

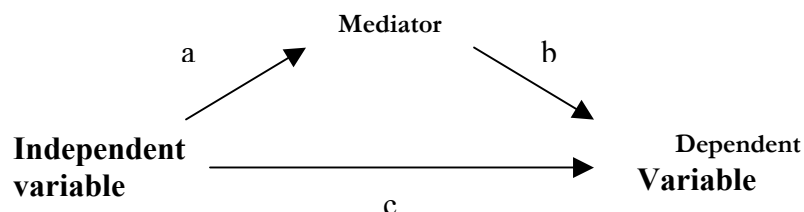
15.13 MEDIATING AND MODERATING RELATIONSHIPS

One of the most frequently cited papers in the psychological literature related to multiple regression in the past 15 years has been a paper by Baron and Kenny (1986) on what they called the moderator-mediator distinction. The important point for both moderating and mediating relationships is that a third variable plays an important role in governing the relationship between two other variables.

MEDIATION

A **mediating relationship** is what it sounds like—some variable mediates the relationship between two other variables. For example, take a situation in which high levels of care from your parents leads to feelings of competence and self-esteem on your part, which, in turn, leads to high confidence when you become a mother. Here we would say that your feelings of competence and self-esteem *mediate* the relationship between how you were parented and how you feel about mothering your own children.

Baron and Kenny (1986) laid out several requirements that must be met before we can speak of a mediating relationship. Consider the diagram below as being representative of a mediating relationship that we want to explain.

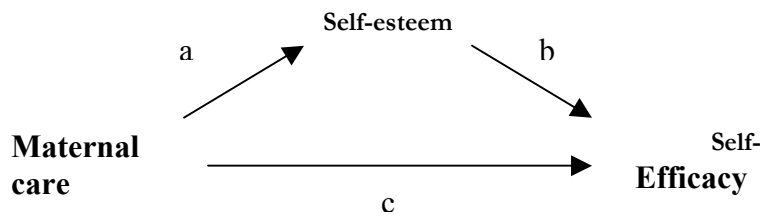


The predominant relationship that we want to explain is labeled “ c ”, and is the path from the independent to the dependent variable. The mediating path has two parts, comprised of “ a ,” the path connecting the independent variable to the potential mediator, and “ b ,” the path connecting that mediator to the dependent variable.

Baron and Kenny argued that for us to claim a mediating relationship, we need to first show that there is a significant relationship between the independent variable and the mediator. (If the mediator is not associated with the independent variable, then it couldn’t mediate anything.) The next step is to show that there is a significant relationship between the mediator and the dependent variable, for reasons similar to those for the first requirement. Then we need to show that there is a significant relationship between the independent and dependent variable. The reason for this should be obvious.

These three conditions require that the three paths (a , b , and c) are all individually significant. The final step consists of demonstrating that when the mediator and the independent variable are used simultaneously to predict the dependent variable, the previously significant path between the independent and dependent variables (c) is now greatly reduced, if not nonsignificant. Maximum evidence for mediation would occur if c drops to 0. In my experience I have never seen a path go away completely. Most likely to happen is that c becomes a weaker, though perhaps still significant, path.

I will take a study by Leerkes and Crockenberg (1999) as an example of a mediating relationship. The authors were interested in studying the relationship between how children were raised by their own mother's, and their later feelings of maternal self-efficacy when they, in turn, became mothers. Their sample consisted on 92 mothers of five-month old infants. They expected to find that high levels of maternal care when the mother was a child translated to high levels of self-efficacy when that child later became a mother. But Leerkes and Crockenberg went further, postulating that the mediating variable in this relationship is self-esteem. They argued that high levels of maternal care lead to high levels of self-esteem in the child, and that this high self-esteem later translates into high levels of self-efficacy as a mother. This relationship is diagrammed below.



The initial conditions of Baron and Kenny (1986) can be tested by looking at the simple correlations among the variables. These are shown below, as produced by SPSS.

Correlations

Pearson Correlation

	Maternal care	Self-esteem	5 month efficacy
Maternal care	1.000	.403**	.272**
Self-esteem	.403**	1.000	.380**
5 month efficacy	.272**	.380**	1.000

** . Correlation is significant at the 0.01 level (2-tailed).

Here we can see that maternal care is correlated with self-esteem and with self-efficacy, and that self-esteem is also correlated with self-efficacy. These relationships satisfy Baron and Kenny’s basic prerequisites. The next step is to use both self-esteem and maternal care as predictors of self-efficacy. This is shown in the following output.

