Module Outline STAT6102: Multilevel Approaches to the Analysis of Repeated Measures Data

1. Aims and Objectives

The main aim is to introduce the ideas and methods relating to the analysis of hierarchical (multilevel and longitudinal data). The unit will present the modelling techniques in an applied way, with theory introduced to ensure understanding. A further aim is to familiarise the participants with the software appropriate for the analysis of hierarchical data. MLwiN will be the main computing tool.

- To introduce students to multilevel methods for analysing hierarchical structures in the context of cross-sectional and longitudinal data.
- To provide students with an understanding of some key methods of hierarchical data analysis, how to apply these methods and how to interpret the results using suitable statistical software.

2. Learning Outcomes

By the end of this course you should be able to:

- Understand and apply different methods for the analysis of hierarchical data;
- Appreciate the basic underlying theory;
- Interpret in non-technical language the results from a hierarchical analysis of a large dataset;
- Use more advanced modelling techniques, including contextual effects, residual analysis and random slopes, multivariate models and logistic models, also for longitudinal data analysis;
- conduct hierarchical data analyses using the statistical software package MLwiN

3. Key Skills

You will develop your problem solving skills by tackling a large data analysis problem. This will also involve written communication skills as the assessment will involve writing a report of real data analysis. IT skills will be further developed through the use of an appropriate statistical package.

4. Staff

Lecturers

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5. Teaching and learning methods

The course consists of a series of lectures and integrated computer workshops. The lectures will cover the theoretical aspects of the course, and the computer workshops will involve some data analysis using the techniques introduced in the lectures.

If we forget to mention this during the lectures, the course content is partly based on materials of the following colleagues: Ian Brunton-Smith, James Brown, Nikos Tzavidis and Peter von der Heijden. We have also used material from the Centre for Multilevel Modeling at the University of Bristol.

6. Module Structure

The module covers the following topics:
Hierarchical data, Intercept only model, models with fixed effects, models with random effects, three level models, residual analysis, contextual effects and cross-level interactions, multilevel logistic modelling, longitudinal data structures.

7. Assessment Methods

For those wishing to earn University credits, the assessment will be 100% coursework. This coursework will involve performing a number of analyses with models for hierarchical data, and writing an academic report on your findings.

Your submission should be posted to the MOffStat Administrator,
Professional Development Unit, Faculty of Social and Human Sciences, Room 2101, Building 58, University of Southampton, Southampton, SO17 1BJ.

The deadline for submission of the assessment is **17 March 2015**, with the post mark required by the preceding Monday. Send 2 copies and attach the coursework hand-in form, available at http://www.southampton.ac.uk/demography/postgraduate/taught_courses/msc_official_statistics.page?
It is policy that all assignments must also be submitted electronically via Turnitin. Please note that this is in addition to submission of a hard copy.

Electronic submission of coursework

To submit coursework electronically via the TurnitinUK plagiarism device, login to Blackboard, select the specific unit for this module (**STAT6102-30178-14-15**:**14-15-Multilevel Approaches to the Analysis of Repeated Measures Data -30178**), and select the Assignments link from the left-hand menu. Find the coursework and click View/Complete. There will be a series of screens to

complete, and full instructions on how to do this are given on the iSolutions webpages at: http://www.southampton.ac.uk/isolutions/computing/elearn/blackboard/student/studentplagiarism.html .

When you submit electronically you will receive a **submission ID number**, which you **MUST** include on the front cover of your hardcopy submission. You will therefore need to submit electronically **BEFORE** you post your hard copy.

Turnitin is a plagiarism detection tool, which checks your work against electronic sources and other submissions for the same assignment. You will only be able to submit your assignment once to Turnitin.

You will also receive an email (maybe up to a day later, but most likely within a few minutes) confirming that you have submitted electronically. You should retain a copy of this email which will act as a receipt for your electronic submission. If you do not receive a submission ID number or an email it means that you have not submitted. If this is the case **you will be penalised**. If you do not receive this email then you should contact the lecturers as soon as possible.

Penalty for late submission
The penalty for unauthorised late submission of coursework is as follows:

University	
Working days late	Mark
1	(final agreed mark)*0.9
2	(final agreed mark)*0.8
3	(final agreed mark)*0.7
4	(final agreed mark)*0.6
5	(final agreed mark)*0.5
More than 5	Zero

For example, if your mark is 63% but you submit your work 3 working days late, then your final mark would be 63 * 0.7 = 44.1%. Note that late submission of ***either*** the hard copy ***or*** the electronic copy will be penalised in this way.

