Data_Analysis.calm: dacMETA

Using HLM for Presenting Meta Analysis Results

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The primary purpose of meta analysis is to summarize the effect size results from a number of independent studies. The major focus is on whether the effect size is significantly different from 0, and whether the estimates are reasonably consistent across studies. Often too, there is an interest in whether the effect size is related to some other variable or variables. In their book, Raudenbush and Bryk (2002) discuss a procedure where HLM can be used to test the significance of both the mean estimate, the variance of the estimates, and the relationship between the estimates and some other variable (e.g., a moderator). The procedure can be run using any type of effect size measure as long as there is an estimate of the sampling variance of the measure. For correlations, Raudenbush and Bryk (2002) recommend using Fisher's Z (see page 209).

This is a slightly different use of HLM than that typically employed in other applications, and is referred to as "V-Known" models by Raudenbush, Bryk, Cheong, Congdon & du Toit (2004). According to these authors, "The V-known program must be implemented in batch or interactive mode; it is not available in Windows mode" (p.186). Like other HLM applications, the procedure involves the use of maximum likelihood procedures. The following describes how to perform this analysis using the interactive approach. The data used in the example were taken from Raudenbush, Bryk, Cheong, Congdon, & du Toit (2004, p. 185) . Raudenbush and Bryk (2002) present the same example except that they (incorrectly?) read in the standard errors of the estimates instead of the sampling variances, thus the results don't agree.

To run the analysis, it is first necessary to construct the data file. This must be an **ascii** file, and it must follow a very specific format. An example, **META.DAT** is presented in Appendix A. There is one line of data for each entry consisting of the following in precisely this order:

1. The ID number in A format
2. The effect size measure (referred to as Q by Raudenbush, Bryk, Cheong, Congdon & du Toit (2004)
3. The error variance for the effect size measure
4. Any potential moderators (i.e., level 2 predictors of the effect sizes)

As indicated above, the program is not run from the Windows prompt. Instead, it is run from the DOS prompt, and initially uses a file in the HLM folder, labeled HLM2S.. In my computer, the HLM folder is in the c:\ directory in a sub-directory, Program Files, and is labeled HLM6S. Thus, to run the program, you would create the following line in the DOS editor:

```
c:\Program Files\ HLM6S> HLM2S
```

This generates the following questions, for which you provide the requisite answers:

Will you be starting with raw data? **y**
Is the input file a v-known file? **y**
How many level-1 statistics are there? **1**
How many level-2 predictors are there? **1**
Enter 8 character name for level-1 variable number 1: **EFFSIZE**
Enter 8 character name for level-2 variable number 1: **WEEKS**

(Note, there can be only 1 level-1 statistic, but if there are more than 1 level-2 predictors, you would provide these names as well)

Input format of raw data file (the first field must be the character ID)
format: **(a8,f8.2,f8.3,f8.0)**

Note, you must type the parentheses, and within these the format specifications for each of the variables. In this example, the ID occurs in the first 8 columns in alphanumeric format, the effect size in columns 9 to 16 (allowing for two decimal values), the variance of the effect size in columns 17 to 24 (allowing for 3 decimal values) and the moderator in columns 25 to 32 (allowing for no decimal values).

What file contains the data? **meta.dat**
Enter name of MDM file: **meta.mdm**

At which time, the computer responds with:
19 groups have been processed

This creates the **meta.mdm** file required to conduct the analysis. In order to run the job, create the following prompt:

c:\Program Files\ HLM6S> HLM2S **meta.mdm**

The computer will ask the following questions, for which you will provide the appropriate answers:
Level 1 predictor variable specification

Which level-1 predictors do you wish to use?
The choices are:
For EFFSIZE enter 1

Level-1 predictor? (Enter 0 to end) **1**

Level-2 predictor specification
Which level-2 variables do you wish to use?

Which level-2 predictors to model EFFSIZE?

Level-2 predictor? (Enter 0 to end) **1**

ADDITIONAL PROGRAM FEATURES

Select the level-2 variables that you might consider for inclusion as predictors in subsequent models.

