# **A mediation analysis of treatment processes in the UK Alcohol Treatment Trial**

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## Abstract

***Objective****:* To determine whether treatment outcomes are mediated by therapist behaviors consistent with the theoretical postulates on which two contrasting treatments are based.***Method****:* We used data from the UK Alcohol Treatment Trial (UKATT), a pragmatic, multi-center, randomized controlled trial comparing the effectiveness of Motivational Enhancement Therapy (MET) and Social Behavior and Network Therapy (SBNT) in the treatment of alcohol problems. N=376 clients (mean age 42.5, 74.5% male) had 12-month follow-up data and one treatment session recorded and coded using the UKATT Process Rating Scale, a reliable manual-based assessment of treatment fidelity including frequency and quality ratings of treatment-specific therapist tasks and therapist styles. Analyses were conducted using a mediation framework. ***Results:*** Analysis of individual paths from treatment condition to treatment process indices (a path) and from treatment process indices to alcohol outcomes (b path) showed that 1) SBNT therapists more often used SBNT-specific behaviors, and did so with overall higher quality; 2) MET therapists more often used MET-specific behaviors, but there was no evidence that they performed these behaviors with higher quality than SBNT therapists; 3) only the quality of MET behaviors significantly predicted 12-month alcohol outcomes, irrespective of treatment condition. Consistently, there were no significant indirect effects. Multiple component analysis indicated that therapist quality of specific tasks influenced outcomes. ***Conclusions:*** The quality of delivery of the same treatment tasks in both treatments studied transcended the impact of delivering treatments according to different theoretical underpinnings in UKATT.

## Public Health Significance Statements

This secondary analysis of the contents of alcohol treatments offers new insights into the lack of difference in outcomes between the two contrasting treatments in the UK Alcohol Treatment Trial. The quality of Motivational Enhancement Therapy specific behaviors was related to better outcomes, and therapists from *both* treatment conditions demonstrated similar levels of quality in these behaviors. The present results suggest the importance of ‘common factors’ in the psychotherapy and addiction process literatures (e.g. empathy, discrepancy enhancement, eliciting commitment to change, reflective listening), as treatment-specific skills used distinctly in the two treatments were not related to better outcomes.

## Keywords

Alcohol treatment; Treatment processes; Mediation analysis; Motivational Enhancement Therapy; Active ingredients.

## Introduction

Reflecting on findings from two large and methodologically rigorous trials of treatment for alcohol problems (Project MATCH Research Group, 1997; UKATT Research Team, 2005), Orford (2008) called for a major rethinking of research on the psychosocial treatment of addiction. Both trials failed to find significant differences in main effects of treatment, and found few or no clinically useful matching effects among treatment modalities based on contrasting underlying theories (Babor & Del Boca, 2003; UKATT Research Team, 2008). Orford’s first proposal was that the addiction field should stop studying named treatments in an attempt to discover which are superior in overall efficacy to others, and focus instead on processes and mechanisms of change associated with good outcomes across treatment modalities. Humphreys and Tucker (2002) also advised researchers to recognize the limitations of “’therapy-tinkering’ research (e.g. horserace comparisons or matching research on different psychotherapies)” (p.130). The present article reports the results of an analysis of the active ingredients from one of the null trials discussed by Orford, the UK Alcohol Treatment Trial (UKATT) (UKATT Research Team, 2005, 2008).

Since Orford (2008) wrote, there already appears to have been a shift away from asking whether treatment works to asking how it works (Longabaugh & Magill, 2011). Given the absence of differential effectiveness in treatments derived from distinctively different theories and assumptions, it follows either that (a) different treatment modalities achieve equivalent outcomes via different mechanisms of change, or (b) different treatments achieve similar outcomes via the same mechanisms of change (Longabaugh, 2007; Longabaugh, Magill, Morgenstern, & Huebner, 2013). Variability in the substantive contents of treatments thus may or may not impact differentially on mechanisms of change.

Rather than pursuing an analysis focused on mechanisms of change related to client behavior and experience, the present analysis is concerned specifically with therapist behavior, i.e., the tasks, skills and behaviors of therapists in interaction with clients, as measured by the UKATT Process Rating Scale (PRS) (Tober, Clyne, Finnegan, Farrin, & Russell, 2008). The UKATT PRS enabled us to measure the extent to which, and the quality with which, each of the two treatments included in UKATT was delivered as intended by the theory of therapeutic change (Miller, Zweben, DiClemente, & Rychtarik, 1992; Copello, Orford, Hodgson, & Tober, 2009) on which it was based. This comparison is useful in better understanding how alcohol treatment may be effective because it can potentially determine whether treatment effectiveness is related to therapist behaviors that differ between the two UKATT treatments or to therapist behaviors they may have in common.

