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## Journal of Substance Abuse Treatment

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## Serial mediation analysis of treatment-specific processes in two contrasting alcohol treatments

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## ABSTRACT

**Introduction:** This study explored whether treatment-specific processes linking therapist behaviors, post-session client ratings, and 3-month proximal outcomes (i.e., end of treatment) can explain 12-month outcomes for two contrasting alcohol treatment conditions with equivalent overall outcomes.

**Methods:** This study is a secondary analysis of the UK Alcohol Treatment Trial (UKATT), a multi-center randomized controlled trial of treatment for alcohol problems comparing 3-session motivational enhancement therapy (MET) to 8-session social behaviour and network therapy (SBNT). Among 742 adult clients included in UKATT, 351 had one treatment session recorded and coded and were followed-up 3 and 12 months after baseline. The study team conducted serial mediation analyses to test whether the frequency and quality of MET and SBNT skills were related to 12-month alcohol outcomes (drinks per drinking day) through postsession client ratings of treatment progress (Processes of Change Questionnaire, PCQ), readiness to change (RTC) and social support for drinking after 3-months.

**Results:** Higher quality of MET skills was related to higher PCQ scores, which were in turn related to greater post-treatment RTC, and subsequently to better alcohol outcomes. Total indirect effect was consistently significant. In contrast, only PCQ was predictive of treatment outcome in the SBNT portion of the model.

**Conclusions:** This study provides evidence from a large pragmatic trial that the quality of MET skills positively influences alcohol outcomes in part through improvements in motivation during treatment and actively trying to change when treatment ends. Research should explore the ways in which SBNT secured outcomes that were equivalent to MET.

### 1. Introduction

Alcohol treatment research has moved away from comparative effectiveness trials of psychosocial interventions toward a greater emphasis on process studies seeking to identify mechanisms of change (Longabaugh & Magill, 2011). This development has been stimulated both by an absence of main effects findings in large-scale randomized controlled trials and by a recognition that common factors exist at both the client and therapist levels that are fruitful to explore (Orford, 2008).

Positive treatment outcomes are the product of a lengthy causal chain. This chain involves therapists being well-trained to deliver high quality treatments, consistent application of skills in practice, usually

working with complex client needs, and impacting how clients think and talk within and outside treatment sessions. This results in attempts to change behavior that are successful and durable after treatment has ended (Miller & Rose, 2009; Moyers, Miller, & Hendrickson, 2005). Evidence has been challenging to assemble, but is nonetheless accumulating, which shows that motivational interviewing (MI) works through the ability of therapists to affect how clients talk about change within sessions, and specific MI skills may have greater impact than others (Brown, Masterson, Latchford, & Tober, 2018; Magill et al., 2018; Singla et al., 2020). Much of the content of MI is not unique to this approach (Miller & Moyers, 2015).

The United Kingdom Alcohol Treatment Trial (UKATT) was a

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pragmatic, multi-center, randomized controlled trial comparing the effectiveness of motivational enhancement therapy (MET) and social behaviour and network therapy (SBNT) in the treatment of alcohol problems (UKATT Research Team, 2005). SBNT is based on the integration of effective strategies found in other network and behavioral treatments (Copello, Orford, Hodgson, Tober, & Barrett, 2002). SBNT aims to replace social support for drinking with social support for change, and thus involves a very different approach to MET's focus on the internal motivation of the client. Outcomes were very similar for the two contrasting treatments (UKATT Research Team, 2005).

In a first analysis of treatment processes within UKATT, we found that, even though the two treatments had different theoretical underpinnings (UKATT Research Team, 2001), the quality of motivational enhancement skills was the only consistent predictor of longer-term (12 months) outcomes (Gaume, Heather, Tober, & McCambridge, 2018). Both treatments were coded using the same scale (comprising both MET and SBNT items) and the quality of MET skills subscale predicted outcomes across the two treatments, suggesting the possibility that shared aspects of treatment are similarly helpful in assisting clients to change. Studies of the treatment of a wide range of psychological problems have highlighted the importance of common factors across different treatment modalities (Wampold & Imel, 2015).

No previous study of treatment-specific processes within SBNT exists, and changing social support for drinking (SSD) is a key candidate for investigation based on the underpinning theory. Research has found SSD to predict poor alcohol treatment outcome and SBNT was developed by integrating strategies focused on the central aim of helping clients to build positive social support for a change in drinking (UKATT Research Team, 2001). Previous analyses of UKATT data have shown that SSD at treatment entry was a strong predictor of outcomes (Dale et al., 2017), and that participants preferring an abstinence drinking goal were more likely to report less SSD (Heather, Adamson, Raistrick, & Slegg, 2010). Therefore, SSD may function as a mediator of treatment outcome in SBNT.

