

COMMENTARY ON MACKINNON AND LUECKEN

Using mediation to identify mechanisms of change

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The MacKinnon and Luecken paper offers an excellent primer on mediation as a tool in intervention research. However, mediation has an important, additional function not addressed by MacKinnon and Luecken that merits attention. Specifically, mediation can aid in the identification of what is responsible for a successful intervention (i.e., the mechanisms of change). Too often, researchers identify a successful intervention (i.e., $X \rightarrow Y$) yet lack understanding of why it works (M is unknown). The lack of understanding may be due to failure to think through the theoretical link between the intervention and the outcome when designing the study, or because the intervention manipulated several variables simultaneously. Understanding why an intervention works is crucially important if researchers wish to apply the intervention to different settings or to different problems.

The following example illustrates the use of mediation to identify the mechanisms of change. Imagine an intervention designed to increase flossing. Patients assigned randomly to the intervention condition hear a 5-minute speech from a hygienist on the harms of failing to floss, watch a brief video on how to floss, and receive a professional brochure describing the benefits of flossing. Patients in the control condition received none of these. A telephone survey conducted 1 month later reveals more frequent flossing in the intervention condition than in the control condition. The intervention appears successful, but why? This question is not academic. The brochure and video cost money to produce, and training the hygienist what to say takes time and effort. Do all three components of the intervention contribute to the increased flossing, or is one component entirely responsible for the group differences in reported flossing?

The researcher can identify the mechanism responsible for the change in flossing (i.e., the mediator) by asking several

questions during the telephone survey. The questions might include numeric ratings of a) patient perceptions of the harm of failing to flossing (assessing the effect of the hygienist's speech); b) patient knowledge of how to floss (assessing the utility of the video); and c) patient reports of the benefits of flossing (assessing the effect of the brochure). The responses to any given question can be entered into a regression model to test for mediation. The researcher might also ask questions that assess how important patients view flossing and how much patients value the advice of the hygienist. Now, imagine that analysis reveals that the harm ratings predict flossing frequency, but the knowledge ratings and the benefits ratings do not. Furthermore, MacKinnon and Luecken's equation 3 reveals that harm ratings partially mediate the effect of the intervention on flossing. Collectively, these findings would suggest that the hygienist's speech was partially responsible for the change in flossing and that the video and brochure may be unnecessary or ineffective.

Of course, the underlying mechanism may be more nuanced, as illustrated by two possible permutations. First, responses to the importance ratings may reveal that patients rate flossing as more important in the intervention condition than in the control condition, and that importance ratings completely mediate the relationship between the intervention and flossing. Such a finding would suggest that the specific content of the hygienist's speech is less important than is the hygienist conveying the message that flossing is important. Second, the harm ratings may mediate the relationship between the intervention and the outcome only among patients who report that they value the advice of the hygienist, suggesting a case of moderated mediation [(1), Chapter 10].

These permutations illustrate the complexities that can arise from exploring mediation. However, the more important take-home point of the example and its possible permutations is to show how mediation analysis can be a powerful tool for exploring the numerous paths by which an intervention eventuates in an outcome.

Conflict of interest

The author declares no conflict of interest.

Reference

1. MacKinnon DP. *Introduction to statistical mediation analysis*. Mahwah, NJ: Lawrence Erlbaum Associates; 2008.

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