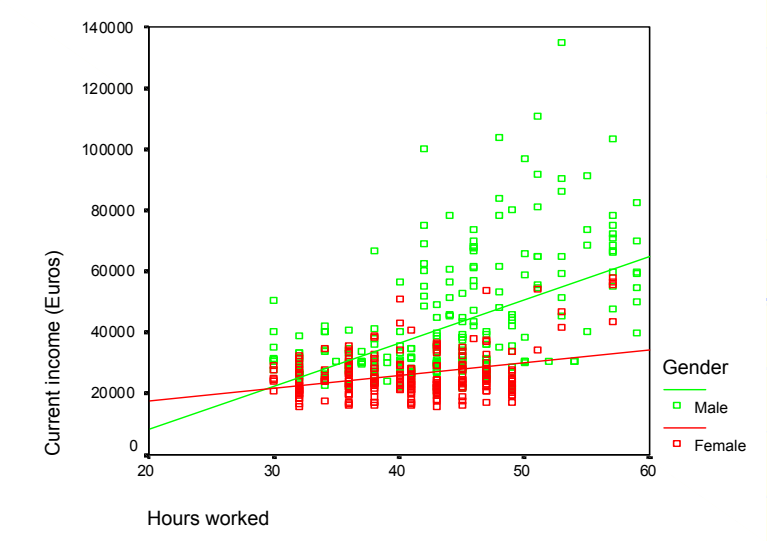
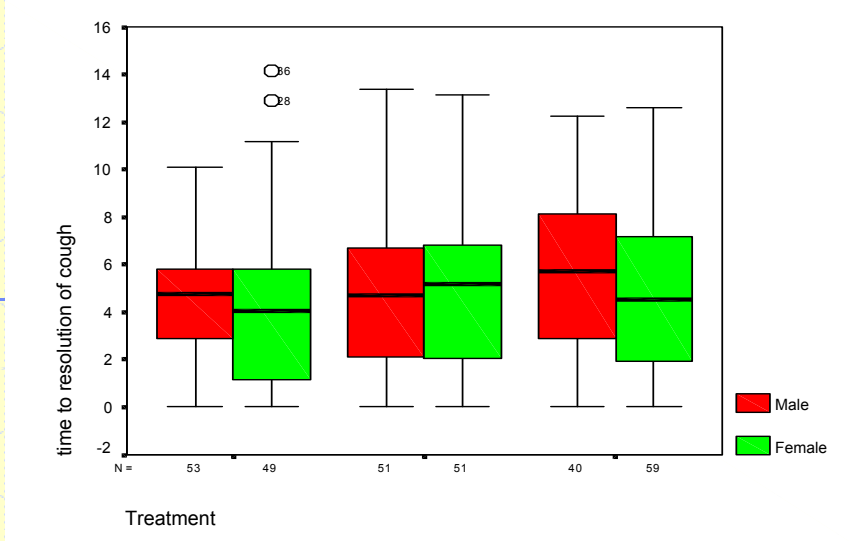
# Research Design & Methods plus an Overview of the Statistical Consulting Unit (SCU), ABCc & CSTAR



# Outline of talk

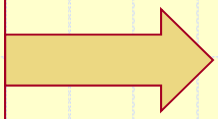
- Research Design and Methods
- Quantitative/Qualitative Methods
- Introduction to Statistical Consulting Unit (SCU), ABCc & CSTAR
- Consultancy
- Courses
- Contact details

# The Research Process

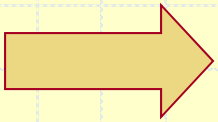
**Study Design:**

Defining the Research Question

**Planning the Analyses needed**



Collecting The data to Feed into The analysis



Conducting The Analysis And Preparing The report

# Quantitative/qualitative Research Methods

- Choice of methodology used will depend on question to be studied
- Often it can be useful to use both qualitative and quantitative methods at different points in the research
- Other times it may be completely apparent that only one or the other is appropriate

# Combining methods

## e.g. in investigating poverty

- (Quantitative) Survey data can give a measured indication of ***extent and pattern*** of poverty
- But less good at describing
  - the **experience** of poverty
    daily hardships; examples of how families cope; consequences for children
  - the **process** which led to poverty
- Better answered with qualitative methodology
  - in-depth interviews; focus groups; individual's own words