Besides our earlier research on therapist behavior, we also investigated clients' mechanisms of change in UKATT. We have previously shown that individuals who reported that they were actively trying to reduce drinking at the end of the 3-month treatment program were much more likely to show positive outcomes 12 months after baseline than those who were not (Cook, Heather, McCambridge, & UKATT Research Team, 2015a; Heather, McCambridge, & UKATT Research Team, 2013). These findings are important, as evidence is scarce and inconsistent regarding whether psychological treatments may actually work through developing readiness to change (RTC) (Barnett et al., 2010; Borsari, Murphy, & Carey, 2009; Stein et al., 2009).

Because behavior change frequently occurs soon after treatment inception, the Processes of Change Questionnaire (PCQ) was developed in Project MATCH to identify early evidence of change (DiClemente, Carroll, Connors, & Kadden, 1994). In Project MATCH, behavioral and experiential processes of change were not significantly different across treatment conditions; however significant effects of baseline motivation did occur on client process activity both during and immediately after treatment, with clients with higher levels of motivation reporting higher process activity (DiClemente, Carbonari, Zweben, Morrell, & Lee, 2001). End-of-treatment coping (measured using the PCQ) has been found to mediate the positive treatment effects of CBT on one-year drinking outcomes among outpatient clients when dependence severity was high, but not when dependence severity was low or moderate (Roos, Maisto, & Witkiewitz, 2017). The study team adapted treatment specific versions of the PCQ from Project MATCH to suit UKATT treatments' components (UKATT Research Team, 2001), and we provide two indices of processes of change (i.e. motivational processes and social network processes).

The current study extends exploration of therapist behavior through an examination of possible effects on improving client-rated progress during treatment, post-treatment RTC or SSD, and subsequent treatment outcome. Specifically, we hypothesized that treatment-specific

processes existed that were distinct for MET and SBNT, such that 1) the frequency and quality of MET therapist behaviors were associated with motivational processes of change during treatment, RTC as a proximal outcome at the end of treatment (3-month follow-up), and longer-term treatment outcome (12-month post baseline); and 2) that the frequency and quality of SBNT therapist behaviors were associated with social network processes of change during treatment, SSD as a proximal outcome at the end of treatment (3-month), and longer-term treatment outcome (12-month).

## 2. Method

### 2.1. Sample

This study is a secondary analysis of data from the UKATT (UKATT Research Team, 2005). The trial design and methods have been described previously in detail (UKATT Research Team, 2001). Briefly, this pragmatic trial included adult clients who would normally receive an offer of treatment from seven treatment services for alcohol problems at the time of the study. Clinical staff screened clients and researchers interviewed potential participants to confirm eligibility and sign informed consent. After baseline assessment, the study randomly allocated participants to either MET or SBNT. We designed MET to work through a process of individual, internal motivational change (via resolution of ambivalence and eliciting commitment to change) and comprised up to 3 sessions over 8 to 12 weeks. The team designed SBNT to work by recruiting a network that would support change through external sources of influence (enhancing self-efficacy for change vicariously through this means) and comprised up to 8 sessions over 8 to 12 weeks. Ethical approval was obtained through the local NHS ethics committee for each of the seven treatment centers.

The protocol required therapists to record all sessions (with the client's permission) and one video per client (where available) was sampled for monitoring and rating the delivery of each treatment (Tober et al., 2008). Among the 742 clients included in UKATT, 178 (24%) had no video available and an additional 112 (15%) had an unrateable video (mostly sound problems or incomplete recording). Among the resulting 452 clients (61% of the trial population), the study randomly sampled one video, stratified by treatment (MET or SBNT), session number (1 to 3 for MET, 1 to 8 for SBNT) and treatment center. To maintain balance between treatments, session numbers, and centers, the study used replacement sampling when a video was unrateable. Among these 452 clients, 351 (77.7%) had data for the current analysis (i.e., were also followed-up at 3- and 12-months); 151 were in the SBNT group and 200 in the MET group. This subsample was comparable to the complete UKATT sample, with no significant differences in baseline alcohol use, gender, and age.

### 2.2. Measures

#### 2.2.1. Alcohol measures

This study measured alcohol consumption at baseline and 12-month follow-up by means of Form 90 (Miller, 1996). This measure permitted the calculation of primary outcome variables: percent days abstinent (PDA) and drinks per drinking day (DDD). Individuals abstinent at follow-up were scored zero on DDD. In the current analysis, we chose DDD as the primary outcome since previous analyses showed stronger effects on this measure (Gaume et al., 2018). The team conducted sensitivity analyses to confirm findings using PDA as the outcome (see below).

