



## HLM is unable to estimate covariance components for the model specified

The message

“HLM is unable to estimate covariance components for the model specified.  
It is likely that either

1. one or more of the variance components is very close to zero and the reliability of the associated random effect is also close to zero, or
2. there is a collinearity or multicollinearity among the random effects. In this case, the estimated correlations among the random effects would be close to 1.0, or
3. one or more of the OLS level-1 regressions produced extreme values.”

may appear when running an analysis.

- To check option (1), the tau-matrix printed in the output file must be examined. Small values on the diagonal of this matrix indicate the variable causing this problem. Keep in mind that the number of variance-covariance components to be estimated in a 2-level model with homogeneous variance and independent errors at level-1 is  $m(M - 1) / 2 + 1$ , where  $m$  is the number of level-1 predictors in the model. The number of components to be estimated increases rapidly as  $m$  increases. As a result, significantly more information will be required to get reasonable estimates of these components.
- The information needed to check option (2) follows directly after the tau-matrix, where the tau-matrix is given in the form of a correlation matrix.
- Review the OLS estimates for all groups to find problems associated with option (3). If this is the source of the problem, use the option to manually reset the tau(0) matrix on the **Iteration Settings** dialog box accessed via the **Other Settings** menu.

Deciding which level-1 effect to keep random and which to change to non-randomly varying should be based on theory and research purposes. Keep in mind that the number of variance-covariance components to be estimated in a 2-level model with homogeneous variance and independent errors at level-1 is  $m(M - 1) / 2 + 1$ , where  $m$  is the number of level-1 predictors in the model. The number of components to be estimated increases rapidly as  $m$  increases. As a result, significantly more information will be required to get reasonable estimates of these components. The number of random effects that can be successfully estimated may depend on factors such as intercorrelation among them, the size of the level-1 variance  $\sigma^2$ , and other data characteristics. It may thus vary from data set to data set.