More specifically, in the present secondary analysis of UKATT data, we tested the traditional assumption that treatments work in the way described in the theoretical postulates upon which they were developed. In other words, the analysis was designed to test the overarching hypothesis that outcome of both MET and SBNT - where outcome is defined by measures of drinking frequency (Percentage days abstinent) and quantity (Drinks per drinking day) - was mediated by therapist behaviors consistent with their underlying theoretical models of therapeutic change. Thus, we investigated the extent to which MET and SBNT outcomes were mediated by measures of the frequency and quality of performance of treatment-specific tasks and therapist styles. In relation to the two possible explanations mentioned above for lack of significant differences between treatments tested in major clinical trials, we hypothesized that the two UKATT treatments work in different ways via different therapist behaviors.

## Method

### Sample

UKATT (UKATT Research Team, 2005) was a pragmatic, multi-center, randomized controlled trial comparing the effectiveness of MET and SBNT in the treatment of alcohol problems. Both treatments were described in manual protocols. Briefly, MET was designed to work through a process of individual internal motivational change (mostly via resolution of ambivalence and eliciting commitment to change). SBNT was designed to work by recruiting a network that would support and drive change through external influence (and enhancing self -efficacy for change vicariously through this means). The methods used in the trial, including recruitment of participants, screening, inclusion/exclusion criteria, randomization procedures, follow-up arrangements and details of treatments and therapists, were described elsewhere (UKATT Research Team, 2001). Written informed consent from the client to participate in the study and to have each session video-recorded for the purpose of supervision, rating treatment delivery and future research was collected by the local researcher at the point of recruitment to the study. Ethical approval was obtained through the local NHS ethics committee for each of the treatment centers. The protocol required therapists to record all sessions 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, an additional 15% (N=112) had an unrateable video (mostly sound problems or incomplete recording). Among the resulting 452 clients (61%), one video was randomly sampled, 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, replacement sampling was used when a video was unrateable.

In the present analysis, we matched the process data extracted in Tober et al. (2008) to data from clients followed-up at 12-month in the main UKATT dataset (UKATT Research Team, 2005). This resulted in a sample of N=376 (N=217 for MET and N=159 for SBNT) with one coded session each (see Table 1).

###### Insert Table 1 about here.

### Therapist selection and training

As this was a pragmatic trial, therapists were randomly assigned to one of the two treatments after they had been accepted to practice in the study. Criteria for recruitment included two requirements, one relevant to each condition, i.e. ability to demonstrate basic MI style (MET), and ability to work with more than one person at a time (SBNT). This was assessed by candidate therapists submitting two video recordings of their practice. Therapists in the MET condition were taught to apply motivational interviewing core skills and strategies to the protocol for MET; SBNT therapists were taught to engage and address the network skills and strategies in line with the protocol for SBNT; their motivational style of so doing was not addressed. Thereafter, therapists were supervised separately and asked to avoid discussing their assigned trial intervention with colleagues working in the other condition (Tober et al. 2005).

### Measures

Baseline variables were measured during pre-treatment, interviewer-led assessments, including socio-demographic information and alcohol consumption by means of Form 90 (Miller, 1996). Form 90 was repeated at 3- and 12-month follow-ups (in this analysis we use the latter), permitting the calculation of the primary outcome variables of percent days abstinent (PDA) to record frequency of drinking and drinks per drinking day (DDD) to record intensity of drinking, with individuals totally abstinent at follow-up scored zero on DDD. In the present analysis, we used both variables at baseline, as well as gender and age, as control variables in regression models. As the session coded for each client was randomly selected among all available treatment sessions (session 1 to 3 for MET; session 1 to 8 for SBNT, see above), we also measured the number of days between baseline assessment and the coded session to control for time in treatment.

Process variables were extracted using the UKATT PRS (Tober et al., 2008). This was developed as a manual-based, time-efficient method of rating treatment fidelity, including frequency and quality of the delivery of treatment components, treatment manual adherence, therapeutic style and discriminability between different treatments. It is a 20-item scale divided into two sections: 13 items measuring treatment-specific tasks (i.e. *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; *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 treatment-specific therapist style (i.e. *MET*: Empathy, Exploration of feelings, and Reflective listening; *SBNT*: Focus on interpersonal relationships, Task-oriented, Treatment as a collaborative effort, and Therapist as agent for change).

