EDITOR'S CHOICE

What is a CI?

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The theory

When reading a research report, the range of the CI provides assurance (or confidence) regarding how precise the data are. CIs are calculated at a confidence level, for example 95%. This level is predetermined by the researcher. Confidence levels are usually calculated so that this percentage is 95% although others 90%, 99%, and 99.9% are sometimes applied.

Researchers collect numerical data and then apply statistical tests. An example of a common statistical test applied by researchers is the mean which is then used to approximate the average for an entire population. CIs provide an indication of how reliably these results reflect the whole population.

CIs are considered a more useful measure than p values, which only reflect a level of statistical significance.[1](p values were discussed in a previous *Research Made Simple* paper.[2])

The concept

A CI is a numerical range used to describe research data. For example, for a study outcome of weight, a CI may be 53 to 71 kg. This interval of 53 to 71 kg is where there is 95% certainty that the true weight would lie (if you were applying a 95% CI).

The mainstream press often quote CIs when interpreting the results of polls, for example: the results of the latest XXX Research telephone poll considering two weight loss techniques showed that 62% of respondents favoured technique A while 39% would chose technique B. This telephone poll of 12 073 respondents had a margin of error of plus or minus 4.2 percentage points.

Presuming a 95% confidence level was applied, these results suggest there is a 95% chance that between 64.2% and 57.8% of people would chose technique A (62%±4.2%). Conversely, there is a 5% chance that fewer than 57.8% of people or more than 64.2% of people would choose technique A.

CIs are used to interpret the reliability of research data. The width or range of the CI indicates the reliability of the data (sometimes known as precision). A narrow CI implies high precision and credible values whereas a wide interval suggests the reverse. A wide interval may indicate more data should be collected before conclusions can be drawn. Sometimes when a CI is very wide, it may indicate an inadequate sample size.

Meaning and interpretation

CI is usually found in the results section of a paper and provide the reader with an opportunity to draw conclusions about the importance of the size or strength of the results. CIs are expressed as X (A–B), where X is the observed statistic for example, a mean, A is the lower limit of the CI, and B is the upper limit.

Two questions should be considered when interpreting a CI:

1. Does the CI contain a value that implies no change or no effect?

Does the CI include (cross) zero? If it does, this implies no statistically significant change. For example, research on a treatment for hypertension found that the 95% CI included zero (−1 to 13) suggesting the treatment is ineffective.

2. Does the CI lie partly or entirely within a range of clinical indifference or clinical significance?

Clinical indifference represents values of such a small size that you would not want to change current practice. For example, a weight reduction programme showing a loss of 3 kg over 2 years, or a diagnostic test that had a predicative value of less than 50% would not be considered useful.

Some examples

A

Researchers examined the efficacy of a homeopathic preparation for analgesia and swelling postoral surgery. Two days postoperatively the homeopathic preparation had led to a mean reduction in swelling of 3 mm. The 95% CI ranged from −5.5 to 7.5 mm. This wide interval (which crosses zero) suggests there was neither a large increase in nor a decrease in swelling due to the homoeopathic preparation. As the CI crosses zero, this suggests the treatment is ineffective.

B

If parliamentary elections were held today and an opinion poll predicted the Blogs party would win 62% of the vote, the pollster might attach a 95% CI to the interval, so the range would then be 59 to 65%. It would be reasonable to conclude the Blogs party would get between 59% and 65% of the total vote. This CI is quite narrow telling us the estimated value is relatively reliable and that repeated polls would give similar results.

Competing interests None.

References

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