

x of y units failed the conditioning check for inversion of the level-1 predictor matrix

Description

In order to perform iterations, the level-1 predictor matrix needs to be inverted. This message indicates that for a number of units a unique inverse for this matrix could not be found, and will only appear if more than 50 % of the groups have this condition. It is a not uncommon bur serious problem that needs to be fixed if a stable solution is to be obtained.

Inversion is dependent on the design matrix being of full rank. Columns of data (i.e. predictors included in the analysis) must be independent. In the example below, an example is given for a level-2 unit with 5 level-1 units nested within the level-2 unit. The first column represents the intercept term, which is by default included in any HLM model. The second column represents the scores of the 5 respondents from this level-2 unit. As the scores of all 5 respondents are very similar, the second column is almost a multiple of the first.

Intercept	Score
1	20
1	20
1	20
1	20
1	21

Groups that passed the various checks on $X'X$ (X = level-1 data), invertibility, positive determinant, condition number $< 1E6$, will have the OLS coefficients printed out. Groups that fail either of the first two checks will not appear, and will be counted as insufficient data. Groups that fail the condition check will be counted, and produce the message noted above. The level-1 coefficients for all "acceptable" units can be requested from the **Output Settings** dialog box (accessible from the **Other Settings** menu) by setting that field to the number of level-2 groups (or some large number). The results for "acceptable" groups will be printed. Note that this option is only available for HLM2.

This can also be caused by a lack of sufficient data for certain groups. For example, let's say we have a model with 3 random effects. Groups with less than 3 level-1's per level-2 (using HLM2 as an example) will cause this error, and probably at least some of the groups with three records will as well.

Solution

Possible solutions to this problem are:

- Scaling of the problem variable(s) may be considered, for example centering of predictors. Centering predictors reduce correlations between random effects.
- If retaining a variable that is a multiple of the intercept term is a problem, the intercept term may be deleted from the model.
- A mean value for a variable can be calculated at group level. The mean can then be used as a level-2 covariate instead.