These 20 items were rated on two 5-point scales, one measuring the extent to which the item was performed (frequency) and the other measuring how well the therapist performed the item (quality). Quality was assessed only where performance of the item in question had been identified, thus resulting in considerable variability in the number of sessions providing data for individual items (see Tober et al., 2008 for details). The frequency scale was labeled: 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. Mean frequency and quality scores, as well as frequencies of quality scores for individual items, are presented in Tober et al. (2008). Four indices were derived from the UKATT PRS: the frequency of MET behaviors (met-f); the quality of MET behaviors (met-q); the frequency of SBNT behaviors (sbnt-f); and the quality of SBNT behaviors (sbnt-q). All four indices were calculated as the unweighted mean of the related scales and are thus measured on the same 0 to 4 scale. Inter-rater reliability was measured among 76 randomly selected sessions which were coded by 2 independent raters using intra-class correlations (two-way mixed effects, average measures, absolute agreement) and indicated excellent reliability for frequency summary scores (met-f=0.79, sbnt-f=0.94), and good reliability for quality summary scores (met-q=0.65, sbnt-q=0.65).

### Statistical analysis

We first described our sample using standard descriptive statistics. We then tested our hypotheses using a mediation framework. Mediation analyses (Baron & Kenny, 1986) posit how, or by what means, an independent variable (X) affects a dependent variable (Y) through one or more potential intervening variables, or mediators (M). Several paths are tested using regression analyses (see Figure 1). Path *a* represents the effect of X on the proposed mediator, whereas path *b* is the effect of M on Y partialling out the effect of X. The indirect effect of X on Y through M can then be quantified as the product of the *a* and *b* paths (Sobel, 1982). Bootstrapping, a nonparametric resampling procedure, is a method advocated for testing mediation where an empirical approximation of the sampling distribution of *ab* is built and used to construct confidence intervals for the test of the indirect effect (Hayes, 2013; Preacher & Hayes, 2008). We used this approach as implemented in Model 4 of the PROCESS macro for SPSS developed by Hayes (2013). Here, received treatment (MET vs. SBNT) was used as the independent variable (X), the alcohol outcome (PDA or DDD) at 12-month follow-up as outcome variable (Y), and the 4 UKATT PRS summary scores as the mediator (M). Each mediator was tested separately with each outcome variable, resulting in 4x2=8 mediation models. All models were ordinary least squares regressions controlling for the baseline measure of the dependent variable, gender, age, and number of days between baseline and the coded session. In order to detect potential therapist effect in our findings, we repeated *a* and *b* paths analyses using mixed models with random intercept and slopes at the therapist level.

###### Insert Figure 1 about here

In the eventuality of a significant *b* path, we added a last step to test which individual items of the significant index had an influence on outcomes. Data reduction techniques were used as PRS indices are comprised of several items and several of these are measuring similar or related behaviors. As the quality ratings were evaluated only when items were observed (frequency>0), resulting in missing data, we used multiple correspondence analysis (MCA), treating missing values as ordinary values. MCA can be viewed as a generalization of principal component analysis where the variables to be analyzed are categorical, not continuous (Greenacre & Blasius, 2006). We used coordinate plots and discrimination measures (variable principal normalization) to describe resulting dimensions. The resulting dimensions’ scores were saved as variables (“Save object scores” function in SPSS 23). These variables were then entered in a regression model similar to those in *b* paths of the mediation models, i.e., with PDA or DDD at 12-month follow-up as outcome variable and controlling for the baseline measure of the dependent variable, gender, age, and number of days between baseline and the coded session.

## Results

### Sample description

The sample for the present analysis was comparable to the complete UKATT sample, with no significant differences between those clients included (N=376) and excluded (N=366) on baseline alcohol use (p=0.26 for PDA, and p=0.17 for DDD) and gender (p=0.83). However, those included tended to be older than those excluded (42.5 years vs. 40.8 on average, p=0.02). As shown in Table 1, there were no significant differences on the same measures between those having received MET (N=217) and SBNT (N=159). Overall, about three quarters of the sample were male, mean age was 42 years (SD=10.0), PDA at baseline was 28.0 (26.0), and DDD 23.9 (14.0). The values of the UKATT PRS data used here were similar to those presented in Tober et al. (2008) for the larger validation study. Three of the 4 indices strongly discriminated between the two treatments (p values < 0.0001): met-f, sbnt-f, and sbnt-q. However, met-q (i.e. the quality of MET behaviors) did not significantly differ between MET and SBNT (p=0.08), although the trend was in the expected direction (i.e. slightly higher scores in MET). There was also only a small difference on this measure in Tober et al. (2008), though that was statistically significant (p=0.04). Parallel to results of the main trial (UKATT Research Team, 2005), there were no significant differences between treatments on primary outcomes at 12-month follow-up.

