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Sponsorship and service as mediators of the effects of Making Alcoholics Anonymous Easier (MAAEZ), a 12-step facilitation intervention

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Abstract

A recent trial (n=508) of “Making Alcoholics Anonymous Easier” (MAAEZ), a group-format 12-step facilitation program, showed that MAAEZ participants had increased odds of abstinence (OR = 1.58, $p = 0.063$). Effects were especially marked in several subgroups, including those with more prior AA/NA/CA exposure, and those with severe psychiatric problems. This paper examines whether the effects of MAAEZ were explained by higher engagement in particular Alcoholics Anonymous (AA) and other 12-step organization activities. Mediation analyses were performed, estimating MAAEZ effects attributable to AA/NA/CA meeting attendance, overall AA/NA/CA involvement, having a sponsor, and engaging in 12-step service. The only variable that appeared to mediate MAAEZ effects in the sample overall was doing service at either 6 months or at both 6 and 12 months. Among those with high prior AA/NA/CA attendance, both having a sponsor and doing service emerged as mediators, with having a sponsor explaining approximately 25% of the MAAEZ effect. Doing service also partially explained the MAAEZ effect among those with high psychiatric severity. Results highlight the value of studying specific AA/NA/CA activities as mediators of treatment effects, and demonstrate the importance of exploring subgroups when trying to understand treatment mechanisms. Findings also suggest that treatment programs should emphasize specific activities for particular clients. For example, individuals may have attended many AA/NA/CA meetings, but never known how to ask for a sponsor or get involved in service; doing service may represent a non-threatening way of connecting with 12-step members for clients with psychiatric problems such as social anxiety.

Keywords

Mechanisms of treatment; mediators; mediation; twelve-step facilitation; twelve-step participation; Alcoholics Anonymous

1. BACKGROUND

Recognizing factors that explain treatment effects is crucial to providing optimal care. This involves studying mediation, or variables that lie on the causal chain between treatments and outcomes. Causal chain analyses can explain why treatments work, identify “weak linkages” between hypothesized mediators and outcomes that point to erroneous theory, and elucidate effects that only emerge in particular subgroups (Finney, 1995). A prime example of the utility of mediation analyses within subgroups comes from Project MATCH (Matching

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Alcoholism Treatments to Client Heterogeneity) that identified an “inoculation effect” from the negative influences of social networks supportive of drinking. This effect only was found among those with networks saturated with heavy-drinking influences (Longabaugh et al., 2001). Causal chain analyses showed that greater involvement in Alcoholics Anonymous (AA) explained the effect in this subgroup among those treated in “Twelve-Step Facilitation” (TSF). Importantly, mediation analyses also determined that TSF (relative to the comparison condition) had not differentially decreased the amount of support for drinking in this group’s social network; rather, results suggested that the recovering individuals encountered in AA exerted a counter-balancing influence. This type of mediation analysis highlights targets for treating particular client subgroups, and is the emphasis here.

This paper explores mediators of a different TSF intervention, Making Alcoholics Anonymous Easier (MAAEZ), which has shown to be effective among subgroups not affected by earlier TSF approaches: those with high psychiatric severity, and with high prior involvement in Alcoholics Anonymous (AA), Narcotics Anonymous (NA) and Cocaine Anonymous (CA) (Kaskutas et al., 2009). MAAEZ is a manualized, group-format intervention designed for use in front-line treatment centers.

TSF interventions encourage participation in support groups that provide aftercare following specialty treatment. Project MATCH and many other studies have shown that treatment effects decline over time, and that sustained involvement in 12-step groups such as AA, NA, and CA can help in maintaining good recovery outcomes for years after formal treatment ends (Moos and Moos, 2006). TSF interventions thus often focus on meeting attendance (as it is the entree into the 12-step group), while also emphasizing other 12-step activities found to predict abstinence such as doing the steps (Toumbourou et al., 2002), having a sponsor (Crape et al., 2002), or helping behaviors such as being a sponsor (Cross et al., 1990).

