

# WHAT MECHANISMS OF BEHAVIOR CHANGE (MOBC) ARE READY FOR DISSEMINATION & IMPLEMENTATION (D/I)?

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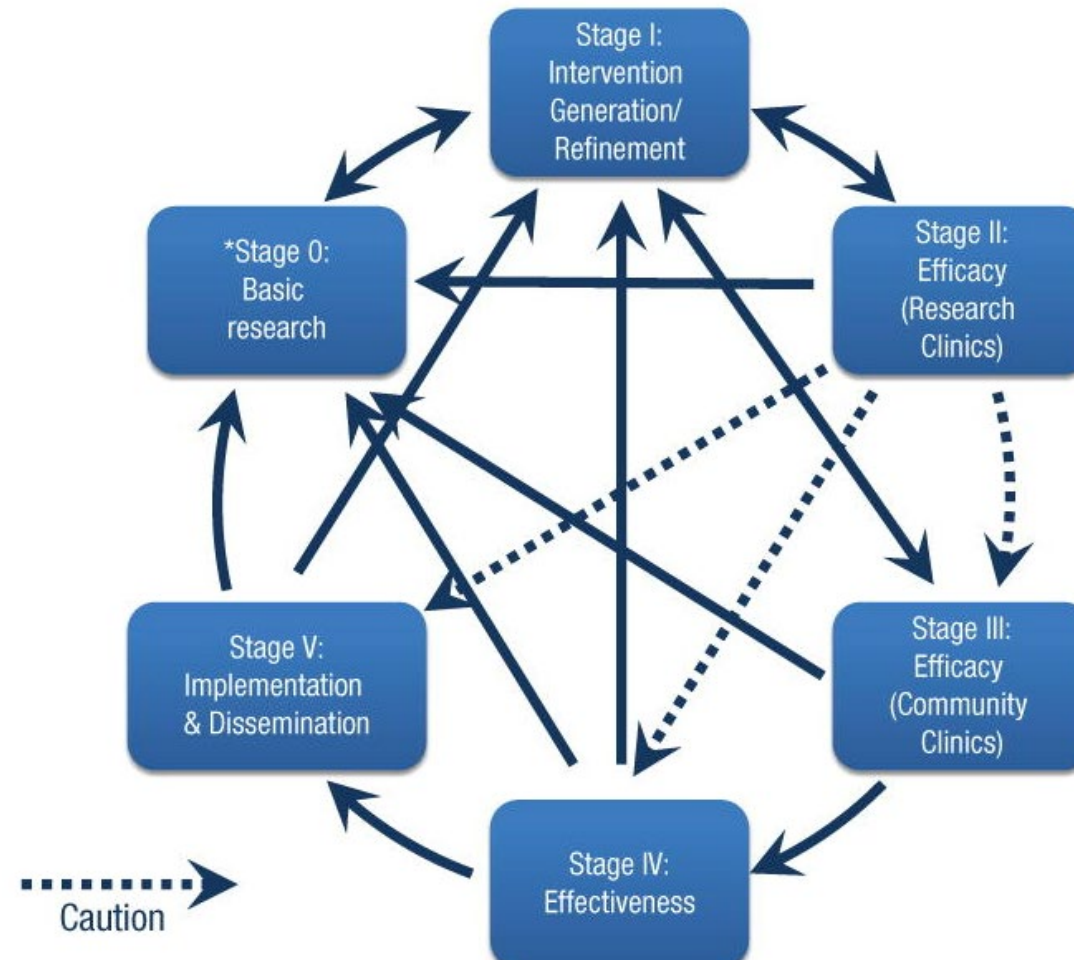
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# OVERVIEW

- ▶ Onken et al. (2014) NIH model of the development of behavioral interventions model
- ▶ Definitions of mediator & mechanism
- ▶ The successful search to find mediators of SUDs treatment effects
- ▶ What to do with all the mediators of SUDs treatment effects that have been identified?
- ▶ From mediators to mechanisms and the implementation of interventions hypothesized to change them
  - ▶ Overall note about this presentation re Adolescents (Black & Chung, 2014; Meisel, Magill, et al., 2022)

# ONKEN ET AL. (2014)

Fig. 1. NIH stage model: common and cautionary pathways. Note: Dotted arrow indicates the importance of using caution when considering this pathway.



