Problems with detecting assumed mediation using the hierarchical multiple regression strategy ☆

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ABSTRACT

In human resource management (HRM) and allied fields (e.g., organizational behavior, management, and industrial and organizational psychology), tests of mediation are frequently conducted using the hierarchical multiple regression (HMR) strategy of Baron and Kenny [Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173–1182]. Although previous research has identified a number of serious problems with this approach, the present study adds to the literature by identifying yet additional problems with its use in inferring the existence of mediation. Using a statistical simulation, we found that certain patterns of correlation coefficients guarantee inferences about mediation, whereas other patterns preclude such inferences. On the basis of various analyses including logistic regression and inspection of three-dimensional plots, we identified patterns of correlation coefficients needed to satisfy Baron and Kenny's [Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173–1182] conditions for inferring mediation. The same patterns have no necessary relation to actual causal connections among variables in mediation models. Moreover, as a consequence of the failure of the HMR strategy to detect mediating effects, many instances of actual mediation in HRM and allied fields may have gone undetected. In view of the foregoing, we conclude that the HMR strategy should no longer be used in testing for mediation.

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Theoretical models that involve mediation are very common in human resource management (HRM) and such allied fields as organizational behavior, and industrial and organizational psychology (see, for example, Cascio, 2006; Cascio & Aguinis, 2005; Gatewood & Feild, 2001; Noe, Hollenbeck, Gerhart, & Wright, 2008). Among the many examples of this are (a) the impact of training on worker performance is mediated by worker ability, (b) the relation between job task specifications and the development of selection procedures is mediated by the identification of job-relevant knowledge, skills, and abilities, and (c) the impact of compensation practices on worker performance is mediated by worker motivation. The understanding of such mediating effects is vital to both the development of sound theory and the improvement of practice in HRM and related fields because it provides knowledge about the mechanisms underlying relations between independent variables and dependent variables.

In the following sections, we define mediation and comment on its ubiquity in HRM and related fields. Next, we focus our attention on a commonly used procedure described by Baron and Kenny (1986) to infer mediation. In particular, we identify additional problems with the same procedure which are unique from those discussed in previous studies (see e.g., MacKinnon,

Lockwood, Hoffman, West, & Sheets, 2002; Stone-Romero & Rosopa, 2004). Finally, we describe the results of a simulation to bolster our arguments.

1. Assumed versus actual mediation

Mediation exists when the influence of an independent variable (*X*) on a dependent variable (*Y*) is transmitted through a mediator (*M*) (Stone-Romero & Rosopa, 2004, 2006, 2008). Fig. 1 shows two possible mediation scenarios. Actual complete mediation exists when *X* exerts only indirect effects on *Y* (Fig. 1A). Actual partial mediation exists when *X* exerts both direct and indirect effects on *Y* (Fig. 1B).

It is important to recognize at the outset that there is a critical distinction between *actual* mediation and *assumed* mediation. Actual mediation exists when the causal flow is that of either of the just described models. In contrast, assumed mediation exists when a researcher *infers* the existence of mediation from a set of covariances among measures of *X*, *M*, and *Y*, *without* having credible evidence about the true causal connections among these variables. Because a number of substantively different alternative models may fit an observed set of covariances (MacCallum, Wegener, Uchino, & Fabrigar, 1993; McDonald, 1999; Stelzl, 1986), assumed as opposed to actual mediation is all that can be inferred when a study's data are from nonexperimental research (Stone-Romero & Rosopa, 2004, 2006, 2008).

Noteworthy, there may exist situations when ethical or logistical issues would preclude the use of an experimental design to test a mediation hypothesis (Mathieu & Taylor, 2006). Although quasi-experimental and nonexperimental designs may be used in such instances (Stone-Romero & Rosopa, 2008), it is important that researchers remain guarded in the interpretations of their study and refrain from using inappropriate causal language (Stone-Romero & Gallaher, 2006; Stone-Romero & Rosopa, 2008). Mathieu and Taylor (2006) argue that "inferences of mediation are founded first and foremost in terms of theory, research design, and the construct validity of measures employed" (p. 1032). With respect to research design, various researchers have stressed that mediation inferences are strongest when based on experimental designs (Mathieu & Taylor, 2006; Spencer, Zanna, & Fong, 2005; Stone-Romero & Rosopa, 2004, 2006, 2008).

In view of the importance of mediation in HRM and allied disciplines, tests of mediation models are widespread in empirical research. In addition, although large proportions of such tests rely on data from studies that use nonexperimental designs, inferences about causal connections between assumed independent, mediator, and dependent variables are quite common. For example, in a review of 25 years of research involving tests of mediation published in the *Journal of Applied Psychology*, *Organizational Behavior and Human Decision Processes*, *Academy of Management Journal*, *Personnel Psychology*, and *Administrative Science Quarterly*, Wood, Goodman, Beckman, and Cook (2008, p. 289) stated that "claims of causality were made or implied for 471 (66%) of all mediation models tested. Just over half of these claims of causality (52% or 247 claims) were for models tested in nonexperimental designs, including 233 models in which measures of the independent, mediator, and dependent variables were all collected at the same time. For 9 studies (15 models), the order of measurement was different from the proposed causal order (e.g., *Y* was measured before *M*)" (Wood et al., 2008, p. 289). Examples of such mediation inferences include: (a) intensity of
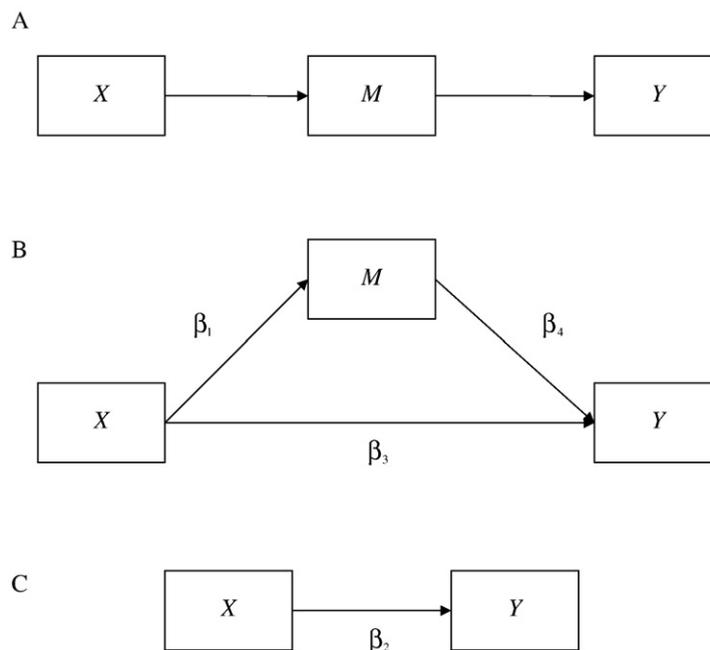

Fig. 1. An independent variable (*X*), mediator variable (*M*), and dependent variable (*Y*) in (A) complete and (B) partial mediation models. (C) Total effect of *X* on *Y*.