Because TSF interventions ultimately encourage AA/NA/CA attendance and involvement, TSF and 12-step effectiveness are closely intertwined, and mediators of the TSF effect should be considered in the context of AA/NA/CA effectiveness studies. Theoretical perspectives of behavioral change used to explain mechanisms for AA (and NA, CA etc.) include social learning theory, cognitive behavioral theory, psychodynamic theory, and spirituality; see (Kaskutas, 2009; Moos, 2008 for reviews). For example, AA involvement leads to more positive social networks (Bond et al., 2003; Humphreys et al., 1999; Kaskutas et al., 2002; Timko et al., 2005), greater self-efficacy and coping skills (Humphreys et al., 1999; Kelly et al., 2002; Morgenstern et al., 1997; Timko et al., 2005), higher motivation for abstinence (Kelly et al., 2002), greater life meaning (White and Laudet, 2006), and spiritual changes (Kaskutas et al., 2003; Robinson et al., 2008; Zemore, 2007). Causal chain analyses of these 12-step variables has influenced the development of TSF interventions, as well as provided a logical framework for examining mediators of TSF.

For example, mediation analyses of several evidence-based TSF interventions have focused on having a sponsor, who (consistent with social learning theory) provides a successful role model. Most of these studies have also considered summary measures of overall involvement, since 12-step “dose” involves more than meeting attendance (Emrick et al., 1993) or any single activity. As reported above, AA involvement was a mediator of the “Project Match TSF” effect among those with high network support for drinking. Overall AA involvement partially mediated the effect of another TSF approach, “Intensive Referral,” which involved arranging for an AA member to meet the client at a meeting (Timko et al., 2006). Sustaining particular activities (e.g., doing service during both the first and second follow-up periods, and having a sponsor at each follow-up) significantly predicted abstinence at 6 and 12 months in that study (Timko and DeBenedetti, 2007).

Overall AA involvement also partially mediated the effects of a “Directive” TSF intervention focused on meeting attendance. This Twelve-Step Directive study compared outcomes for participants who signed contracts detailing their personal AA attendance goals to those who had simply been told that they would probably benefit from AA but that the decision to go was “up to you” (Walitzer et al., 2009, p. 394). A third motivational enhancement TSF condition did not significantly affect outcomes.

Although overall involvement was also emphasized in MAAEZ, the key focus was on promoting involvement with the 12-step *fellowship*. For example, MAAEZ incorporates role-plays of asking for a sponsor, and presents doing service as a way of getting outside oneself and feeling part of the AA/NA/CA fellowship. Our choice of potential mediators of the MAAEZ effect was theoretically derived from the intervention’s broad goal of connecting with the 12-step culture, and thus we focus here on having a sponsor and doing service.

The MAAEZ emphasis on the 12-step fellowship also is consistent with the empirical literature, as other studies of AA-oriented predictors of outcome conducted in diverse samples have shown this to be important (Crape et al., 2002; Emrick et al., 1993; Toumbourou et al., 2002; Weiss et al., 2005; Weiss et al., 1996; Witbrodt and Kaskutas, 2005; Zemore and Kaskutas, 2004; Zemore et al., 2004) and highlight its significance as a target for TSF interventions. Recent mediation analyses of Project MATCH TSF-derived “Network Support” therapy (Litt et al. 2009) provide additional compelling evidence for an emphasis on the AA fellowship. The “Network Support” condition emphasized AA’s utility in meeting new, sober people, and found that AA attendance and the number of abstinent friends in the social network each appeared to mediate the Network Support treatment effect.

The primary focus here lies on subgroup effects that have not been observed in other TSF interventions. Subgroups that appeared to benefit especially from MAAEZ (Kaskutas et al., 2009) included those with high levels of prior AA/NA/CA exposure (i.e., 91 meetings or more), and those with more severe psychiatric problems (i.e., who were above the median ASI psychiatric composite score). These groups respectively represent a large proportion of treatment populations (Humphreys et al., 1998b; Regier et al., 1990) and are especially difficult to treat successfully (Rounsaville et al., 1987; Weisner et al., 2000). In contrast to MAAEZ, Project MATCH TSF carried an advantage at 1-year only among those with low psychiatric severity (Project MATCH Research Group, 1997), and Timko’s “Intensive Referral” TSF was superior at 6 months among those with low levels of prior 12-step group meeting exposure (Timko et al., 2006).

