# CLINICAL EVIDENCE MADE EASY

M HARRIS, G TAYLOR & D JACKSON

2nd EDITION


THE BASICS OF EVIDENCE-BASED MEDICINE

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# Contents

# Preface to the second edition

This book is designed for healthcare professionals who need to know how to understand and appraise the clinical evidence that they come across every day.

We do not assume that you have any prior knowledge of research methodology, statistical analysis or how papers are written. However basic your knowledge, you will find that everything is clearly explained.

We have designed a clinical evidence appraisal tool for each of the main types of research method. These can be found in the second section of the book, '*Clinical evidence at work*', and you can use them to help you evaluate research papers and other clinical literature, so that you can decide whether they should change your practice.

You can also test your understanding of what you have learnt by working through the extracts from original papers in the '*Clinical evidence at work*' section.

For this new edition, we have added questions at the end of each chapter so that you can check how well you have understood the concepts. Model answers are provided.

*Michael Harris, Gordon Taylor and Daniel Jackson*

# About the authors

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# Acknowledgements

We would like to thank our publisher, Dr Jonathan Ray, for his patience and helpful advice.

# How to use this book

## If you want a clinical evidence and critical appraisal skills course

- Work through the book from start to finish for a complete course in how to understand and appraise clinical evidence.
- The first page starts with the assumption that you want to go right back to first principles.
- Each chapter will build on what you have learnt in previous chapters.
- The chapters have simple examples that illustrate what you are reading.
- We have cut down on the jargon as much as possible. All new words are highlighted and explained.

## If you are in a hurry

- Choose the chapters that are relevant to you. Each chapter is designed so that it can be read in isolation.

## If you want a reference book

- You can use this as a reference book. The index is detailed enough for you to find what you want quickly.
- New concepts are highlighted in bold in the text so that you can find them and their explanations quickly and easily.

## Test your understanding

- The questions at the end of each chapter use practical scenarios to let you check how well you have understood the concepts. You can compare your answers with the ones we give at the end of the book.

## Applying your knowledge

- The appraisal tools in the '*Clinical evidence at work*' section give you a system that you can use to evaluate the clinical evidence that you encounter.
- See how these appraisal tools are used in extracts from real-life published papers in the '*Clinical evidence at work*' section. We have made minor changes to the abstracts to make them easier to follow, but the data has not been changed.

## Study advice

- Go through difficult sections when you are fresh and try not to cover too much at once.
- You may need to read some sections a couple of times before the meaning sinks in. You will find that the examples help you to understand the principles.

# Abbreviations

| | |
|---|---|
| ARR | absolute risk reduction |
| CI | confidence interval |
| CONSORT | Consolidated Standards of Reporting Trials |
| EBHC | evidence-based healthcare |
| EBM | evidence-based medicine |
| EBP | evidence-based practice |
| GRADE | Grading of Recommendations Assessment, Development and Evaluation |
| HR | hazard ratio |
| ICER | incremental cost-effectiveness ratio |
| IQR | inter-quartile range |
| ITT | intention to treat |
| LR | likelihood ratio |
| NICE | National Institute for Health and Care Excellence |
| NNH | number needed to harm |
| NNT | number needed to treat |
| NPV | negative predictive value |
| OR | odds ratio |
| OTC | over the counter |
| PP | per protocol |
| PPV | positive predictive value |
| RCT | randomized controlled trial |
| ROC | receiver operating characteristic |
| RR | risk ratio |
| RRR | relative risk reduction |
| SD | standard deviation |
| SIGN | Scottish Intercollegiate Guidelines Network |

# Understanding clinical evidence

# Chapter 6
# Statistics that describe

Most papers start their results sections with some 'descriptive statistics'. These provide a context for the overall results of the research. We can then use this information when comparing samples or assessing the generalizability of the results to our own patient population.

See *Chapter 19* for a tool that will help us to decide whether appropriate descriptive statistics have been used.

## Definition

Statistics is the science of collecting, summarizing and analysing numerical data. Therefore any paper involving counting also uses statistics.

**Descriptive statistics** summarize the main features of sets of data. They do not test any hypotheses that we have or make predictions – they are simply a way to describe our data.

