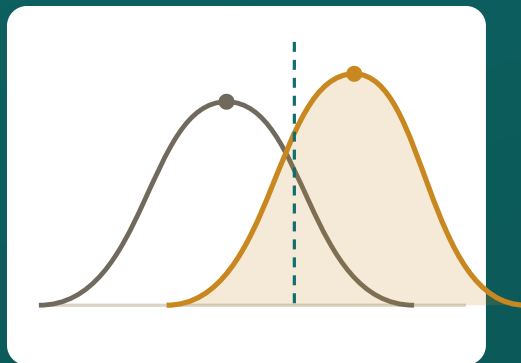


Reading a Confidence Interval Correctly

The interpretation that holds up, the one almost everyone gets wrong, and how to use an interval to say more than a p-value ever can. A working guide from PhD statisticians.



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A confidence interval is about the method, not a single result

The confidence interval is the most useful number in your results and the most commonly misstated. Get the wording right and it carries more information than a p-value, because it shows both the size and the precision of your effect. Get it wrong, and you hand a committee an easy correction.

PRINCIPLE

A 95 percent confidence interval means that if you repeated your study many times and built an interval each time, about 95 percent of those intervals would contain the true value. The confidence is a property of the procedure across many samples, not a probability statement about your one interval.

The line that gets corrected

1 The tempting wording

It is natural to write "there is a 95 percent probability the true value lies in my interval." This is the single most common interval error, and examiners watch for it.

2 Why it is wrong

Once your interval is calculated, the true value either is or is not inside it. The 95 percent describes how often the method captures the truth over repeated sampling, not the odds for your particular interval.

3 The wording that holds

Write "we are 95 percent confident the true value lies between X and Y," understanding confidence as a long-run property of the procedure. This phrasing is accepted and defensible.

What the width and position tell you

An interval answers two questions a p-value cannot: how big is the effect, and how precisely did you measure it. Read both before you draw a conclusion.

READING THE INTERVAL

What you see	What it tells you
A narrow interval	The effect is estimated precisely; your sample was informative
A wide interval	The estimate is uncertain; often a sign of a small sample
Interval excludes the no-effect value	Consistent with a statistically significant result
Interval includes the no-effect value	The effect is not statistically significant at that level
Interval sits far from zero but is wide	A possibly large effect measured imprecisely; worth more data

WATCH OUT FOR

The no-effect value depends on your measure. For a difference in means it is zero; for an odds ratio or relative risk it is one. An interval that crosses its no-effect value indicates a non-significant result, so always check which value matters for your statistic before you interpret it.

WATCH OUT FOR

The overlap trap costs marks in vivas. Seeing two groups' confidence intervals overlap and concluding the groups do not differ is wrong: intervals can overlap substantially while the difference between them is still significant, because the interval on the *difference* is what tests it, not the two separate intervals. If you want to compare two estimates, construct the interval on their difference and read that. Equally, do not treat every value inside the interval as equally supported: under the compatibility reading now urged by methodologists, values near the point estimate are far more compatible with the data than values near the bounds, so an effect technically inside a wide interval is not thereby a likely effect.

Report the interval alongside the estimate

A strong results sentence gives the point estimate, its interval, and a plain reading of what the interval implies for your question.

Reporting template (adapt to your statistic)

Estimate: [the effect, e.g. mean difference = 4.2]
 Interval: 95% CI [lower, upper]
 No-effect value: [0 for differences, 1 for ratios]
 In words: [the effect is estimated at 4.2, and we are
 95% confident the true value lies between
 [lower] and [upper]]
 Precision note: [if wide: acknowledge the uncertainty;
 if narrow: note the estimate is precise]

PRINCIPLE

Lead your interpretation with the interval, not the p-value. Telling a reader the effect is "between 2 and 6 points, with 95 percent confidence" is more honest and more useful than telling them only that it was significant. The interval shows the range of effects your data are compatible with, which is what a thoughtful committee actually wants to know.

The confidence interval checklist

If every box is ticked, your intervals will say exactly what your data support, in wording an examiner will accept.

- ☒ You describe confidence as a long-run property of the method, not the odds for one interval.
- ☒ You never write that there is a 95 percent probability the truth is in your specific interval.
- ☒ You report the interval alongside the point estimate, not on its own.
- ☒ You identify the correct no-effect value for your statistic.
- ☒ You read the width as precision and the position as direction.
- ☒ You compare two groups using the interval on their difference, not by eyeballing whether their separate intervals overlap.
- ☒ You acknowledge uncertainty when an interval is wide.
- ☒ You lead interpretation with the interval rather than the p-value.

WHEN THE NUMBERS HAVE TO BE READ CORRECTLY

Have your estimates and intervals reported the right way

If you want your effects reported with correct confidence intervals, read and worded so they hold up under questioning, our PhD statisticians run and present the analysis with you. You stay the author and understand exactly what each interval means.

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