# (Quantitative) Survey research – step by step

**Components of a survey**

- Defining research question and method
- Designing a questionnaire
- Taking a sample
- Collecting data
- Building a database (data entry)
- Analysis
- Presentation

# Stage 1 – Identify the research goals

**Design of a Survey should be guided by the questions you want it to be able to answer**

- Do we simply want to estimate base-line characteristics of the population (point estimates) e.g. unemployment level, or do more complex analysis? (hypothesis testing)
- Do we want to distinguish sub-groups in analysis? Which sub-groups?
- Which are the key variables we want to generate (dependent and independent variables)?
- What statistical methods will be used?
- Answers to these will inform decision on sampling and methods of data collection

# Stage 2: Defining the survey population

- Determined by the research question
  - what are the survey units?
  - e.g. individuals, households, businesses
  - does it concern the general population or sub-group(s) of it?
  - are there demographic criteria? Geographic? Other?

- Budget constraints usually mean a finite number of interviews, so the more broadly you define a population the more thinly you spread available interviews – this means analysis of sub-groups will be based on fewer cases and so inference to the general population will be less precise.

# Key concepts - Inference

If you have taken a representative **random sample** you can:

- Calculate how close its values (**sample estimates**) are to the true population figure (calculate **confidence intervals**)
- Use **sampling theory** to test whether differences between groups could be due to chance

# Types of sample

Sample may be either a probability sample or a non-probability sample

**Probability sample:** Each person in population has an equal, or known, chance of being selected

**Non-probability sample:** Some people in population have a greater, or unknown, chance of being selected

# Size matters

- Waste of resources doing a study/survey where sample size is too small to yield reliable results
- Waste of resources conducting a study/survey with a sample size that is larger than necessary to generate an acceptable level of accuracy
- Sample size calculations can be carried out to work out the sample size required to give a particular power given a specified outcome and significance level.

# Introduction to Statistical Consulting Unit (SCU)

- Statistical Consultancy services offered internally and externally
- Courses in quantitative research methods offered internally to PGs and staff on a regular basis as well as externally to organisations e.g. HSE, businesses

# Introduction to SCU
# Where?

- Unit is based in Main building (D2029)
- Free Drop-in sessions are available every Tuesday and Thursday term-time from 11-1 (and/or other times as notified by email)
- Courses are run in lecture theatres in main building and main maths lab
- Free preliminary consultation meetings (usually 1 hr) can be arranged at any time during the year and can take place whenever and wherever appropriate

# Overview of SCU – (Consultancy)

- Most research involves collection and analysis of data
- Statistical software accessible to wide audience
- Complexity of questions being studied in many disciplines often need knowledge of statistics
- Most researchers do not have time to become statistical experts!

# Overview of SCU – (Consultancy)

The SCU can be involved at many stages in the research process

1. **Study design and protocol development**
   - **1a Sample size calculations**
   - **1b Randomisation schemes**
2. **Database construction and cleaning**
3. **Analyses of data**
4. **Report preparation**
5. **Integrating statistical reports with other reports**
6. **Preparation of Journal papers and books**

# Overview of SCU – (Consultancy)

**The SCU can be involved in many different kinds of analysis (and data!)**

- **Market Research**
- **Survey Design and Analysis**
- **Financial Analysis**
- **Pharmaceutical and Clinical Trials**
- **Agricultural Sciences/Engineering – Design of Experiments**
- **Expert witness presentations in court cases**
- **Data Mining**

# Overview of SCU - (Consultancy)

When during a study should a researcher approach the SCU for a consultation?

1. **At the beginning!**
2. **At the beginning!**
3. **At the beginning!**

Sometimes an initial meeting is all that is required!

# Overview of SCU - (Consultancy)

What does the statistician need to know about your study?

- Background
- Status
- Aims/objectives/hypotheses
- How much help needed?
- What help needed?
- When  is it needed by?

