Commentary

WHY AND HOW DO SUBSTANCE ABUSE TREATMENTS WORK? INVESTIGATING MEDIATED CHANGE

Litt and colleagues [1] are to be commended for addressing the most important, and often ignored, question for substance abuse treatment researchers: why or how does a particular treatment work? The authors demonstrated that self-efficacy and coping were significant predictors of abstinence following a motivation enhancement/ cognitive-behavioral treatment (MET/CBT), contingency management (ContM), or combined treatment (MET/ CBT + ContM). From a cognitive-behavioral perspective this mechanism of change is not too surprising for the CBT conditions [2], but it is quite surprising for these changes to be observed following ContM. The authors hypothesized that mastery experiences with abstinence while contingencies were in place may have increased self-efficacy for abstinence. This is an exciting hypothesis worthy of further study.

In addition, the results suggested that an increase in self-efficacy during treatment was significantly related to increases in coping and subsequent abstinence, but only when the correlation between coping and readiness to change was included in the model. Importantly, readiness to change was not directly related to long-term abstinence. The authors do not speculate much on this finding, but we feel it is a critical clue on additional potential mechanisms, specifically a moderated mediation process. The moderated mediation model is the case when the mediating process of some outcome regressed on some predictor varies by the level of some moderating variable [3]. Litt and colleagues provide evidence that self-efficacy (predictor) is directly related to abstinence (outcome) and this effect is partially mediated by coping (mediator), but only when readiness to change (moderator) is included. Clinically, it implies that coping only mediates the relationship between self-efficacy and outcomes when an individual's readiness to change increases as a function of treatment. If an individual does not report increases in readiness to change and coping no longer mediates the relationship between self-efficacy and outcomes, then what are the mechanisms of change? It would be interesting to conduct a formal examination of these alternative change mechanisms.

As described above, Litt and colleagues [1] have provided an excellent example of how mechanism research can be conducted. However, did the authors meet basic requirements for the successful demonstration of a mechanism of change? The conditions necessary to infer some causal mechanism of behavior change [4] will be enumerated within the context of evaluating the methods applied by Litt and colleagues.

- (i) Strong associations between the interventions, selfefficacy, coping, and long term abstinence rates were demonstrated, thus a basic criteria for mechanism research was met.
- (ii) Specificity, the demonstration that other constructs do not account for change in the outcome, was only partially demonstrated by ruling out readiness to change as a direct mechanism of change. Given the multitude of potential mechanisms it is clearly not the responsibility of a single study to evaluate all plausible constructs, however future work in this area that builds on the findings of Litt et al [1] needs to be conducted.
- (iii) Gradient, the demonstration of a dose-response relationship, was also shown. Specifically, MET/CBT predicted change in self-efficacy, but not a change in coping; whereas MET/CBT+ContM was significantly related to both changes in self-efficacy and changes in coping. Thus, adding a larger dose of treatment predicted larger changes in the change mechanisms.
- (iv) Experimental studies must be conducted to demonstrate that the manipulation of a causal mechanism is associated with change in the outcome of interest. One may argue that the MET/CBT treatment targeted self-efficacy and coping, thus these constructs were manipulated via random assignment to treatment; but the lack of a no treatment control group greatly limits this interpretation. Furthermore, if a treatment specifically targets coping without any focus on self-efficacy, will the same relationships exist?
- (v) The *temporal relation* between the proposed change mechanism and outcome must be established, meaning the changes in self-efficacy and coping must precede the change in abstinence status. This criterion is only weakly demonstrated by having pre- and post-treatment measurements. To fully examine the temporal relations it would be important to assess self-efficacy, coping and marijuana use during treatment. This is especially the case with self-efficacy, which has been shown to be dynamically related to substance use behavior [5, 6], and coping skills, which are often situation dependent. In general, designing studies with repeated measurement of hypothesized change mechanisms during treatment is critical to the evaluation of mechanisms of change [7].

- (vi) Consistency, the replication of the observed change mechanisms across studies or samples, could not be independently established by Litt and colleagues [1]. The next step would be for an independent investigator to replicate the observed mechanism of change in a new sample.
- (vii) *Plausibility and coherence* of the proposed mechanism by clearly articulating a credible explanation for the findings was provided, however future research could be conducted to link these findings with other potential change mechanisms.

Litt and colleagues [1] broke the mould by recognizing that solely studying the main effects of treatment will not progress our understanding of addiction or how to improve our treatments. To truly dismantle treatments, addiction researchers need to also evaluate whether adding specific components incrementally improves efficacy by incrementally changing the proposed mechanisms of change. Moreover, determining who wins the horse race is simply not useful for 21st century addiction science, even when there is grant money riding on that horse. It is important to accept and embrace the fact that even a gold standard treatment might be effective for some, but ineffective or even harmful for others. To further this science we need to gain a much broader understanding of why a particular treatment is effective and for whom.

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