###### Insert Table 1 about here.

### Mediation analysis

On the *a* path, MET significantly predicted higher met-f, while SBNT significantly predicted higher sbnt-f and sbnt-q (see Table 2). However, as previously observed in Table 1, MET was not significantly related to met-q. Findings were similar for both the PDA outcome models (top 4 rows in Table 2) and the DDD outcome models (bottom 4 rows in Table 2), with small differences due to different control variables (baseline PDA or DDD).

On the *b* path, met-q was a significant predictor of both higher PDA and lower DDD at 12-month follow-up. There was no strong evidence that the three other indices were related to either DDD or PDA, though met-f approached statistical significance in relation to PDA only. Indirect effects were all non-significant, which is consistent with the fact that no models had both significant *a* and *b* paths.

We then repeated *a* and *b* paths analyses using mixed models with random intercept and slopes at the therapist level to detect potential therapist effect in our findings. There was evidence of a small therapist effect on the *a* path models, but the patterns of results were similar (i.e. there were small but significant differences in intercept and slopes between the 48 therapists, but the associations between treatment condition and behaviors measured in the PRS remained in the same direction and at similar level of significance when taking them into account; data not presented, available on request to the first author). There was no evidence of a therapist effect on the *b* path models.

###### Insert Table 2 about here

### Individual items influencing the significant b path

The met-q summary score was a significant predictor of both alcohol outcomes. Descriptive statistics of met-q individual items are presented in Table 3. We tested which individual items of this index had an influence on outcomes using multiple correspondence analysis (MCA). MCA indicated a two-dimension solution. Figure 2a presents coordinate plots (i.e. the coordinate of each category on the 2 dimensions, for each variable independently) and Figure 2b a plot of discrimination measures (i.e. the percent of variance of each dimension explained by each variable). Examination of these figures showed that Eliciting client concern, providing Feedback on negative consequences, and Exploration of feelings characterized Dimension 1 (horizontal axis). On the other hand, Eliciting commitment to change drinking, Empathy, Creating internal conflict/enhance discrepancy, Reflective listening, and Discussing commitment to drinking goals characterized Dimension 2 (vertical axis).

###### Insert Table 3 and Figures 2a & 2b about here

When using MCA dimensions’ scores to predict alcohol outcomes, Dimension 2 was a significant predictor of both outcomes (PDA: B= -6.53, p<0.001; DDD: B=1.66, p=0.009), while Dimension 1 was not (Table 4).

###### Insert Table 4 about here

## Discussion

Using a mediation framework to study the active ingredients of the treatments in UKATT offers a better understanding of the trial’s overall null findings. While there were no significant indirect effects, analysis of individual paths from treatment condition to treatment process indices (*a* path) and from treatment process indices to alcohol outcomes (*b* path) showed that: 1) SBNT therapists more often used SBNT-specific behaviors, and did so with an overall higher quality; 2) MET therapists more often performed MET-specific behaviors, but there was no evidence that they performed these behaviors at higher quality than SBNT therapists; 3) only the quality of MET behaviors significantly predicted 12-month alcohol outcomes. The quality of MET-specific behaviors was thus related to better drinking outcomes, and therapists from both treatment conditions helped achieve positive treatment outcomes in this way. In relation to the hypothesis tested, there is no evidence from the present analysis that treatment outcomes are mediated by therapist behaviors consistent with the theoretical postulates on which the two treatments are based. The met-q finding, which does not provide strong evidence to support any mediational hypothesis *per se*, nonetheless provides some data suggestive of the possibility that these two treatments, as they were delivered in UKATT, have similar active ingredients.

Given these findings for met-q, it was of interest to investigate which individual met-q items measured in the UKATT PRS were related to better outcomes. Multiple correspondence analysis pointed to variables that are commonly associated with the style of motivational interviewing (i.e., empathy, discrepancy enhancement, eliciting and discussing commitment to change, reflective listening). However, as shown in the present analysis, these therapist qualities are not unique to motivational interviewing, and can be seen as common factorsof effective treatment as describedin the addiction process (Miller & Moyers, 2015) and general psychotherapy (Frank & Frank, 1991; Wampold & Imel, 2015) literatures. Miller and Moyers (2015), whilst describing evidence for the large impact of relational factors such as empathy on addiction treatment outcome and their importance for research progress, point out that such factors are not accurately described as ‘common’ because they can and do vary substantially across therapists. Neither should they be called ‘non-specific’ because they can be clearly specified, as done in the present study.