#### 2.2.2. UKATT process rating scale

This analysis coded within-session therapist behaviors using the UKATT Process Rating Scale (PRS) (Tober et al., 2008). The UKATT-PRS was developed for rating treatment fidelity, treatment manual adherence, therapeutic style, and discriminability between the two

treatments. It comprises 20 items divided into two sections: 13 items measuring putatively treatment-specific tasks (for MET: Focus on ambivalence, Discuss commitment to drinking goals, Elicit commitment to change drinking, Create internal conflict or discrepancy, Elicit client concern, Elicit client self-efficacy, Elicit optimism for change, and Feedback on negative consequences; for SBNT: Discuss alternative activities to drinking, Plan or review homework, Involve others in behavior change, Stress the importance of social support in changing, and Identify sources of support for change); and 7 items measuring putatively treatment-specific therapist style (for MET: Empathy, Exploration of feelings, and Reflective listening; for SBNT: Focus on interpersonal relationships, Task-oriented, Treatment as a collaborative effort, and Therapist as agent for change).

The study rated the 20 items for both treatment conditions on two 5-point scales, one measuring the extent to which the therapist performed the item (frequency) and the other measuring how well the therapist performed the item (quality). The frequency scale was labelled: 0 = not at all, 1 = a little, 2 = somewhat, 3 = considerably, and 4 = extensively. The quality scale was anchored with 0 = not at all well, and 4 = very well. We derived four indices from the UKATT PRS: the frequency of MET skills; the quality of MET skills; the frequency of SBNT skills; and the quality of SBNT skills. The team calculated these indices as the unweighted mean of the related scales. Inter-rater reliability was measured among 76 randomly selected sessions coded by two independent raters using intra-class correlations (ICC; computed using SPSS software while specifying two-way mixed effects, average measures, and absolute agreement). Reliability was excellent for the frequency summary scores (ICC = 0.79 and 0.94 for frequency of MET skills and frequency of SBNT skills, respectively), and good for the quality summary scores (ICC = 0.65 for both quality of MET skills and quality of SBNT skills).

### 2.2.3. Processes of change

The study adapted the PCQ from the original version designed for Project MATCH (DiClemente et al., 1994) to suit UKATT treatment components (UKATT Research Team, 2001). The client completed it following the second treatment session and after the last session of either SBNT (i.e., session 8) or MET (i.e., session 3). As only one session per client was coded with PRS, we selected the closest subsequent PCQ questionnaire available (e.g., PCQ rated after session 2 if session 1 or 2 was PRS-coded, PCQ rated after session 8 if session 5 was PRS-coded). See *Supplemental online* Table 1 for the frequency of coded session numbers and PCQ availability by treatment conditions. Note that data were available for  $N = 211$  participants on this measure. When comparing those having data on the PCQ to those not ( $N = 140$ ), the study found no significant differences on age, gender, and baseline PDA, but baseline DDD was higher among those missing PCQ (mean = 26.0, SD = 1.3, vs. mean = 22.2, SD = 0.9;  $t(349) = 2.5, p = 0.01$ ). When repeating this analysis in each treatment condition, the study found no significant differences.

The PCQ comprised 10 items, rated on a 5-point Likert scale from 1 "Never" to 5 "Repeatedly". Five items were theoretically relevant to each treatment (MET: 1. "I consider that feeling good about myself includes changing my drinking behaviour." 2. "I stop to think about how my drinking is hurting people around me." 3. "I become disappointed with myself when I depend on alcohol." 4. "I make myself aware that I can choose to overcome my drinking if I want to." and 5. "I think about the type of person I will be if I am in control of my drinking." SBNT: 1. "I have someone who listens when I want to talk about my drinking." 2. "I change relationships which contribute to my drinking." 3. "I spend time with people who reward me for not drinking." 4. "Someone in my life helps me to face my drinking problem." and 5. "Someone in my life tries to make me feel good when I don't drink"). The study calculated a summary score for processes of change related to each treatment as the sum of its respective items. Cronbach's alpha was 0.79 for social network processes and 0.81 for motivational processes.

### 2.2.4. Readiness to change

The study assessed RTC at baseline and 3-month follow-up using the revised edition of the Readiness to Change Questionnaire: Treatment Version (Heather & Honekopp, 2008), a 12-item instrument designed for use in alcohol treatment-seeking populations that refers to both quitting and cutting down on alcohol consumption. The study assigned clients to stages of change (precontemplation, contemplation, or action), though only one client was in precontemplation at baseline and 5 were at that stage at 3-months. We thus created a binary variable contrasting actively trying to change drinking (action) vs. not actively trying to change drinking status (precontemplation and contemplation) before treatment began and after treatment ended.

### 2.2.5. Social support for drinking

SSD measures the social network support for drinking and relates to a network's drinking behavior and how supportive of the client's drinking it is (i.e., a decrease in SSD is sought). The study measured a client's social network using the Important People and Activities Inventory (Clifford & Longabaugh, 1991) at baseline and 3-month follow-up. We defined SSD as the sum of standardized scores of 11 indices relating to the client's social network (Heather et al., 2010).

