

PROCEEDINGS ARTICLE

Treatment matching for obesity: identifying mediators of psychosocial and behavioral intervention components

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In light of the limited long-term success of obesity treatments, it is tempting to consider the elusive goal of 'treatment matching', in which characteristics of individuals are optimally matched to targeted treatments to improve success. Previous frameworks for treatment matching in obesity have primarily focused on basic physiological characteristics, such as initial degree of overweight, and on treatment intensity, such as stepped-care alternatives (self-help manuals, group support, medication and surgery). Few studies have empirically evaluated the success of these frameworks. Given recent advances in genomics, neuroscience and other fields, both the breadth of domains and combinations of individuals' characteristics that could be used for treatment matching have increased markedly. Although the obesity field seems poised to build on these advances, a crucial challenge remains regarding the treatments themselves. Ultimately, the success of treatment matching will rely on identifying treatment intervention components with well-differentiated and empirically supported mediators, that is, clear insights into how intervention components work. Here we examine the scope of this challenge specifically for the design of efficacious psychosocial and behavioral intervention components, and identify areas for future research.

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STATUS OF CURRENT RESEARCH

The large variability in weight outcomes in response to obesity treatments of all kinds, including behavioral, pharmacological and surgical interventions, is well documented.^{1,2} One approach that capitalizes on the large variability in weight outcomes is 'treatment matching', in which characteristics of individuals are optimally matched to targeted treatments to improve success.^{2,3} Although the goal is tempting, few treatment-matching frameworks exist and are limited in scope. These frameworks primarily focus on matching individuals' initial degree of overweight to stepped-care treatments (self-help manuals, group support, medication, surgery).^{1,4} Virtually, no studies have empirically tested whether treatment matching with these frameworks results in better weight outcomes.

To optimize the goal of treatment matching, attention must be paid both to characteristics and treatments. Identifying characteristics of *who* is likely to lose more weight and who is not, for given treatments, involves identifying *moderators* of treatment.^{5,6} Given recent advances in genomics, neuroscience and other fields, both the breadth of domains and combinations of characteristics that could be used for treatment matching have increased markedly,^{3,7} and now, more accurately reflects the multidimensional nature of obesity as a chronic disease. However, before identifying moderators of treatment, a crucial challenge exists—the importance of identifying treatment intervention components that have well-differentiated and empirically supported *mediators*, that is, clear insights into *how* intervention components work. Here we examine the scope of this challenge specifically for psychosocial and behavioral intervention components.

The state of empirical evidence regarding how intervention components work via the role of mediators remains limited. Most current behavioral weight management interventions are complex, time-intensive and comprise many individual compo-

nents. They are typically informed by multiple disciplines and complementary theoretical frameworks, and the simultaneous presence of the different intervention components is thought to help improve weight loss. For instance, the Diabetes Prevention Program, a large-scale behavioral intervention trial that resulted in clinically significant weight loss and a 58% reduction in diabetes incidence was comprised of seven major components, including individual case managers; frequent contact by managers; a 16-session curriculum of multiple behavioral self-management strategies, such as goal setting, problem solving and social support; supervised physical activity classes; and a 'toolbox' of adherence strategies among other components.^{8,9} However, the number and complexity of components in current behavioral weight management interventions makes it difficult to identify how intervention components work, and to determine which components may be most essential—critical issues given current health-care costs.

Calls to avoid the adoption of seemingly monolithic obesity treatment 'packages' have existed for a while¹⁰ and presaged more recent calls to 'dismantle' behavioral intervention components to identify mechanisms of action.³ Instead, treatment packages and accompanying theoretical frameworks have expanded further to include techniques regarding relapse prevention, motivational interviewing skills, self-determination and/or environmental influences. Inspired by the explosion of innovative available technology, the field has focused on conducting trials that optimize the time- and cost-efficient delivery of established treatment packages via telephone, the Internet, texting and other options (for examples, see Perri *et al.*,¹¹ Tate¹² and Harvey-Berino *et al.*¹³).

Unfortunately, despite the increased use of theoretical frameworks to inform the design of the intervention components included in obesity treatment packages, we know little about how

the different intervention components actually work. With few exceptions,¹⁴ intervention components are rarely isolated and/or tested against one another in randomized trials, and mediator analyses are considered a secondary focus, if at all. Even less is known about how the different components may work (or not work) for different subgroups of people, limiting the ability to proceed with treatment matching.

One solution is to dismantle the intervention components and determine how individual components work by systematically identifying their respective mediators. For example, in a randomized trial, extended staff contact delivered either by cost-efficient telephone or in face-to-face sessions greatly improved weight-loss maintenance at 1 year relative to education alone.¹¹ Both active interventions used a core component, a succinct interactive five-step problem-solving model. In a future trial, it would be ideal to explicitly determine the role of problem-solving skills as a mediator, that is, whether participants exposed to the model indeed improved their problem-solving skills at the end of a weight-loss intervention,¹⁵ and most importantly, whether the improvement in skills predicted subsequent maintenance compared with a relevant control condition (for details on statistical approach, see Kraemer *et al.*^{5,16}). Dismantling intervention components to identify mediators may also require the inclusion of innovative measures from other fields. For example, among participants who were recruited with three (self-selected) friends and attended a behavioral intervention program comprising both standard components and social support strategies that emphasized inter- and intra-group facilitation, 66% fully maintained their weight loss at a 10-month follow-up.¹⁷ In contrast, only 24% of the participants who were recruited alone and just attended a standard program maintained their weight loss at follow-up.¹⁷ It is interesting to note that among groups of friends who received the facilitated social support strategies, most groups did not gain weight; however, those groups that did gain weight gained more than participants in any of the other study conditions. Besides bringing to mind 'when [they were] good, [they were] very very good, and when [they were] bad, [they were] horrid', assessing innovative mediators, such as measures of group dynamics and social networks, could provide new insights about the impact of social influences on obesity.

