount of contact the client has with that person, and averaging these values across the entire network
Maximum drinking of network members on a drinking day	Formed by multiplying the value each person described in the network receives on the variable: "What is the maximum this person drinks on a drinking day?" by the amount of contact the client has with this person
Percentage of heavy drinkers in network	Formed by counting the number of network members listed as heavy drinkers, and dividing by the total number of network members listed
Percentage of abstainers and recovering alcoholics in network*	Formed by counting the number of network members who are recorded as abstainer or recovering alcoholic and dividing by the total number of network members listed
Most support for drinking among most important people	Formed by identifying the most supportive reaction to the person's drinking, in response to the question: "How has this person responded to your drinking?" among the people listed by the client as most important
Least support for drinking among most important people*	Formed by identifying the least supportive reaction to the person's drinking, in response to the question: "How has this person responded to your drinking?" among the people listed by the client as most important
Average support for drinking among most important people	Formed by computing the product of three values for each person listed as most important: how much the client likes the person, how important the person is to the client, and the person's response to their drinking

*The signs are reversed for indices with asterisks so that all indices have the same direction, with larger scores indicating more support for drinking. The indices are standardized to a mean of 0 and a standard deviation of 1, and a "Composite support index" is created by summing the standardized scores for each of the 11 indices.

change patterns in drinking behavior as a function of treatment and pre-treatment characteristics (such as support for drinking), and does not require that all subjects be measured at all points in time in order to be included in the analysis. The results of these analyses are not the primary focus of the present report, having been reported elsewhere (Project MATCH Research Group, 1997a, 1998a), and will only be summarized.

In essence, two steps are involved in the procedure. At the first step, the slope and intercept—and possibly additional parameters, in the case of a non-linear model specification—of each person's growth curve (describing for example, the relationship between percentage of days abstinent and time) are computed. At the second step, these parameters effectively become the dependent variables in separate regressions on

treatment, support and the treatment-by-support interaction. The results enable the analyst to detect possible effects of treatment, support and the interaction on changes in individuals' growth patterns. It should be noted that, as a confirmatory step, the results of the latent growth analyses in Project MATCH were compared to those produced by more classical modeling procedures, and the two sets of results were found to be highly similar.

Preliminary analyses of the final three 30-day periods at the 39-month follow-up interview (months 37–39) showed no evidence of time trends; therefore values were calculated over the full 3 months to create single percentage of days abstinent and drinks per drinking day scores for each client. To test for the hypothesized matching effect during this follow-up period, ANCOVAs were conducted separately for each primary drinking variable (percentage of days abstinent and drinks per drinking day). Independent variables were treatment assignment, pre-treatment network support for drinking dichotomized at the median and their interaction term. To control for rival explanations for results, covariates included the pertinent primary drinking variable, treatment site, treatment site by treatment assignment and treatment site by treatment assignment by pre-treatment support for drinking (Project MATCH Research Group, 1998b).

To set the family-wise error rate to 5%, a Bonferroni correction was used. Network support for drinking was involved in two *a priori* matching hypotheses: CBT vs. MET as well as TSF vs. MET (Longabaugh *et al.*, 1998). Therefore, the TSF vs. MET alpha level was divided by two. As there were two primary dependent variables, the alpha was again divided by two. Thus, the overall alpha level was set at 0.0125.

Results

The interaction of the TSF/MET contrast with network support for drinking

Aftercare arm

There were no significant interactions observed for the TSF vs. MET contrast either during the treatment period or the year following treatment. Thus, there was no support for the hypothesized matching effect of TSF and network support for drinking in the aftercare arm of study.

Outpatient arm

During treatment. A significant interaction was observed within treatment that changed over time (see Table 2). During the first month of treatment percentage of abstinent days = 91% for TSF clients with high network support for drinking, while percentage of abstinent days = 82% for MET clients. For clients with low network support for drinking those assigned to TSF and MET did not differ in their percentage of days abstinent (TSF = 85%, MET = 87%). However, this initial effect dissipated during the second month of treatment and totally disappeared by the end of treatment.

A similar finding was observed for drinks per drinking day where clients high on network support for drinking assigned to TSF had fewer drinks per drinking day, averaging about one drink, than those assigned to MET, who were averaging more than three drinks per drinking day throughout the first month of treatment. In contrast, clients with networks unsupportive of drinking who were assigned to MET averaged less than one drink per drinking day through the first month of treatment, while those assigned to TSF started at nearly three drinks per drinking day, but reduced this to almost one drink by the sixth week of treatment, such that this initial matching effect also disappeared by the end of treatment.

One year post-treatment. No significant interaction was observed during the year following treatment (see Table 2). Rather, network support for drinking had a consistent prognostic effect on drinking outcome. Irrespective of treatment condition, clients with networks supportive of drinking had fewer days abstinent ($F = 9.74$, $p < 0.0018$) and drank more drinks per drinking day ($F = 8.39$, $p < 0.0039$). Thus, it would appear that the temporary buffering effect that TSF provided outpatients during the first month of treatment was overwhelmed by the effect of a network supportive of drinking.

Months 37–39. A significant interaction effect reappeared at 3 years follow-up. For percentage of days abstinent the p for the one-tailed test = 0.0033 and for drinks per drinking day, $p = 0.0090$. In Fig. 2 clients were divided at the median into groups high and low on network support for drinking [1]. The figure indicates, as was hypothesized, that the effect was attributable

Table 2. *Hierarchical linear modeling results for within-treatment and 1 year post-treatment drinking: outpatient study. Tests of attribute, treatment, and attribute × treatment time effects*

		SUPPORT × Tx		SUPPORT × Tx × Time	
		PDA	DDD	PDA	DDD
Within-treatment (weeks 1–12)					
CBT-MET	*t*	0.35	−0.76	−1.88	1.91
	p	*		0.060	0.056
CBT-TSF	*t*	0.42	−0.15	0.92	−0.54
	p				
MET-TSF	*t*	−0.78	0.92	2.85	−2.50
	p			0.004**	0.0124**
Overall effect	*F*	0.31	0.49	4.22	3.46
	p		0.015	0.032	
Post-treatment (months 4–15)					
CBT-MET	*t*	−0.98	0.50	−1.22	1.52
	p				
CBT-TSF	*t*	1.72	1.62	−0.84	1.75
	p	0.087	0.105		0.080
MET-TSF	*t*	−0.71	1.11	0.39	0.21
	p				
Overall effect	*F*	1.47	1.38	0.77	1.79
	p				

*p values ≥ 0.11 are not reported.
**p values exceeding those specified as "significant" after the Bonferroni adjustment.

to TSF clients with networks supportive of drinking having had better drinking outcomes than comparable MET clients, while for clients with networks unsupportive of drinking, treatment assignment did not affect drinking outcomes. Clients with high network support for drinking assigned to TSF had more days abstinent (83%) than those assigned to MET (66%) [2], a 17% difference, whereas for those with low network support for drinking there was no significant difference (TSF = 80%, MET = 84%).