2. METHODS

2.1 Sample and design

The MAAEZ trial was approved by the Public Health Institute’s Institutional Review Board. The study was implemented in existing California treatment centers, which offered long- and short-term residential and outpatient services. Participants were recruited between July 2005 and May 2006. The study used an “OFF-ON” design; those recruited during the OFF condition received usual care (n=196), while six usual care sessions were replaced by six MAAEZ sessions during the ON condition (n=312). The ON condition followed the OFF condition. MAAEZ effectiveness was based on comparisons between those in the OFF vs. ON conditions.

Prior to conducting the baseline interview, the 508 participating clients (211 long-term residents, 136 short-term residents, and 161 outpatients) provided consent (an 82%

participation rate). Seventy-five percent were re-interviewed by telephone at 6 months ($n = 380$) and 76% at 12 months ($n = 384$). Client incentives totaled \$100 (\$20 at baseline and \$40 at 6 and 12 months).

Comparisons of gender, age, and race of the 508 who participated in the study to the 114 who refused showed no significant differences. Regarding attrition, proportionately fewer long-term residential clients were interviewed at 12 months (65%) than short-term residential clients and outpatients (82% and 83%, respectively, $p < .001$). Reflective of long-term residents' demographics, those lost to follow-up at 12 months were more likely to have reported less than a college education, unemployed status, lower income, and a drug-dependence only diagnosis (all p 's $< .05$).

Overall, the sample was 33% female, 52% White, and 28% married. Dependence diagnoses broke down to 17% alcohol only, 43% drug only, 23% drug and alcohol, and 18% undiagnosed. The mean ASI psychiatric severity score was 0.33 ($SD = 0.27$), similar to that found among individuals entering substance abuse treatment in a large health maintenance organization (0.37) and well above that of its general membership (0.03) (Weisner, et al., 2000). Forty percent of the sample had attended more than 90 AA/NA/CA meetings in their lifetime. Of those with high prior AA/NA/CA attendance ($n = 201$), 56.7% had high psychiatric severity; of those with high psychiatric severity ($n = 255$), 44.7% had high prior AA/NA/CA attendance.

2.2 Measures

All variables were measured at baseline, and 6 and 12 months. Psychiatric problem severity was based on a median split of the Addiction Severity Index (ASI) psychiatric composite score (McLellan et al., 1992) at baseline. Prior AA/NA/CA exposure was based on a question from the AA Affiliation Scale (Humphreys et al., 1998a) which allowed us to determine whether the respondent had attended more than 90 meetings prior to the baseline interview. In addition to number of meetings attended and overall AA involvement, two AA involvement questions of interest here also came from the AA Affiliation Scale: currently having a sponsor, and having done service in the past 30 days (yes/no). Composite variables were created to reflect status at both follow-up periods (e.g., reported doing service at *both* 6 and 12 months vs. did not). For information regarding instrument sources and validity, please see (Kaskutas et al., 2009).

Given that AA is abstinence oriented, the dependent variable of interest here was total abstinence from both alcohol and drugs. A dichotomous variable was created to represent total abstinence for the 30 days prior to the 12-month follow-up interview vs. not, based on ASI alcohol and drug answers. To maximize reliability of self-reports, all individuals were asked to return for urinalysis.

2.3 Statistical Analyses

2.3.1—Classic mediation analysis requires that mediators temporally precede outcomes (Kazdin and Nock, 2003), such that the mediator is lagged rather than concurrent with the outcome. We conducted lagged analyses, using mediator values measured at the 6-month interview to study total abstinence for the 30 days preceding the 12-month interview.