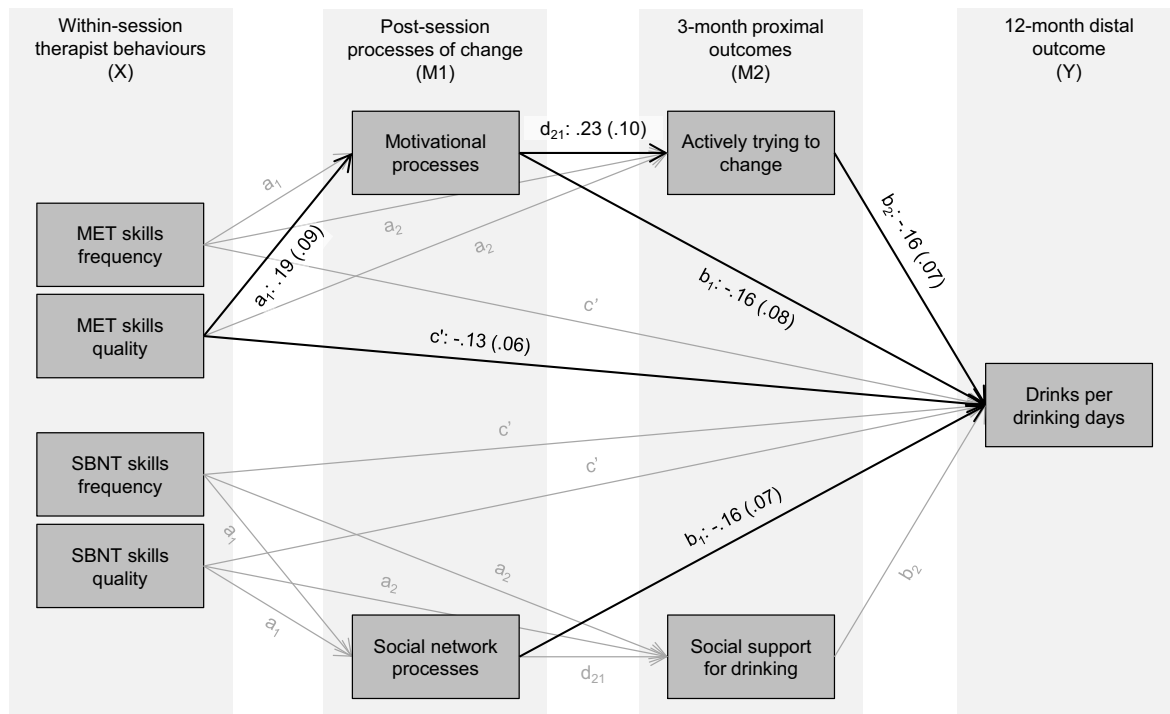
## 2.3. Statistical analysis

We tested our hypotheses using serial mediation models in a structural equation modeling (SEM) framework. SEM allows testing of several paths and indirect effects within the same model. In the current analysis (see Fig. 1), the study team entered therapist skills (i.e., the frequency and quality of MET skills and the frequency and quality of SBNT skills) as independent variables (X). The team entered motivational and social network processes of change, measured for the post-treatment session using the PCQ, as first mediators (M1). RTC and SSD, measured at 3-month follow-up and controlling for baseline measure, were entered as subsequent mediators (M2). Finally, the team entered alcohol outcome (DDD) as the dependent variable (Y), controlling for baseline measures.

We tested our two serial mediation hypotheses within the same model (see Fig. 1). One serial mediation included MET mechanisms of change, i.e., frequency and quality of MET skills predicting motivational processes of change (path  $a_1$ ) and 3-month RTC ( $a_2$ ), motivational processes of change predicting alcohol outcome ( $b_1$ ), 3-month RTC predicting alcohol outcome ( $b_2$ ), and motivational processes of change predicting 3-month RTC ( $d_{21}$ ). The other serial mediation included SBNT mechanisms of change similarly (i.e., frequency and quality of SBNT skills, social network processes of change, 3-month SSD, and alcohol outcome). Accordingly, we tested indirect effects for 1) alcohol outcome on frequency of MET skills through MET mediators, 2) alcohol outcome on quality of MET skills through MET mediators, 3) alcohol outcome on frequency of SBNT skills through SBNT mediators, and 4) alcohol outcome on quality of SBNT skills through SBNT mediators.

The research team broke indirect effects down into 3 estimates: specific indirect effect through M1 (path  $a_1*b_1$ ), specific indirect effect through M2 (path  $a_2*b_2$ ), and specific indirect effect through M1 and M2 in serial (path  $a_1*d_{21}*b_2$ ); we also computed the total indirect effect (sum all specific indirect effects, i.e.,  $a_1*b_1 + a_2*b_2 + a_1*d_{21}*b_2$ ). The study estimated confidence intervals using bootstrapping with 5000 replications. The study team computed all models using Mplus version 8.3 (Muthén & Muthén, 2017). Since one mediator, RTC, was dichotomous, we used weighted least squares mean and variance adjusted estimator (WLSMV). With WLSMV, missing values are handled with pairwise deletion and not full information maximum likelihood (FIML), as is the case when maximum likelihood (ML) is used with continuous outcomes (Asparouhov & Muthén, 2010).

