Edinburgh Imaging
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Statistics

Semester 1 / Autumn   **10 Credits**

Each Course is composed of Modules & Activities.

Modules:

Introduction to Statistics	IMSc	NI4R
How to Read a Paper	IMSc	NI4R
Assessing the Accuracy of Diagnostic Tests	IMSc	NI4R
Assessing Differences Between Observers	IMSc	NI4R
Systematic Reviews	IMSc	NI4R
ROC Curves	IMSc	NI4R

Each Module is composed of Lectures, Reading Lists, MCQ self-assessments, & Discussion Boards.

These Modules are taught on the following Programmes, or are incorporated into blended Courses which teach students enrolled outwith the Edinburgh Imaging Academy:

- NI4R - Neuroimaging for Research programme
- IMSc - Imaging programme

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Introduction to Statistics

Lecture 1
Title: Introduction to statistics
Description: This module describes the topics that will be covered, and not covered, in the statistics course.
Author(s): Prof. Joanna Wardlaw
Learning Objectives

- Plan your learning for the main modules in this course
- Know the terminology for assessing test accuracy and observer variation
- Think about different ways of approaching the assessment of the role of diagnostic tests – the frequentist and the Bayesian approaches

How to Read a Paper

Lecture 1
Title: How to assess a paper on imaging
Description: A critique of what to look for in publications so as to judge whether the study is likely to be useful and the results reliable and valid.
Author(s): Prof. Joanna Wardlaw
Learning Objectives

- Read and critically assess a paper
- List key points which to look for in a paper
- Decide whether the methods are likely to be valid or have a major flaw
- Decide whether the results are likely to be reliable
- Decide whether the study adds to what is known about the topic already
- Avoid being misled by "glossed up" but probably over-positive findings

Assessing the Accuracy of Diagnostic Tests

Lecture 1
Title: Assessing the accuracy of diagnostic tests
Description: Core tests of diagnostic accuracy: sensitivity, specificity, positive and negative predictive values
Author(s): Prof. Joanna Wardlaw, with assistance from Ms Francesca Chappell
Learning Objectives

- Define sensitivity, specificity, positive and negative predictive values
- Describe the data required to calculate sensitivity, specificity, positive and negative predictive values
- Calculate sensitivity, specificity, positive and negative predictive values from raw data

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Assessing Differences Between Observers

Lecture 1
Title: Introduction and Kappa statistic
Description: A general introduction to assessing differences between observers or tests assessing the same variable and the use of kappa coefficient.
Author(s): Prof. Joanna Wardlaw
Learning Objectives
- Explain principles of assessing agreement between observers
- Explain what tests are useful for what situations and types of data
- Calculate and interpret kappa coefficient

Lecture 2
Title: Continuous variables and Bland Altman plot
Description: Introduction to use of Bland Altman plot to assessing differences between observers or tests assessing the same variable
Author(s): Prof. Joanna Wardlaw
Learning Objectives
- Explain the use of Bland Altman plot and its interpretation

Systematic Reviews

Lecture 1
Title: Introduction
Description: A general introduction to systematic reviews – what, why, how?
Author(s): Prof. Joanna Wardlaw
Learning Objectives
- Describe the purpose of systematic reviews
- Describe what a systematic review is
- Describe the key components of a systematic review
- Explain the basic principles of how to do a systematic review
- Cite some examples of systematic reviews of diagnostic tests

Lecture 2
Title: Example
Description: An example of a recent systematic review of non-invasive carotid imaging to diagnose carotid stenosis
Author(s): Prof. Joanna Wardlaw, Ms Francesca Chappell
Learning Objectives
- Cite a detailed example of a systematic review
- Discuss practical considerations regarding conduct of systematic reviews in depth
- Describe why it is important to avoid bias in primary studies
- Explain the importance of sufficient data for derivation of sound conclusions
- Explain what heterogeneity is and why it is important to look for

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ROC Curves

Lecture 1
Title: Introduction to ROC curves
Description: Construction and interpretation of ROC curves as a means of summarising the performance of diagnostic imaging
Author(s): Francesca Chappell, Miriam Brazzelli
Learning Objectives
- Describe what receiver operator characteristic (ROC) curves are and their purpose
- Describe, in simple terms, how the ROC curve is constructed to summarize data from single studies
- Interpret the meaning of a ROC curve
- Outline limitations in their interpretation

Lecture 2
Title: Assessing several studies
Description: Summary ROC curves to assess several studies testing the same imaging modality
Author(s): Francesca Chappell, Miriam Brazzelli
Learning Objectives
- Describe some differences between using ROC curves in single studies and to summarize several studies
- Outline the different methods which can be used to produce SROC curves and their advantages and disadvantages
- List the areas for future research