ABOUT THIS DOCUMENT

This module specification applies for the academic year 2019-20

Last revised 26 July 2019 by Ruth Keogh, Alex Lewin, Alexina Mason

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GENERAL INFORMATION

<table>
<thead>
<tr>
<th>Module name</th>
<th>Survival Analysis and Bayesian Statistics</th>
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<tbody>
<tr>
<td>Module code</td>
<td>2463</td>
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<tr>
<td>Module Organisers</td>
<td>Dr Ruth Keogh (Survival), Dr Alex Lewin and Dr Alexina Mason (Bayesian)</td>
</tr>
<tr>
<td>Contact email</td>
<td><a href="mailto:Ruth.keogh@lshtm.ac.uk">Ruth.keogh@lshtm.ac.uk</a>, <a href="mailto:Alex.lewin@lshtm.ac.uk">Alex.lewin@lshtm.ac.uk</a>, <a href="mailto:Alexina.Mason@lshtm.ac.uk">Alexina.Mason@lshtm.ac.uk</a></td>
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<tr>
<td>Home Faculty</td>
<td>Epidemiology &amp; Population Health</td>
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<tr>
<td>Credit</td>
<td>15 credits</td>
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<tr>
<td>Accreditation</td>
<td>Not currently accredited by any other body.</td>
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<tr>
<td>Keywords</td>
<td>Research; Epidemiology; Statistics; Quantitative methods; Survival analysis; Bayesian methods</td>
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AIMS, OBJECTIVES AND AUDIENCE

Overall aim
To equip students with the necessary skills to understand the principles and apply the techniques of Survival Analysis and Bayesian Statistics.

Intended learning outcomes
By the end of this module, students should be able to:
- Demonstrate an understanding of the theoretical basis of Survival Analysis and assumptions related to different Survival Analysis models
- Use Survival Analysis for analysis of data in Stata (There will also be the opportunity to learn how to perform survival analysis in R for those who wish to do so).
- Demonstrate an understanding of the theoretical basis of Bayesian reasoning and Bayesian inference
- Understand the consequences of using different prior knowledge, including vague priors
- Write and estimate Bayesian models with MCMC algorithms using the statistical software packages OpenBUGS and R

**Target audience**

This module is intended for people with both mathematical (up to first year undergraduate level) and statistical backgrounds (undergraduate degree level in joint mathematics/statistics for example) intending to pursue a career in medical statistics.

**CONTENT**

**Session content**

The module is expected to include sessions addressing the following topics:

**Survival Analysis:**
- Non parametric and parametric estimation of survival curves
- Functions used in the description and analysis of survival data, including hazard and survivor functions
- The theory and use of proportional hazard models, including parametric models and the Cox model.
- Assessment of model assumptions
- Time dependent covariates
- Non-proportional hazards models
- Competing risks

**Bayesian statistics:**
- Bayesian reasoning and Bayesian inference
- Prior and posterior distributions
- Bayesian analysis with conjugate priors
- Bayesian analysis with MCMC methods
- Use of OpenBUGS and R statistical packages for Bayesian analysis
- Interpretation of and reporting the results of Bayesian analyses

**TEACHING, LEARNING AND ASSESSMENT**

**Study resources provided or required**

Module Information can be found on the Virtual Learning Environment (MOODLE) containing information about each session and key references for the module.

**Survival Analysis lecture notes; recommended books:**

**Bayesian Statistics lecture notes and exercises; recommended books:**

**Teaching and learning methods**

Learning will generally be based on relevant practicals following lectures. Some sections of each module will involve the use of computers and/or groupwork. Assignments will also be given as part of the practical work.
### TIMING AND MODE OF STUDY

<table>
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<tr>
<th><strong>Duration</strong></th>
<th>5 weeks at 2.5 days per week</th>
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<tr>
<td><strong>Dates</strong></td>
<td>Wednesday lunchtime to Friday afternoon</td>
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<tr>
<td><strong>Timetable slot</strong></td>
<td>Term 2 - slot D2</td>
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<td><strong>Mode of Study</strong></td>
<td>The module is taught face-to-face in London. Both full-time and part-time students follow the same schedule.</td>
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| **Learning time**     | The notional learning time for the module totals 150 hours, consisting of:  
  - Contact time ≈ 50 hours  
  - Directed self-study ≈ 30 hours  
  - Self-directed learning ≈ 20 hours  
  - Assessment, review and revision ≈ 50 hours  
  Approximately half of the time is spent on Survival Analysis and the other half on Bayesian Statistics, including the assessment time that should be about 50%-50% respectively. |

### APPLICATION AND ADMISSION

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<th><strong>Pre-requisites</strong></th>
<th>A knowledge of linear regression, analysis of variance, logistic regression, maximum likelihood estimation and simple methods of analysing quantitative and categorical data is essential (t-test, RR, OR). Have attended term-1 medical statistics modules and Generalised Linear Models or have equivalent knowledge. Have attended the &quot;Introduction to Bayesian Statistics&quot; lectures in term 1 or have equivalent knowledge. Knowledge of classical inference and the idea of likelihood is needed. Knowledge of hierarchical models (mixed models) would be beneficial, but hierarchical Bayesian models will be motivated and introduced from scratch. Familiarity with STATA and R is needed.</th>
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<tr>
<td><strong>English language requirements</strong></td>
<td>A strong command of the English language is necessary to benefit from studying the module. Applicants whose first language is not English or</td>
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<tr>
<td><strong>Student numbers</strong></td>
<td>25-40 (numbers may be capped due to limitations in facilities or staffing)</td>
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<td><strong>Student selection</strong></td>
<td>Preference will be given to LSHTM MSc students, particularly those registered on the Medical Statistics MSc for whom the module is compulsory, and LSHTM research degree students. Other applicants meeting the entry criteria will usually be offered a place in the order applications are received, until any cap on numbers is reached. Applicants may be placed on a waiting list and given priority the next time the module is run. Partial Registration (partial participation) by LSHTM research degree students is allowed for this module.</td>
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