# WHAT PROVIDES “EVIDENCE” THAT A VARIABLE IS A MOBC?

- ▶ Evidence of mediation
- ▶ Evidence of mechanism
- ▶ “Mediation is to mechanism what correlation is to cause” (Tryon, 2018, p. 626)

# ANSWER TO WHAT MOBC ARE READY FOR IMPLEMENTATION?: WHAT HAS SUFFICIENT EMPIRICAL SUPPORT

- ▶ “Mechanisms of change in psychotherapy: Advances, break throughs, and cutting-edge research (doesn’t yet exist)” (Kazdin, 2006, chapter title)
- ▶ Are there candidates for MOBC to be found in findings of studies of mediation of treatment effects?

# CAREY ET AL. (2019) SYNTHESIS OF THE LITERATURE ON “BEHAVIOR CHANGE TECHNIQUES” AND THEIR PURPORTED MECHANISMS OF ACTION



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- ▶ Identified published articles reporting development or evaluation of BCTs in which authors described links between BCTs and MoAs
- ▶ List of 26 general MoAs: 14 domains from the “theoretical domains framework,” and 12 of the most frequently hypothesized MoA constructs from a set of 83 theories of behavior change
- ▶ Articles identified through literature searches, requests to experts in health psychology, and reference lists of systematic reviews
- ▶ Articles published 1982-2016
- ▶ Results: Most frequently linked MoAs: “Beliefs about capabilities” & “Intention”
- ▶ Results not necessarily from an empirical study (of mediation), and if they were, not contingent on quality or integrity of research design

# MAISTO & MOSKAL: METHOD

- ▶ Conducted review of systematic and narrative reviews
- ▶ Searched PsycINFO, PubMed, and Google Scholar databases from 2008-2022 using terms referencing alcohol/substance use, mechanisms/mediators, treatment, and review; occurred in two phases: searched 2008-2018 in 2019; searched 2019-2022 in 2022
- ▶ Example search parameters from PsycINFO:
  - ▶ ( "alcohol" OR "drinking" OR "substance use" OR "substance abuse" OR "drug use" OR "drug abuse" ) AND ( treatment OR intervention OR therapy OR pharmacotherapy OR program ) AND ( "mechanism of action" OR "mechanism of behavior change" OR "mechanism of change" OR "mechanism" OR "mediator" OR "mediat\*" OR active ingredient) AND ( "review of literature" OR "literature review" OR "meta-analysis" OR "systematic review" OR "narrative review" )
- ▶ Eligibility criteria: (1) systematic or non-systematic review paper (2) on one or more specific SUD treatment approach(es), that (3) included information about empirically tested mechanisms (i.e., referenced findings from empirical test of true mediation effect), and (4) was tested in adult sample

# RESULTS: N=4 Systematic Reviews

Review Study	Treatment	Empirical support for Mechanisms Reviewed <sup>1</sup>		Findings
				