# Overview of SCU - Who to Contact

**Dr Jean Saunders**
**Executive Director**
**Statistical Consulting Unit/ABCc/CSTAR**
**Graduate Entry Medical School**
**(Affiliated to Department of Mathematics and Statistics)**
**University of Limerick**
**Tel: +353 - 61 – 213471**
**Mob: +353 – 86 - 3866353**
**Fax: +353 - 61 - 334927**
**email jean.saunders@ul.ie**

# Overview of SCU - How to Contact

- **Best approach is to send an email explaining the problem and asking to arrange an initial appointment**
- **Or Come along to Drop-in centre (D2029 – usually Tues/Thurs 11-1)**
- **Timelines are agreed for work**
- **SFI/EI sponsored drop-in/consultancy**
- **Quote given (if necessary) after initial meeting for any further work to be undertaken by unit**

***(Quote will be needed only if extensive amount of work involved e.g. complicated modelling carried out by statistician)***

# New Consultancy Service

**Applied Biostatistics Consulting Centre**

**ABCc**

**Part of the SCU but structurally situated within the Graduate Entry Medical School**

**Also part of CSTAR – health related research support centre – offering research methodology advice to whole of Ireland together with UCD**

**HRB Sponsored**

**It will concentrate on Biostatistical and Medical Applications e.g. Clinical Trials, Health Services/Methods Research**

# Overview of SCU (Courses)

Most research studies require only simple statistical methods to analyse them

- **Basic quantitative research methods courses PLUS**
- **Basic courses on the use of statistical analyses packages e.g. SPSS**

**Enable most researchers to carry out their own studies from beginning to end!**

## Advantage!

**Researcher has a better 'feel' for their own data**

**Easier for them to generate new hypotheses and/or discover associations within their data that may not have been seen by statistician!**

# Overview of SCU - Courses currently offered

- Courses are offered twice a year
- Jan and May/June each year
- Next set of courses:

  Mid Jan 2010
- Full details on SCU website

# Overview of SCU -
## Courses currently offered
## (not ALL courses offered each session)

**Questionnaire Design**

**Duration: 1 day**

**This introductory course covers the basic elements of questionnaire design and question wording. The different requirements for postal and interview questionnaires will be emphasised and practical exercises will be given in question wording. Some suggestions for ways of improving response rates will also be given. It will also be a useful course for those involved in proforma design. It is a complimentary course to 'Surveys and Sampling'.**

**Surveys and Sampling**

**Duration: 1 day**

**This course examines how sampling techniques can be applied in survey and other types of research. We begin by looking at the role of sampling in the survey process. We introduce the basic principles of sampling theory and how this relates to sampling strategies and sample design in a practical context. Practical exercises address the questions of the required sample size and precision of estimates, sampling strategies and when sample surveys are appropriate. It is a complimentary course to 'Questionnaire Design'.**

# Overview of SCU - Courses currently offered (2)

**Introductory SPSS**

**Duration:** 1 day

This course provides an intensive introduction to SPSS (a statistical analysis software). It assumes that participants will have a basic familiarity with the Windows environment. We will examine the features of SPSS for Windows, use a simple data set to cover the topics of transforming variables, selecting data for analysis, then performing basic analyses to produce frequency distributions, summary statistics and cross tabulations before examining some of the extensive graphics capabilities of SPSS.

# Overview of SCU - Courses currently offered (3)

**Analyses of Categorical (Survey) Data**

**Duration**: 1 day

The course will provide an introduction to the basic approaches to exploratory data analysis. No knowledge of statistics is assumed although familiarity with Windows and basic SPSS is assumed. The course focuses on hands-on learning through practical exercises, and covers the following: ways of exploring variable distributions using tables and charts; use of cross-tabulation and the use of control variables to explore the relationship between variables, techniques for recoding and deriving new variables; the use of weighting. More formal statistics covering hypothesis testing and tests of association for tables will also be covered and supported by a course handbook.

# Overview of SCU - Courses currently offered (4)

**Exploring Relationships and Regression Analyses**

**Duration:** 1 day

This course will build on Analyses of Categorical Data by taking a more formal look at the relationships between variables at different levels of measurement. More formal statistics covering the normal distribution, sampling distributions and hypothesis testing will also be covered and supported by a course handbook. The course will also cover correlation between two variables and simple bivariate regression analysis. Again there will be a high practical component with examples based on data provided for the course.