## How easy is this to understand?

Descriptive statistics are not normally complex. They usually involve the presentation of data as tables of frequency and percentages, means and standard deviations, or medians and inter-quartile ranges.

More details are given in our companion book, *Medical Statistics Made Easy*.

## Frequencies and percentages

Frequencies are the number of times that events occur. Percentages give the reader a scale on which to assess or compare those frequencies. 'Per cent' means per hundred, so a percentage describes a proportion of 100.

**EXAMPLE**

A practice recorded the smoking status of all its patients with diabetes. It did the same again after a year-long stop-smoking campaign.

| | Start of study | End of study |
|---|---|---|
| Number of diabetic smokers | 48 | 49 |
| Number of patients with diabetes | 300 | 326 |
| Percentage of diabetic patients who smoke | 16% | 15% |

Note that, although there was one more smoker at the end of the year than at the start, the total number of patients in the practice diagnosed with diabetes also increased, so the proportion of those smoking fell from 16% to 15%.

## Means and standard deviations

We use means when the spread of the data is fairly similar on each side of the mid-point, for example when the data show a **normal distribution**. The mean is the sum of all the values, divided by the number of values.

The normal distribution is the symmetrical, bell-shaped distribution of data shown in *Figure 6.1*.

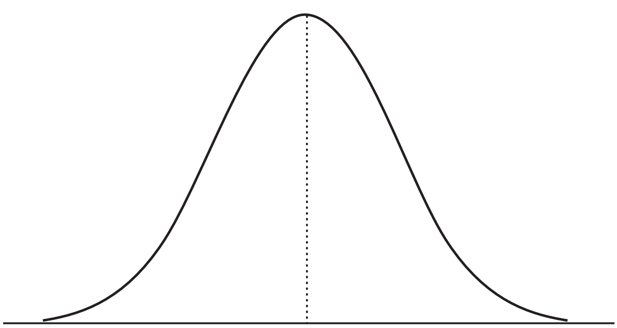

**Figure 6.1.** The normal distribution. The dotted line shows the mean of the data.

**Standard deviations** provide information on how much the data are spread around their means. A range of one standard deviation (**SD**) above and below the mean (abbreviated to ± 1 SD) includes 68.2% of the values; ± 2 SD includes 95.4% of the data; ± 3 SD includes 99.7%.

**EXAMPLE**

*Figure 6.2* compares the means and standard deviations of two sets of total cholesterol measurements.

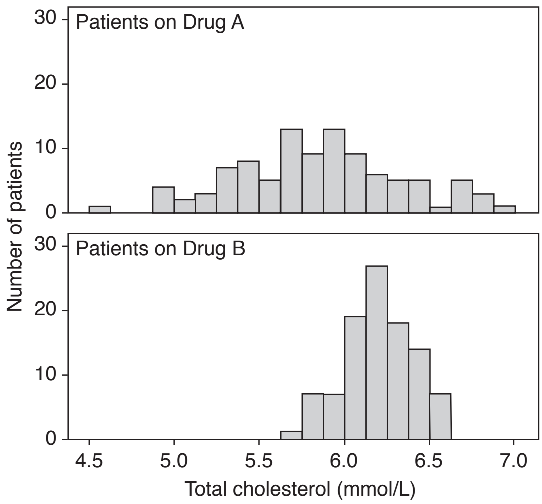


**Figure 6.2.** Total cholesterol levels of two groups of 100 patients. For patients on Drug A the mean is 5.8 mmol/L, SD 0.49 mmol/L. For patients on Drug B the mean is 6.2 mmol/L, SD 0.2 mmol/L.

Both curves follow a normal distribution but have different means. The values for patients on Drug B are more closely spread around their mean, reflected by the smaller standard deviation for that group.

Note how the curves are uneven. This is to be expected, given the relatively small numbers in each group.

## Medians and inter-quartile ranges

Medians are used to represent the average when the data are not symmetrical, for instance the **skewed distributions** in *Figure 6.3*. The median is the point at which half the values are above, and half below.

When the long tail of the graph is to the right of the peak, the data are said to be **positively skewed**.