Kelly et al., 2009	AA	-	<ul style="list-style-type: none"> <li>• <b>Common processes (e.g., self-efficacy, commitment to abstain)</b></li> <li>• <b>AA-specific practices (e.g., 12-step behaviors/cognitions, abstinence goal)</b></li> <li>• <b>Social &amp; spiritual processes (e.g., social support, locus of control)</b></li> </ul>	<ul style="list-style-type: none"> <li>• N = 13 completed full mediational tests; N = 6 completed partial tests.</li> <li>• “Results suggest AA helps individuals recover through common process mechanisms associated with enhancing self-efficacy, coping skills, and motivation, and by facilitating adaptive social network changes. Little research or support was found for AA’s specific practices or spiritual mechanisms.”</li> </ul>
Fazzino et al., 2019	Behavioral economic (BE)	-	<ul style="list-style-type: none"> <li>• <b>Self-regulation</b></li> <li>• <b>Protective behavioral strategies</b></li> </ul>	<ul style="list-style-type: none"> <li>• N = 12 studies; 2 conducted formal test of mediation between condition and outcome.</li> <li>• “Self-regulation at 1 month follow up significantly mediated the association between condition and alcohol related problems at 6 months follow up.”</li> <li>• “Protective behavioral strategies significantly, partially mediated the relationship between BE treatment condition and alcohol-related problems at 1 month follow up.”</li> </ul>
Magill et al., 2020	CBT	• Self-efficacy <sup>2</sup>	<ul style="list-style-type: none"> <li>• <b>Coping skills</b></li> <li>• <b>Craving</b></li> </ul>	<ul style="list-style-type: none"> <li>• N=15 studies, primarily between-condition analyses.</li> <li>• “Among the mediator candidates, support for changes in coping skills was strongest, although the specificity of this process to CBT or CBT-based treatment remains unclear.”</li> </ul>
Manhapra et al., 2019 <sup>3</sup>	Pharmacotherapy	<ul style="list-style-type: none"> <li>• Genotype</li> <li>• Craving</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Self-efficacy</b></li> </ul>	<ul style="list-style-type: none"> <li>• Focus of the review was not mediation, but included the following:</li> <li>• “Genotype (CC) moderated the effects of topiramate on craving, positive alcohol expectancies, and self-efficacy, but only changes in self-efficacy mediated treatment response.”</li> </ul>

Note. AA = Alcoholics Anonymous. CBT = cognitive behavioral therapy. MI = motivational interviewing.

<sup>1</sup>Empirical support constitutes any reference to true statistical test of mediation; left: no significant mediation reported; right/boldface text: ≥1 significant mediation reported.

<sup>2</sup>Self-efficacy was a significant mediator in within-, but not between-condition analyses.

<sup>3</sup>Paper presented in narrative format but systematic search was conducted.



# RESULTS: N=5 Non-Systematic Reviews

Review Study	Treatment	Empirical support for Mechanisms Reviewed <sup>1</sup>		Findings
		⊘	✔	
Kelly & Greene, 2014	AA	<ul style="list-style-type: none"> <li>• daily spiritual experiences</li> <li>• forgiveness of others</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Private religious practices</b></li> </ul>	<ul style="list-style-type: none"> <li>• “In general, positive mediational findings for spiritual/religious in explaining recovery benefit attributable to AA appear to be more strongly related to changes in behavioral “practices” rather than in changes in spiritual/religious beliefs”</li> <li>• “AA participation predicted increases in private religious practices, daily spiritual experiences, and forgiveness of others. However, only private religious practices (prayer, mediation, reading scriptures) mediated the relationship between AA and alcohol use.”</li> </ul>
Kelly, 2017	AA	<ul style="list-style-type: none"> <li>• reduced selfishness/ self-centeredness</li> <li>• reduced anger/ resentment</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Spirituality</b></li> <li>• <b>Self-efficacy</b></li> <li>• <b>Depression symptoms</b></li> <li>• <b>Positive/ negative social networks</b></li> <li>• <b>Craving</b></li> <li>• <b>Impulsivity</b></li> </ul>	<ul style="list-style-type: none"> <li>• “AA’s beneficial effects seem to be carried predominantly by social, cognitive and affective mechanisms.”</li> <li>• “... spirituality was a significant mediator of AA’s beneficial effects.”</li> </ul>
Magill et al., 2015	CBT	-	<ul style="list-style-type: none"> <li>• <b>Coping skills</b></li> <li>• <b>Self-efficacy</b></li> </ul>	<ul style="list-style-type: none"> <li>• “The acquisition of an improvement in coping skills and self-efficacy have support as mediators (and potential MOBCs) of CBT’s effect on a range of treatment outcomes.”</li> </ul>
McCrary et al., 2020 <sup>2</sup>	Female-specific CBT	-	<ul style="list-style-type: none"> <li>• <b>Coping skills</b></li> <li>• <b>Self-efficacy</b></li> <li>• <b>Autonomy</b></li> <li>• <b>Sociotropy</b></li> <li>• <b>Social support</b></li> <li>• <b>Depression symptoms</b></li> </ul>	<ul style="list-style-type: none"> <li>• “Across treatments, women changed their drinking via increased coping skills, abstinence self-efficacy, and increased autonomy. For women in female-specific CBT, change in drinking also occurred through decreases in sociotropy and increases in social support for abstinence. Surprisingly, change in depression was linked to better drinking outcomes in gender-neutral CBT.”</li> </ul>
Magill & Hallgren 2019	MI	-	<ul style="list-style-type: none"> <li>• <b>Change talk</b></li> </ul>	<ul style="list-style-type: none"> <li>• “... client change talk mediates the relationship between MI-consistent skills and client alcohol or other drug use outcomes. However, when individual paths of the technical model are considered, the story of the evidence becomes more complex.”</li> </ul>