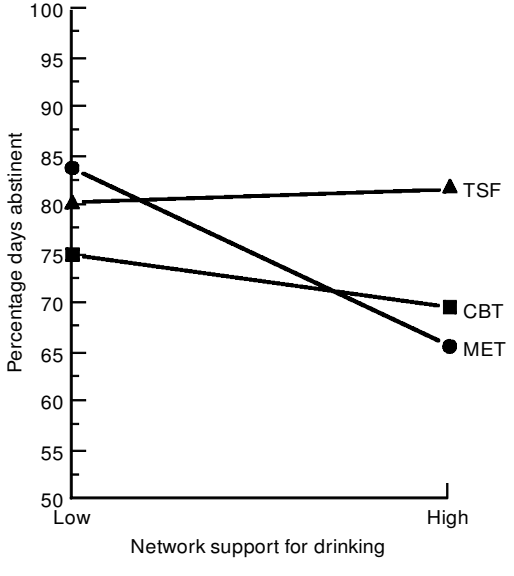

Figure 2. *Interaction of treatment condition × network support for drinking on PDA, months 37–39.*

This ordinal interaction effect was also present for drinks per drinking day as TSF clients with networks supportive of drinking were averaging 2.2 drinks while comparable MET clients averaged 4.1. For clients with networks unsupportive of drinking there was no difference, as both groups averaged slightly more than two drinks per drinking day.

Discussion of the matching hypothesis results

In order to achieve a better understanding of why the interaction effect reappeared 3 years after treatment, average percentage of days abstinent and drinks per drinking day were graphed for each treatment separately for clients with high and low network support for drinking throughout the entire period of observation, starting from month 1 and continuing to month

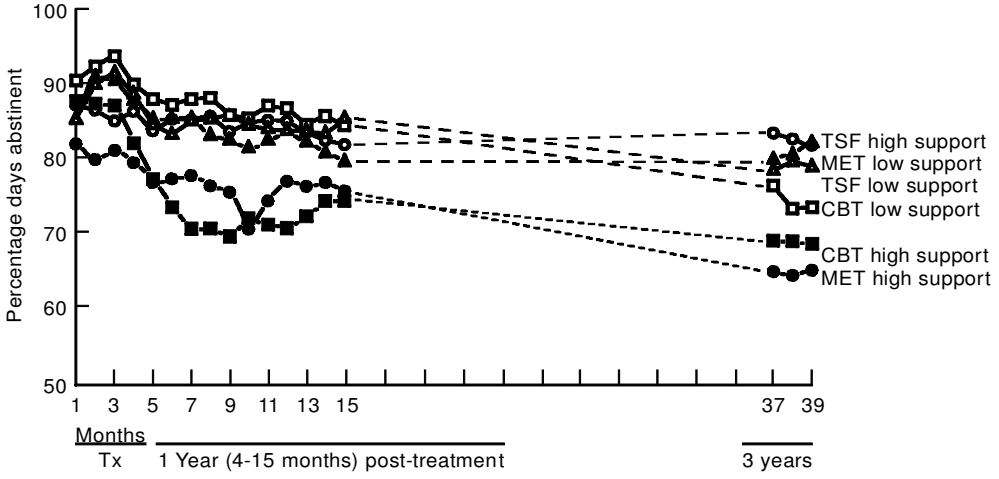

Figure 3. *Percentage of days abstinent plotted for months 1–39 for clients high and low in network support for drinking in TSF, MET and CBT.*

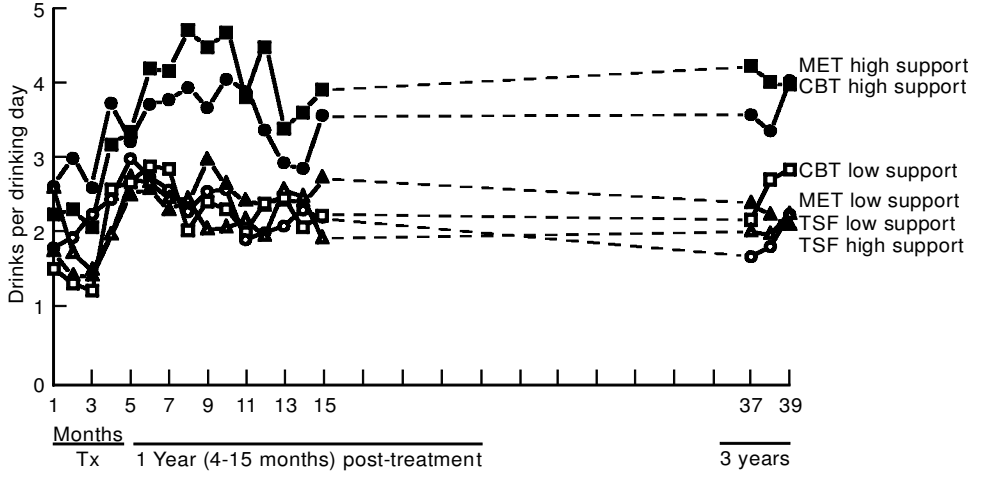

Figure 4. *Drinks per drinking day plotted for months 1–39 for clients high and low in network support for drinking in TSF, MET and CBT.*

39 (see Figs 3 and 4). (Because Form 90 was not used to collect data during months 16 to 35, averages for this period are not plotted.)

The graphs of percentage of days abstinent and drinks per drinking day suggest that while the matching effect was not significant during this initial post-treatment period, the anticipated directionality was present. Of note, among clients with high network support for drinking, the MET clients did less well than the TSF clients who did about as well as clients in either treatment with networks unsupportive of drinking. The overall poor prognostic effect of network support for drinking was generally evident, as those with low network support for drinking had a greater percentage of days abstinent and fewer drinks per drinking day than those with high drinking support.

What happened between months 15 and 39 to produce the interaction was that MET clients with networks supportive of drinking declined to 66% days abstinent during months 37–39,

whereas comparable TSF clients maintained their level of abstinent days at 83%. The same pattern was discernible for drinks per drinking day (see Fig. 4). MET and TSF clients with networks unsupportive of drinking were averaging slightly more than two drinks per drinking day during months 37–39, as were TSF clients with networks supportive of drinking, while MET clients averaged 4.1.

