Missing data in HLM 8.1

The information below replaces the current sections 2.5.1 and 2.6 in the HLM manual. Additional information on the handling of missing data in other HLM modules is also included.

1. HLM2

Please recall that, in HLM2, one builds the MDM file by specifying and saving an MDM template file. Under the level-1 specification in the MDM template file, you will see the prompt "**Missing Data**." if there are no cases with missing values, in your data set, click on "**No**." If your data set does contain cases with missing values, click on "**Yes**."

If you click on "**Yes**" you will have two options. If you wish to delete all cases having missing values when making the MDM file, click on **"Delete missing data when: making mdm**.**"** Any level-2 case with a missing value on any level 2 variable will be deleted; and, among the remaining level-2 cases, any level-1 cases with a missing value on a level-1 variable will also be deleted. The advantage of this choice is that every analysis conducted on the MDM will have exactly the same sample sizes at both levels. The disadvantages are that "complete data analysis" can lead to bias and there may be considerable loss of precision because of significantly reduced sample sizes.

Having clicked on "**Yes**," the other option is to select **"Delete missing data when: running analyses."** Choosing this option opens up three strategies for handling missing data during the analysis.

       Option A: When you specify a model, HLM2 will use all cases having complete data on those variables you selected to be in the model. While this option uses more cases than you would have when using deletion when making the MDM, a disadvantage is that models with different sets of variables will likely have different sample sizes. Therefore, likelihood ratio tests and other model comparisons are not meaningful.

       Option B: In order to ensure the same number of units over analyses, the **Level-1 deletion** list option can be used. This option allows the user to select a subset of level-1 variables to base deletion on. As long as no variable with missing data not included in this list was used, the number of observations used in analyses would stay constant. Similarly, HLM2 has now added a **Level-2 deletion** list option as well.

Using this option to select a subset of level-2 variables to base deletion on, especially when used in conjunction with the **Level-1 deletion** list, will keep the number of observations over analyses the same.

   Option C: In order to use all of the available data efficiently, one can choose "**automatic imputation**." This method is described in detail in Chapter 20 of the HLM manual. Using this option, HLM2 will inspect your data set for missing values and estimate a multivariate "imputation" model from which HLM2 will automatically impute multiple complete data sets. HLM2 will then run the desired analysis on each data set and combine the results in a principled way. This option is available for continuous outcomes only.

   Option D: HLM2 can also analyze multiply imputed data sets that you have saved, whether those are computed using HLM2's "**automatic imputation**" option or using some external imputation program. See Section 11.2 of the HLM manual.

2. HLM3

As in HLM2, when using HLM3 and you do not have missing data, check "**No**" under the prompt "**Missing data**." If your data set does contain cases with missing values, click on "**Yes**."

If you click on "**Yes**" you will have two options under the box. If you wish to delete all cases having missing values when making the MDM file, click on **"Delete missing data when: making mdm."** Any level-3 case with a missing value on a level-3 variable will be deleted; within the remaining level-3 cases, any level-2 case having a missing value on any level-2 variable will be deleted; and within the remaining level-2 units, any level-1 case having a missing a missing value on a level-1 variable will be deleted.

Having clicked on "**Yes**," the other option is to select **"Delete missing data when: running analyses."** Under this option, any level-3 case having one or more missing values on a level-3 variable will be deleted; and of the remaining level-3 cases, any level-2 case having a missing value on a level-2 variable will be deleted. However, among the remaining level-1 cases, every case will be retained if such a case has at least one variable with a non-missing value. Choosing this option opens up Options **A**, **B**, and **D** described under HLM2, but Option **C** is not available in HLM3.

3. HLM4

As in HLM2, and HLM3, if you do not have missing data in using HLM4, check "**No**" under the prompt "Missing data." If your data set does contain cases with missing values, click on "**Yes**."

If you click on "**Yes**" you will have two options under the box. If you wish to delete all cases having missing values when making the MDM file, click on **"Delete missing data when: making mdm."**Any level-4 unit having a missing case will be deleted; of the remaining level-4 units, any level-3 case having a missing value will be deleted; among the remaining level-2 cases, any case having a missing value on a level-2 variable will be deleted; and among the remaining level-1 cases, any case having a missing level-1 value on a level-1 variable will be deleted.

Having clicked on "**Yes**," the other option is to select **"Delete missing data when: running analyses."** Under this option, any level-4 case having a missing value on a level-4 variable will be deleted; of the remaining level-4 cases, any level-3 case having a missing value on a level-3 variable will be deleted; among the remaining level-3 cases; any case having a missing value on a level-2 variable will be deleted. However, among the remaining level-2 cases, every level-1 case will be retained if such a case has at least

one variable with a non-missing value on a level-1 variable. Choosing this option opens up Options **A**, and **B** described under HLM2, but Options **C** and **D** are not available.

4. HCM2, HCM3, and HLMHCM

The logic here is the same as in HLM3 and HLM4. If you wish to delete all cases having missing values when making the MDM file, click on **"Delete missing data when: making mdm."** Higher level-1 units with missing values will be deleted as will level-1 units within those higher-level units that have a missing value on a level-1 variable. If you check **"Delete missing data when: running analyses,"** higher level-1 units with missing values will be deleted. However, every level-1 case will be retained if such a case has at least one variable with a non-missing value. Choosing this option opens up Options **A**, and **B** described under HLM2 are available, but Options **C** and **D** are not available.