Procedure for coursework extensions
Deadlines are made to be met. If you want to request an extension, you must have medical or personal circumstances to justify the late submission of assessed coursework (medical evidence must be substantiated by a doctor's note). You should initially fill out a coursework extension request form available at
http://www.southampton.ac.uk/demography/postgraduate/taught_courses/msc_official_statistics.page? and send it to the programme coordinator who will, where appropriate, authorise the extension of the deadline after discussion with the lecturers and the Examinations Officer. Under no circumstances will extensions be allowed beyond a period of two weeks.

Resit Arrangements
If you find yourself in the unfortunate position of having to resit this module, then you will be set another coursework.

8. Feedback

'Feedback' refers to any instance in which you receive information about how well you understand the material, how successfully you are progressing in the module, or how to improve your performance. Feedback is continuous and does not refer merely to comments on your assessed work (but certainly includes that). Other instances in which you receive feedback include: seminar/tutorial discussions, question time during lectures, replies to questions during computer workshops, interaction with others in any online discussion forum, replies to email questions you send us, discussions with us during the week.

In line with University policy, feedback on your coursework assessment will be provided within four weeks of the submission deadline, and is likely to be in the form of an individual feedback sheet containing suggestions for improvement.

9. Provisional Timetable

The course will take place in B39 (S3RI). The provisional timetable is as follows:

Day 1	**9th February**
09.45 – 10.00	Registration
10.00 – 10.15	Introduction to the course
10:15 – 11.15	Lecture 1: Introduction to multilevel and longitudinal data structures
11.15 – 11.30	Tea / Coffee Break
11.30 – 13.00	Computer Workshop 1: Introduction to MLwiN
13.00 – 14.00	Lunch
14.00 – 15.00	Lecture 2a: The basic random intercepts model
15.00 – 15.45	Lecture 2b: Random intercept model continued (adding a level-1 explanatory variable)
15.45 – 16.00	Tea / Coffee Break
16.00 – 17.00	Computer Workshop 2: Fitting a random intercepts model in MLwiN

Day 2	**10th February**
9.15 – 9.45	Review of day one
9.55 – 10.40	Lecture 3a: Interpreting the model parameters and model checking
10:40 – 11.00	Tea / Coffee Break
11.00 – 11.45	Lecture 3b: Hypothesis testing
11.45 – 13.00	Computing Three: Residual analysis and simple tests
13.00 – 14.00	Lunch
14.00 – 14.45	Lecture 4a: Extending the random structures with random slopes and three levels
14.55 – 15.40	Lecture 4b: continued
15.40 – 16.00	Tea / Coffee Break
16.00 – 17.00	Computing Four: Random slopes and adding a third level

Day 3	**11th February**
9.15 – 9.45	Review of day two
9.55 – 10.40	Lecture 5a: Extending the fixed part with contextual variables
10:40 – 11.00	Tea / Coffee Break
11.00 – 11.45	Lecture 5b: continued
11.45 – 13.00	Computing Five: Adding contextual variables
13.00 – 14.00	Lunch
14.00 – 14.45	Lecture 6a: Multilevel models for repeated measures data
14.55 – 15.40	Lecture 6b: continued
15.40 – 16.00	Tea / Coffee Break
16.00 – 17.00	Computing Six: Example with longitudinal data set

Day 4	**12th February**
9.15 – 9.45	Review of day three
9.55 – 10.40	Lecture 7a: Multilevel models for binary response data (Multilevel logistic regression analysis)
10:40 – 11.00	Tea / Coffee Break
11.00 – 11.45	Lecture 7b: continued
11.45 – 13.00	Computing Seven: Multilevel logistic regression analysis in MLwiN.
13.00 – 14.00	Lunch
14.00 – 15.00	Tutorial for coursework preparation
15.00 – 15.30	Course Evaluation
15:30 – 15.50	Tea / Coffee Break
15.50 – 17.00	Self-study
Day 5	**13th February**
10:00 – 12.00	Real-life examples showing applications of multilevel models

10. Pre-requisites

The pre-requisite is STAT6095 (Regression Modelling) or an equivalent introduction to statistical modelling. Hence participants should be familiar with basic statistical inference (confidence intervals and hypothesis testing), linear and logistic regression.

11. Further Reading

The copies of the lecture slides are essential reading! The following is a list of recommended text books in this area. Some of these will be available in the Moffstat library, and most, if not all, of these books are available in the University main library.