A posteriori effects: TSF vs. CBT

Support for the hypothesis prompted us to re-examine *post hoc* the TSF vs. CBT matching contrast, one for which we did not have an *a priori* hypothesis. Our question was: does pre-treatment network support for drinking interact with TSF vs. CBT in the same way? Returning to Figs 3 and 4 it can be seen that CBT clients with networks supportive of drinking appear like comparable MET clients, except during the treatment period when their percentage of days abstinent appears like that of comparable TSF clients. This suggests that CBT was initially a protective factor during treatment for clients with networks supportive of drinking. Results reported in Table 2 are consistent with the picture portrayed in the figures. During treatment the CBT vs. MET × network support matching effect appears to be interacting with time, approaching a two-tailed unprotected significance level for both percentage of abstinent days ($p < 0.06$) and drinks per drinking day ($p < 0.06$). Once treatment ended, however, these CBT clients declined rapidly to levels of days abstinent and drinks per drinking day comparable to the MET clients. Further examination of Table 2 provides the suggestion of some statistical support for a weak TSF vs. CBT matching effect resulting from this decline in CBT clients. While the CBT vs. MET matching contrast observed during treatment was no longer evident, the CBT vs. TSF × network support post-treatment contrast had a two-tailed significance level of $p < 0.09$ for percentage of days abstinent and $p = 0.105$ for drinks per drinking day.

Time to event analyses of secondary variables support the interpretation that the matching effect changed over time during the post-treatment period. A test of the hypothesis of linearity of matching effect over time was rejected for both time to first drink and time to first heavy drinking day. The χ^2 for the matching effect × time interaction for time to first drink = 11.27, $df = 2$, $p = 0.0036$; for time to first heavy drinking day $\chi^2 = 7.82$, $df = 2$, $p = 0.02$. These highly provocative findings underscore the need for an analysis of the causal links involved in this emergent matching effect.

The causal chain analysis

Ad hoc causal chain

Given the evidence for the emergence of the treatment × support for drinking matching hypothesis over time, our focus now turns to identifying a causal chain that mediates this longer-term interaction effect. How does this effect evolve that TSF clients with networks supportive of drinking had increasingly better drinking outcomes than either MET or CBT clients with networks supportive of drinking, whereas for those with pre-treatment networks unsupportive of drinking such a differential effect was not evident? What does TSF have that CBT and MET lack that would differentially affect clients with high and low network support for drinking? What TSF ingredient would make a difference that would increase in impact as the time between formal treatment completion and follow-up observation increases?

The most obvious candidate for a mediating variable is AA involvement. If a client does indeed become involved in AA, exposure to this social network is in itself highly supportive of abstinence, irrespective of any impact that such involvement might have on the broader social network of the client. We therefore hypothesized the following causal chain (see Fig. 5).

First, clients with networks supportive of drinking prior to treatment would have fewer abstinent days post-treatment than clients with networks unsupportive of drinking. Secondly, clients having networks supportive of drinking would also be less likely to participate in AA. Nevertheless, thirdly, because of its primary aims, clients assigned to TSF would be more likely to participate in AA than clients assigned to either MET or CBT, irrespective of their pre-treatment network support for drinking. We made (but did not test) the assumption that clients participating in AA would have greater support for abstinence than those who did not participate. Thus, AA participation would reduce the negative impact of network support for

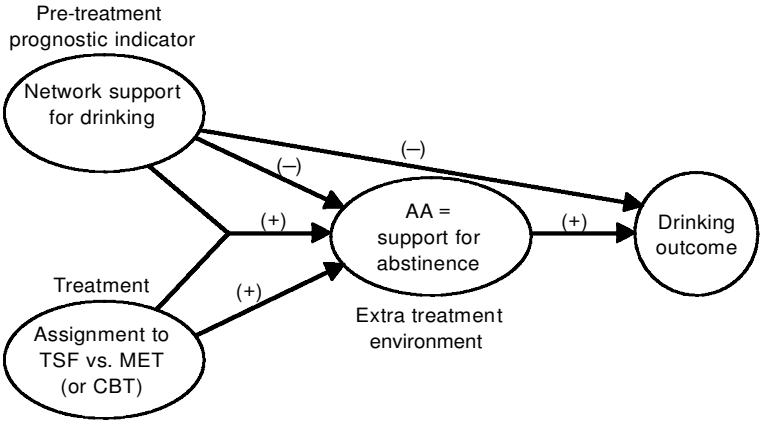

Figure 5. *Hypothesized TSF vs. MET, CBT × network support for drinking causal chain.*

drinking on post-treatment abstinence. This effect would be greatest for clients with pre-treatment networks more supportive of drinking. Finally, the greater AA participation of such clients in TSF would mediate the observed matching effect of the combination of TSF treatment assignment and network support for drinking on drinking outcome.

Results of testing the causal chain

First, network support for drinking was a prognostic indicator of fewer post-treatment percentage of days abstinent and fewer drinks per drinking day during months 37–39 (one-tailed p values = 0.002 and 0.005) [3].

The next steps in the causal chain are tested in Table 3, which displays the likelihood of AA involvement as a function of network support for drinking and treatment assignment, split into those with high and low pre-treatment network support for drinking. From the table it can be seen that, as hypothesized, network support for drinking decreased the likelihood of high client involvement in AA ($p < 0.0003$). However, also as predicted, assignment to TSF resulted in greater AA involvement than either MET or CBT (also highly significant). Most pertinent, for clients with high network support for drinking, high AA involvement was evident for 62% of TSF clients, vs. only 38% of MET, and 25% of CBT clients. Thus, the relationship between treatment assignment and differential AA involvement by clients with networks supportive of drinking is confirmed: TSF led to higher AA involvement of clients with networks supportive of drinking than did either CBT or MET.

The next link in the causal chain was to test whether the greater AA involvement of TSF clients with network support for drinking accounted for the matching effect that clients with network support for drinking assigned to TSF had better drinking outcomes at 3-year follow-up. The test of this last step in the causal chain was conducted by partialing out the effects of AA involvement for clients with high and low network support for drinking in each of the three groups. If AA involvement for clients with high and low network support for drinking in each of the three groups was mediating this matching effect we would expect to find that partialing out this effect would reduce the strength of the relationship between treatment assignment for those clients and their drinking outcomes.

As can be seen from Table 4, when the effect of differential AA involvement was accounted for, clients with high network support for drinking were most affected, while there was little discernible effect on those low in network support for drinking. As anticipated, the percentage of days abstinent of clients with high network support for drinking who were assigned to TSF was reduced when the effect of their AA involvement was partialed out. In MET and CBT there was a small change in the opposite direction. Thus, prior to partialing out AA's effect, the difference in abstinent days between TSF and

Table 3. *Likelihood of high AA involvement as a function of network support for drinking and treatment assignment*

Network support for drinking			Outpatient arm: AA involvement ($\bar{x} = 1.96$ SD = 1.51)							
			CBT		MET		TSF		Total	
($\bar{x} = 0.03$, SD = 0.46)			Low	High	Low	High	Low	High	Low	High
Low	*N*		73	69	77	71	40	119	189	260
		%*	48%		48%		75%		58%	
High	*N*		108	37	89	55	61	99	259	190
		%*	25%		38%		62%		43%	
Total	*N*		181	106	166	126	101	218	448	450
			37%		43%		68%			

*Percentage of clients who have high AA involvement (> 1.96) during the 15-month period of observation.

