



Controlling for Endogeneity Biases in Estimating Alcoholics Anonymous' Effect on Drinking Outcomes in Project MATCH

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Evaluation Café
December 4, 2007**

BACKGROUND



Evaluation of mutual aid (“self-help”) is in an early stage.

The greatest interest has been in mutual aid for substance abuse problems, since formal treatment has been of limited effectiveness, and expensive besides.

The majority of this mutual aid research has focused on Alcoholics Anonymous (AA), a voluntary fellowship begun in 1935 based on the now-famous “12 Step program of recovery.”

A considerable research literature *suggests* relations between AA participation and less drinking or “abstinence” from alcohol/drugs.

BACKGROUND

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The limitation is that existing studies are almost universally correlational only, including those with longitudinal data.

So the question has been, are the documented associations causal in nature, in particular, does AA participation lead to (“cause”) reductions in drinking or abstinence?

The theoretically strongest method of establishing a causal effect is a randomized controlled trial (RCT), but RCTs of AA are impractical, and in fact there are none.

For instance, “assigning” alcoholic subjects to AA cannot ensure that they will participate, and subjects not so assigned cannot be prevented from participating.

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Such attempted assignment also runs afoul of ethical issues – given the research suggesting the effectiveness of AA, is it ethical to propose that some subjects in need of help not attend AA, even if a treatment alternative is offered?

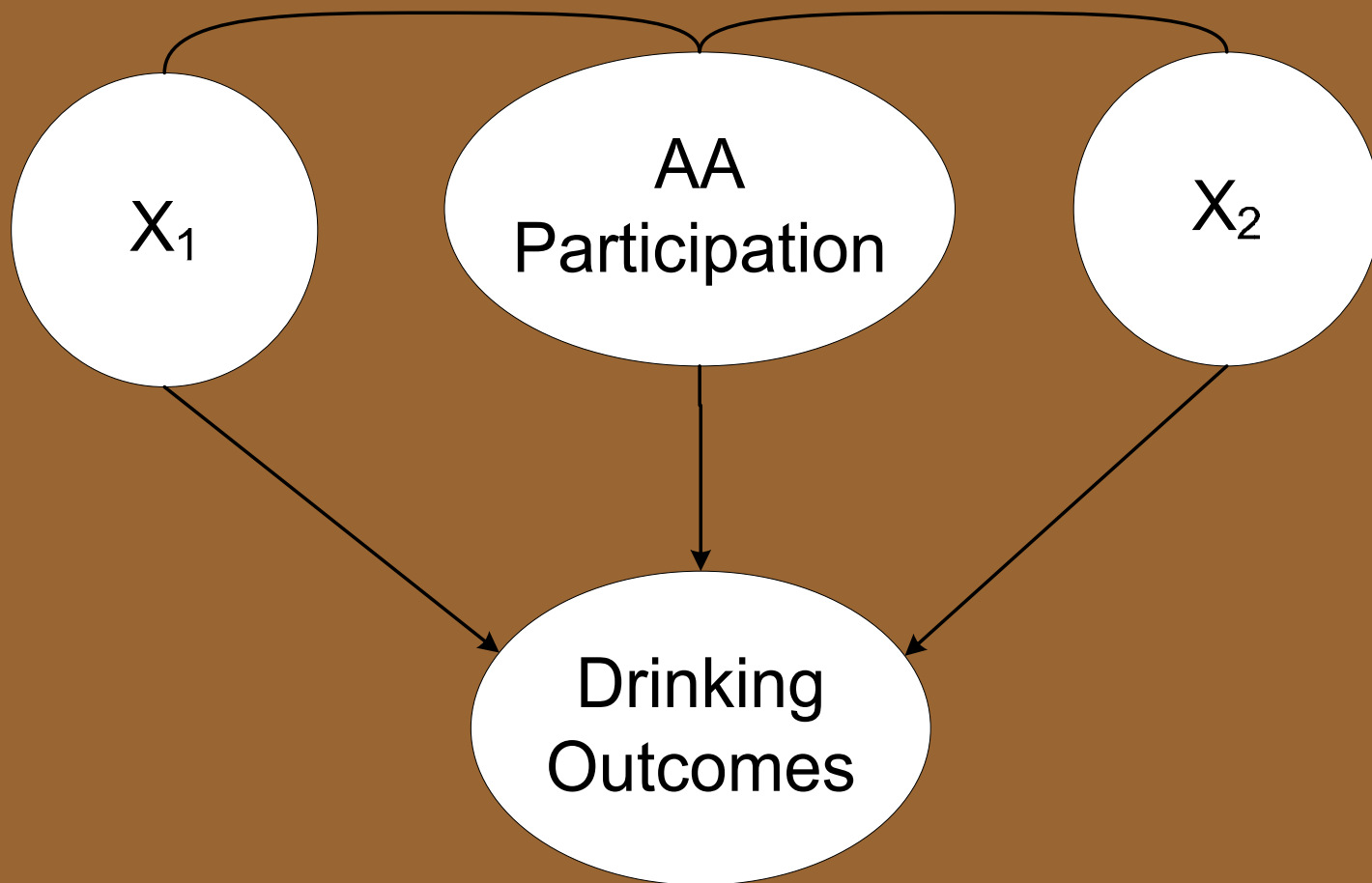
Although courts have in the past “ordered” alcoholics charged or convicted of offenses to participate in AA, recent rulings have deemed this unconstitutional, AA being considered similar to a religion for legal purposes.