Note. AA = Alcoholics Anonymous. CBT = cognitive behavioral therapy. MI = motivational interviewing.

<sup>1</sup>Empirical support constitutes any reference to true statistical test of mediation; left: no significant mediation reported; right/boldface text: ≥1 significant mediation reported.

<sup>2</sup>Mechanisms tested using network analysis rather than traditional mediation tests

# Number of Systematic and Non-systematic Reviews Citing Significant Mediation Effect by SUD Treatment Mechanisms

10



†One review cited only non-significant mediation effect

¥One review cited significant mediation effect within- but not between-conditions

Additional mediators were noted in one review but cited only as non-significant mediation effect:

- Genotype
- Reduced selfishness
- Reduced anger
- Forgiveness

## Several additional ineligible reviews reference mechanisms of behavior change without explicit mediation tests

Note. CB = Cognitive behavioral, CBT = Cognitive behavioral therapy, MET = Motivational enhancement therapy  
 \*McCrary et al., 2020 also included in eligible articles (mechanisms here not statistically examined as mediators)  
 \*\* See table 1 in Witkiewitz et al., 2022 for full list of mechanisms of behavior change

Study	Review Details	Treatments	Mechanisms
Boumans et al., 2022	<ul style="list-style-type: none"> <li>61 studies (qualitative and quantitative)</li> <li>Conducted in Western high-income countries, published after 2000, with adult outpatients that focused on interventions for outpatients to prevent or reduce (problematic) alcohol consumption and that mentioned effective elements</li> </ul>	<ul style="list-style-type: none"> <li>Range of interventions (e.g., CBT, 12-step facilitation, MET, personalized feedback, alcohol behavioral couple therapy); focus is on intervention elements rather than specific intervention types</li> </ul>	<p>Several mechanisms (without explicit reference to statistical tests of mediation) are noted, e.g.,:</p> <ul style="list-style-type: none"> <li>therapeutic alliance</li> <li>decreased attention to drinking</li> <li>improved partner relationship quality</li> <li>decreased exposure to alcohol cues</li> </ul>
McCrary et al., 2020*	<ul style="list-style-type: none"> <li>Narrative review</li> <li>Describe barriers to treatment entry, unique characteristics, and current knowledge about effective treatments in women with AUD</li> </ul>	<ul style="list-style-type: none"> <li>Women's Recovery Group (CB and relapse prevention elements)</li> <li>Female-specific CBT</li> </ul>	<p>"Research on mechanisms of change has suggested the importance of targeting":</p> <ul style="list-style-type: none"> <li>anxiety and depression</li> <li>affiliative statements in treatment</li> <li>abstinence self-efficacy</li> <li>coping skills</li> <li>autonomy</li> <li>social support for abstinence</li> </ul>
Witkiewitz, 2022**	<ul style="list-style-type: none"> <li>Narrative review</li> <li>Review scientific literature that examined how individuals make changes to substance use behavior and recover from SUD; focuses on the processes of behavior change with and without formal treatment</li> </ul>	<ul style="list-style-type: none"> <li>CBT</li> <li>Contingency management</li> <li>Motivational interviewing</li> <li>Mindfulness-based interventions</li> <li>Mutual help/12-step facilitation</li> <li>Pharmacological treatments</li> </ul>	<p>Several mechanisms discussed that are proposed/statistically examined in individual paths of mediation model, e.g.,:</p> <ul style="list-style-type: none"> <li>coping skill utilization</li> <li>change talk</li> <li>sustain talk</li> <li>craving</li> <li>self-compassion</li> <li>self-regulation</li> <li>mindfulness</li> <li>spirituality</li> </ul>