Table 4. *Average predicted percentage of days abstinent (PDA) months 37–39, before and after partialling out the effects of AA involvement*

Network support for drinking	PDA	Treatments: TSF	MET	CBT
High support	Before	83.2	66.5	69.7
	After	79.4	68.0	73.2
	Difference	3.8	− 1.5	− 3.5
Low support	Before	80.3	83.8	74.6
	After	78.5	83.7	74.8
	Difference	1.8	0.1	− 0.2

MET clients with high network support for drinking was 17%. After removing the effect of AA involvement the difference was reduced to 11%. Similarly, the difference between TSF and CBT clients decreased from 13% to 6% for those with high network support. For clients with low support the differences between these treatments were only slightly changed. Overall, once the effect of AA involvement was removed, the significance of the matching effect was significantly reduced. The one-tailed p value increased from 0.003 to 0.02. As reflected in Table 5, similar results prevail with respect to drinks per drinking day. For this outcome variable, the p value increased from 0.009 to 0.029.

We conclude that AA involvement by clients with networks highly supportive of drinking is a partial mediator of these observed matching effects. That the p values remain significant, although at reduced levels, indicates that other mediators still to be identified may also be operative.

The last set of figures shows this differential effect of AA involvement on clients with high and low network support for drinking for each of the three treatment groups. Figure 6a and b shows the relationship for TSF clients, where the difference was largest. Clients with networks highly supportive of drinking who nevertheless were highly involved in AA (Figure 6a and b) averaged 91% days abstinent during months 37–39. Clients not involved in AA had only 60% days abstinent, a 31% difference. In contrast, clients with networks unsupportive of drinking and involved in AA had 83% abstinent days, while those not involved in AA had 72%, only an 11% difference.

The effect on drinks per drinking day was comparable. Clients with high network support for drinking and involvement in AA averaged 1.5

Table 5. *Average drinks per drinking day (DDD) months 37–39, before and after partialling the effects of AA involvement*

Network support for drinking	DDD	Treatments		
		TSF	MET	CBT
High support	Before	2.21	4.10	4.01
	After	2.53	4.01	3.84
	Difference	−0.32	0.09	0.17
Low support	Before	2.32	2.16	2.91
	After	2.50	2.16	2.92
	Difference	−0.18	0.00	−0.01

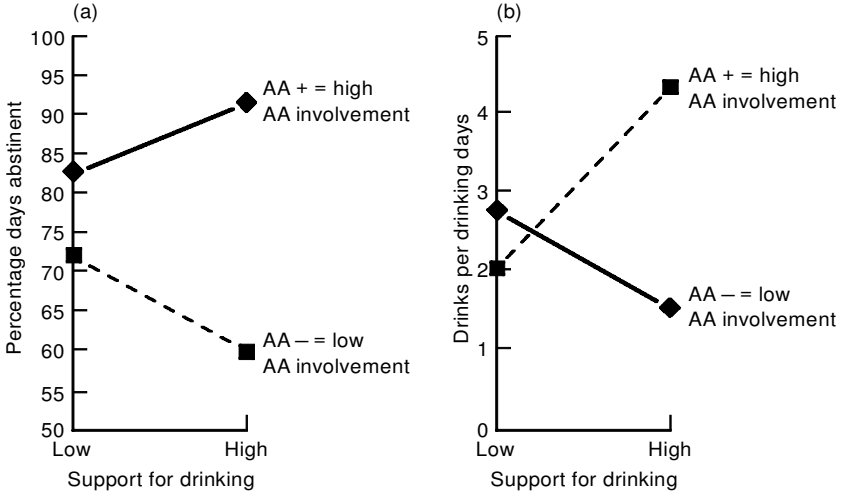

Figure 6. (a and b) *TSF: effects of AA involvement on clients with high and low support for drinking on PDA and DDD.*

drinks per day while those not involved in AA averaged more than four drinks. Clients with networks unsupportive of drinking averaged two drinks per drinking day when AA involvement was low and, curiously, 2.75 when AA involvement was high.

Figure 7a and b shows the same pattern for MET clients. Clients with networks supportive of drinking and involved in AA averaged 77% abstinent days during months 37–39, whereas those who were not involved in AA averaged only 59%, a difference of 18%. For clients with networks unsupportive of drinking the difference was less: those with high AA involvement had 89% days abstinent while those who did not averaged 78%, an 11% difference. For drinks per drinking day, the effects on clients with networks supportive of drinking were similar: those highly involved in AA averaged 2.7 drinks per drinking day whereas those not involved in AA averaged 4.4. Again of interest, for clients with low network support for drinking high AA involvement was associated with more drinks per drinking day than was low AA involvement.

Finally, for clients assigned to CBT (see Figure 8a and b) the relationship was also apparent. CBT clients with networks supportive of drinking who were highly involved in AA averaged 80% days abstinent, while those not involved averaged 66%, a 14% difference. Clients with networks unsupportive of drinking differed much less as a function of AA. Those highly involved in AA averaged 77% days abstinent, while those not highly involved averaged 74%, only a 3%

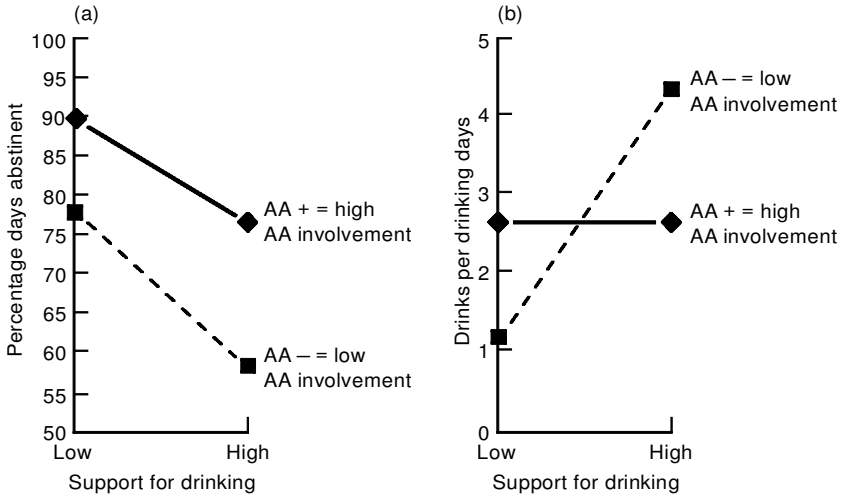

Figure 7. (a and b) *MET: effects of AA involvement on clients with high and low support for drinking on PDA and DDD.*

