TRUST Research Center

Non-inferiority and Equivalence Studies Calculator

User Guide

Complete guide to data entry, Excel upload, result interpretation, and PDF report export for all 8 calculators.

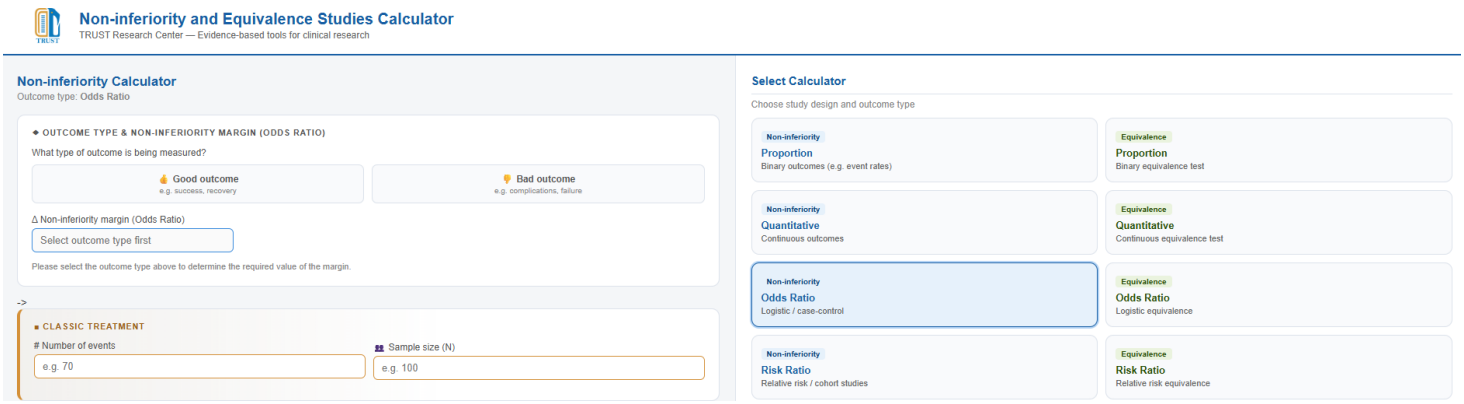

Figure 1. Two-panel layout: data entry on the left, calculator selector on the right.

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1. Overview of the Calculator

The TRUST Non-inferiority and Equivalence Studies Calculator is a browser-based statistical tool designed to help clinical researchers evaluate whether a new treatment is non-inferior or equivalent to a standard treatment. It covers four outcome types across both study designs, producing 95% confidence intervals, z/t-values, p-values, and publication-quality plots.

The calculator supports **8 individual calculators**:

Study Design	Outcome Type	Key Statistic	P-value test
Non-inferiority	Proportion (binary)	Z-score	Normal distribution
Non-inferiority	Quantitative (continuous)	t-value	t-distribution (df=n1+n2-2)
Non-inferiority	Odds Ratio	Z-score (log scale)	Normal distribution
Non-inferiority	Risk Ratio	Z-score (log scale)	Normal distribution
Equivalence	Proportion (binary)	Two Z-scores	Highest p-value reported
Equivalence	Quantitative (continuous)	Two t-values	Highest p-value reported
Equivalence	Odds Ratio	Two Z-scores (log scale)	Highest p-value reported
Equivalence	Risk Ratio	Two Z-scores (log scale)	Highest p-value reported

2. Interface Layout

The calculator uses a two-panel layout that fills the browser window:

- **Left panel** — contains the data entry cards, results, and the CI plots for whichever calculator is currently active.
- **Right panel** — contains the calculator selector grid (8 buttons) and the feedback/usage counter.