Given interest in what happens initially (at 6 months) and is sustained (at 12 months), we also studied composite mediators that reflected both lagged and concurrent values—for example, whether the respondent had done service at both 6 and 12 months. Our analytic approach in studying potential mediators of the MAAEZ effect was informed by Timko and Benedetti's (2007) mediation analysis of overall AA involvement which only "credited" a

given activity if it was reported at both the 6- and 12-month follow-ups. This provided comparison between those engaged in particular behaviors during *both* follow-up periods, to those who did not engage in the behavior during one or both periods, in predicting improvement in alcohol or drug problems between the two periods. For example, analyses using the composite “service” variable allowed us to compare those who did service at both timepoints, to those who did not do service during one or both intervals. Analyses with the composite “sponsor” variable were done similarly.

Importantly, this approach allows analysis of AA mediators that is consistent with AA’s notion that continued sobriety requires *maintenance* of 12-step practices (Alcoholics Anonymous, 1939). However, we note that this conflicts somewhat with classic mediation analysis in which the mediators may not overlap with the outcome. Considering the high face validity of this approach, in our analysis of having a sponsor and doing service, we therefore consider not only whether individuals had a sponsor or did service at 6 months, but also whether they reported doing so at both follow-ups (vs. did not). This temporal resolution fits better theoretically in the context of the proposed mechanisms of action between the TSF treatment, mediators such as having a sponsor, and abstinence outcomes, and may yield clearer results. In addition, following other TSF-oriented studies of mediation (Litt et al., 2009; Longabaugh et al., 1998; Walitzer et al., 2009), we also explore whether meeting attendance and overall AA/NA/CA involvement mediated MAAEZ outcomes.

2.3.2—To determine mediation, both the Baron and Kenny method (Baron and Kenny, 1986) as well as Sobel’s test (Sobel, 1982) of the indirect effect of the independent variable on the dependent variable via the mediator (MacKinnon et al., 2002) were implemented. The first requirement of mediation, as proposed by Baron and Kenny (Baron and Kenny, 1986) is a significant relationship between intervention and mediator. Thus, study condition was entered as a predictor of 12-step meeting attendance, of overall AA involvement, of having a sponsor, and of doing service, controlling for potential confounders identified in the parent study (marital status, length of stay, and treatment program type). These tests used linear and logistic regressions.

The next Baron and Kenny requirement is that the mediator is significantly associated with the outcome. Here, the potential mediators were each entered in separate logistic regressions predicting 12-month abstinence, controlling for the same covariates. The final Baron and Kenny criterion requires showing that the magnitude of the treatment effect decreases when controlling for the mediator. Thus we calculated the percent reduction in the MAAEZ odds ratio (OR) when the mediator was included versus when it was not included in the model. Specifically, the MAAEZ OR with the mediator in the model was subtracted from the MAAEZ OR when the mediator was not in the model. This difference was divided by the MAAEZ OR without the mediator in the model. This yielded the proportion of the MAAEZ effect explained by a given mediator. This approach has been used in our prior work (Bond et al., 2003; Kaskutas et al., 2002) and discussed in the epidemiologic literature (Hafeman, 2009).

To determine whether the same mediators were at work in the sample overall as well as in key subgroups, all mediation analyses were performed identically for the sample overall and for each subgroup. Because of concerns that small samples produce non-significant results at $p < 0.05$ despite large coefficients, Kenny has recommended that “statistical decision making” be informed by considerations of sample size (Kenny, 2009). Especially given our focus on subgroup effects, a more liberal significance level of $p < 0.10$ was applied to the Baron and Kenny criteria for studying mediation.

3. RESULTS

3.1 MAAEZ effects on mediators

The first Baron and Kenny criterion, a significant relationship between the treatment and outcome, is satisfied since MAAEZ was previously shown to predict abstinence in the sample overall (Kaskutas et al., 2009) and within subgroups (OR = 2.94, $p = 0.02$ in high prior AA/NA/CA attendance group; OR = 2.16, $p = 0.03$ in high psychiatric severity group). Although $p > 0.05$ for the MAAEZ effect in the sample overall, it was close to significance (.063), and thus given the importance of examining causal chains we decided to investigate.