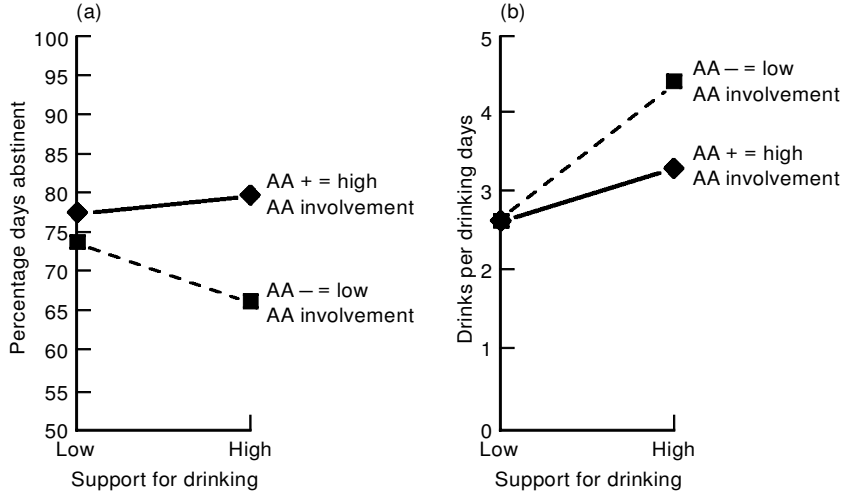

Figure 8. (a and b) *CBT: effects of AA involvement on clients with high and low support for drinking on PDA and DDD.*

difference. For clients with networks supportive of drinking, those low in AA involvement averaged 4.4 drinks per drinking day, while those highly involved in AA averaged 3.3. For clients with networks unsupportive of drinking, AA involvement made no difference: both groups averaged 2.6.

In summary, the causal chain developed to explain the long-term TSF vs. MET/CBT matching effect was supported. Irrespective of treatment assignment, clients with networks more supportive of drinking prior to treatment were less likely to become involved in AA than clients with networks unsupportive of drinking. However, for TSF clients the probability of their being involved in AA was increased, irrespective of pre-treatment network support for drinking. AA involvement in turn was associated with a greater percentage of abstinent days and fewer drinks per drinking day. Partialing out AA involvement from the pre-treatment network support × treatment matching effect on drinking at

months 37–39 reduced the significance of the relationship, revealing that AA involvement was a partial mediator of the observed matching effect.

General discussion

As the treatment × network support for drinking matching effect was partially mediated by AA involvement, this suggests that AA should be considered as an important ingredient in interventions with clients having social networks supportive of their drinking. For such clients, irrespective of treatment assignment, those involved in AA had superior drinking outcomes on both of the primary drinking measures. For clients having networks not supportive of their drinking, AA involvement was much less important in TSF and made no difference to CBT clients. Of interest, for clients having networks unsupportive of drinking MET appeared to be somewhat more effective than either TSF or CBT, irrespective of AA involvement, on both drinking measures.

The time dependence of the observed matching effect suggests a complex dynamic. While TSF appeared to be especially effective with clients having networks highly supportive of their drinking during the first month of treatment, this initial success disappeared rapidly. Following treatment completion neither of the primary dependent variables, percentage of days abstinent or drinks per drinking day, showed significant evidence of matching, but the secondary measures of time to first drink and time to first heavy drinking day suggest that a post-treatment matching effect was present which was changing over time. Inspection of graphs of the course of lapse and relapse for clients in the three treatment groups split into high and low network support for drinking (not shown) indicates that TSF clients with network support for drinking were initially protected from relapse, but that this protective effect again faded over time. Finally, at the 3-year follow-up TSF clients with high network support for drinking reported a sustained level of percentage of days abstinent and fewer drinks per drinking day, whereas MET and CBT clients gave evidence of further decline in drinking outcomes over the extended period.

Our speculation regarding this dynamic matching effect is that clients high in network support for drinking prior to treatment are in high conflict at the initiation of treatment. Therapists are advocating abstinence, whereas the client's social network is unsupportive of this goal. Combined with the client's own inner conflict regarding drinking (Longabaugh & Beattie, 1985), the conflict is potentiated. The effect of the TSF therapist intervention is enhanced by the client's immediate involvement in AA. However, AA involvement conflicts with the client's pre-existing social network. Initially treatment providers have the greater effect, but this effect dissipates with lack of support of clients who continue their involvement with their pre-existing social network. For such clients, in the face of this resistance, many discontinue their AA involvement. With increasing time an increasing proportion of clients resume drinking. For many who do so negative consequences may eventually reoccur. We hypothesize that at this point clients having previously been involved in AA have a salient alternative to consider. Some of these clients may reinitiate AA involvement on their own. Alternatively, although they may not actually resume their participation in AA, the beliefs of this reference group may be reinstated, with the client resuming abstinence. While the alcohol dependent client may experience this cyclic phenomenon through several iterations, each iteration may present another opportunity to achieve sustained abstinence. By 3 years post-treatment clients who are going to maintain their abstinence have stabilized. Trying to tease out and test these conjectures with the existing dataset will require considerable further investigation.

Another question to address is why a comparable matching effect was not observed in the aftercare arm. One possible explanation is that the observed matching effect was most apparent at 3-year follow-up, and we did not conduct a comparable 3-year follow-up with aftercare clients. Thus, there was not time for it to emerge. A second explanation may lie in the finding that treatment differences in AA involvement were considerably less in the aftercare arm. In fact, the average MATCH aftercare client had a higher involvement in AA than did outpatients, irrespective of treatment condition. This treatment setting effect may be attributable to the prior intensive treatment that clients had just completed, during which virtually all treatment programs in MATCH promoted AA involve-

ment. Thus, even the less involved CBT and MET aftercare client was more likely to have greater AA involvement than their outpatient counterparts.

A third possible explanation is that aftercare clients were in a different phase of treatment than outpatients when they were administered the IPA instrument. In aftercare they had already received inpatient or partial hospital treatment. For many such clients this prior phase of treatment may have already influenced relationships with members of their social networks. Network members supportive of their abstinence may have become more important, and/or the client may have modified or withdrawn from relationships supportive of their drinking. In contrast, outpatient clients had not yet started treatment when they completed the IPA, and as such may have reported more stable pre-existing social networks.