Additionally, being ordered to participate violates the voluntary tenets of 12 Step mutual aid.

SIGNIFICANCE



The existing correlational studies designs are susceptible to two main kinds of artifacts due to potential *endogeneity bias* in variables.



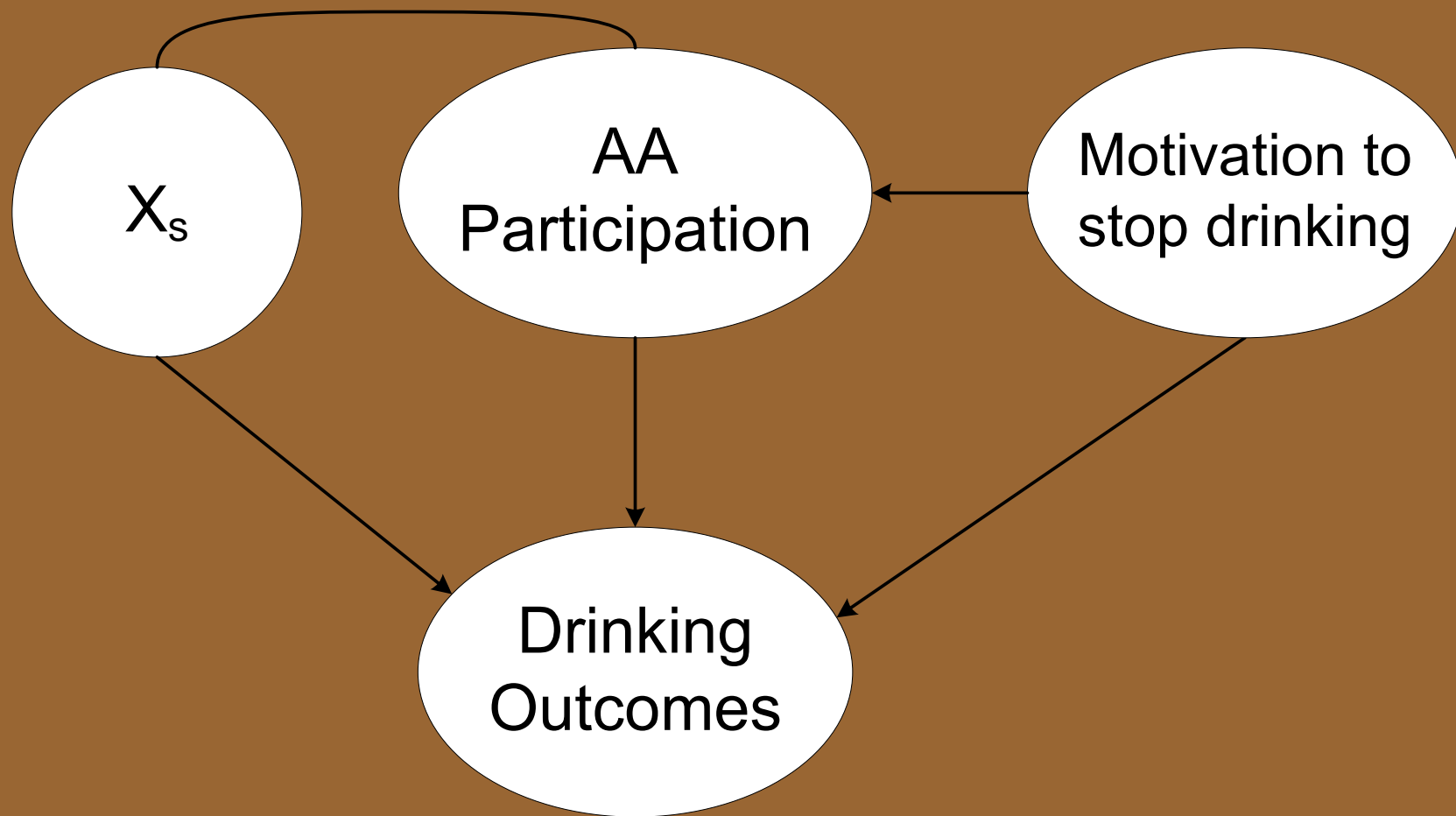


Endogeneity is a situation where variables treated as exogenous may actually be endogenous, that is, they have presumed causes that need to be explicitly represented in a causal model.

One such artifact is selection bias, e.g. where different types of people choose to participate or not participate in AA.

Example of such an artifact - a spurious relation between AA participation and drinking due to the possibility that individuals who develop motivation to stop drinking are more likely both to attend AA and to stop drinking.

In this example, motivation could well “explain” the observed correlation between AA participation and drinking behavior.