The second Baron and Kenny criterion is that treatment significantly predicts the mediator (Baron and Kenny, 1986). MAAEZ condition did not predict meeting attendance or overall AA involvement in the full sample, nor among those with high prior AA/NA/CA attendance or high psychiatric severity. We thus did not further pursue those variables as potential mediators. However, in the sample overall and among those with high psychiatric severity, MAAEZ condition did significantly predict having done service at both follow-ups (vs. not, $p < 0.05$) and marginally predicted having done service at 6 months ($p < 0.10$) among those respondents. Among the high prior AA/NA/CA attendance group, MAAEZ condition also marginally predicted service at both interviews ($p < 0.10$), as well as having a sponsor at 6 months or at both interviews ($p < 0.10$). Given the null results ($p > 0.10$) for having a sponsor in the sample overall and among those with high psychiatric severity, we did not pursue sponsorship as a mediator among those respondents. Table 1 shows the proportions in each condition who reported having a sponsor or doing service.

3.2 Mediator effects on abstinence

Overall, both sponsorship and service, at either or both timepoints, predicted abstinence at 12 months ($p < 0.05$). Having done service at 6 months or at both 6 and 12 months also highly predicted abstinence ($p < 0.01$) among those with high psychiatric severity. Among those with high prior AA/NA/CA attendance, having a sponsor at 6 months, or at both follow-ups, also highly predicted abstinence ($p < 0.01$), as did having done service at both follow-ups ($p < 0.01$); having done service at 6 months marginally predicted abstinence in this group.

3.3 Mediated effects in the sample overall

Figure 1a summarizes results in the sample overall for doing service in AA. The MAAEZ effect on 12-month total abstinence was reduced by 8% when service at 6 months was considered. However, the reduction in odds ratios was higher—14%—when doing service at both 6 and at 12 months was in the model. These changes in odds ratios satisfy the final Baron and Kenny criterion of having a reduction in treatment effect when considering the mediator (Baron and Kenny, 1986). As shown in Figure 1a, the odds of abstinence for those doing service at 6 months (vs. not), and both 6 and 12 months (compared to those who did service at only one timepoint or neither) were respectively 3.38 and 7.99 (both p 's $< .01$).

Sobel's test (shown as "IE" in Figure 1a) was marginally significant at $p < .10$ for both the 6-month and composite mediators, and strongest for doing service at both 6 and 12 months ($p = .057$). As noted above, the MAAEZ effect on doing service at both 6 and 12 months was also significant ($p < .05$). Taken together, these results suggest that MAAEZ encouraged continuous service work at both the 6- and 12-month timepoints in the sample overall, which subsequently led to increased odds of abstinence.

3.4 Mediated effects in the high prior AA/NA/CA attendance subgroup

The pattern of results in terms of significance levels and magnitude of effects in the high prior AA/NA/CA attendance subgroup were similar to those obtained in the sample overall

for doing 12-step service (Figure 1b). For example, the odds of abstinence associated with doing service at both 6 and 12 months was 6.57 ($p<.01$) in the high prior AA/NA/CA attendance group, and the MAAEZ effect was reduced by 11% when doing service at both 6 and 12 months was considered.

However, results diverged from the null findings obtained in the sample overall for having a sponsor (Figure 1c) in that among those with high prior AA/NA/CA attendance, having a sponsor at 6 months was marginally predicted by MAAEZ. Having a sponsor at 6 months generated a marginally significant indirect effect of 0.081 with $p<.10$. The OR reduction in MAAEZ effect was 25% when considering having a sponsor at 6 months.

Results for having a sponsor at both follow-ups mirrored the findings for 6 months, but with a much higher odds of abstinence associated with having a sponsor at both 6 and 12 months, compared to only having a sponsor at either one timepoint or neither ($OR=16.63$; $p<.01$). This pattern of results suggests that MAAEZ may have influenced those with high prior AA/NA/CA exposure to obtain a sponsor, especially early on, and encouraged them to sustain this behavior, which subsequently increased their odds of abstinence. Sustaining the habit of doing service at both 6 and 12 months also seems to partially explain the MAAEZ effect on abstinence among those with high prior AA/NA/CA exposure.