A more general question needs to be addressed. In a prior publication (Project MATCH Research Group, 1997b) matching results obtained from Project MATCH were evaluated. The small number of matching effects observed relative to those tested, and the modest effect of those that were observed, led us to question whether matching to three individually delivered treatments does effect outcomes. Further, during the initial 1-year post-treatment period network support for drinking did not show significant matching effects on the primary dependent variables. Thus, the validity of this matching effect emerging at 3 years must be questioned. Is it a spurious finding? We think not. First, as we have described above, glimpses of this effect had been identified early within the treatment period, and on secondary drinking outcomes in the first year post-treatment. More important in lending credibility to the effect is identification of a causal chain that partially mediates this matching effect. To date, this is the only matching effect in Project MATCH that has a supporting causal chain (Longabaugh & Wirtz, 1998).

If the validity of this matching effect is granted, this leads to the question as to why a network support for drinking effect should emerge over this extended period when no other has done so. (Client anger has shown a *consistent* modest post-treatment matching effect for outpatients throughout the post-treatment period (Project MATCH Research Group, 1998b); however, as of yet no supporting causal chain has been identified to support it (Waldron *et al.*, 1998.) We believe that the network support for drinking matching hypothesis is different from other Project MATCH hypotheses in two ways. First, it is based upon mediational factors hypothesized to lie in the interpersonal domain, network support for drinking, rather than in the intrapersonal. Secondly, other Project MATCH hypotheses were predicated to a greater extent upon treatment alone being a sufficient cause for matching. In contrast, the causal chain implicated in the TSF support for drinking matching hypothesis is predicated upon consequent changes occurring outside of treatment, i.e. AA involvement. By its exception to the overall pattern in Project MATCH, confirmation of the network support for drinking matching effect suggests that matching predicated upon differential response to three individual treatments of only 12 weeks duration is very unlikely to have a major impact on drinking outcomes. Matching effects are likely to be more robust when the differential effects of such stand-alone treatments are predicated upon contextual concurrent and post-treatment variables, such as involvement in AA.

The appearance of a matching effect 3 years after treatment must nevertheless be treated with caution. What alternative explanations might account for this apparent "sleeper effect"? One explanation might have to do with differential drop-out across the three treatment groups at the 3-year follow-up. This possibility was checked: there was a near significant tendency for MET clients to be missing from the 3-year follow-up more than TSF or CBT clients ($p = 0.054$) (Project MATCH Research Group, 1998b). This is not an obvious challenge to the hypothesis, as missing clients are somewhat more likely to be judged less improved, suggesting that MET clients returning for the 3-year follow-up may be doing somewhat better than the entire MET group. Nevertheless, this explanation cannot be totally dismissed.

The primary drinking outcome variables have been validated by collateral and biochemical assays, so it is unlikely that they are biased. Any random unreliability would simply lower the possibility of detecting an effect. That the matching effect was equally strong for both dependent variables strengthens confidence that the result is not a type I error.

The network support for drinking index is a complex composite measure of overall network

support for drinking. It was predictive of 1-year outcomes on both primary drinking variables in both arms of the study but might, however, be a proxy for some other pre-treatment measure. Intercorrelations among the matching variables at baseline indicated that network support for drinking had only slight association to a few of the remainder. Moreover, the fact that few of these other variables showed matching effects would appear to rule out the possibility that network support was a proxy for any of these. The possibility remains, however, that pre-treatment network support for drinking may be a correlate of some other, as yet undetected, variable having matching potential.

Perhaps the finding was simply one that occurred by chance. While a family-wise Bonferroni correction had been applied, some would argue that a trial-wise Bonferroni correction should have been used. The Project MATCH Steering Committee debated this question, and concluded that because the matching hypotheses tested trial-wide were conceptually independent, a family-wise correction would be sufficient.

Identification of AA involvement as a partial mediator of this matching effect does not prove causality, only association. Experimental manipulation of AA involvement is required to establish causation. AA involvement is at least partially an index of client motivation, as well as a measure of treatment effect. Nevertheless, the differential impact of AA involvement on clients with varying network support for drinking suggests that even if it is an indicator of motivation, this index of client motivation is differentially interacting with treatment condition. More direct measures of client motivation such as URICA-measured motivational readiness show main effects across treatment, but little indication of interacting with treatment condition (Project MATCH, 1997a, 1998b).

Because the AAI summary variable is a relatively new and untested measure of AA involvement we also tested (as reported elsewhere) frequency of AA attendance as a second index of AA involvement. We found stronger evidence that AA participation is partially mediating the matching effect. The p value for the matching effect dropped from 0.0053 to 0.04 after partialing out the effects of AA attendance (Longabaugh *et al.*, 1998).

Looking beyond the results of this study, if this were the first time that such a delayed matching effect had been observed, this would increase uncertainty regarding its verisimilitude. This is the first time that this particular matching effect has been tested. However, previous research on social support and interventions to improve drinking outcomes through relationship enhancements has given some indication that such a delayed effect may not be a unique finding. Stout *et al.*, (1987) reported that greater focus on relationship enhancement vs. more individually focused treatment showed a delayed effect on improving the abstinence of married alcoholics at long-term follow-up, even though these effects were not apparent during the first year. In a more recent investigation of long-term treatment outcomes Stout and colleagues reported a reversal of a matching effect from 1 to 4 years following treatment. In this analysis clients lacking alcohol-specific support initially benefited during the first year of follow-up by being matched to more intensive relationship enhancement treatment (Longabaugh *et al.*, 1995). However, by 3–4 years after treatment, while the overall interaction term testing the matching effect remained statistically significant, these same clients now were doing the most poorly (Stout *et al.*, 1996). Thus, a short-term gain had turned into a long-term failure.

The results of these two studies and Project MATCH indicate that longer-term effects of interventions focusing on extra-treatment variables such as alcohol-specific support might not be immediately evident. This suggests the exciting possibility that therapeutic ingredients (e.g. AA involvement) that interact with contextual variables (e.g. social support) can have effects that increase in magnitude over time, rather than diminish as is so often the case when treatment focuses mainly on the individual. Whether such effects would increase or reverse themselves may depend upon the extent to which these social relationships continue to be supportive, and whether the client's commitment to these relationships persists. This speculation is a matter for future investigation.

Further research questions

While a host of further research questions arise from these findings, the following are especially pressing.

(1) *Refinement of the network support for drinking variable*. In order to test the *a priori* match-

ing hypothesis it was necessary to combine a multi-dimensional construct of support for drinking into a single measure. The indices which go into making up this overall index are only moderately correlated and it is possible that some dimensions of support for drinking are more important than others in their influence on drinking outcomes.

(2) *Generalizability of matching effects on outcome*. While two indices of drinking have served to measure treatment outcome, it is important to assess whether any of the matching effects reported for these two drinking measures generalize to dimensions of outcome other than drinking.