# Overview of SCU - Courses currently offered (5)

## Basic Statistics for Researchers
## Duration: 2 days

- **A basic statistics course covering the basic methods of analysis needed for quantitative research. A mix of practice and theory. No prior knowledge of statistics is assumed although you will require a basic knowledge of using SPSS and/or other statistical software packages. This course will be mainly suited to those from the sciences or medical fields but others may find it useful. Subjects covered include:**
- **Sampling**
  **Data analysis – an overview; Types of data; Scales of data measurement;**
  **Coding questionnaire data**
  **Describing data using graphical and numerical methods**
  **Normal Probability distributions**
  **Confidence Intervals and Hypothesis Testing (Parametric and non-parametric)**
  **Multivariable analysis – Qualitative (categorical) variables – Chi-squared Tests**
  **Multivariable analysis – Quantitative (continuous) variables – Scatter plots, correlation and regression.**

# Overview of SCU - Courses currently offered (6)

**Introduction to Design of Experiments**
**Duration: 1 day**

**This course is only offered intermittently by the Statistical Consulting Unit. It covers the principles of DOE but at an introductory level. It would be useful for anyone new to research in the sciences that needs to understand these principles before planning their research. It will cover simple DOE techniques, when they are applicable, how to design efficient experiments and an introduction to analysing the results. During the day you will also be introduced to a simple DOE package. It will not be possible in one day to look at more complicated designs but you will be introduced to enough methodology to be able to investigate these further if needed.**

# Overview of SCU - Courses currently offered (7)

## Nvivo

### Duration: 1 day

- The workshop covers the computerised annotation and coding of qualitative data. The workshop uses NVIVO qualitative coding software. NVIVO is a standard package for non-numerical un-structured analysis of texts and other data objects. The notion of qualitative data that we use is multi-media: digital audio, photos, and texts are all included.
- We aim to integrate your existing knowledge of qualitative interpretation techniques with a growing awareness of the possibilities for computerised manipulation and annotation of data. Sample data sets and coded output are provided. Participants in the workshop are urged to construct graphical images ('iconic models') to represent the findings. About half of the workshop time is spent in lecture/discussion, and half of the time is spent in practical activities using one personal computer for each participant. You may continue the practical activity after the workshop.

## Lisrel (Introductory Structural Equation Modelling)

### Duration: 2 days

- Day 1
  - What is SEM
  - An in introduction to PRELIS
  - Path analysis
  - Confirmatory factor analysis
- Day 2
  - Combining measurement and structural models
  - The full LISREL model
  - Q&A Session

