

# What's the Use of Statistics?

Stella Dudzic

My presentation at the 2014 SMC Conference arose from two projects I had been working on. One of them was the Royal Statistical Society Report *A world full of data* for which I was assistant researcher. Although the report is subtitled *Statistics opportunities across A-level subjects*, many of the findings are applicable to any education system.

To find the information for the report, discussions were held for each of the following subjects: Biology, Geography, Business Studies, History, Chemistry, Physics, Computing, Psychology, Economics and Sociology. Each discussion included representatives from HE, employment, learned societies, teachers, exam boards and curriculum experts.

There was strong agreement from the Higher Education representatives that they wanted students to be able to engage with and interpret data with confidence and competence. Employers wanted graduate employees to be able to work with data, including reports and research papers, and communicate the results to colleagues.

The Clothworkers' Foundation had provided some funding to MEI for a project aiming to highlight the importance of mathematics and its uses to sixth form students and to improve skills in mathematical and statistical problem solving. As part of this Integrating Mathematical Problem Solving (IMPS) project, we have written some resources about the mathematics and statistics used in other subjects at post-16 level. These resources are freely available to anyone. See:

[www.mei.org.uk/?section=resources&page=imps](http://www.mei.org.uk/?section=resources&page=imps).

Some of the ideas in some of the resources are outlined below.

## News or not?

Which of the following have been newspaper headlines and which ones have been made up?

- Brushing your teeth twice a day could save you from a heart attack
- Daily pint can help your heart
- Fizzy pop heart risk for women
- Doctors say alcohol free days needed to protect liver
- Coffee lowers depression risk
- Chocolate may protect the brain and heart

The NHS has information about health-related news stories on its website in a section called *Behind the headlines*

[www.nhs.uk/news/Pages/NewsIndex.aspx](http://www.nhs.uk/news/Pages/NewsIndex.aspx).

Information is given about recent news reports and the research that led to the news story. This is a useful resource for teachers who want to introduce students to statistical research in the context of health.

In fact, all the news headlines in the bullet points above have been genuine headlines. I was going to make some up when I was writing the resource but I became concerned that something I made up could later come up as a genuine news story so I stuck to real headlines.

## Brushing your teeth twice a day could save you from a heart attack

This headline arose from research which looked for an association between the state of people's gums and whether or not they had heart disease. The IMPS resources go on to look at the importance of statistical hypothesis testing for medical research using the example of a chi-squared test used by the researchers who were looking to see whether there was such a link.

## Can you read a map without turning it round?

You can check your ability to rotate images mentally with an online test e.g.

[www.cambridgebrainsciences.com/browse/concentration/test/rotation-task](http://www.cambridgebrainsciences.com/browse/concentration/test/rotation-task).

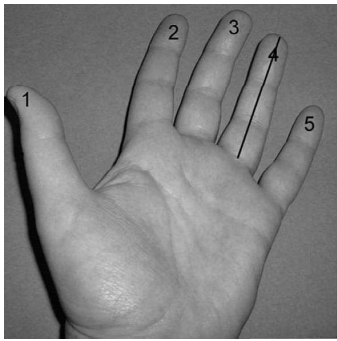
There is a paper based version for the IMPS resources.



Microsoft image

## What has the length of your fingers got to do with it?

The digits of the hand are numbered from 1 for the thumb. The digits are named as follows:



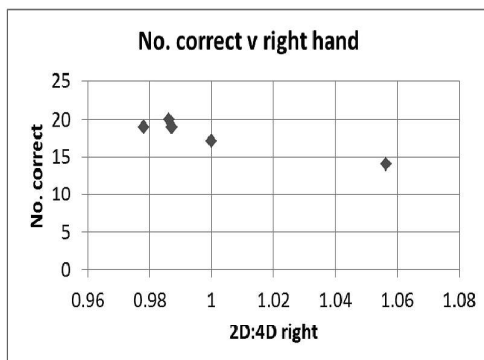
- 1D Thumb
- 2D Index finger
- 3D Middle finger
- 4D Ring finger
- 5D Little finger

Turn your hand palm up and measure digits 2 and 4 in centimetres, to the nearest tenth of a centimetre. Measure from the crease where the digit meets the palm, up to the fingertip.

A number of studies in psychology are related to the ratio of two of the digit measurements 2D:4D; the length of the second digit divided by the length of the fourth digit. 2D:4D tends to be lower for males than females. Typical values for the UK are 0.98 for males and 1 for females. It is thought that 2D is a measure of exposure to oestrogen in the womb whereas 4D is a measure of exposure to testosterone in the womb. You may want to reflect on likely measurement error when measuring digits and how this would translate into an error in the value of 2D:4D. Some researchers have resorted to asking participants in their studies for a photocopy of their hands in order to minimise errors in measuring the digits.

### Is mental rotation ability correlated with the digit ratio 2D:4D?

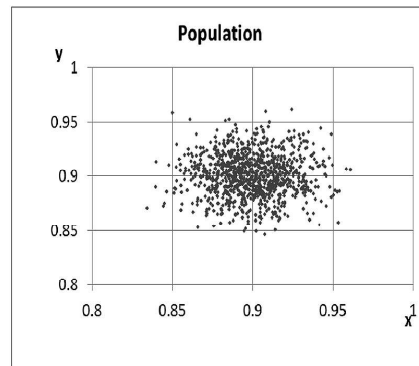
Here is some sample data (not from the SMC presentation); the correlation coefficient is -0.95 but it is a small sample and there is an outlier, so does it provide any evidence to suggest there is a correlation between mental rotation ability and digit ratio in the general population?



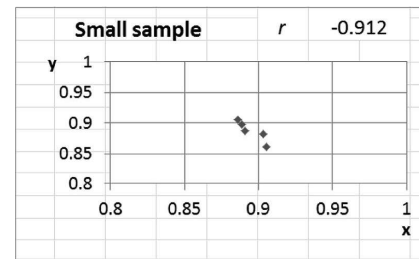
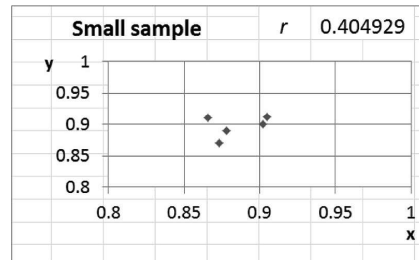
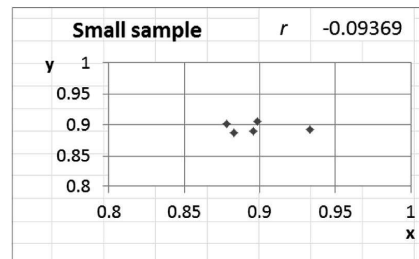
### Correlation and sample size

Imagine taking samples from a large population where there is no correlation.

Small samples will have correlation coefficients which vary quite a lot, even though there is no correlation in the population being sampled.



How big do we need the correlation coefficient to be for a sample before we start to think that there really is some correlation in the population it comes from? That is



essentially what critical values for correlation coefficients provide. To explore further, you can use the spreadsheet in the IMPS resources and use the other resources to find out more about hypothesis testing using a correlation coefficient:

[www.mei.org.uk/?section=resources&page=imps](http://www.mei.org.uk/?section=resources&page=imps).

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