Statistics

Semester 1 / Autumn 10 Credits

Each Course is composed of Modules & Activities.

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

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
Modules:

Introduction to Statistics:
Introduction to statistics

How to Read a Paper:
How to assess a paper on imaging

Assessing the Accuracy of Diagnostic Tests:
Assessing the accuracy of diagnostic tests

Assessing Differences Between Observers:
Introduction and Kappa statistic
Continuous variable and Bland Altman plot

Systematic Reviews:
Introduction
Example

ROC Curves:
Introduction to ROC curves
Assessing several studies
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
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
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