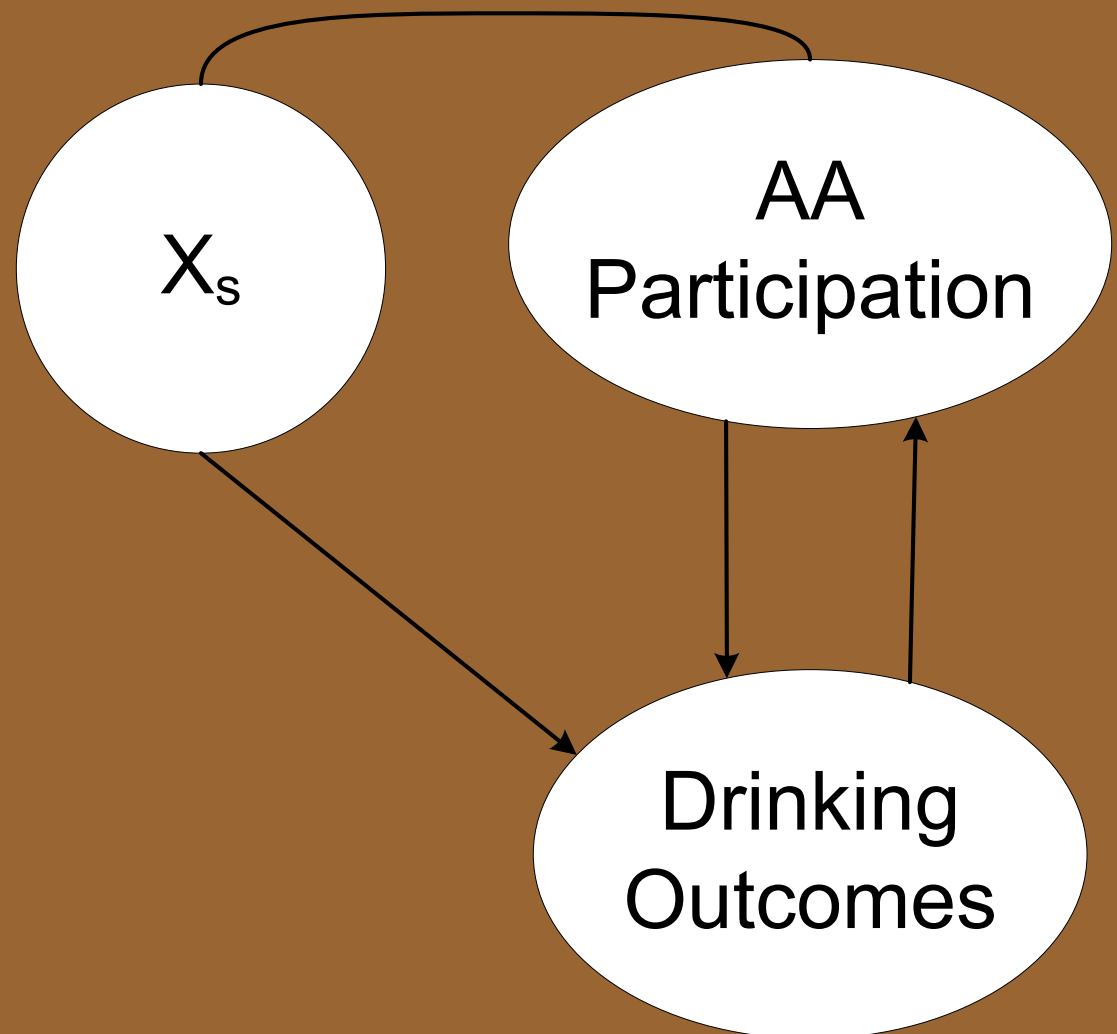


Observed measures of motivation may not be adequate statistical controls.

The second endogeneity artifact is “reverse causation,” i.e., the possibility that reducing or stopping drinking leads to increased or sustained AA participation, thus “explaining” in a different way the observed correlation between AA participation and drinking behavior.



Objective: to control for these possible endogeneity biases to determine the “true” magnitude of effect and causal direction in the relation between AA participation and drinking behavior.



STUDY METHODS



Purpose of the Study

To conduct a secondary analysis of AA participation and drinking behavior in the Project MATCH alcoholism treatment database using three statistical techniques – propensity score matching, instrumental variable analysis and structural equation modeling with cross-lagged panel data- that are designed to control for possible selection and/or reverse causation biases in correlational data.



