# MODULE SPECIFICATION

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| **Academic Year (student cohort covered by specification)** | 2023-24 |
| **Module Code** | 2038 |
| **Module Title** | Foundations of Medical Statistics |
| **Module Organiser(s)** | Tim Collier and Kathy Baisley |
| **Faculty** | Epidemiology & Population Health |
| **FHEQ Level** | Level 7 |
| **Credit Value** | **CATS:** 30<br>**ECTS:** 15 |
| **HECoS Code** | 101031 |
| **Term of Delivery** | Term 1 |
| **Mode of Delivery** | For 2023-24 this module will be delivered by predominantly face-to-face teaching modes.<br><br>Where specific teaching methods (lectures, seminars, discussion groups) are noted in this module specification these will be delivered by predominantly face-to-face sessions. There will be a combination of live and interactive activities (synchronous learning) as well as recorded or self-directed study (asynchronous learning). |
| **Mode of Study** | Full-time |
| **Language of Study** | English |
| **Pre-Requisites** | A good first degree, basic algebra and calculus at a standard at equivalent to at least A level Maths and some familiarity with elementary probability and statistics. |
| **Accreditation by Professional Statutory and Regulatory Body** | None |
| **Module Cap (indicative number of students)** | 35 (numbers may be capped due to limitations in facilities or staffing) |
| **Target Audience** | This module is compulsory for the MSc Medical Statistics |
| **Module Description** | This module introduces students to the basic principles of probability, classical statistical inference, linear regression, robust statistical methods and Bayesian statistics. It covers methods, applications and interpretation within simple medical settings. The module is assessed through 3 written |

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| | assignments and the June exams. |
| **Duration** | 10 weeks at 1.5 days per week |
| **Timetabling slot** | Term 1 |
| **Last Revised (e.g. year changes approved)** | June 2023 |

| **Programme(s)**<br>This module is linked to the following programme(s) | **Status** |
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| MSc Medical Statistics | Compulsory |

## Module Aim and Intended Learning Outcomes

| **Overall aim of the module** |
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| The overall module aim is to:<br>• Introduce the basic principles of probability, classical statistical inference, linear regression models, robust statistical methods and Bayesian statistics, and their application in simple medical settings. |

| **Module Intended Learning Outcomes** |
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| Upon successful completion of the module a student will be able to:<br>1. Have a working knowledge of the fundamentals of statistical inference (frequentist and Bayesian) and elementary probability<br>2. Apply appropriately, and understand the strengths and limitations, of basic statistical methods in a medical context<br>3. Understand the theoretical basis and application of linear regression methods<br>4. Understand the principles of robust statistical methods, and apply them appropriately in a number of simple settings |

## Indicative Syllabus

| **Session Content** |
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| The module is expected to cover the following topics:<br>• The fundamentals of probability, including an introduction to common distributions and measures of location and dispersion<br>• An introduction to classical inference including the distinctions between population and sample, and between statistics and population values. This component will also include sampling distributions (approximate and exact), estimation, properties of estimators, hypothesis tests, type I and II errors, sensitivity and specificity and confidence intervals. |

| Session Content |
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| • Applications in common settings, including hypothesis tests and confidence intervals in simple applications, comparisons of groups, association (contingency tables and correlation) and the importance of assumptions.<br>• Linear regression models, analysis of covariance, interaction and confounding, methods for assessing model fit and handling model inadequacies.<br>• An introduction to Bayesian inference including the Bayesian view of probability, the idea of incorporating prior knowledge through prior distributions, and the Bayesian posterior predictive distribution with conjugate priors.<br>• Non-parametric and rank-based procedures, permutation procedures, the bootstrap, and sandwich-style estimators of standard errors |

## Teaching and Learning

**Notional Learning Hours**

| Type of Learning Time | Number of Hours | Expressed as Percentage (%) |
|---|---|---|
| Contact time | 90 | 36 |
| Directed self-study | 50 | 20 |
| Self-directed learning | 40 | 16 |
| Assessment, review and revision | 70 | 28 |
| **Total** | **250** | **100** |

Student contact time refers to the tutor-mediated time allocated to teaching, provision of guidance and feedback to students. This time includes activities that take place in face-to-face contexts such as lectures, seminars, demonstrations, tutorials, supervised laboratory workshops, practical classes, project supervision as well as where tutors are available for one-to-one discussions and interaction by email.