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations	
		B	Std. Error	Beta			Zero-order	Part
1	(Constant)	3.260	.141		23.199	.000		
	maternal care	.112	.042	.272	2.677	.009	.272	.272
2	(Constant)	2.929	.173		16.918	.000		
	maternal care	5.817E-02	.044	.142	1.334	.185	.272	.130
	self esteem	.147	.048	.323	3.041	.003	.380	.295

a. Dependent Variable: 5 month efficacy

The first model in the previous table uses maternal care as the sole predictor. The second model has added self-esteem as a predictor. Here you can see that when we add self-esteem to maternal care, which was clearly significant when used alone to predict self-efficacy, maternal care is no longer significant ($t = 1.334, p = 0.185$). This is evidence that self-esteem is serving a mediating role between maternal care and self-efficacy. The output also shows what SPSS calls the “part correlation,” but which the rest of us call the semipartial correlation. The semipartial correlation between self-esteem and self-efficacy

is 0.295, whereas the simple correlation (zero-order) between self-esteem and self-efficacy was 0.38. It remains significant, as we can see by the t test on self-esteem.

These results support Leerkes and Crockenberg's hypothesis that self-esteem played a mediating role between maternal care and self-efficacy. Caring parents seem to produce children with higher levels of self-esteem, and this higher self-esteem translates into positive feelings of self-efficacy when the child, in turn, becomes a mother.

In this situation Leerkes and Crockenberg were fortunate to have a situation in which the direct path from maternal care to self-efficacy dropped to nonsignificance when self-esteem was added. Unfortunately, that does not always happen. (In fact, it seems to happen relatively infrequently.) The more common result is that the direct path becomes less important, though it remains significant. There has been considerable discussion about what to do in this situation, but there is a relatively simple answer, due to Sobel (1982), that was referred to by Baron and Kenny.

When we have a situation in which the direct path remains significant, though at a lower value, one way to test for a mediating relationship is to ask whether the complete mediating path from independent variable to mediator to dependent variable is significant. To do this we need to know the regression coefficients and their standard errors for the two paths in the mediating chain. We will soon also need the regression of Self-esteem on Maternal Care, so that table follows.

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	2.257	.294		7.687	.000			
	pbi maternal care	.364	.087	.403	4.178	.000	.403	.403	.403

a. Dependent Variable: self esteem

The important statistics from the two regressions are shown in Table 15.6. Because SPSS does not report the standard error of Beta, we need to calculate it. The t statistic given in these tables is either the unstandardized regression coefficient (b) divided by its standard error, or the standardized regression coefficient divided by its standard error. Thus we can solve

$$t = \frac{\beta}{s_{\beta}}; \quad s_{\beta} = \frac{\beta}{t} = \frac{0.403}{4.178} = 0.096$$

Similarly for the path from Self-esteem to Self-efficacy, partialling Maternal care, we have

$$t = \frac{\beta}{s_{\beta}}; \quad s_{\beta} = \frac{\beta}{t} = \frac{0.323}{3.041} = 0.106$$

These results yield the following table.

Table 15.6 Regression coefficients and standard errors for two parts of mediating path

Path <i>a</i>		Path <i>b</i>	
Maternal Care	Self-esteem	Self-esteem	Self-efficacy
	→		→
β	0.403	β	.323
s_a	0.096	s_b	.106
t	4.18*	t	3.041*

Then the regression coefficient for the path from Maternal care → Self-esteem → Self-efficacy is equal to $\beta_a * \beta_b = 0.403 * 0.323 = 0.130$, where *a* and *b* refer to the relevant paths. (Path *c* is the direct path from Maternal care to Self-efficacy.) In addition, we know that the standard error of this two-part path is given by

$$s_{\beta_a\beta_b} = \sqrt{\beta_a^2 s_b^2 + \beta_b^2 s_a^2 - s_a^2 s_b^2}$$

where β_a and β_b are the paths, and s_a^2 and s_b^2 are the corresponding standard errors of the standardized regression coefficients for those paths¹. We can calculate the standard error of the combined path as:

¹ There is some disagreement over the exact form of these equation, but the one given here is recommended by Baron and Kenny. The differences among the various equations turn out to be very minor in practice.

$$\begin{aligned}
s_{\beta_a\beta_b} &= \sqrt{\beta_a^2 s_b^2 + \beta_b^2 s_a^2 - s_a^2 s_b^2} = \sqrt{.403^2 (.106^2) + .323^2 (.096^2) - (.106^2)(.098^2)} \\
&= \sqrt{0.0027} \\
&= 0.052
\end{aligned}$$

We now know the path coefficient ($0.403 \times 0.323 = 0.130$) and its standard error (0.052), and we can form a t ratio as

$$t = \frac{\beta_1\beta_3}{s_{\beta_1\beta_3}} = \frac{.130}{.052} = 2.50$$

Sobel (1982) stated that this ratio is asymptotically normally distributed, which, for large samples, would lead to rejection of the null hypothesis at $\alpha = 0.05$ when the ratio exceeds ± 1.96 . It would presumably have a t distribution on $N - 3$ df for small samples. In our case the path is clearly significant, as we would expect from the previous results.

Therefore we can conclude that we have convincing evidence of a strong mediating pathway from maternal care through self-esteem to self-efficacy. Because the regression coefficient (and semipartial correlation) for the direct path from maternal care to self-efficacy is not significant, the main influence of maternal care is through its mediating relationship with self-esteem.