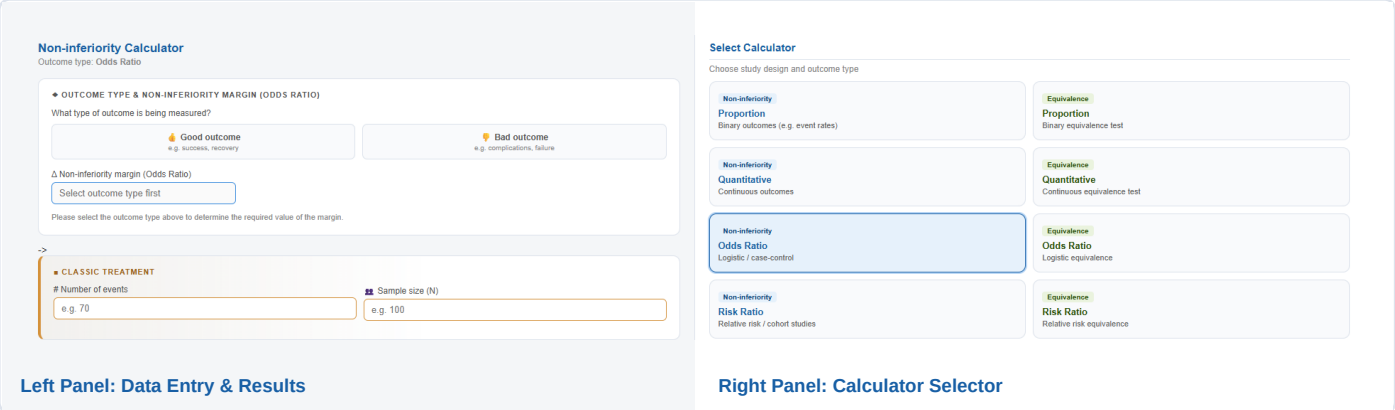

Figure 2. Left panel (data entry) and right panel (calculator selector). Click any button in the right panel to switch calculators.

3. Selecting a Calculator

In the right panel, eight buttons are arranged in a 2 × 4 grid — two columns (Non-inferiority in blue, Equivalence in green) and four rows (one per outcome type). Click any button to load that calculator in the left panel.

> The active calculator button is highlighted with a colored border. Blue for Non-inferiority, green for Equivalence.

4. Data Entry — Manual Input

Each calculator's left panel is divided into input cards. Fill them top to bottom before clicking the Calculate button.

4.1 Non-inferiority — Proportion

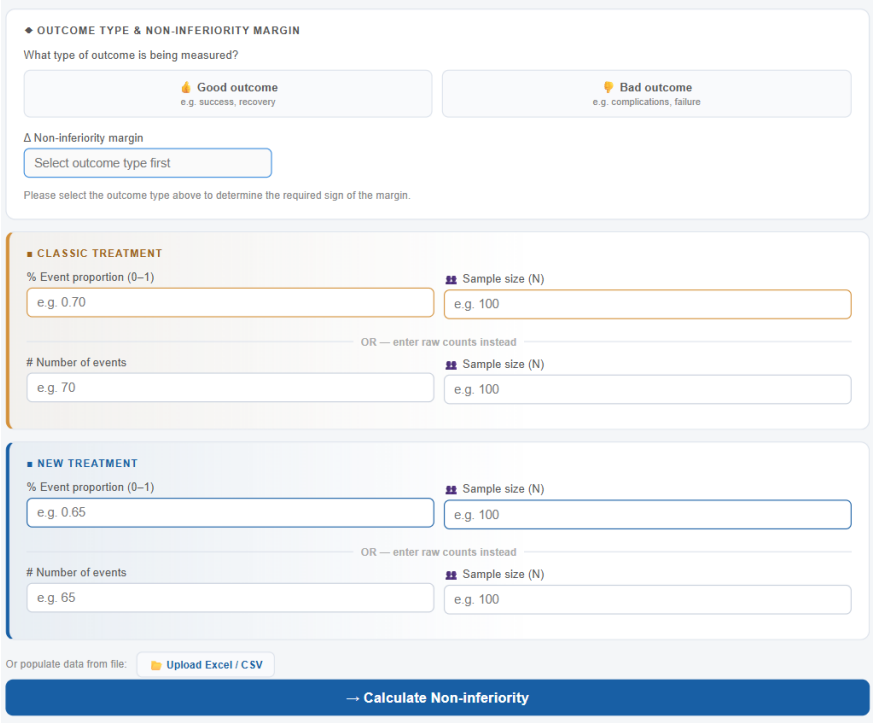

Figure 3. Non-inferiority Proportion input panel.

Step 1 — Outcome type: Select **Good outcome** (e.g. survival, recovery — non-inferiority margin must be *negative*) or **Bad outcome** (e.g. complications, failure — non-inferiority margin must be *positive*).

Step 2 — Non-inferiority margin (Δ): Enter the maximum acceptable difference between treatments. The sign is enforced based on your outcome type selection.

> Example: For a good outcome, if you accept up to 10% reduction in success rate, enter -0.10. For a bad outcome where you allow 10% increase in complications, enter 0.1

Step 3 — Classic treatment: Enter either the **event proportion** (0–1) + sample size (N), OR the raw **number of events** + N. Both give the same result.

Step 4 — New treatment: Same fields for the new/experimental treatment group.

Step 5: Click **"Calculate Non-inferiority"**.