Some Key Books

Diggle, P. J., Heagerty, P., Liang, K.Y. and Zeger, S.L. (2013). *The Analysis of Longitudinal Data.* Oxford: Clarendon Press.

Goldstein, H. (2011). *Multilevel Statistical Models. 4th* ed., John Wiley and Sons, Chichester.

Hox, J. (2010). *Multilevel analysis. Techniques and applications. 2nd ed.,* New York: Routledge.

Raudenbush, S.W. and Bryk, A.S. (2002). *Hierarchical Linear Models: Applications and Data Analysis Methods. 2nd ed., Advanced Quantitative Techniques in the Social Sciences,* Thousand Oaks, Sage Publications.

Singer, J.D., Willett, J. B. (2003). *Applied Longitudinal Data Analysis: Modelling Change and Event Occurrence*. New York: Oxford University Press.

Snijders, T.A.B. and Bosker, R.J. (1999). *Multilevel Analysis.* 2nd ed., London: Sage.

Please also have a careful look at the online material, in particular the online course modules, of the Centre for Multilevel Modelling at the University of Bristol. http://www.bristol.ac.uk/cmm/ (look at learning and training in particular)

You are encouraged to report to the Library (and to the lecturers) books that you are finding difficult to get hold of – this will alert the Library to a potential excess demand over supply.

12. Availability of MLwiN for home PC's

The free MLwiN download is available via http://www.cmm.bris.ac.uk/clients/reqform/ to academics and students who are employed or registered in a university that is based in the UK.

13. Workload for the Module

So that you are under no illusions, the University considers that a full-time postgraduate student should spend 1200 hours working (per year). This includes time spent attending lectures, seminars and computer workshops, and time spent studying and being assessed. This works out at **100** hours for a 10 CATS module (which is what STAT6095 is). This will give you an idea of the time you need to devote to this module!

14. Procedures for Problems Associated with the Module

If you have any kind of problem with this module, you should raise the issue with the lecturers in the first instance. If you are not happy with the outcome, you should approach the MSc Official Statistics programme coordinator, Dr Solange Correa Onel. If you are still not happy, you should take up the issue with the Head of Teaching Programmes for the Department of Social Statistics and Demography (Dr Dave Holmes).

If you have a major difficulty during the module, e.g. a health problem that prevents you from attending lectures or seriously interferes with your work, you should make sure you obtain the relevant documentation (e.g. a medical certificate), fill in a special considerations form, bring these to the programme coordinator for signature, and then submit these to the Programme Administrator for filing.

15. Blackboard Unit

To access the Blackboard site use Internet Explorer and enter the web address http://blackboard.soton.ac.uk/ , login and select **STAT6102-30178-14-15**:**14-15-Multilevel Approaches to the Analysis of Repeated Measures Data -30178**. Materials for all of the computer workshops, including the worksheets, the datasets, and the solutions, will be made available here. There is also a discussion board on Blackboard so that you can communicate with your fellow students. All students are automatically enrolled on this blackboard site. If you cannot access the site for any reason please let the lecturers know so that you can be enrolled.

16. Academic Integrity

The University places the highest importance on the maintenance of academic integrity in the conduct of its affairs, and the Academic Integrity Statement for Students can be found in the University Calendar available online at http://www.calendar.soton.ac.uk/sectionIV/academic-integrity-statement.html . Please familiarise yourself with what is expected of you in this regard by reading through this statement. Your attention is drawn particularly to Appendix 1, which outlines those things which you must seek to avoid, including cheating and plagiarism. A very useful set of interactive guides is available at http://www.studyskills.soton.ac.uk . These aim to help you gain a better understanding of academic integrity and develop your skills so that your assessed work does not accidentally plagiarise the work of others.

You must take particular care in using sources in essays/reports and in your dissertation. Remember that plagiarism includes not only verbatim copying but also direct paraphrasing of a source. Verbatim quotes from a source should always be in quotation marks, with the source indicated, and should be used only occasionally in an essay or other report. Detailed advice on appropriate referencing in essays and dissertations is given in the Department of Social Statistics and Demography “Guidelines on writing essays”.

Students are encouraged to discuss and exchange ideas, since this is an important part of the educational process. However, it is NOT acceptable that you read and gain ideas for your coursework from another student’s finished work. Copying includes using another student's computer program, output or graphics. If academic integrity is deemed to have been breached, there are a range of penalties that may be applied.

If you are unsure about what is and is not permitted, ask - we will be happy to explain and discuss.