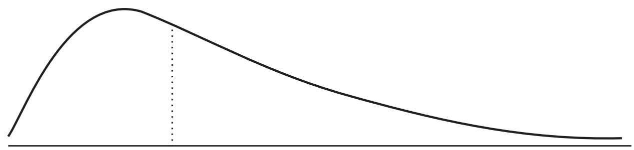

**Figure 6.3.** A skewed distribution. The dotted line shows the median.

Medians may be given with their **quartiles**. These give an idea of the spread of the data. The first quartile point has a quarter of the data below it, the third quartile point has three-quarters of the sample below it, so the **inter-quartile range (IQR)** contains the middle half of the sample, i.e. between the first and third quartile.

**EXAMPLE**

*Figure 6.4* shows the spread of Hamilton Depression Rating Scale (HAM-D) scores for two groups of patients. Both curves are skewed. In Sample A the median is 5.2, IQR 3.5–8.3. The median for Sample B is 13.8, IQR 8.6–17.8.

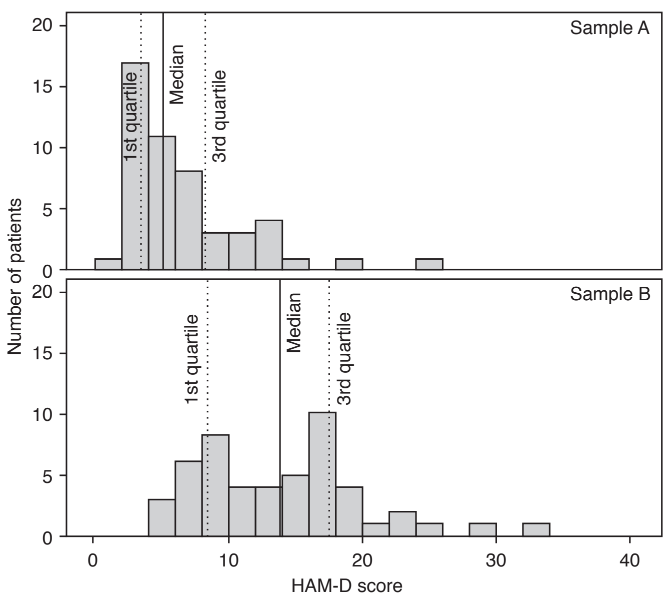


**Figure 6.4.** HAM-D scores for two groups of patients.

## Survival analysis

Survival analysis techniques are methods to represent the time until a single event occurs. While that could be death, it could be any other single event, for example time until discharge from hospital.

Survival analysis techniques are able to deal with situations in which the end event has not happened in every patient or when information on a case is only known for a limited duration. These are known as **censored** observations.

A **life table** shows the proportion of patients surviving over time. Life table methods look at the data at a number of fixed time points and calculate the survival rate at those times.

### Kaplan–Meier curves

The most commonly used life table method is the Kaplan–Meier approach. This method recalculates the survival rate when an end event (e.g. death) occurs in the data set. This is usually represented as a **survival plot**. *Figure 6.5* shows an example of two survival curves. Note how it is easy to make a comparison of the survival rates at a specific time and to estimate at what level the survival rates 'level off'.

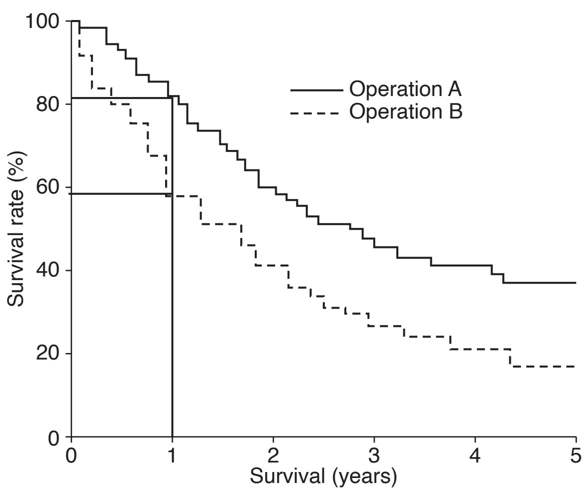


**Figure 6.5.** Kaplan–Meier survival curve comparing patients who have had two different types of operation for gastric cancer.