To test the reliability of our findings, we conducted several sensitivity analyses. First, we repeated our model while adjusting for age, gender, and the number of days between baseline and the coded session



**Fig. 1.** Serial mediation model. Black arrows indicate significant paths (all  $p < 0.04$ ) and grey arrows indicate n.s. paths (all  $p > 0.13$ ). Numbers are standardized estimates (standard errors). MET serial mediations controlling for Readiness to change (actively trying to change) at baseline and SBNT serial mediations controlling for Social support for drinking at baseline; all mediation models controlling for Drinks per drinking days at baseline. Total effects and indirect effects all n.s. for MET skills frequency, SBNT skills frequency, and SBNT skills quality. For MET skills quality: total effect ( $c$ ) =  $-0.18$  (95% CI  $-0.29$  to  $-0.08$ ), total indirect effect ( $a_1*b_1 + a_2*b_2 + a_1*d_{21}*b_2$ ) =  $-0.06$  (95% CI  $-0.12$  to  $-0.01$ ), specific indirect effect through M1 – Motivational processes ( $a_1*b_1$ ) =  $-0.03$  (95% CI  $-0.08$  to  $0.001$ ), specific indirect effect through M2 – Actively trying to change ( $a_2*b_2$ ) =  $-0.02$  (95% CI  $-0.07$  to  $0.007$ ), specific indirect effect through M1 and M2 in serial ( $a_1*d_{21}*b_2$ ) =  $-0.007$  (95% CI  $-0.02$  to  $0.001$ ). 95% CI based on 5000 bootstrap draws. MET = Motivational Enhancement Therapy; SBNT = Social Behavior and Network Therapy.

(to control for time in treatment because the session coded for each client was randomly selected among all available treatment sessions). Second, we replicated our model while removing cases with missing data in the PCQ ( $N = 210$  with complete PCQ data vs.  $N = 351$  in the primary analysis). Third, we replicated the primary model while adding links between all PRS indices and mediators to test whether non-treatment specific effects occurred (i.e., effects of SBNT skills through motivational processes and RTC, or effects of MET skills through social network processes and SSD). Finally, we repeated our model with PDA as the alcohol treatment outcome measure. In a post-hoc analysis, we focused our model on the MET processes portion where we observed significant findings to strengthen statistical power.

### 3. Results

#### 3.1. Sample description

Table 1 describes the sample for the current analyses. Most were male (73.8%), mean age was 42.3 years ( $SD = 9.9$ ), and mean levels of drinking improved following treatment (see Table 1). UKATT PRS indices for SBNT and MET were similar to those presented by Tober et al. (2008) for the larger validation study. Regarding PCQ scores, clients rated social network processes somewhat lower than motivational processes. Of note, the study found no differences in scores between treatment groups on both variables derived from the PCQ ( $t(208) = 0.1$ ,  $p = 0.96$  for social network processes;  $t(209) = -1.1$ ,  $p = 0.28$  for motivational processes). At baseline, around half the sample reported actively trying to change drinking (50.4% in action vs. 49.6% in pre-action). At 3-month follow-up, approximately 73% were actively trying to change, while 27% were in pre-action. Changes in SSD scores were very small.

#### 3.2. Primary serial mediation analysis

Our serial mediation model showed significant findings for MET processes with quality of MET skills as the independent variable (see Fig. 1). Quality of MET skills was significantly related to a higher score on postsession motivational processes (path  $a_1$ ). This score was subsequently positively related to actively trying to change (path  $d_{21}$ ) and *actively trying to change* was a significant predictor of better alcohol outcomes (path  $b_2$ ). Higher motivational processes score was also a significant predictor of better alcohol outcomes (path  $b_1$ ). As previously observed (Gaume et al., 2018), quality of MET skills was significantly related to better alcohol outcomes ( $c$  path). This relation was lowered when controlling for motivational processes and RTC ( $c'$  path), indicating partial mediation. Consistently, the total indirect effect was significant. Specific indirect effects (i.e., through M1, M2, or both) were nonsignificant, indicating that none of the two mediators independently explained mediation. All paths were nonsignificant when considering frequency of MET skills as the independent variable. When looking at the SBNT processes portion of the model, all paths were nonsignificant except for the social network processes score rated by the client post-session, which was related to better alcohol outcome (path  $b_1$ ).

#### 3.3. Sensitivity analyses

Sensitivity analyses confirmed these patterns of findings overall. When adjusting for age, gender, and the number of days between baseline and the coded session to control for time in treatment, significant results were all in the same direction, with the exception of the  $b_1$  path from motivational processes to outcome, which was of similar magnitude but no longer significant ( $B = -0.14$ ,  $SE = 0.08$ ,  $p = 0.09$ ).