3.5 Mediated effects in the high psychiatric severity subgroup

As was the case for having a sponsor in the sample overall, mediation by sponsorship was not pursued among those with high psychiatric severity. However, results for doing 12-step service as a mediator of the MAAEZ effect mirrored those reported above in the sample overall and among the high prior AA/NA/CA attendance subgroup, with results especially strong for doing service at both 6 and 12 months (Figure 1d). For example, the odds of abstinence associated with doing service at both timepoints in this group was 6.27 ($p<.01$), and inclusion of this variable reduced the OR for MAAEZ condition by 18%. The point estimate from Sobel's test was significant at $p<.05$. It appears that MAAEZ may have worked among those with high psychiatric severity at baseline because it led to their doing 12-step service at both 6 and 12 months.

3.6 Summary of mediation results

Table 2 summarizes the significant results. The percent reduction in MAAEZ OR's is shown for each mediator across groups. Results are consistent with the MAAEZ effect in the high prior AA/NA/CA attendance group being mediated by their having done service and had a sponsor. For the sample overall and for those with high psychiatric severity, doing service was key.

4. DISCUSSION

4.1 Moderated mediation

MAAEZ, a manualized, twelve-step facilitation intervention, appears to increase the odds of abstinence in part by connecting participants with 12-step members or by enhancing involvement with the 12-step fellowship. Results from both the lagged and composite mediation models suggest that MAAEZ affected the 12-step behaviors it was designed to target. This is especially important, since these behaviors strongly predicted increased odds of abstinence 12 months post-baseline. Yet while MAAEZ seems to work through both sponsorship and service, MAAEZ appears to improve abstinence outcomes via different mechanisms for different subgroups. Doing service seems helpful in general, and for both client subgroups, when sustained at both follow-up intervals, whereas having a sponsor at

both 6 and 12 months seems to mediate the MAAEZ effect among those with high prior AA/NA/CA exposure.

The fact that different mediators appear to be operating in different subgroups implies “moderated mediation,” a phenomenon describing situations in which the mechanisms of action differ according to a moderating factor (Muller et al., 2005; Preacher et al., 2007). Because subgroups represent individual differences, or moderating variables, and because distinct mediators emerge as significant across subgroups, the mediating process differs for people characterized by high prior AA/NA/CA attendance and high psychiatric severity. The results suggest particular client groups need different kinds of help engaging in 12-step groups.

The differences across subgroups have several implications for how treatment providers can help to optimize particular clients’ 12-step involvement. First among the sample overall, the lagged analysis suggests that MAAEZ participants did service at 6 months somewhat more often than those in usual care, and that doing service subsequently increased odds of 12-month abstinence. Overall those in MAAEZ appear to have recognized the importance of being involved in AA/NA/CA and giving back to the 12-step community. This involvement that MAAEZ participants gained over their non-MAAEZ counterparts ultimately benefited MAAEZ participants, as reflected by the significantly higher odds of abstinence among those who had done service at 6 months in the sample overall.