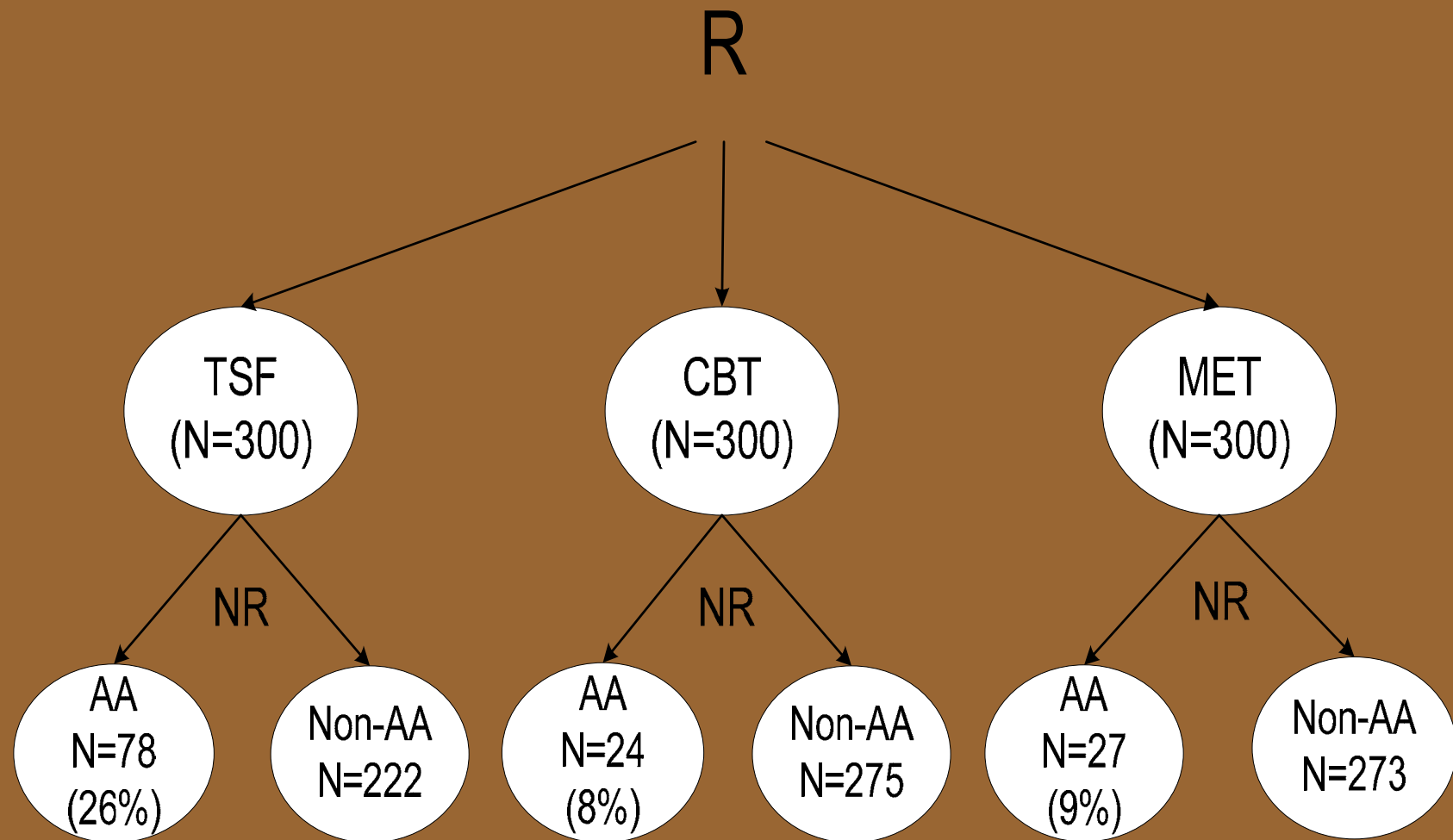
Methods

Project MATCH was a national alcoholism treatment trial that randomly assigned volunteers to one of three treatments:

Twelve Step Facilitation (TSF),
Cognitive-Behavioral Therapy (CBT)
Motivational Enhancement Therapy (MET).

TSF and CBT had 12 scheduled weekly sessions and MET had 4 sessions, all over a 3 month period. There were two arms, Aftercare (i.e., after inpatient treatment) and Outpatient.

The major follow-ups were conducted at the scheduled end of treatment (3 months), every 3 months up to 15 months, and at three years (the latter only for the Outpatient sample).





