Experimental Design

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Class hours: Monday, Friday 12:30pm-2:00pm (1st week)
Friday 12:30-3:30pm (after 1st week)
Office hours: Friday 3:30-4:30pm

Description: Basic principles of design: randomization, treatment comparisons, estimations of variance components, intraclass correlation coefficient (ICC), RCBD, Latin square, split-plot experiments, mixed model, designs of clinical trials, design of cancer clinical trials, observational study and survey design. (3G credits)

No required text book

Student Evaluation
60% of student’s evaluation is based on the lectures (9 weeks) given by Xie
Class participation (6%)
3 assignments (30%)
1 project (24%)

40% of student’s evaluation is based on the lectures (6 weeks) given by Ying and Huang
Class participation (6%)
2 assignments (20%)
1 project (14%)

1. Introduction (1 week: Aug. 25, 29, by Xie)
   1.1 Why we should care about design
   1.2 Define hypothesis
   1.3 Research design principles
2. Completely randomized design (CRD) and treatment comparisons (1 week: Sep. 5, by Xie)
   2.1 Analysis of variance table
   2.2 Tests of hypotheses
   2.3 Advantages and disadvantages of CRD
   2.4 Family-wise Error rate (FWER)
   2.5 Comparison of all treatment with a control
   2.6 Pairwise comparison of all treatments
3. Experiments to study variance (1 week: Sep. 12, by Xie)
3.1 Random effects vs. fixed effects
3.2 Estimates of variance components
3.3 Intraclass correlation coefficient
Assignment 1 due on Sep. 19

4. Factorial treatment designs (1/2 week: Sep. 19, by Xie)
   4.1 Why we need factorial designs
   4.2 Three type of treatment factor effects
   4.3 Statistical model

5. Block design (1 week: Sep. 19, 26, by Xie)
   5.1 Advantages and disadvantages of blocking
   5.2 How to select blocks
   5.3 Latin square design
   5.4 In complete block design

6. Split-plot design (1/2 week: Sep. 26, by Xie)
   Assignment 2 due on Oct. 3

7. Designs of clinical trials (2 week: Oct. 3, 10, by Xie)
   7.1 Introduction (phase, blinding)
   7.2 Parallel group design
   7.3 Cluster randomized design
   7.4 Crossover design
   7.5 Group sequential design
   7.6 Adaptive design

8. Designs of cancer clinical trials (1 week: Oct. 17, by Xie)
   8.1 Introduction
   8.2 3+3 design
   8.3 Continual reassessment method
   8.4 mTPI method
   Assignment 3 due on Oct. 24
   Project 1 due on Oct. 31

9. Survey and Sampling Design (3 weeks: Oct. 31, Nov. 7, 14, by Ying)
   9.1 Sampling methods
   9.2 Questionaire and measurements
   9.3 Missing observations and imputation
   9.4 Survey analysis and computation

10. Design of Observational Studies (3 week: Nov. 21, Dec. 5, 12, by Ying and Huang)
    10.1 Observational study vs. interventional study
    10.2 Types of observational studies
    10.3 Longitudinal setting in the observational studies
    10.4 Biasness, confounding, propensity score and multivariate matching