Sheffield Hallam University | Centre for Sport and Exercise Science

Faculty of Health and Wellbeing

PhD Students' Training

Session 6 Wednesday March 08 2017: Statistics

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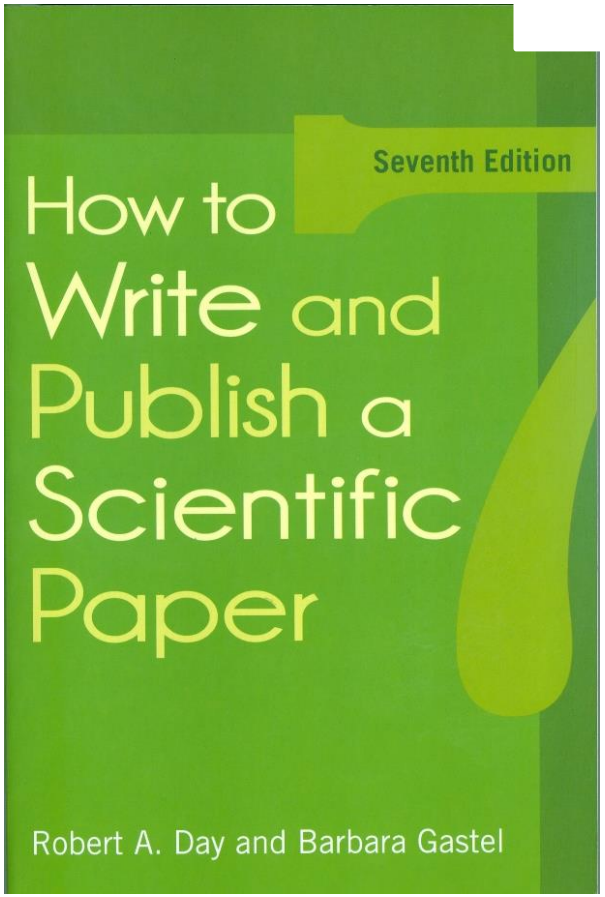
Important . . .

Day and Gastel

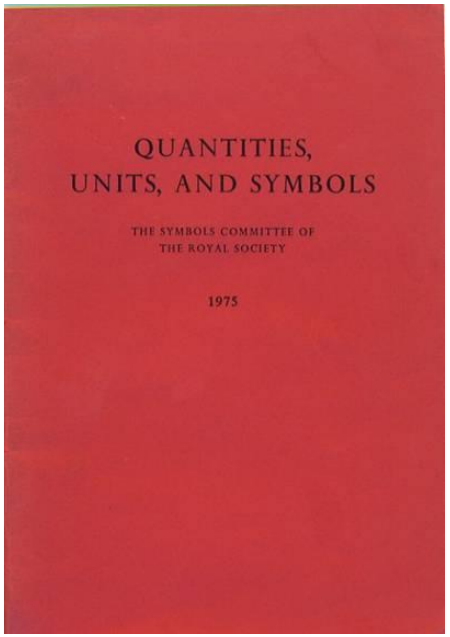


Important . . .

Editorials

Important . . .

Royal Society



Statistics

- A mean value of some sort for a sample
- As opposed to a parameter: a mean value for a population/collective
- The science of collecting, analysing, presenting and interpreting data
- A logical framework that allows the objective evaluation of research questions of interest
- Descriptive, reliability and inferential

Statistical and other analyses

The fundamental purpose:

To help us get a meaningful answer to a research question

When are analyses planned?

Before the collection of data

Levels of measurement

- Nominal
- Ordinal
- Interval
- Ratio
- Measurement and assessment

Parametric data

- Normally distributed
- Gauss

Non-parametric data

- Not normally distributed

Tests for normality

- Shapiro-Wilk
- Kolmogorov-Smirnov
- Anderson-Darling
- Skewness (positive and negative)
- Kurtosis (platykurtosis and leptokurtosis)
- Transformations

Other basics

- "Average"
- Mean
- Median
- Mode
- Variance $\Sigma(x - \bar{x})^2/n - 1$
- Standard deviation $\sqrt{}$Variance
- z scores

Selection and application

- Differences between/among groups
- Relationships
- Variance, standard deviation
- ANOVA (one-way, factorial, ANCOVA, MANOVA)
- $F = t^2$
- Homogeneity of variance (Levene's test)
- Sphericity (compound symmetry)
- Correlation (association but not necessarily causality)
- Regression
- Type I
- Type II, geometric-mean, least-products
- Non-linear

Principles

- Sampling
- Statistical power: the probability of correctly rejecting a false null hypothesis (0.8)
- Type I and Type II errors
- Sample size
- Randomised controlled trials
- Probability of drawing from the same population
- Popper and falsifiability
- Hypothesis testing H_o and H_1
- α (0.05)
- "Noise": reproducibility studies (CofV, test-retest, LPR, Bland-Altman others . . .)

Current approaches

- Magnitude-based inferences as opposed to NHST
- Effect sizes ($\bar{x}_2 - \bar{x}_1/\mathrm{SD}$)
- Jacob Cohen
- Confidence intervals
- Statistical significance and practical meaningfulness
- Minimum important clinical differences (0.2)
- "Proof"
- Probability
- Evidence-based practice
- The results suggest that a influences b

Fundamental aim/premise

- Get a meaningful answer to the research question
- Advance knowledge and understanding
- Change practice