As expected, AA participation was higher in TSF than in the other treatments. But some patients in all treatments selected themselves for participation in community AA meetings.

For instance, in the Outpatient arm, 26% of TSF patients attended AA during both treatment and the post-treatment one year follow-up vs. 8% of CBT and 9% of MET patients.

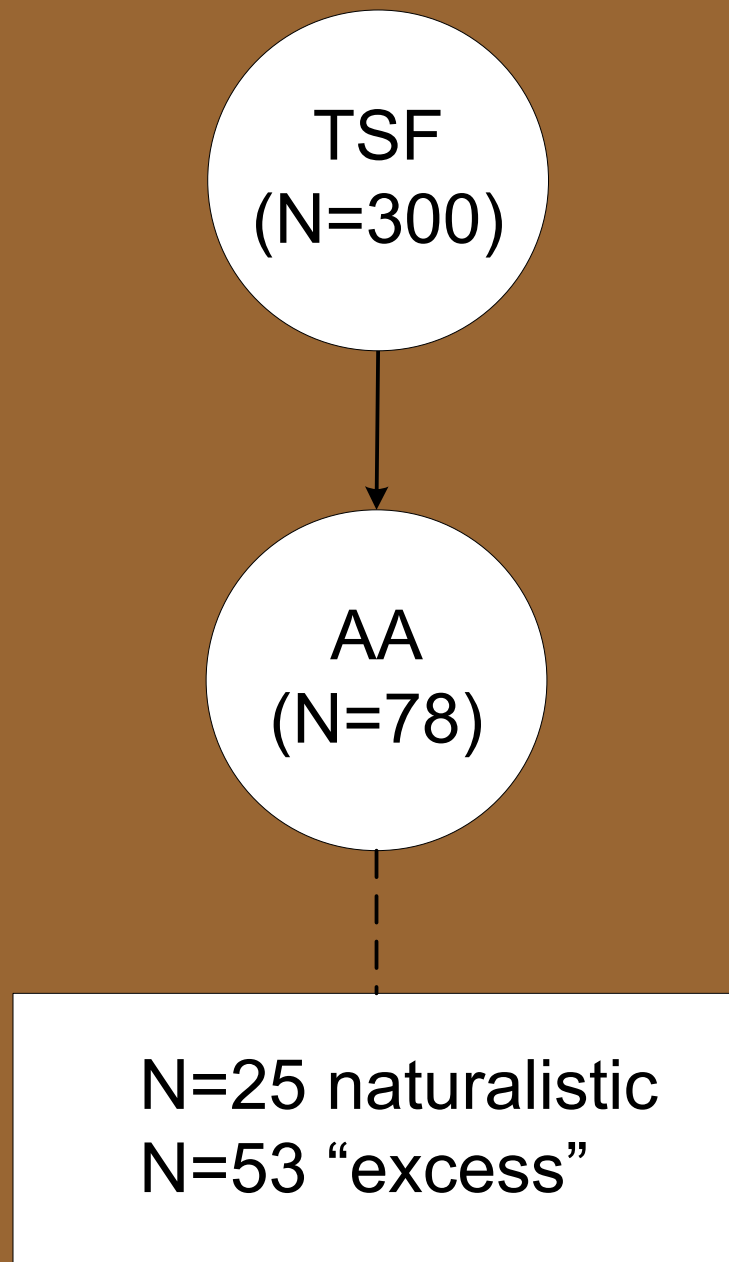
Although the AA and non-AA participants were not randomly assigned in this study, the feature of random *treatment* assignment feature can be statistically exploited, because it resulted in a significant correlation between treatment assignment and AA participation.