The present findings would appear to provide support for Orford’s (2008) arguments about the limited value of trials comparing different treatments when they share important common factors. We suggest they have important implications for the future conduct of alcohol treatment trials. They call for rigorous determination of shared and unique factors within and across treatments as a necessary basis for the design of trials that are not unwittingly biased by contamination. In UKATT it was specifically required that all therapists possessed both basic MI skills and an ability to work with more than one person at a time, thus meaning that the present analysis concerns the ability of subsequent high quality training and supervision packages in each modality to produce differential treatment outcomes. Findings also indicate the need for careful attention to therapist selection with regard to pre-existing skill levels, and suggest restrictions on the experimental contrasts possible for motivational interviewing if key therapist skills in this approach are prevalent among candidate therapists to such an extent that they should also be expected to be present in control conditions. For example, non-inferiority hypotheses may be more amenable to testing than superiority hypotheses, and dismantling designs may be needed to provide experimental evidence of component effects. In both cases, larger sample sizes are required.

In terms of the two possible explanations discussed in the Introduction for lack of significant main effects in UKATT and the more general finding that different *bona fide* alcohol treatments yield similar outcomes on average (Imel, Wampold, Miller, & Fleming, 2008). (i.e., that different treatment modalities achieve equivalent outcomes via different mechanisms of change, or that, despite theoretical divergence, different treatments achieve similar outcomes via the same mechanisms of change (Longabaugh, 2007; Tober, 2002), our findings offer some support to the second explanation. They can also be seen as explaining, in part at least, the failure to confirm the general matching hypothesis that careful client-treatment matching improves overall effectiveness of treatment for alcohol problems (Babor & Del Boca, 2003; Project MATCH Research Group, 1997, 1998; UKATT Research Team, 2008). Met-q was not, however, a mediator of MET outcomes. We suggest that further studies could disaggregate met-q and address the contribution of its components to outcomes. This could be done, for example, by using a control group design allowing any one hypothesized mediator to be experimentally manipulated (Longabaugh et al., 2013, pp.579-580).

The present findings are consistent with evidence that therapist interpersonal skills are associated with better treatment outcomes (Miller & Moyers, 2015), and it should be noted in this regard that met-q is specifically a measure of the quality of motivational interviewing skills evidenced in delivery. Therapist empathy predicts reduced drinking across a wide range of clients and settings (Miller & Baca, 1983; Miller, Taylor & West, 1980; Moyers & Miller, 2013). A recent process study of brief MI intervention has shown that counselors that were more experienced and had higher MI- relational skills, had significantly better outcomes (Gaume et al., 2014). Data from this same study also demonstrated that a key mechanism hypothesized by MI theory (i.e. strength of change talk) was operative only when counselors were experienced in MI, suggesting the importance of therapist selection, training, and supervision (Gaume et al., 2016). In the present analysis it is also interesting that MCA dimension 2, which was associated with treatment outcomes, describes therapist behaviors more likely to evoke change talk (e.g. Eliciting commitment to change drinking, Creating internal conflict/enhance discrepancy, and Discussing commitment to drinking goals).

With regard to the therapeutic relationship, there is good evidence from the alcohol treatment (Connors, Carroll, DiClemente, Longabaugh, & Donovan, 1997) and general psychotherapy (Martin, Garske, & David, 2000) fields that a strong working alliance is associated with better outcomes. In a previous UKATT paper (Cook, Heather & McCambridge, 2015a), it was reported that the strength of the client-rated working alliance was associated with drinking during treatment and post-treatment motivation to change for clients in both treatment groups and drinking behavior at follow-up in the MET group. It is plausible to hypothesize that met-q has the effect of increasing the strength of the working alliance. The specific focus on the relationship between quality of delivery and working alliance here is supported by studies causally linking therapist skilfulness and client involvement (e.g. Moyers et al., 2005). Other UKATT research (Cook, Heather & McCambridge, 2015b; Heather & McCambridge, 2013) showed that clients who were assessed as ready to change drinking at the end of treatment were much more likely to show positive drinking outcomes 9 months later than those who did not indicate a readiness to change. Combining these results with the present finding suggests a hypothetical causal chain: higher met-q leads to a stronger working alliance which then leads to greater readiness to change at the conclusion of treatment and hence to improvements in drinking and other outcomes at follow-up. Future research should be conducted to test this hypothesis.

