

# Module 15: Multilevel Modelling of Repeated Measures Data

## MLwiN Practical<sup>1</sup>

George Leckie, Tim Morris & Fiona Steele  
Centre for Multilevel Modelling

### Pre-requisites

- MLwiN practicals for Modules 3 and 5

If you find this module helpful and wish to cite it in your research, please use the following citation:

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<sup>1</sup> This MLwiN practical is adapted from the corresponding Stata practical: Steele, F. (2014). Multilevel Modelling of Repeated Measures Data: Stata Practical. LEMMA VLE Module 15, 1-61. (<http://www.bristol.ac.uk/cmm/learning/course.html>).

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## P15.1 Repeated Measures Data

### P15.1.1 Introduction to physical health functioning dataset


In the first part of this practical we will fit growth curve models to data on health functioning from a study of British civil servants called the Whitehall II study (also known as the Stress & Health Study).<sup>2</sup> Health functioning was assessed by the SF-36, a 36 item instrument that comprises eight subscales covering physical, psychological and social functioning. These eight scales can be summarised into physical and mental health components. These are scaled using general US population norms to have mean values of 50 and low scores imply poor functioning. We will study change in physical health functioning which was measured on up to six occasions for each respondent.

The data are in wide form, i.e. with one record per individual and six variables for health functioning at the six measurement occasions. The dataset also includes information on the respondent's age at each occasion, their employment grade at the first occasion, and their gender. The analysis file contains the following variables for 4427 individuals:

Variable	Description and codes
id	Individual identifier (coded 1, 2, . . . , 8815)
female	Gender (1=female, 0=male)
grade	Employment grade at baseline (1=high, 2=intermediate, 3=low)
age1	Age at occasion 1 (years)
phf1	Physical health functioning score at occasion 1
...	...
age6	Age at occasion 6 (years)
phf6	Physical health functioning score at occasion 6

To open the worksheet:

From within the LEMMA Learning Environment

- Go to **Module 15: Multilevel Modelling of Repeated Measures Data**, and scroll down to **MLwiN Datafiles**
- If you do not already have MLwiN to open the datafile with, click ([get MLwiN](#)).
- Click “ 15.1.wsz”

The **Names** window will appear.

<sup>2</sup> <http://www.ucl.ac.uk/whitehallII>

Name	Cn	n	missing	min	max	categorical	description
id	1	4427	0	1	4427	False	Individual identifier
female	2	4427	0	0	1	False	
grade	3	4427	0	1	3	True	employment grade
age1	4	4427	251	39	63	False	
phf1	5	4427	251	6.40769...	70.5704...	False	
age2	6	4427	659	42	65	False	
phf2	7	4427	659	11.8043...	70.3771...	False	
age3	8	4427	1024	44.7939...	68.8815...	False	
phf3	9	4427	1024	11.4731...	69.6277...	False	
age4	10	4427	1146	48.1718...	71.125	False	
phf4	11	4427	1146	9.54526...	69.8192...	False	
age5	12	4427	1176	50.5051...	73.9329...	False	
phf5	13	4427	1176	9.96906...	71.8561...	False	
age6	14	4427	1181	50.3046...	76.1875	False	
phf6	15	4427	1181	7.42553...	70.0969...	False	
c16	16	0	0	0	0	False	
c17	17	0	0	0	0	False	
c18	18	0	0	0	0	False	

- To view a selection of the data, in the **Names** window select the variables **id**, **female**, **grade**, **age1**, **phf1**, **age6**, and **phf6** and click the **View** button under the **Data** heading.

	id(4427)	female(4427)	grade(4427)	age1(4427)	phf1(4427)	age6(4427)	phf6(4427)
1	1.000	1.000	intermediate	55.000	39.591	MISSING	MISSING
2	2.000	1.000	low	56.000	29.311	70.953	22.994
3	3.000	1.000	low	53.000	46.749	MISSING	MISSING
4	4.000	0.000	high	51.000	45.788	64.703	43.568
5	5.000	0.000	high	55.000	46.772	69.313	41.974

We can see that individuals 1 and 3 have missing data for occasion 6. We will obtain a summary of missing data patterns before fitting any models.

### P15.1.2 Restructuring data from wide to long form

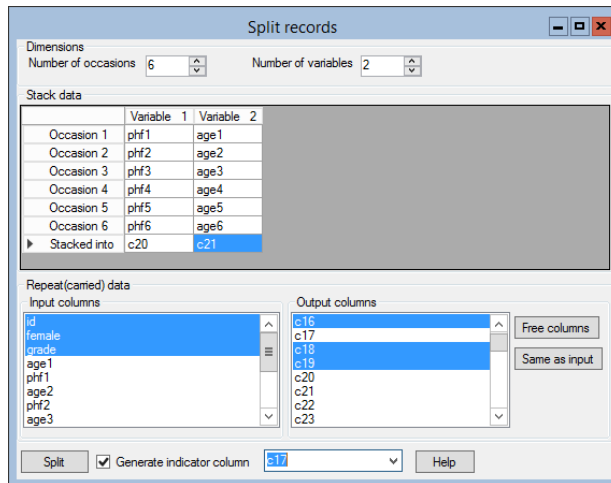
Our first task is to convert the data from wide form (i.e., one record per individual) to long form (i.e., one record per occasion per individual). In other words, we need to create six records for each individual, with each record corresponding to one of the six measurement occasions of the two variables **age** and **phf**.

