

## Mediation

### *Requesting the analysis in SPSS (the alternative medical partial correlation example continued)*

The three regression analyses are carried out as in Chapter 4 by choosing **Analyze**, then **Regression**, then **Linear** to get Dialog Box 4.1. For the first regression, move DEPRESSION into the **Dependent** box and FAMILYHIST into the **Independent(s)** box, and click **OK**. The second regression is carried out in the same way except that the proposed mediator variable, ANXIETY (state - trait), is moved into the **Dependent** box in place of DEPRESSION. For the third regression, put DEPRESSION in the **Dependent** box and both FAMILYHIST and ANXIETY in the **Independent(s)** box.

### *The mediation analysis: understanding the output*

The required unstandardized coefficients and their standard errors are in the output tables labelled **Coefficients** (SPSS Output 6.4). It can be seen from the first and third tables that the regression coefficient for FAMILYHIST  $\rightarrow$  DEPRESSION reduces from 0.541 to 0.249 when ANXIETY is added to the regression, suggesting that ANXIETY may be exerting a partial mediating effect. The relevant values needed for the Sobel test for mediation are FAMILYHIST  $\rightarrow$  ANXIETY: unstandardized coefficient ( $a$ ) = -0.938, standard error ( $s_a$ ) = 0.224 (2nd table) and ANXIETY  $\rightarrow$  DEPRESSION, with FAMILYHIST controlled: unstandardized coefficient ( $b$ ) = -0.311, standard error ( $s_b$ ) = 0.089 (3rd table).

Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.101	.335		3.289	.002
	familyhist	.541	.188	.310	2.879	.005

a. Dependent Variable: depression

Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.409	.399		3.528	.001
	familyhist	-.938	.224	-.428	-4.187	.000

a. Dependent Variable: anxiety

Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.539	.337		4.570	.000
	familyhist	.249	.194	.143	1.281	.204
	anxiety	-.311	.089	-.391	-3.509	.001

a. Dependent Variable: depression

*SPSS Output 6.4. Regression coefficients for a mediation analysis*

Application of the Sobel approximate formula to these unstandardized coefficient and standard error values yields the statistic  $Z = 2.68$ ,  $p = 0.008$ . So, according to this mediation analysis, it is confirmed that ANXIETY (state - trait) significantly mediates the relationship between FAMILYHIST and DEPRESSION. This confirms our earlier partial correlation analysis of the same data. Note, however, that the partial correlation analysis did not allow us to test the *difference* between the two correlations of FAMILYHIST and DEPRESSION with and without controlling for ANXIETY. The Sobel test in the mediation analysis described here has provided us with a way to check whether the reduction when ANXIETY (state - trait) is controlled is significant. The mediation analysis has used unstandardized regression coefficients rather than correlation coefficients to measure the effect of the IV on the DV, and Baron and Kenny (1986) suggest that this is always preferable. We endorse that conclusion. Nonetheless, it is necessary to keep an eye on the possibility of substantial

*multicollinearity* when using the regression approach, and we consider this in the next section.

#### *Mediation analysis: multicollinearity and power*

Multicollinearity refers to the existence of a strong correlation between the IV and the mediator. Of course, if there is mediation, a correlation necessarily exists, but if it is very high it will explain virtually all of the variance in the mediator, leaving minimal unique variance in the mediator to explain variance in the IV. When substantial multicollinearity is present, the power of tests of the regression coefficients is compromised. So, with a strong mediation effect, a larger sample size is needed to achieve power equivalent to that available with a smaller sample when we have a weak mediator. In our case, the correlation between FAMILYHIST and ANXIETY was moderate ( $r = -0.43$ ), so multicollinearity was not a serious problem.

#### *Mediation analysis: measurement error*

Another problem that arises in mediation analysis is when the assumption that the measurement of the mediator is free of error is not realistic. In such circumstances, the estimates of the regression coefficients are likely to be biased; typically overestimation of the IV to DV coefficient and underestimation of the mediator to DV coefficient. The best way to circumvent this problem is to use multiple indicators of the mediator, treated as a *latent* variable; that is, one that cannot be measured directly. This is the approach taken in confirmatory factor analysis and, by extension, in structural equation modelling. These approaches will be discussed in Chapter 8.