**Strengths and limitations**

This secondary analysis has a number of strengths, including a large sample size for a treatment process analysis, which was drawn from a large pragmatic trial. Participants included in this analysis were broadly representative of the trial population, which in turn reflected the range and severity of alcohol problems presenting to UK alcohol treatment services at the time of the study. We suggest that study findings are generalizable to similar populations characterized by voluntary participation in treatment.

Although session-level sampling for video recording ensured equal distribution in session numbers and treatment centers, only 1 session per client was coded of the possible 3 MET sessions and 8 SBNT sessions. Thus only one part of each individual treatment process has been examined here.

A limitation of the present analysis is that, apart from drinking behavior at follow-up, it says nothing about the effects of treatment on client variables such as affect, cognition or behavior further along the causal path. In other words, we have not identified a mechanism of change, defined as events or processes that occur within the client or a changed relationship between a client and his/her environment (Longabaugh et al., 2013). It is interesting to note, however, that, when at follow-up UKATT clients were asked about factors to which they attributed positive changes they had made, “characteristics of the therapist and of the client’s relationship with the therapist were the most popular attributions, outnumbering motivational-type attributions for motivational enhancement therapy for (MET) clients and social-type attributions for social behavior and network therapy clients (SBNT)” (Orford, 2008, p. 876; Orford, Hodgson, Copello, Wilton, & Slegg, 2009). Nevertheless, the lack of coding of client language is another limitation of this analysis to be borne in mind.

**Conclusions**

The present analysis suggests that the quality of the accomplishment of core treatment tasks is equivalently impactful on outcomes in two treatments that were designed to provide a strong contrast, one of which was social network focused and required no more than basic motivational interviewing skills and an ability to work with people other than the client who were present at the session prior to SBNT training. Further research on how treatment works and why is needed which pays rigorous attention to therapist skills and the quality of therapist behaviors within sessions. Such study may benefit from the use of motivational interviewing skills measures such as the PRS across treatment modalities as they appear capable of contributing to our understanding of what is it that therapists do that enhances outcomes. Further research should also give careful attention to the client, and their interactions with the therapist. The importance of the quality of delivery of named treatment tasks transcends the impact of delivering treatments with different theoretical underpinnings in UKATT.

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#### Table 1

#### Sample description

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | | MET | | SBNT | | Total | | p\* |
|  | | | N=217 | | N=159 | | N=376 | |  |
| Baseline | | |  |  |  |  |  |  |  |
|  | | Age (mean, SD) | 42.5 | 10.2 | 42.5 | 9.6 | 42.5 | 9.9 | 0.89 |
|  | | Gender (N Male, %) | 159 | 73.3% | 121 | 76.1% | 280 | 74.5% | 0.53 |
|  | | PDA (mean, SD) | 29.9 | 26.8 | 25.1 | 24.9 | 27.9 | 26.1 | 0.10 |
|  | | DDD (mean, SD) | 23.0 | 12.5 | 25.0 | 15.6 | 23.8 | 13.9 | 0.45 |
| Session-level process measures | | |  |  |  |  |  |  |  |
|  | | Days from baseline (mean, SD) | 41.8 | 27.3 | 46.7 | 24.9 | 43.9 | 26.4 | 0.04 |
|  | | met-f (mean, SD) | 1.3 | 0.4 | 0.5 | 0.2 | 0.9 | .05 | <0.001 |
|  | | met-q (mean, SD) | 2.5 | 0.5 | 2.4 | 0.7 | 2.4 | 0.6 | 0.08 |
|  | | sbnt-f (mean, SD) | 0.4 | 0.3 | 1.4 | 0.5 | 0.8 | 0.6 | <0.001 |
|  | | sbnt-q (mean, SD) | 1.9 | 0.8 | 2.3 | 0.7 | 2.1 | 0.8 | <0.001 |
| 12-month follow-up | | |  | |  | |  | |  |
|  | | PDA (mean, SD) | 51.5 | 38.2 | 51.0 | 36.1 | 51.2 | 37.3 | 0.83 |
|  | | DDD (mean, SD) | 14.6 | 13.1 | 15.6 | 15.4 | 15.0 | 14.1 | 0.83 |

*Note*. MET=motivational enhancement therapy; SBNT=social behavior and network therapy; SD=standard deviation; DDD=drinks per drinking days; PDA=percent days abstinent; met-f=frequency of MET behaviors; met-q=quality of MET behaviors; sbnt-f=frequency of SBNT behaviors; sbnt-q=quality of SBNT behaviors.

\* p value based on Chi-squared test for categorical variable and Wilcoxon rank-sum test for continuous variables.