**Table 1**  
Descriptive statistics by treatment groups.

	SBNT		MET	
	Mean/ N	SD/%	Mean/ N	SD/%
Age	42.2	9.5	42.4	10.3
Gender: male	117	77.5%	142	71.0%
Gender: female	34	22.5%	58	29.0%
Alcohol consumption				
Drinks per drinking days at baseline	25.2	15.9	22.6	12.5
Drinks per drinking days at 12-month	15.0	18.2	14.5	13.3
Percent days abstinent at baseline	25.0	25.3	30.6	27.0
Percent days abstinent at 12-month	51.6	36.0	52.6	38.1
Within-session therapist behaviors (0–4 scale)				
Frequency of MET skills	0.5	0.2	1.3	0.4
Quality of MET skills	2.4	0.8	2.5	0.5
Frequency of SBNT skills	1.4	0.5	0.4	0.3
Quality of SBNT skills	2.3	0.7	1.9	0.8
Post-session processes of change (5–25 scale)				
Motivational processes	20.3	3.8	20.9	3.4
Social network processes	16.9	4.6	16.8	4.4
Proximal outcome: readiness to change				
Actively trying to change at baseline	78	51.7%	99	49.5%
Not actively trying to change at baseline	73	48.3%	101	50.5%
Actively trying to change at 3-month	109	76.8%	124	69.3%
Not actively trying to change at 3-month	33	23.2%	55	30.7%
Proximal outcome: social support for drinking				
Social support for drinking at baseline	−0.9	5.1	−0.2	4.8
Social support for drinking at 3-month	−0.7	4.6	0.0	4.2

MET = Motivational Enhancement Therapy skills; SBNT = Social Behavior and Network Therapy; SD = standard deviation.

When removing cases with missing data on the PCQ, effects were similar to our primary model, with some exceptions: the direct effect ( $c'$  path) from quality of MET skills to DDD was no longer significant ( $B = -0.05$ ,  $SE = 0.08$ ,  $p = 0.52$ ), so too was the  $b_1$  path from motivational processes to DDD ( $B = -0.12$ ,  $SE = 0.07$ ,  $p = 0.07$ ). Nevertheless, the effects from quality of MET skills to motivational processes, from motivational processes to RTC, and from RTC to outcome were all significant and of the same magnitude, as was the total indirect effect. In addition, a significant effect of SSD at 3-month occurred on outcome in this model ( $B = -0.18$ ,  $SE = 0.08$ ,  $p = 0.03$ ), but SSD was not significantly related to social network processes nor to SBNT frequency or quality. When adding links between all PRS indices and mediators to detect non-treatment specific effects, patterns of findings were similar to the primary model, except that the direct effect ( $c'$  path) from quality of MET skills to DDD was not significant ( $B = -0.10$ ,  $SE = 0.07$ ,  $p = 0.14$ ). When repeating our model with PDA as the alcohol outcome, the main findings were consistent with our primary model. Again, the effects from quality of MET skills to motivational processes, from motivational processes to RTC, and from RTC to outcome were all significant and in the expected direction, as was the total indirect effect. The direct effect ( $c'$  path) from quality of MET skills to PDA was not significant ( $B = 0.04$ ,  $SE = 0.06$ ,  $p = 0.46$ ), like the  $b_1$  path from motivational processes to PDA ( $B = 0.08$ ,  $SE = 0.06$ ,  $p = 0.15$ ).

### 3.4. Post-hoc analysis

Since our primary model and sensitivity analyses consistently showed significant findings from quality of MET skills to PCQ motivational processes, from motivational processes to RTC, and from RTC to outcome, and no effects when considering frequency of MET skills, frequency of SBNT skills, and quality of SBNT skills as the independent variable, we conducted post-hoc analysis removing SBNT processes and frequency of MET skills to strengthen statistical power. These results are

presented in Table 2. Individual paths from quality of MET skills to PCQ motivational processes, from PCQ motivational processes to RTC, and from RTC to outcome were significant (all  $p < 0.04$ ). Quality of MET skills was significantly related to better alcohol outcomes ( $c$  path) and this relation was lowered when controlling for motivational processes and RTC ( $c'$  path), indicating partial mediation. Consistently, the total indirect effect was significant. When looking at specific indirect effects, the specific effect through both mediators ( $a_1 * d_{21} * b_2$ ) was significant (i.e., the confidence interval did not comprise 0).

## 4. Discussion

This study demonstrates that, within UKATT, the quality of MET skills positively influenced longer-term alcohol outcomes, in part through progress made during treatment. Looking at individual paths, we observed clear relationships in the data: a) higher quality of MET skills was related to client accounts of progress as measured by the motivational items of the PCQ postsession; b) higher PCQ scores on motivational processes were related to trying to change drinking after treatment ended, as measured by the RTC; c) improved RTC was a strong predictor of lower DDD; d) quality of MET skills was related directly to 12-month alcohol outcome; and e) only PCQ social processes were predictive of treatment outcome in the SBNT portion of the model. Controlling for PCQ motivational processes and RTC, the effect between quality of MET skills and alcohol outcome was attenuated, and computing bootstrapped confidence intervals indicated significant indirect effects through PCQ and RTC. A range of sensitivity analyses confirmed these findings.