(3) *How much AA is enough to enhance drinking outcomes of clients with networks supporting drinking*? AA involvement was measured over the entire initial 15-month period of observation. It will be important to separate AA involvement into different blocks of time in order to isolate the periods during which AA involvement has the largest impact on outcome, and the incremental gains to be made with AA involvement during additional time blocks. While the effects of AA involvement were apparent 3 years after treatment, AA attendance itself did not differ for the three treatment groups at 3 years (Project MATCH Research Group, 1998b). How long must AA involvement continue for clients high in network support for drinking to reap these beneficial effects? As reported elsewhere (Project MATCH Research Group, 1998b), AA participation is highest during treatment and diminishes as time from treatment completion increases. The matching effect reported in the present paper would suggest that while AA participation is diminishing over time, the benefit to be gained by clients with networks supportive of drinking is increasing for those who have already been involved in AA.

(4) *Gaining a more comprehensive understanding of clients affected by the matching process*. What are other client characteristics that increase the likelihood of those with networks supportive of drinking becoming involved in AA? We have observed that clients assigned to TSF were most likely to participate in AA. For those who did participate, their drinking outcomes were best, but for those who did not participate in AA despite the TSF push, their outcomes were poor. If we can identify other characteristics besides network support for drinking that reduce the likelihood of clients utilizing AA, we could plan treatments particularly suited to these types of clients. This would improve overall treatment effectiveness by triaging AA-aversive clients with networks supportive of drinking to other kinds of intervention.

(5) *AA or any self-help group*? A question of theoretical as well as practical importance is whether the mediating effect identified for AA is specific to AA or whether participation in other self-help groups would have the same effect. In this study AA (or, on occasion, NA) were for all intents and purposes the only self-help groups available to most clients. Tonigan *et al.* (1995) have described the heterogeneity among AA groups. Despite this heterogeneity, AA has been shown to have a partial mediating effect. What ingredients of AA involvement make the difference? Is it the philosophy and/or the social support mechanism that is/are the predominant active ingredients? If the former, then participation in self-help groups with other philosophies (e.g. Rational Recovery and Support of Sobriety) or goals (e.g. Moderation Management) would not be helpful. If, as we have argued, it is the social support for abstinence that is the active ingredient, then other self-help groups supporting abstinence would be equally effective. If support of non-abusive drinking is all that is essential, then self-help groups such as Moderation Management would also be equally effective. Taking this question a step further, it is plausible that the philosophy and goals of the self-help group might interact with those of the treatment. In the present study we have noted in passing that the mediational effect of AA was not as apparent with CBT as with TSF or MET. It may be that a self-help group with a different philosophy and goal might be synergistic with CBT. Questions such as these suggest an important research agenda to be pursued in this area.

(6) *Greater specification of the causal chain*. We need to examine the causal chain in greater detail in order to identify what it was in the experience of the client that led to the

emergence of this matching effect 3 years after treatment.

(7) *Finally, differential AA involvement does not fully explain the observed TSF vs. MET matching effect for clients with high network support for drinking*. What other factors are involved? What other causal chains may be identified? Further research is planned to address each of these questions.

Conclusions

Matching clients to treatment on the basis of network support for drinking has been found to have long-term benefits for outpatients. TSF clients with high network support for drinking had better drinking outcomes than clients receiving other treatments, while this was not so for those with low network support for drinking. This effect is partially attributable to differential involvement in AA by TSF clients. The emergence of a matching effect 3 years after treatment is not plausible if predicated solely upon events occurring within relatively brief outpatient treatments. However, when the intervention is successful in altering the post-treatment social environment of clients with unsupportive networks, an emergent effect that grows with time becomes credible. A closer look at the unfolding dynamic of this matching effect is necessary to better understand how it occurs. Replication of the finding is also called for. In the meantime treatment providers with clients having a goal of abstinence might give special consideration to incorporating AA involvement as an essential ingredient of intervention for alcohol-dependent clients with social networks supportive of client drinking. Doing so may increase their likelihood of favorable long-term drinking outcomes.

Acknowledgements

This research was supported by a series of grants from the National Institute on Alcohol Abuse and Alcoholism. We gratefully acknowledge the collaboration of the Project MATCH Research Group. We thank Gerard Connors and William Miller for their review of an earlier draft of the manuscript. We also thank Isabel McDevitt and Johnie Sanders of Brown University for their considerable assistance in the preparation of this article.

Notes

[1] In an analysis of 3-year matching effects conducted for all matching hypotheses (Project MATCH Research Group, 1998b), network support for drinking was treated as a continuous variable. In the present report we treated the network support for drinking variable as dichotomous, to be consistent with our use of it when conducting the causal chain analysis. In order to interpret meaningfully the results of three-way interaction terms such as treatment × network support × AA involvement, dichotomization was necessary. Using the continuous and dichotomized network support for drinking variables, separate tests for the hypothesized TSF vs. MET interaction effect were conducted at 3 years for percentage of days abstinent and for drinks per drinking day. All analyses were statistically significant after applying a family-wise Bonferroni correction.

[2] These numbers differ from those reported elsewhere describing this matching effect (Project MATCH Research Group, 1998b). The differences are due to: (1) the separation of clients into two halves, based upon their network support for drinking score in the present paper, vs. a separation into thirds in the other publication, and (2) the present scores being adjusted for baseline values vs. unadjusted values in the later paper.

[3] In the Project MATCH Research Group 1998b publication, network support for drinking is not reported as having a significant prognostic effect on 3-year drinking outcomes. In the present report these effects are reported as statistically significant. Two factors account for the apparent discrepancy. First, this report is based on a dichotomized network support for drinking variable, whereas results reported in the other publication are based on network support for drinking measured as a continuous variable. However, even these differences are more apparent than real. When considered as a one-tailed hypothesis (as is the case in the present paper with its theory-driven causal chain analysis), results using the continuous measure of network support for drinking would also be reported as statistically significant for both percentage of days abstinent ($p = 0.03$) and drinks per drinking day ($p = 0.03$). As two-tailed hypotheses, however, neither was significant.

References

Babor, T. F., Longabaugh, R., Zweben, A., Fuller, R. K., Stout, R. L. & Anton, R. F. (1994) Issues in the definition and measurement of drinking outcomes in alcoholism treatment research, in: Donovan, D. M. & Mattson, M. E. (Eds) Alcoholism treatment matching research: methodological and clinical approaches, *Journal of Studies on Alcohol*, 12 (suppl.), 101–111.

Beattie, M. & Longabaugh, R. (1997) Interpersonal factors and post-treatment drinking and subject well-being, *Addiction*, 92, 1507–1521.

Beattie, M., Longabaugh, R. & Fava, J. (1992) Assessment of alcohol-related workplace activities: de-

velopment and testing of "Your Workplace", *Journal of Studies on Alcohol*, 53, 469–475.

Bryk, A. S. & Raudenbush, S. W. (1987) Application of hierarchical linear models to assessing change, *Psychological Bulletin*, 101, 147–158.