#### Table 2

#### Mediation analysis (N=374)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| a path (X🡪M) | | | | | |  | b path (M🡪Y, controlling for X) | | | | | |  | Indirect effect | | | |
| X | M |  |  |  |  |  | M | Y |  |  |  |  |  |  |  |  |  |
|  |  | B | SE | t | p |  |  |  | B | SE | t | p |  | Effect | SE \* | 95% \* | CI \* |
| MET | met-f | 0.83 | 0.03 | 24.61 | <0.001 |  | met-f | PDA | 11.00 | 5.70 | 1.93 | 0.054 |  | 9.14 | 4.71 | -0.38 | 18.30 |
| MET | met-q | 0.09 | 0.07 | 1.42 | 0.16 |  | met-q | PDA | 7.65 | 2.88 | 2.66 | 0.008 |  | 0.73 | 0.65 | -0.18 | 2.44 |
| SBNT | sbnt-f | 0.97 | 0.04 | 23.46 | <0.001 |  | sbnt-f | PDA | 3.41 | 4.66 | 0.73 | 0.47 |  | 3.32 | 4.52 | -5.41 | 12.13 |
| SBNT | sbnt-q | 0.38 | 0.08 | 4.79 | <0.001 |  | sbnt-q | PDA | 4.17 | 2.50 | 1.67 | 0.10 |  | 1.58 | 0.99 | -0.07 | 3.86 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MET | met-f | 0.83 | 0.03 | 24.55 | <0.001 |  | met-f | DDD | -0.34 | 2.00 | -0.17 | 0.86 |  | -0.29 | 1.71 | -3.59 | 3.03 |
| MET | met-q | 0.11 | 0.07 | 1.58 | 0.11 |  | met-q | DDD | -3.84 | 1.00 | -3.86 | <0.001 |  | -0.41 | 0.31 | -1.16 | 0.09 |
| SBNT | sbnt-f | 0.97 | 0.04 | 23.47 | <0.001 |  | sbnt-f | DDD | -0.47 | 1.63 | -0.29 | 0.77 |  | -0.46 | 1.57 | -3.45 | 2.67 |
| SBNT | sbnt-q | 0.36 | 0.08 | 4.58 | <0.001 |  | sbnt-q | DDD | -0.84 | 0.88 | -0.95 | 0.34 |  | -0.30 | 0.34 | -1.08 | 0.30 |

*Note*. X=independent variable (treatment allocated in the present analysis: MET, motivational enhancement therapy; SBNT, social behavior and network therapy). M=mediator (Process Rating Scale summary scores in the present study: met-f, frequency of MET behaviors; met-q, quality of MET behaviors; sbnt-f, frequency of SBNT behaviors; sbnt-q, quality of SBNT behaviors). Y=dependent variable (12-month alcohol outcome in the present analysis; DDD, drinks per drinking days; PDA, percent days abstinent). SE=standard error; CI=confidence interval.

\* estimated on 5000 bootstrap samples.

All models are ordinary least squares regressions controlling for baseline measure of the dependent variable, gender, age, and number of days from baseline.

#### Table 3

#### Descriptive statistics of PRS MET quality items

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | MET |  |  | SBNT |  |  | Total |  |  |
|  | N | Mean | SD | N | Mean | SD | N | Mean | SD |
| Focus on ambivalence | 71 | 2.2 | 1.0 | 3 | 2.3 | 1.5 | 74 | 2.2 | 1.0 |
| Elicit commitment to change drinking | 52 | 2.2 | 1.2 | 5 | 1.8 | 0.5 | 57 | 2.2 | 1.2 |
| Elicit client concern | 135 | 2.6 | 1.1 | 13 | 1.9 | 1.3 | 148 | 2.5 | 1.1 |
| Create internal conflict or discrepancy | 28 | 2.2 | 1.1 | 3 | 1.7 | 0.6 | 31 | 2.2 | 1.0 |
| Empathy | 203 | 2.5 | 0.8 | 120 | 2.4 | 1.0 | 323 | 2.5 | 0.9 |
| Exploration of feelings | 156 | 2.0 | 0.8 | 48 | 1.7 | 0.7 | 204 | 1.9 | 0.8 |
| Feedback on negative consequences | 110 | 2.9 | 1.1 | 3 | 1.0 | 1.0 | 113 | 2.9 | 1.1 |
| Discuss commitment to drinking goals | 205 | 2.5 | 1.2 | 124 | 2.3 | 1.2 | 329 | 2.4 | 1.2 |
| Elicit optimism for change | 150 | 2.4 | 1.2 | 21 | 2.1 | 1.2 | 171 | 2.4 | 1.2 |
| Reflective listening; | 214 | 2.9 | 0.6 | 135 | 2.8 | 0.9 | 349 | 2.8 | 0.7 |
| Elicit client self-efficacy | 60 | 2.1 | 1.0 | 12 | 1.5 | 0.8 | 72 | 2.0 | 1.0 |