This evidence suggests that the extent to which high quality MET skills delivered within sessions impact longer-term outcomes partially depends on securing progress during treatment. The findings on the PCQ, for which distinct treatment-specific social network and motivational processes were examined, are striking. These should be interpreted in light of our earlier findings on the short form of the Working Alliance Inventory (WAI), assessed after the first treatment session only (Cook, Heather, McCambridge, & Ukatt Research Team, 2015b). In this earlier study, we found that client (and not therapist) rating was strongly related to treatment outcomes for MET only. In the current study, we have identified strong evidence of the importance of the client rating of the processes of change intended in the design of the treatment, rather than of the experience of treatment per se. Note, however, that the PCQ assessed processes of change during treatment, and not necessarily within treatment sessions, whereas the earlier WAI finding more directly attested to the importance of how helpful the client found the first session. The current findings, thus, extend the earlier evidence. In both the current study and the earlier WAI study, SBNT therapist behaviors did not influence client rating of change. Treatment is a complex process and unmeasured variables, or measured variables not included in these analyses, could be exerting selection effects and acting as confounders. We are not making the claim here that MET quality is the main pathway to change, and we also recognize that findings on partial indirect effects may be restricted, i.e., underestimated by measurement limitations of any of the instruments used.

The observed quality and frequency of SBNT therapist behaviors had no influence on any variables included within this analysis, including treatment outcome. SBNT skills were not more successful in promoting changes in clients' social networks than MET skills, as they were designed to do. This key hypothesized mediator was also found not to be related to treatment outcome. These findings are concerning, and indicative of the underdevelopment of process studies of these kinds of treatments compared to MET, where progress in understanding how effects are exerted has required enormous effort. Further study is needed of the currently unknown ways in which SBNT secured observed outcomes that are equivalent to MET in UKATT. It may be helpful to give further attention to possible treatment-specific processes alongside common factors across treatments.

**Table 2**  
Serial mediation model for MET mechanisms of change.

Path	Path description	Estimate	SE	Est./SE	p	[95% CI]	
a <sub>1</sub> (M1 on X)	PCQ motivational processes on MET skills quality	0.24	0.07	3.60	<0.0001	0.10	0.37
a <sub>2</sub> (M2 on X)	RTC on MET skills quality	0.11	0.08	1.40	0.16	-0.04	0.25
b <sub>1</sub> (Y on M1)	DDD on PCQ motivational processes	-0.15	0.09	-1.75	0.08	-0.32	0.02
b <sub>2</sub> (Y on M2)	DDD on RTC	-0.15	0.08	-2.00	0.045	-0.31	-0.01
d <sub>21</sub> (M2 on M1)	RTC on PCQ motivational processes	0.31	0.09	3.29	0.001	0.13	0.50
c' (direct effect)	DDD on MET skills quality, controlling for PCQ motivational processes and RTC	-0.11	0.05	-2.26	0.02	-0.21	-0.01
c (total effect)	DDD on MET skills quality	-0.18	0.04	-4.10	<0.0001	-0.26	-0.09
Total indirect effect	Sum of all specific indirect effects	-0.06	0.03	-2.43	0.02	-0.12	-0.02
Specific indirect 1	a <sub>1</sub> *b <sub>1</sub> (i.e. through M1 - PCQ motivational processes)	-0.04	0.02	-1.52	0.13	-0.09	0.00
Specific indirect 2	a <sub>2</sub> *b <sub>2</sub> (i.e. through M2 - RTC)	-0.02	0.02	-1.03	0.30	-0.05	0.01
Specific indirect 3	a <sub>1</sub> *d <sub>21</sub> *b <sub>2</sub> (i.e. through M1 and M2 in serial)	-0.01	0.01	-1.47	0.14	-0.03	-0.001

Standardized estimates. Controlling for RTC and DDD at baseline, as well as age, gender, and number of days between baseline and coded session. 95% confidence interval based on 5000 bootstrap draws. SE = standard error; CI = confidence interval; PCQ = Processes of change questionnaire; MET = Motivational Enhancement Therapy; RTC = Readiness to change (actively trying to change drinking vs. not); DDD = Drinks per drinking days.

The findings reported here contribute to the research literature by providing further empirical evidence on how alcohol treatment works and how it can become more effective by studying treatment processes (Longabaugh & Magill, 2011; Longabaugh, Magill, Morgenstern, & Huebner, 2013; Orford, 2008). More specifically, the hypothesis of a mechanism of change associated with therapist behavior, in the form of the quality of motivational enhancement delivery (Gaume et al., 2018), has now been considerably strengthened by evidence of its effect on clients' reported accounts of progress, and in turn readiness to change at the end of treatment, on the pathway to treatment outcomes. The rating of videos by trained observers corresponds well to what the clients later reported during treatment about their progress and subsequent outcome assessments. The current findings also complement those of Singla et al. (2020), who found that treatment-specific skills exerted effects on alcohol outcomes in part by suppressing counter-change talk in an intervention with a similar underlying motivational perspective. The outcomes of treatment for alcohol problems are determined by complex, interacting processes and events, making the findings reported here important in understanding links in a causal chain, though they do not rule out other mechanisms of change.