# CONCLUSIONS FROM THE REVIEWS

- ▶ Health-related behavior change researchers have been engaged in identifying M(ediators) OBC
- ▶ Same holds for MOBC of SUD treatment effects
- ▶ Little empirical support for treatment-specific mediators
- ▶ Exception: MI and proportion of change talk and motivation to change as empirically supported mediator
  - ▶ Investigated in the context of delivery of MI but has implications for delivery of all alcohol treatment
- ▶ Mediators common to several treatments (CBT, MI, AA, pharmacotherapy [topiramate], e.g.) show consistent empirical support: coping skills, social support for abstinence, and self-efficacy to manage substance use

# WHAT TO DO WITH ALL OF THE DATA ON MEDIATORS OF SUDs TREATMENT EFFECTS

- ▶ Several candidates for further exploration as possible MOBC of SUDs treatment, e.g., self-efficacy, coping skills, social support
  - ▶ A way to begin the search for empirically supported MOBC

# WHY SEARCH FOR MOBC?

- ▶ Implementation shifts attention from mediators to mechanisms of BC:
  - ▶ Because you've homed in on what drives treatment effects, you're likely to find clinically significant effects of a treatment, which in turn makes practitioners more likely to implement it
  - ▶ Advantages in treatment adaptation: You have the knowledge to implement what's essential
  - ▶ Overall, "optimizes" treatment
- ▶ Advances knowledge about treatment and behavior change

# HOW DO WE PROCEED?

- ▶ The first step is to advance theory of health behavior change in general, and SUD treatment specifically
  - ▶ MOBC are constructs, theory specifies how a set of constructs inter-relate to predict and explain phenomena and thus offers direction and structure to the search for MOBC
    - ▶ Wealth of theories of health behavior change (see Michie et al., 2014, e.g.)
    - ▶ SUD EBTs (e.g., CBT, MI/MET, TSF) do well in specifying their theoretical bases
    - ▶ Important for theories to specify links between behavior change components and MOBC
    - ▶ Important for the field to continually revise and refine its theories as empirical findings emerge
- ▶ Roles of treatment approach-specific and "common factor" theories as productive guides
  - ▶ In the health behaviors area, Carey et al., and Michie & colleagues' research program in general, are "common factors" approaches to studying MOBC that may be treatment- or non-treatment related
  - ▶ Case can be made to pursue both at this point

# USE OF HEALTH BEHAVIOR THEORY, LITERATURE SYNTHESIS, AND EXPERT CONSENSUS TO IDENTIFY MOBC: Michie et al.(2018) PROTOCOL

- ▶ Use literature synthesis and expert consensus to identify how MOBC are linked to theory-based BCTs
- ▶ Produce an online integrated matrix of “behavior change techniques” and MOBC links that note strength of links
- ▶ Designed for world-wide dissemination and implementation
- ▶ Still needs systematic research for empirical validation of matrix links



# DO RESEARCH—WHAT HAS THE SEARCH FOR TREATMENT-RELATED MOBC (Mediators) LOOKED LIKE?

- ▶ SOBC/MOBC published research dominated by clinical trials, quantitative (as opposed to qualitative) research and “efficient causes” vs. “final causes” paradigm
  - ▶ Also dominated by emphasis of theory and analysis on the individual level, as opposed to the interpersonal, group, community, or cultural level
  - ▶ Influence of moderators often neglected
- ▶ As evident from multiple sources, has not been successful in identifying true treatment-related MOBC
- ▶ Has been successful in identifying predominantly individual level mediators of treatment effects

# WHAT MIGHT A SUCCESSFUL MOBC RESEARCH PROGRAM LOOK LIKE?

- ▶ Several excellent published discussions of desirable characteristics of SUD treatment MOBC research design: Byrne et al. (2020); Kazdin (e.g., 2007, 2014); Magill et al. (2020); Witkiewitz et al. (2022)
  - ▶ Research goal is to accrue evidence that a variable is a MOBC, by the technical definition of a MOBC, as opposed to a mediator
  - ▶ Papers address some of the gaps identified earlier, e.g., going beyond the clinical trial in research design, importance of moderators, and consideration of one mechanism→multiple outcomes, multiple mechanisms→one outcome, and different outcomes may be determined by different mechanisms