Next, among those with high prior AA/NA/CA attendance, having a sponsor and doing service, at 6 months or at both 6 and 12 months, seems to partially explain the MAAEZ effects on 12-month abstinence. While the service finding coincides with the overall sample’s mechanisms, the result for having a sponsor, albeit marginal, is unique to this group. Although the marginal result requires cautious interpretation and awaits replication, we believe the finding should be helpful to providers now, who each day see many clients frustrated with prior failure in 12-step groups. Because sponsorship appears to be a mediator unique to the high prior AA/NA/CA attendance group, this specific support and guidance in the 12-step program could be most crucial for this subgroup. Perhaps those who had attended many AA/NA/CA meetings before participating in MAAEZ lacked some insight regarding how to best use the 12-step fellowships, preventing them from connecting with members. Or perhaps they had been frustrated or alienated in their earlier attempts to speak with 12-step members. Because MAAEZ includes homework assignments like asking for a temporary sponsor, role-playing exercise like practicing how to deal with rejection from potential sponsors, and ideas about how to have fun without drinking, MAAEZ most likely offered those in the high prior AA/NA/CA attendance group novel tools for reinforcing their social networks and support systems. Given the large population represented by treatment clients with high levels of prior AA/NA/CA exposure, research that explains how higher rates of abstinence can be obtained is of high significance. In this population, doing service explained about 5–11% of the MAAEZ effect on 12-month abstinence, and having a sponsor explained about 22–25%. Although there is no published standard for a typical percentage of mediation (i.e., percent effect explained by mediator) in the substance abuse treatment field, previous studies of TSF and AA mediation have reported 2–26% reductions in main effects when accounting for mediators such as network support for abstinence (Bond et al., 2003; Kelly et al., 2010; Timko and Debenedetti, 2007).

Finally, for those with high psychiatric severity, doing service at both 6 and 12 months appeared to significantly mediate MAAEZ’s effects on 12-month abstinence. These results indicate that involvement with the 12-step fellowship through doing service could be especially important for this group. Some of those with high psychiatric severity may be socially anxious, depressed, narcissistic, or have other psychiatric problems that prevent

them from participating well in group settings or with strangers. Doing service may help such individuals become more comfortable with the fellowship in order to benefit from AA, while those with high prior AA/NA/CA attendance would already be comfortable with the group and benefit more from having a specific person from whom they can get help and support (i.e., a sponsor). Further speculating, doing service might also provide relief from a singular concern with one's severe emotional problems, perhaps briefly at first and more powerfully when service behaviors are sustained. Other TSF interventions have not been especially effective among those with high psychiatric severity, perhaps because they did not emphasize service, or did so in a way that seemed too difficult for such individuals to actually try. Simple examples of service activities were offered in MAAEZ, and most sessions stressed the many benefits of doing service.

High prior AA/NA/CA attendance and high psychiatric severity are but two of many patient characteristics that most likely affect both treatment and 12-step mechanisms of action. Although marginal, the Baron and Kenny test as well as Sobel's test yielded consistent results for service in the sample overall and for service and sponsorship for those with high prior AA/NA/CA attendance; among those with high psychiatric severity, doing service at both follow-ups was significant at $p < 0.05$. Therefore we believe that our findings contribute to the nascent understanding of these distinct mechanisms, building upon the underlying Project MATCH theory that certain subgroups require achieving particular aspects of treatment or 12-step groups (e.g., attending meetings or obtaining a sponsor) in order to remain abstinent. Although MAAEZ did not provide specialized treatment relative to baseline patient characteristics (e.g., high psychiatric severity), it follows that mechanisms of action would differ by patient characteristics.

4.2 Lagged vs. composite mediators analyses

The causal chain from treatment condition to mediator to abstinence relies on proper temporality; the mediator must precede the outcome for the causal chain to exist. However, behavior change, especially modification of addictive behaviors, requires sustained effort. Analyzing composite mediators that encompass both 6- and 12-month mediator values may be crucial to fully understanding how interventions work to help participants retain new habits. Therefore, including more proximal mediators in the mediator construct may be more meaningful than examining more distal variables, such as assessing only 6-month mediators to explain effects at 12 months. Our results support this theory, as the indirect effects of the mediating variables measured at 6 months were consistently weaker than the indirect effects of those same variables consisting of both 6- and 12-month measurements.

4.3 Limitations

Only one result (having done service at both 6 and 12 months for those with high psychiatric severity) was statistically significant at the conventional level, and the composite, "unlagged" nature of this variable precludes establishing "mediation" per se. However, we believe that our findings indicate important variables for intervention nonetheless, especially for the hard-to-treat and highly represented subgroups, those with high psychiatric severity and those with high prior AA/NA/CA attendance. Specifically, the importance of sponsorship and service in predicting abstinence should be conveyed, as treatment providers can easily apply this information and encourage, for example, patients with high psychiatric severity to engage in service.