Our findings have practical clinical implications for therapist training and the conduct of treatment. First, across all types of treatment aimed at reducing alcohol-related harm, therapist training should give prominence to the quality of MI skills—which here were observed to be related to outcome for SBNT as well as for MET—paying attention to those which may have most impact (Brown et al., 2018). In this regard, disaggregating the components of quality of MET skills and considering their relationships with outcomes, as reported previously (Gaume et al., 2018), could offer more specific candidate guidance on training content. Second, treatment providers should encourage and support enduring efforts at change throughout the process of treatment, even in the face of setbacks and challenges, as reflected in the important role of readiness to change.

The UKATT PRS is much less commonly used than instruments derived from the Motivational Interviewing Skills Code (MISC) such as the Motivational Interviewing Treatment Integrity Code (Moyers, Martin, Catley, Harris, & Ahluwalia, 2003; Moyers, Martin, Manuel, Hendrickson, & Miller, 2005), which assess therapist MI behaviors. Thus, its distinct features are worthy of consideration. Not only does the UKATT PRS directly rate the quality of delivery rather than having a primary orientation to fidelity per se, it was also designed to be applicable to different types of treatments, and this may make it more amenable to identifying common factors across treatments. It may be the case that a more direct focus on the quality of therapy (Fairburn & Cooper, 2011), such as is afforded by the UKATT PRS, will be useful to further investigations of alcohol treatment outcomes.

Much existing addiction treatment process research focuses on MI or MET and the key client variables in the literature pertain to change talk. This study does not investigate directly any aspect of client verbal

behavior within sessions. Incorporating data linking client speech within sessions with the variables analyzed here may be a promising direction for future investigations.

The fact that UKATT PRS-rated sessions could occur at any point during treatment is a study limitation. In the current analysis, we used treatment session recordings coded for monitoring treatment fidelity and not primarily for process analysis. Only 1 session per client of the possible 3 MET sessions and 8 SBNT sessions was randomly selected and coded, and thus only one part of each individual treatment process has been captured. Hence, our time variable offers a limited form of adjustment in these analyses. In the same vein, the study collected PCQ data only after the second and last treatment sessions and we used only one rating of the PCQ in the current analysis. This resulted in many missing data for this scale, precluding further analyses (e.g., comparing early and late treatment processes), and weakening the strength of inferences possible due to temporality issues (e.g., therapist skills measured at SBNT session 4; PCQ measured after session 8, which is just before 3-month follow-up vs. therapist skills measured at session 2; PCQ measured after this session, and 3-month follow-up several weeks later). These limitations of our data will no doubt contribute to the extent of variability not explained in the mediation models reported here. In addition, proportions of randomized participants having a coded SBNT session, and having provided PCQ ratings were lower than in the MET condition. Although no significant differences existed between those with and without PCQ ratings, it is difficult for us to gauge to what extent the null findings relating to SBNT skills and social network processes of change reflect more limited statistical power. Nevertheless, the strength of the patterns of mediation and the size of the effects observed in the current analysis are important, even while probably capturing only a small part of the treatment process.

Overall, this study provides evidence that, in a large pragmatic trial of alcohol treatment, the quality of MET skills positively influenced longer-term alcohol outcomes, in part through improvements during treatment, as measured in client reports of motivational progress, and in the effects on the client's attitude toward change when treatment ended. This evidence deepens our understanding of the causal chain linking treatment-specific processes in MET to improved outcomes, and suggests that improving the quality of therapists' specific skills in MET can contribute to better treatment outcomes on one key pathway to change.

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## Ethical standards

Ethical approval was obtained through the local NHS ethics committee for each of the seven treatment centres. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

## Guideline checklist

None (secondary analysis of a randomized controlled trial).

## CRediT authorship contribution statement

**Jacques Gaume:** Conceptualization, Methodology, Investigation, Formal analysis, Visualization, Writing – original draft, Writing – review & editing. **Nick Heather:** Funding acquisition, Data curation, Validation, Writing – original draft, Writing – review & editing. **Gillian Tober:** Funding acquisition, Data curation, Validation, Writing – review & editing. **Joseph Studer:** Formal analysis, Visualization, Writing – review & editing. **André Bedendo:** Writing – review & editing. **Duncan Raistrick:** Funding acquisition, Data curation, Writing – review & editing. **Jim McCambridge:** Conceptualization, Methodology, Investigation, Validation, Writing – original draft, Writing – review & editing.

## Declaration of competing interest

None.

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