Despite the appeal of systematically dismantling intervention components, a problem exists. As Moyer *et al.*¹⁸ underscored in their careful methodological analysis of 55 alcohol treatment trials, the intervention components themselves (and thus the proposed mediators) may not be that separate or distinct. This problem is not constrained to intervention components for obesity (and their accompanying theoretical frameworks); areas such as chronic low back pain are replete with physiotherapies that ostensibly differ, but may in fact not be that distinct.¹⁹ Rather than attempting to dismantle components that are not well differentiated, an alternative solution may be to focus on designing new intervention components specifically honed for particular mediators. For instance, in a subgroup analysis of overweight/obese women in a randomized behavioral weight management trial, we found that women who initially reported 'never' experiencing support from friends for diet and physical activity habits were most likely to be successful at losing weight during the intervention period.²⁰ Although results initially seemed counterintuitive, participants in the group-based programs may have received the support they needed from the group members, support that was lacking from established friendships, especially as session attendance remained high throughout the trial.²⁰ The standard intervention component for social support encourages participants to effectively elicit the support they need from established friendships or encourages participants to stay connected to the weight-loss group members after the intervention period via additional classes up to a year or more.²¹ Both approaches have had limited success, and no trials have evaluated whether the proposed mediator, social support for

diet and activity from friends, actually increases, and whether it differentially predicts weight outcomes compared with a relevant control group. However, new components could be developed.²⁰ As we propose in the paper,²⁰ one component could encourage participants to develop new friendships around healthy behaviors, in part, by accessing new social networks in which social support for diet or physical activity behaviors is already high, such as joining hiking or walking clubs.²⁰ Another component could encourage participants to foster greater reliance on themselves rather than on others, that is, increasing self-determination. Notably, each of the four intervention components has different proposed mediators enhancing different sources of support (old friends, group members, new friends, self). Developing well-differentiated intervention components could subsequently lead to determining which components may be better for which subgroups.

FUTURE RESEARCH

Three strategies could contribute to the design of well-differentiated intervention components and move away from monolithic packages. One strategy would be to develop components as free-standing 'nimble' modules. Not all participants may need exposure or practice with all intervention components in part, because they may already have mastered particular components, thus enhancing time- and cost-effectiveness. For instance, some individuals may already engage in regular physical activity but need to adjust dietary habits, or vice versa. Eventually, a bank of components with empirically supported mediators that address particular deficits could be available online for individuals, investigators or clinicians to combine with other needed components.

A second strategy for designing well-differentiated intervention components would be to routinely test the effect of a component on the proposed mediator in a separate sample before testing the effect of the component (and the effect of the mediator) on a health outcome in a randomized trial. This is similar to experimental manipulation checks in social psychological laboratory paradigms. It requires smaller sample sizes than the larger outcome trial, the intervention component can be honed over several iterations and study samples, and manipulation check results from the prior sample(s) could be cited as additional evidence within the larger outcome trial. (An important caution is that experimentally testing whether an intervention component affects a proposed mediator variable via a manipulation check in a separate prior sample does not demonstrate that the variable is indeed a mediator. To do that would require deciding *a priori* to examine whether the variable was a mediator of the intervention component in a larger outcome trial and explicitly testing the mediator hypothesis using a systematic statistical approach^{5,16}). Given the importance of better differentiating behavioral components and proposed mediators, it would be useful to include key variables thought not to be affected by the behavioral component and demonstrate that they do not change. A recently released National Institutes of Health program announcement (PA-11-063) takes systematic development of interventions and mediators much further. Investigators are required to start from basic behavioral and social science findings in which the mediator is already thoroughly examined and then implement well-controlled developmental studies to translate those findings into potent interventions.

A third strategy for designing well-differentiated intervention components requires the development of 'pithy' yet psychometrically strong measures of mediators. Many psychosocial and behavioral measures have focused on the value of comprehensive and detailed assessments to maximize the face and construct validity with thorough but lengthy assessments of multiple dimensions, such as the 52-item Three-Factor Eating Inventory

assessing dietary restraint, disinhibition and hunger.²² However, the recent focus on electronic health records and calls for biomarkers to be routinely included in large-scale clinical trials⁷ underscores the need for investigators in psychosocial and behavioral arenas to develop succinct psychometric strong measures so that these measures can routinely be included as well. For instance, the 14-item Perceived Stress Scale, a long established measure with excellent psychometrics across multiple behavioral arenas, has a 4-item version with adequate psychometrics.²³ In another example, a concise measure of leisure-time physical activity has recently been found to have excellent psychometrics and sensitivity to change among overweight/obese women in a behavioral weight-loss program.²⁴

SUMMARY

In summary, identifying innovative intervention components with well-differentiated and empirically supported mediators will advance our efforts toward the tantalizing goal of efficacious and cost-effective treatment matching in the future.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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