Propensity score matching, instrumental variable analysis and structural equation modeling with cross-lagged panel analysis can be used to control for potential endogeneity biases in the data.

This presentation will be limited to the description of the proposed *propensity score matching*.

The general line of the analysis is to determine the effects of AA participation on drinking outcomes for individuals who do not “naturalistically” select themselves for AA participation during outpatient treatment for alcoholism.



It appears that 8.5% of alcoholism subjects in the Project MATCH Outpatient arm select themselves for AA “naturalistically” (i.e., the percent of subjects who attended AA in the CBT and MET conditions). We can then infer that *17.5% (26% - 8.5%, $n=53$) of the subjects in the TSF condition would not have attended AA save for their assignment to TSF*. We can term these 53 subjects the “excess” AA participants.

(Btw, an example of contrafactual reasoning)



The advantage of the random assignment feature is: The AA participation of the excess participants cannot be explained by “ordinary” AA selection biases, since the factor explaining their AA participation is known (and is different) – *assignment to TSF*.

Thus it would be useful to compare the drinking outcomes of alcoholics who naturalistically select themselves for AA vs. alcoholics who participate in AA although they would not ordinarily do so.



This can be interpreted as an estimate of the effect of AA participation on drinking outcomes *that is unaffected (or much less affected) by “ordinary” biased selection into AA.*

But who exactly are the 53 “excess” AA participants?

The proposed study will use *propensity score matching* to construct matched groups of AA participants in TSF that are similar in characteristics and relative size (approx. $n = 25$) to the AA participants in CBT or MET.



The remainder of the AA participants in TSF (N = 53) will thus be identified as the subjects who only participated in AA due to the TSF assignment, i.e., they would not have selected themselves for AA participation had they been assigned to the CBT or MET conditions.

The study will be able to determine differences both in observable characteristics and drinking outcomes between the propensity score-matched and “excess” AA participants within TSF.



Propensity Score Matching

Definition of Propensity Score: The predicted conditional probability of an entity being classified in a specified group given a set of observed covariates.

Procedure for this study:

Pool the AA participants in TSF, CBT and MET ($78 + 24 + 27 = 129$). (After verifying the similarity of AA participants in CBT and MET).

Compute the predicted conditional probability of a patient being an AA participant in CBT/ MET, given a set of patient observed characteristics that are associated with being an AA participant in TSF vs. CBT/MET (“covariates”).



AA participants in TSF whose characteristics are “similar” to those of AA participants in CBT/MET will have a relatively high propensity score (i.e, the predicted probability of being an AA participant in CBT/MET).

AA participants in TSF with relatively high propensity scores are good candidates for *matching* to AA participants in CBT/MET (i.e., randomly select 25 AA participants from CBT/MET).

The remaining AA patients in TSF will be identified as the “excess” AA participants in TSF.



Statistical techniques for obtaining propensity scores:

- Logistic or multinomial regression

- Discriminant analysis

- Classification trees (non-parametric) – given the sample size, this may be preferred.

- Other....

Methods for defining the adequacy or closeness of a “match:”

- Nearest neighbor (e.g., AA participant in TSF with the closest propensity score to a randomly selected AA participant from CBT/MET - select 25)

- Others (e.g., Caliper; Mahalanobis Metric Matching)