Carroll, K. M., Connors, G. J., Cooney, N. L., DiClemente, C. C., Donovan, D. M., Kadden, R. R., Longabaugh, R., Rounsaville, B. J., Wirtz, P. W. & Zweben, A. (1998) Internal validity of Project MATCH treatments: discriminability and integrity, *Journal of Consulting and Clinical Psychology*, 66, 290–303.

Clifford, P. R. & Longabaugh, R. (1991) Manual for the Important People and Activities Instrument, Center for Alcohol and Addiction Studies, Brown University, Providence, RI, USA (available upon request).

Donovan, D. M., Kadden, R. M., DiClemente, C. C. *et al.* (1994) Issues in the selection and development of therapies in alcoholism treatment matching research, in: Donovan, D. M. & Mattson, M. E. (Eds) Alcoholism treatment matching research: methodological and clinical approaches, *Journal of Studies on Alcohol*, 12 (suppl.), 138–148.

Havassy, B. E., Hall, S. M. & Wasserman, D. A. (1991) Social support and relapse: commonalties among alcoholics, opiate users, and cigarette smokers, *Addictive Behaviors*, 16, 235–246.

Kadden, R. M., Carroll, K., Donovan, D. M. *et al.* (Eds) (1992) *Cognitive–Behavioral Coping Skills Therapy Manual: a clinical research guide for therapists treating individuals with alcohol abuse and dependence*, vol. 3, Project MATCH Monograph Series (Rockville, MD, National Institute on Alcohol Abuse and Alcoholism).

Longabaugh, R. & Beattie, M. C. (1985) Optimizing the cost effectiveness of treatment for alcohol abusers, in: McCrady, B. S., Noel, N. E. & Nirenberg, T. (Eds) *Future Directions In Alcohol Abuse Treatment Research*, pp. 104–136, NIAAA Research Monograph No. 15, DHHS Publication No. Adm. 85–1322, (Washington, DC, US Government Printing Office).

Longabaugh, R. & Beattie, M. C. (1986) Social investment, environmental support and treatment outcomes of alcoholics, *Alcohol Health and Research World* (Summer), 64–66.

Longabaugh, R., Beattie, M. C., Noel, N. E., Stout, R. L. & Malloy, P. (1993) The effect of social investment on treatment outcome, *Journal of Studies on Alcohol*, 54, 465–478.

Longabaugh, R. & Wirtz, P. W. (Eds) (1998) *Project MATCH: a priori matching hypotheses, results, and mediating mechanisms*, vol. 8, Project MATCH Monograph Series (Rockville, MD, National Institute on Alcohol Abuse and Alcoholism) in press.

Longabaugh, R., Wirtz, P. W., Beattie, M. C., Noel, N. & Stout, R. (1995) Matching treatment focus to patient social investment and support: 18-month follow-up results, *Journal of Consulting and Clinical Psychology*, 63, 296–307.

Longabaugh, R., Wirtz, P. W., Zweben, A. & Stout, R. L. (1998) *Network Support for Drinking*, vol. 8, Project MATCH Monograph Series (Rockville, MD, National Institute on Alcohol Abuse and Alcoholism) in press.

Miller, W. R. (1996) *Manual for Form 90: a structured assessment interview for drinking and related behaviors*, vol. 5, Project MATCH Monograph Series (Rockville, MD, National Institute on Alcohol Abuse and Alcoholism).

Miller, W. R. & Del Boca, F. K. (1994) Measurement of drinking behavior using the Form 90 family of instruments, *Journal of Studies on Alcohol*, 12 (suppl.), 112–118.

Miller, W. R., Zweben, A., DiClemente, C. C. & Rychtarik, R. G. (1992) *Motivational Enhancement Therapy Manual: a clinical research guide for therapists treating individuals with alcohol abuse and dependence*, vol. 2, Project MATCH Monograph Series (Rockville, MD, National Institute on Alcohol Abuse and Alcoholism).

Nowinski, J., Baker, S. & Carroll, K. (1992) *Twelve Step Facilitation Therapy Manual: a clinical research guide for therapists treating individuals with alcohol abuse and dependence*, vol. 1, Project MATCH Monograph Series (Rockville, MD, National Institute on Alcohol Abuse and Alcoholism).

Project Match Research Group (1997a) Matching alcoholism treatments to client heterogeneity: Project MATCH posttreatment drinking outcomes, *Journal of Studies on Alcohol*, 58, 7–29.

Project Match Research Group (1997b) Matching alcoholism treatment to client heterogeneity: tests of the Project MATCH secondary *a priori* hypotheses, *Addiction*, 92, 1671–1698.

Project Match Research Group (1998a) Matching alcoholism treatments to client heterogeneity: treatment main effects and matching effects on drinking during treatment, *Journal of Studies on Alcohol*, in press.

Project Match Research Group (1998b) Matching alcoholism treatments to client heterogeneity: Project MATCH three-year drinking outcomes, *Alcoholism: Experimental and Clinical Research*, in press.

Shrout, E. R. & Fleiss, J. L. (1979) Interclass correlations: uses in assessing rater reliability, *Psychological Bulletin*, 86, 420–428.

Spitzer, R. L. & Williams, J. B. W. (1985) *Structured Clinical Interview for DSM-III-R Patient Version* (New York, Biometric Research Department, New York State Psychiatric Institute).

Stout, R. L., Longabaugh, R., Rice, C., Gogineni, A., Noel, N. & Beattie, M. (1996) Patient–treatment matching: outcome over four years. Research Society on Alcoholism, Washington, DC, June 22–27.

Stout, R. L., McCrady, B. S., Longabaugh, R., Noel, N. E. & Beattie, M. C. (1987) Marital therapy enhances the long-term effectiveness of alcohol treatment. *Alcoholism: Clinical and Experimental Research, 11*, 213.

Tonigan, J. S., Ashcroft, F. & Miller, W. R. (1995) AA group dynamics and 12-step activity, *Journal of Studies on Alcohol*, 56, 616–621.

Tonigan, J. S., Connors, G. J. & Miller, W. R. (1996a) The alcoholics anonymous involvement (AAI) scale: reliability and norms, *Psychology of Addictive Behaviors*, 10, 75–80.

TONIGAN, J. S., TOSCOVA, R. & MILLER, W. R. (1996b) Meta-analysis of the Alcoholics Anonymous literature: sample and study characteristics moderate findings, *Journal of Studies on Alcohol*, 57, 65–72.

WALDRON, H., MILLER, W. R. & TONIGAN, J. S. (1998) *Client Anger as a Predictor of Differential Response to Treatment*, vol. 8, Project MATCH Monograph Series (Rockville, MD, National Institute on Alcohol Abuse and Alcoholism) in press.