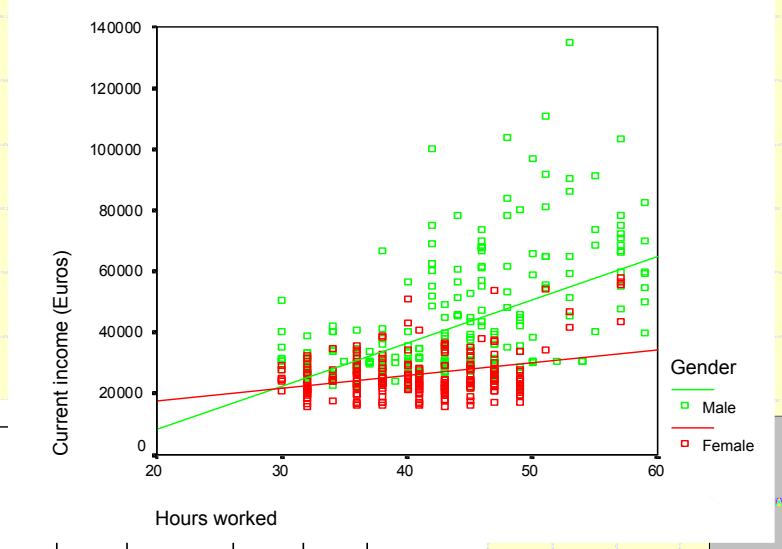
# Overview of SCU - Future Courses

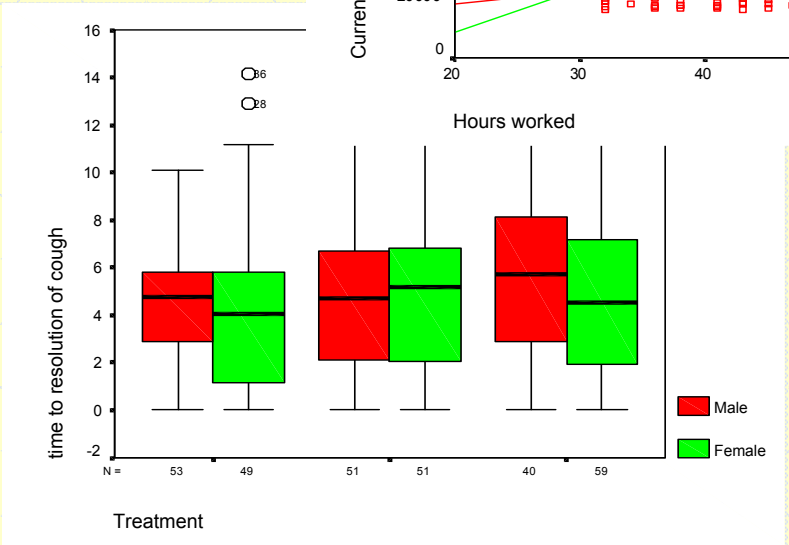
- Logistic Regression/Multiple Regression
- Any other 'further' courses requested that have sufficient demand
- Other 'basic' courses that might be useful to researchers

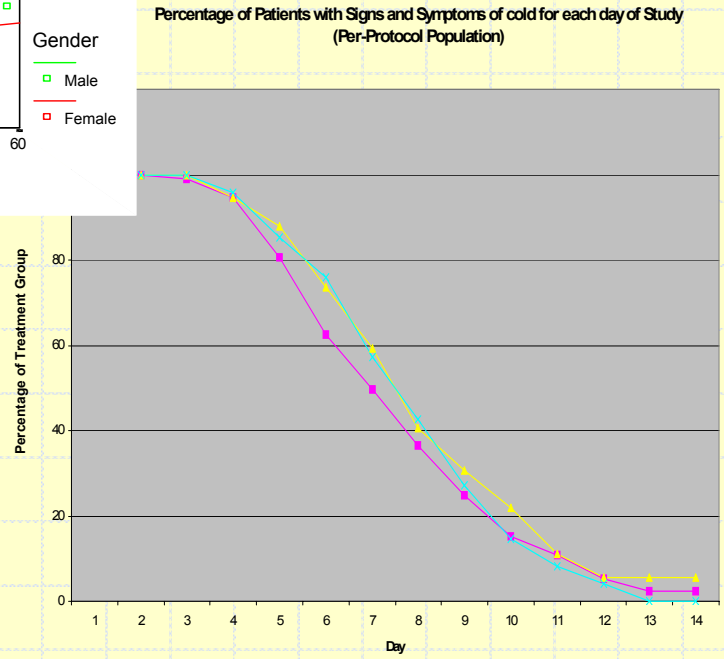
# Overview of SCU – Summary

1. **Contact the SCU as early as possible in a study**
2. **Provide as much information as you can**
3. **If contact not made early (for whatever reason!) the SCU is still happy to get involved at any stage of study and give any advice needed**
4. **Courses are available to staff and PGs to consolidate knowledge of quantitative methods and use of statistical software**
5. **Courses/consultancy services free (at present) to all PGs**
6. **Drop-in services available**
7. **Statisticians are friendly people - honest!**

# Research Design and Methods & Overview of SCU – Questions?



# Overview of SCU – Statistics as fun!

## THE TOP TEN REASONS TO (NOT?) BECOME A STATISTICIAN

1. Deviation is considered normal.
2. We feel complete and sufficient.
3. We are "mean" lovers.
4. Statisticians do it discretely and continuously.
5. We are right 95% of the time.
6. We can legally comment on someone's posterior distribution.
7. We may not be normal but we are transformable.
8. We never have to say we are certain.
9. We are honestly significantly different.
10. No one wants our jobs.