The choices are:
For WEEKS enter 1
Which level-2 variables to model EFFSIZE?
Level-2 variable (Enter 0 to end) **0**

Do you wish to use any of the optional hypothesis testing procedures? **n**

OUTPUT SPECIFICATION

Do you want a level-2 residual file? **n**
How many iterations do you want to do? **10000**
Do you want to see OLS estimates for all of the level-2 units? **n**
Enter a problem title: **Raudenbush et al., example**
Enter name of output file: **meta.lis**

At which time, the computer states:
Computing . . . . , please wait

It then lists a few lines of output and returns to the initial prompt:

c:\Program Files\ HLM6S>

You can then use Notepad or any other ascii based editor to print the output file from the directory where it was stored. In this example, it will be in:

c:\Program Files\ HLM6S>

The output file is presented in Appendix B. There it will be noted that the estimate of the mean effect size INTERCEPT2, G10 = .408572 is significant, and that the regression of the individual effect sizes on weeks is WEEKS, G11 = -.157963, which is also significant. Because the value is negative it suggests that as the value of WEEKS increases, the values of the Effect sizes decrease. The results also show that the standard deviation of the effect sizes (Random Effect, EFFSIZE U = 0.00283 is not significantly greater than 0, indicating that the estimates are stable over the various studies.

Appendix A

Data Listing of META.DAT (in 8 column fields)

1	.03	.016	2.00
2	.12	.022	3.00
3	-.14	.028	3.00
4	1.18	.139	.00
5	.26	.136	.00
6	-.06	.011	3.00
7	-.02	.011	3.00
8	-.32	.048	3.00
9	.27	.027	.00
10	.80	.063	1.00
11	.54	.091	.00
12	.18	.050	.00
13	-.02	.084	1.00
14	.23	.084	2.00
15	-.18	.025	3.00
16	-.06	.028	3.00
17	.30	.019	1.00
18	.07	.009	2.00
19	-.07	.030	3.00

Appendix B

Program: HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors: Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher: Scientific Software International, Inc. (c) 2000
techsupport@ssicentral.com
www.ssicentral.com

```
-------------------------------------------------------------------------------
Module:     Hlm2S.exe (6.04.2754.2)
Date:       9 July 2007, Monday
Time:       13:13:12
-------------------------------------------------------------------------------

SPECIFICATIONS FOR THIS HLM2 RUN

 Problem Title: Raudenbush et., al example

 The data source for this run  = meta.mdm
 The command file for this run =
 Output file name              = meta.lis
 The maximum number of level-2 units = 19
 The maximum number of iterations = 10000
 Method of estimation: restricted maximum likelihood
 Note: this is a v-known analysis

 The outcome variable is INTRCPT1

 The model specified for the fixed effects was:
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  Level-1                 Level-2
  Effects                Predictors
----------------------   ---------------
      EFFSIZE, B1      INTRCPT2, G10
                         WEEKS, G11

The model specified for the covariance components was:
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      Variance(s and covariances) at level-1 externally specified

      Tau dimensions
           EFFSIZE slope

Summary of the model specified (in equation format)
```

Level-1 Model

Y1 = B1 + E1

Level-2 Model

B1 = G10 + G11*(WEEKS) + U1

STARTING VALUES

Tau(0)
EFFSIZE,B1 0.02004

Estimation of fixed effects
(Based on starting values of covariance components)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For EFFSIZE, B1					
INTRCPT2, G10	0.433737	0.109700	3.954	17	0.001
WEEKS, G11	-0.168572	0.046563	-3.620	17	0.002

The value of the likelihood function at iteration 1 = -3.414348E+001
The value of the likelihood function at iteration 2 = -3.350242E+001
The value of the likelihood function at iteration 3 = -3.301695E+001
The value of the likelihood function at iteration 4 = -3.263749E+001
The value of the likelihood function at iteration 5 = -3.121675E+001
.
.
The value of the likelihood function at iteration 7849 = -2.979898E+001
The value of the likelihood function at iteration 7850 = -2.979898E+001
The value of the likelihood function at iteration 7851 = -2.979898E+001
The value of the likelihood function at iteration 7852 = -2.979898E+001

Iterations stopped due to small change in likelihood function

******* ITERATION 7853 *******

Tau
EFFSIZE,B1 0.00001

Tau (as correlations)
EFFSIZE,B1 1.000

Random level-1 coefficient	Reliability estimate
EFFSIZE, B1	0.000

The value of the likelihood function at iteration 7853 = -2.979897E+001
Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For EFFSIZE, B1					
INTRCPT2, G10	0.408572	0.087146	4.688	17	0.000
WEEKS, G11	-0.157963	0.035943	-4.395	17	0.000

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
EFFSIZE,	U1	0.00283	0.00001	17	16.53614	>.500

Statistics for current covariance components model

Deviance = 59.597950
Number of estimated parameters = 2