- From the **Data Manipulation** menu, select **Split Records**
- Change **Number of occasions** to **6**
- Change **Number of variables** to **2**
- Under **Stack data**, use the mouse pointer to fill the first column with the variables **phf1** through to **phf6** and then **c20**, and the second column with the variables **age1** through to **age6** and then **c21**. This tells the window to generate a new variable containing the occasion specific values of **phf** in column **c20** and the corresponding occasion specific values of **age** in column **c21**. These two columns therefore have one record per occasion per individual.
- Under **Repeat(carried) data**, select **id**, **female** and **grade** as the **Input columns**, and **c16**, **c18** and **c19** as the **Output columns**. This tells the window

to create long-form versions of the variables **id**, **female**, and **grade** in columns **c16**, **c18**, and **c19**, respectively.

- Finally, check the **Generate indicator column** checkbox and select **c17** in the drop down list to create a measurement occasion indicator variable in **c17**.

Your **Split records** box should look as follows:



- Click **Split**, and when prompted to save the dataset select **No**

Our dataset now stores the original data in both wide and long form. This is confirmed when we inspect the **Names** window. The window shows the original wide-form variables are of length 4427 while the new long-form versions of these variables are of length 26562 (= 6 × 4427).

Column:	Name	Description	Toggle	Categorical	Data:	View	Copy	Paste	Delete	Categories:	View	Copy	Paste	Regenerate	Window:	Used columns	Help
	Name	Cn	n	missing	min	max	categorical	description									
	id	1	4427	0	1	4427	False	Individual identifier									
	female	2	4427	0	0	1	False										
	grade	3	4427	0	1	3	True	employment grade									
	age1	4	4427	251	39	63	False										
	phf1	5	4427	251	6.40769...	70.5704...	False										
	age2	6	4427	659	42	65	False										
	phf2	7	4427	659	11.8043...	70.3771...	False										
	age3	8	4427	1024	44.7939...	68.8815...	False										
	phf3	9	4427	1024	11.4731...	69.6277...	False										
	age4	10	4427	1146	48.1718...	71.125	False										
	phf4	11	4427	1146	9.54526...	69.8192...	False										
	age5	12	4427	1176	50.5051...	73.9329...	False										
	phf5	13	4427	1176	9.96906...	71.8561...	False										
	age6	14	4427	1181	50.3046...	76.1875	False										
	phf6	15	4427	1181	7.42553...	70.0969...	False										
	c16	16	26562	0	1	4427	False										
	c17	17	26562	0	1	6	True										
	c18	18	26562	0	0	1	False										
	c19	19	26562	0	1	3	True										
	c20	20	26562	5437	6.40769...	71.8561...	False										
	c21	21	26562	5437	39	76.1875	False										
	c22	22	0	0	0	0	False										
	c23	23	0	0	0	0	False										
	c24	24	0	0	0	0	False										

In the interests of keeping the worksheet as simple as possible, we will remove all wide-form variables as we will not analyse these further.

- From the **Data Manipulation** menu, select **Command interface**
- In the text entry area at the bottom of the **Command interface** window, type the following commands one by one, pressing return after each one has been inputted to run the commands:

```
ERAS C1-C15
MOVE
NAME C1 'id'
NAME C2 'occ'
NAME C3 'female'
NAME C4 'grade'
NAME C5 'phf'
NAME C6 'age'
DESC 'id' 'individual identifier'
DESC 'occ' 'measurement occasion'
DESC 'female' 'female civil servant'
DESC 'grade' 'employment grade'
DESC 'phf' 'physical health functioning (from SF-36)'
DESC 'age' 'age (years)'
```

- These commands will remove (ERAS) the wide-form variables in columns **c1** to **c15**, shift (MOVE) all remaining variables (i.e., variables currently in columns **c16** to **c21**) to the now empty columns at the beginning of the worksheet, rename (NAME) the six long-form variables, and lastly add variable labels (DESC) to these six variables

Your **Names** windows should now look as follows:

Column:	Name	Description	Toggle	Categorical	Data:	View	Copy	Paste	Delete	Categories:	View	Copy	Paste	Regenerate	Window:	Used columns	Help
	Name	Cn	n	missing	min	max	categorical	description									
	id	1	26562	0	1	4427	False	individual identifier									
	occ	2	26562	0	1	6	True	measurement occasion									
	female	3	26562	0	0	1	False	female civil servant									
	grade	4	26562	0	1	3	True	employment grade									
	phf	5	26562	5437	6.40769...	71.8561...	False	physical health functioning from SF-36)									
	age	6	26562	5437	39	76.1875	False	age (years)									
	c7	7	0	0	0	0	False										
	c8	8	0	0	0	0	False										
	c9	9	0	0	0	0	False										

Note that the restructured file now only contains the six long form variables **id**, **occ**, **female**, **grade**, **age** and **phf**. Each variable has 26562 records which is six times the number of individuals in the data.

- Select these six variables in the **Names** window and click the **View** button to view the new dataset

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