As noted in the Methods section, 12-month interviews were completed with only 65% of the long-term residential participants, who tended to be less educated and drug-dependent only. While this may limit generalizability, significant MAAEZ effects were found in these subgroups (Kaskutas et al., 2009), mitigating this concern somewhat, since MAAEZ appears

to have benefited the less educated and the drug-dependent individuals whom we were able to follow. Furthermore, although those who were lost may have more likely relapsed compared to those who were followed, attrition was equivalent between MAAEZ conditions. Therefore greater dropout of groups potentially prone to relapse should not affect MAAEZ effects or mediators.

Ideally, potential mediators would be measured at a 9- or 11-month follow-up, if not daily up until final outcome measurement, as to capture behaviors more temporally proximal to outcomes. Furthermore, assessment of multiple mediation, while simultaneously including both continuous and dichotomous variables, would be ideal. However, the current multiple mediation software cannot compute indirect effects for dichotomous mediators. Future work could also include cross-lagged panel analysis, one method that can estimate effects of mediators measured concurrently as outcomes.

Type 1 error may be a problem because of multiple testing. However, because these are exploratory tests regarding a new intervention, and because our samples are small, we chose to be liberal and therefore did not perform Bonferroni corrections. Furthermore, some results (as noted in the Table and Figures) were marginally significant. We acknowledge the fact that the multiple testing and marginal results limit confidence in our study, and therefore urge replication of our findings.

4.4 Conclusion

This paper offers some insight into why MAAEZ was effective in increasing odds of 12-month abstinence by elucidating causal mechanisms. The mechanisms of action for MAAEZ appear consistent with the theories under which MAAEZ was developed. Ultimately results show that 12-step activities emphasized in MAAEZ mediated its effects in the sample overall and within subgroups widely represented in treatment: those with high prior AA/NA/CA attendance and those with high psychological severity.

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Figure 1.

Figure 1a. Mediation of MAAEZ effect by service: sample overall

Figure 1b. Mediation of MAAEZ effect by service: high prior AA/NA/CA attendance group

Figure 1c. Mediation of MAAEZ effect by sponsorship: high prior AA/NA/CA attendance group

Figure 1d. Mediation of MAAEZ effect by service: high psychiatric severity group

Table 1

Percentages reporting having a sponsor and doing service at each timepoint, by condition, for sample overall and for subgroups

	6 months		12 months		6 & 12 months	
	Have sponsor	Did service	Have sponsor	Did service	Have sponsor	Did service
Sample Overall	66.5	59.7	59.1	59.4	52.7	46.2
ON	67.6	62.9	58.8	62.7	53.7	50.2
OFF	64.6	54.7 ^{†a}	59.6	54.3 [†]	51.2	39.8 [*]
High Prior AA Attendance	77.5	72.4	73.5	73.5	65.6	61.2
ON	82.4	76.9	75.0	79.5	72.4	68.4
OFF	70.0 [†]	65.6 [†]	71.4	65.1 [*]	55.8 [*]	50.9 [*]
High Psychiatric Severity	66.0	60.1	58.0	56.4	52.5	45.6
ON	68.4	65.3	62.1	62.1	58.0	54.3
OFF	63.3	54.4 [†]	53.8	50.5 [†]	46.8	36.7 [*]

^a p-values regard comparisons between ON and OFF conditions

[†] p<0.10

^{*} p<0.05

^{**} p<0.01

Table 2

Summary of mediation analyses: % reduction in MAAEZ OR

<i>Mediator</i>	SAMPLE OVERALL	HIGH AA	HIGH PSYCH
Service _{6 months}	8%	ns	12%
Service _{both 6 & 12 months}	14%	11%	18%
Sponsor _{6months}	ns ^a	25%	ns
Sponsor _{both 6 & 12 months}	ns	23%	ns

^a Mediator not significant in this group, preliminary results preclude calculation of % reduction in MAAEZ OR