The division of notional learning hours listed above is indicative and is designed to inform students as to the relative split between interactive and self-directed study.

| Teaching and Learning Strategy |
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| The teaching and learning strategy is structured around a combination of lectures followed by computer and non-computer practical sessions. Practical sessions ensure that students have the opportunity to apply the concepts and methods covered by lecture content. The practicals provide students with “hands on” experience in analysing and interpreting data, using data sets drawn from research work of staff in the faculty. Students are provided with detailed solutions to the tasks set in practical sessions, enabling them to check their understanding of the material. Three written assessments are staggered across the ten weeks of teaching, with the first assessment being handed out in week two. One of the |

| Teaching and Learning Strategy |
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| assessments involves analysis of data and writing a short report. The other two assessments involve questions which require short written answers. |

## Assessment

| Assessment Strategy |
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| The assessment for this module has been designed to measure student learning against the module intended learning outcomes (ILOs) as listed above. The grade for summative assessment(s) only will go towards the overall award GPA.<br><br>Formal assessment will also be by written examination in June. |

**Summative Assessment**

| **Assessment Type** | **Assessment Length (i.e. Word Count, Length of presentation in minutes)** | **Weighting** (%) | **Intended Module Learning Outcomes Tested** |
|---|---|---|---|
| Coursework | 1) Probability (no page limit);<br>2) Inference (no page limit);<br>3) Analytical Techniques & Linear Regression (4 pages); | See 2.5.1 in Chapter 2<br><br>The 3 assessments make up the Term 1 practical GPA, and are each weighted as<br>1) 25%<br>2) 25%<br>3) 50%<br><br>The Term 1 practical GPA contributes 14% to the overall Core | 1) 1<br><br>2) 1<br><br>3) 1,2,3,4 |

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| | | GPA | |
| Exam (Papers 1 & 2) | 5 questions in paper 1 and 1 question in paper 2 | See 2.5.1 in Chapter 2 Contribution to Core GPA 57% | 1,2,3,4 |

| **Resitting assessment** |
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| Resits will accord with the LSHTM's Resits Policy<br><br>For students who are required to resit, or granted a deferral or new attempt, the tasks will be resits of exam. |

## Resources

**Indicative reading list**

Altman. Practical statistics for medical research. Chapman and Hall, 1991.

Armitage, Berry and Matthews. Statistical methods in medical research. Blackwell, 2002.

Van Belle, Fisher, Heagerty and Lumley. Biostatistics: A methodology for the health sciences. Wiley, 2004.

Kirkwood and Sterne. Essential Medical Statistics. Blackwell, 2003.

McColl. Probability. Elsevier Butterworth Heinemann, Amsterdam, 1995.

Clayton and Hills. Statistical Models in Epidemiology. OUP, Oxford, 2013

Gelman, Carlin, et al. Bayesian Data Analysis. Chapman and Hall, 1995.

Sprent P. and Smeeton N.C. (2007) Applied Nonparametric Statistical Methods. Fourth edition. Chapman & Hall/CRC.

Good, P. (2005). Permutation, Parametric, and Bootstrap Tests of Hypotheses. Third Edition. Springer.

**Other resources**

Crawlew M. The R Book SecondEdition:
http://www.bio.ic.ac.uk/research/mjcraw/therbook/index.htm

## Teaching for Disabilities and Learning Differences

Students are provided with access to lecture notes, lecture slides, reading lists, and computer practical resources via Moodle. All pre-recorded lectures are made available on Moodle in good time ahead of the related practical. Supplementary exercises consisting of previous exam questions are also provided, and suggestions for background reading are tailored to the students' prior training and learning needs. The module also provides additional support for students with disabilities and learning differences in accordance with the Student Support Services section of the Student Handbook. Reasonable adjustments and support can be arranged, such as rest breaks and additional time for completing assignments, or any other necessary provisions discussed and agreed with the Student Advisor.

The module-specific site on Moodle provides students with access to lecture notes and copies of the slides used during the lecture prior to the lecture (in pdf format). All lectures are recorded and made available on Moodle in time to view before the related practical session. All materials posted up on Moodle areas, including computer-based sessions, have been made accessible where possible.

The LSHTM Moodle has been made accessible to the widest possible audience, using a VLE that allows for up to 300% zoom, permits navigation via keyboard and use of speech recognition software, and that allows listening through a screen reader. All students have access to "SensusAccess" software which allows conversion of files into alternative formats.

For students who require learning or assessment adjustments and support this can be arranged through the Student Support Services – details and how to request support can be found on the LSHTM Disability Support pages.