*Note:* Differences in N are related to variation in frequency ratings (quality rating not evaluated when the behavior was not observed in the session, i.e. frequency=0). MET=motivational enhancement therapy; SBNT=social behavior and network therapy; SD=standard deviation

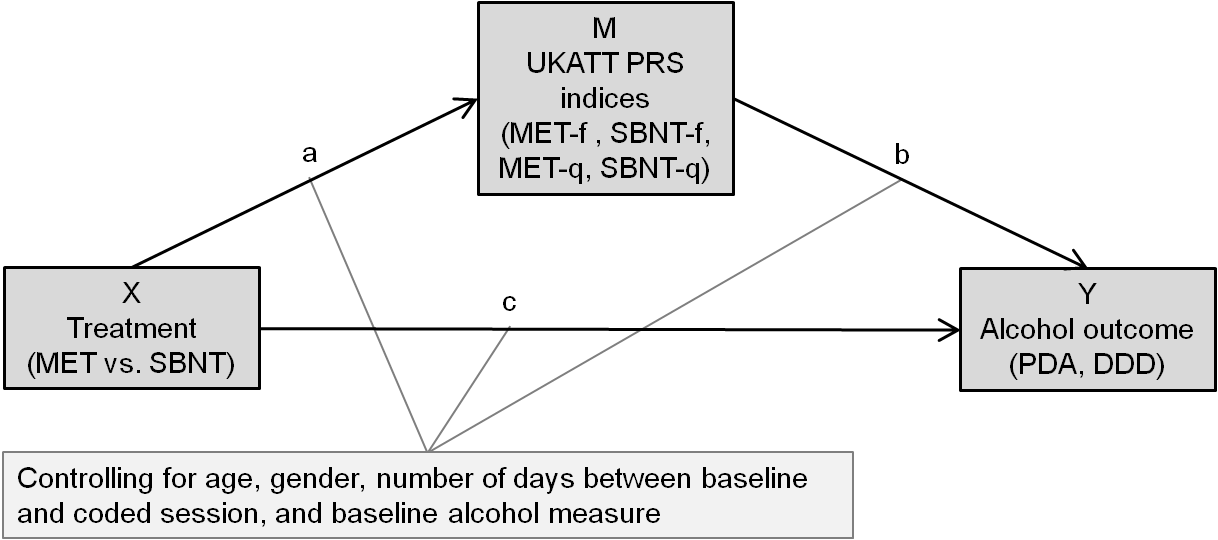
#### Table 4

#### Regression analysis using multiple correspondence analysis dimensions’ scores

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | B | SE | t | p |
| Outcome: PDA | |  |  |  |  |
|  | Dimension 1 score | -3.28 | 1.86 | -1.77 | 0.08 |
|  | Dimension 2 score | -6.53 | 1.80 | -3.63 | <0.0001 |
| Outcome: DDD | |  |  |  |  |
|  | Dimension 1 score | 0.61 | 0.65 | 0.93 | 0.35 |
|  | Dimension 2 score | 1.66 | 0.63 | 2.6170 | 0.009 |

*Note*. PDA=percent days abstinent; DDD=drinks per drinking days; SE=standard error.

Models are 2 ordinary least squares regressions (one per outcome), controlling for baseline measure of the outcome variable, gender, age, and number of days from baseline.



#### *Figure 1*. Mediation models. MET=motivational enhancement therapy; SBNT=social behavior and network therapy; PRS=Process Rating Scale; met-f=frequency of MET behaviors; met-q=quality of MET behaviors; sbnt-f=frequency of SBNT behaviors; sbnt-q=quality of SBNT behaviors; PDA=percent days abstinent; DDD=drinks per drinking day. Each mediator was tested separately with each outcome variable, resulting 4x2=8 mediation models.



#### *Figures 2a and 2b*. Multiple correspondence analysis coordinate plot and discrimination measures plot for UKATT-PRS quality of MET behaviors scales. Sysmis=system missing values when quality rating were not evaluated (item not observed, i.e. frequency=0). In both graphs, horizontal axis represents Dimension 1 and vertical axis represents Dimension 2.

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