## Modes

Mode is the name for the most frequently occurring event.

This is usually only used when we have **nominal variables**, i.e. those that represent different categories of the same feature and where the categories are not ordered. An example is eye colour: there isn't an average of two eye colours, so we can't use the mean or median. The commonest eye colour is called the mode.

The mode can also be used when there is no single average value. If there are two modes in a sample, this is known as **bimodal**.

## Keeping track of the patients

Another important example of descriptive statistics is the **CONSORT diagram**. CONSORT stands for the Consolidated Standards of Reporting Trials and is a set of guidelines for reporting trials. These include a requirement to present a diagram outlining, for each stage on the recruitment and follow-up of a trial, the number of patients who leave and stay. This demonstrates that all patients have been accounted for and shows how many have left at each stage of the trial. *Figure 6.6* shows an example of it in use.

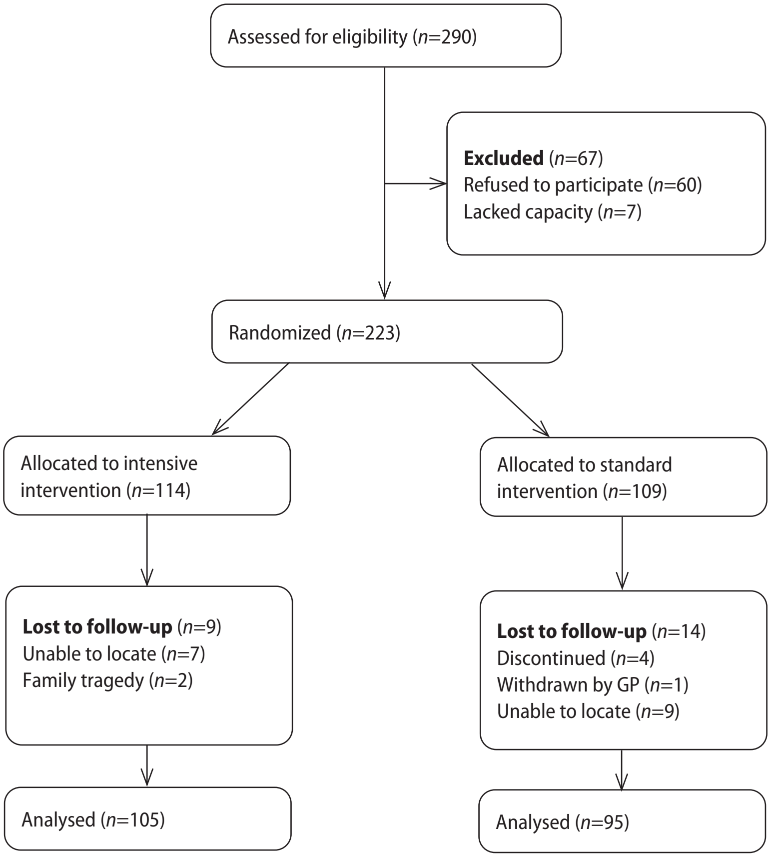


**Figure 6.6.** CONSORT diagram for group of patients in a study on the effect of a dietary intervention on control of diabetes.

## Watch out for...

Means and standard deviations should only be used when data are normally distributed. When we see these values in a paper, a simple way to check whether the data really are normal is to calculate the mean plus (and minus) twice the standard deviation. If either value is outside of the possible range of the data, then we know that the data are unlikely to be normally distributed.

For example, if a visual analogue scale for pain has a scale from zero to 10, and the authors state that their data have a mean of 3 and an SD of

2, then the lower limit for 95.4% of the data (i.e. ± 2 SD) would be –1. However, the lowest possible value for this scale is zero, so the data must be skewed. Because of that, the median and quartiles should have been used instead.

## Test your understanding

**1.** The mean age of a group of patients in a study is 68 years. Their median age is 55. Which measure of spread should the researchers use?

**2.** Look at *Figure 6.5*. Estimate the 5-year survival rates for the two different operations.

See the *Appendix* for the answers.