# HOW MIGHT ATTENTION TO IMPLEMENTATION INFLUENCE FUTURE MOBC RESEARCH?

- ▶ Potential effect of strategy of implementing well-established mediators on advancing identification of MOBC
  - ▶ Emphasis on clinical significance
  - ▶ Onken et al. (2014) model shows Stage 5 (D&I research) results feeding back to influence Stage 0 (in our case, basic research on MOBC)
  - ▶ Use of “hybrid” research designs (e.g., Bauer et al., 2015) rather than the typical efficacy or effectiveness trial
  - ▶ Serious consideration of moderating (of intervention-related change in MOBC) variables (e.g., Alcantara et al., 2020) in research design
  - ▶ Consider how the intervention, and its implementation process, setting & context, interact (Pfadenhauer et al., 2017)
    - ▶ Context and Implementation of Complex Interventions (CICI) framework
    - ▶ Context, implementation, and setting (of intervention delivery) interact among themselves and with the intervention
    - ▶ Multiple level moderators to consider
  - ▶ Broader treatment-related behavior change models & theories that integrate implementation factors
  - ▶ No longer distinguish between “MOBC” and “IS” researchers. Both are one, one is both

# CONCLUSIONS

- ▶ “Understanding mediators and then mechanisms is not a matter of one study but is a matter of creeping up on the process that draws on a series of projects often seemingly unrelated or from different disciplines or types of research” (Kazdin, 2007, p. 11)
  - ▶ The Human Behavior Change Project’s (HBCP) BCI Knowledge System and the use of artificial intelligence and machine learning (Michie et al., 2017)
  - ▶ HBCP: What works, compared with what how well, with what exposure, with what behaviors (for how long), for whom, in what settings, and why?

THANK YOU

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# Supplemental: Non-Systematic Review Aims and Treatment Focus

Study	Treatment	Review Aims
Kelly, 2017	• AA	Literature review, summary and synthesis of studies examining AA's MOBC
Kelly, 2014	• AA	Review theory and research related to AA and spirituality as a mechanism of behavior change
Magill et al., 2015	• CBT	Review state-of-the-art research on CBT, alcohol behavior couples therapy, and 12-step facilitation
McCrary et al., 2020	• Female-specific CBT	Describe the barriers to treatment entry experienced by women with AUD, the unique characteristics and presenting concerns of women with AUD who do seek treatment, and the current knowledge about effective treatments
Magill & Hallgren 2019	• MI	Review the evidence on how MI intervention may result in client change

# Supplemental: Systematic Review Search Parameters and Treatment Focus

Study	Treatment	Search Parameters
Kelly et al., 2009	• AA	<ul style="list-style-type: none"> <li>• Studies examining mediators of AA's effect on alcohol or other drug use outcomes</li> <li>• English language published between 1990 and 2007 (inclusive)</li> </ul>
Fazzino et al., 2019	<ul style="list-style-type: none"> <li>• BE</li> <li>• BA</li> </ul>	<ul style="list-style-type: none"> <li>• Studies published through August 25, 2018 were included if they 1) tested a BA or BE intervention targeting substance use-related outcome(s), and/or 2) tested mechanisms of change in BA or BE efficacy for substance use outcome(s).</li> </ul>
Magill et al., 2020	CBT	<ul style="list-style-type: none"> <li>• Studies published in peer-reviewed journals, in English, between 1990 and 2019, examining CBT or CBT-based treatment efficacy occurring in the context of a randomized clinical trial with adults or other drug using participants where both intervention/intervention ingredient to mediator (a path) and mediator to outcome (b path) paths were reported.</li> </ul>
Manhapra et al., 2019	• Pharmacotherapy	<ul style="list-style-type: none"> <li>• Topiramate + substance use study</li> <li>• English language medical literature search</li> <li>• Published up to Sept. 2017</li> </ul>