4.2 Equivalence — Proportion

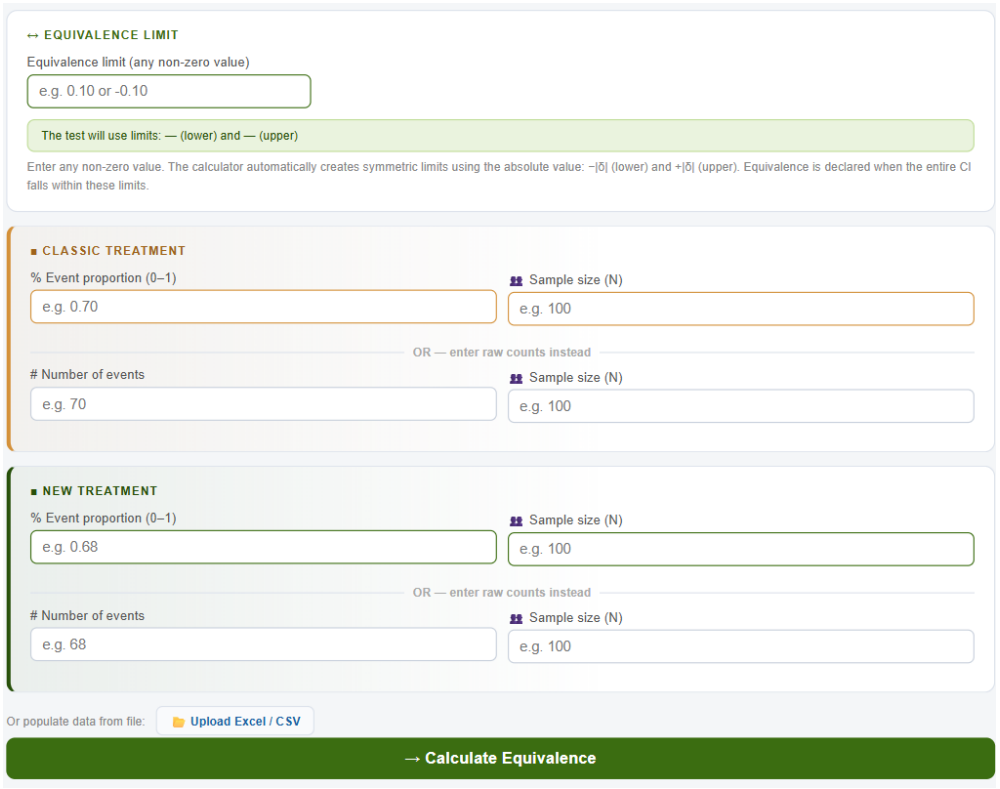

Figure 4. Equivalence Proportion input panel — symmetric limits applied automatically.

Equivalence limit (δ): Enter any non-zero value. The calculator automatically creates **symmetric limits**: –|δ| (lower) and +|δ| (upper). For example, entering 0.10 or –0.10 both produce limits of –0.10 and +0.10.

> The green information box updates in real time to show the exact limits that will be used in the test.

Classic and New treatment fields are identical to the proportion non-inferiority calculator (proportion or raw counts + N).

4.3 Quantitative (Continuous) Outcomes

Used when the outcome is a measured continuous variable (e.g. blood pressure, eGFR, SpO_2, pain score).

Outcome direction: Select **Better when higher** (e.g. lung function) or **Worse when higher** (e.g. diastolic blood pressure). This enforces the correct sign on the margin.

For each treatment group enter:

- **Mean** — arithmetic mean of the measurement
- **Standard deviation (SD)** — spread of the measurement
- **Sample size (N)** — number of patients

For **Equivalence**, enter the equivalence limit; the calculator will compute two t-values (one for each limit) and report the higher of the two p-values.

4.4 Odds Ratio and Risk Ratio

These calculators require **event counts** and **sample sizes** (not proportions). The ratio and its standard error are computed internally.

For each group enter:

- **Number of events** — patients who experienced the outcome
- **Sample size (N)** — total patients in the group

Outcome direction for non-inferiority: **Good outcome** margin < 1 (e.g. 0.80) means the new treatment's odds/risk ratio should not fall below 80% of the classic. **Bad outcome** margin > 1 (e.g. 1.25) means the new treatment's ratio should not exceed 125%.

> For Equivalence OR/RR: enter any positive ratio ≠ 1. The calculator automatically computes both limits: e.g. entering 1.25 creates limits of 0.80 (lower) and 1.25 (upper).

5. Data Entry — Excel / CSV Upload

Instead of entering summary statistics manually, you can upload a patient-level data file. The calculator reads individual rows, computes all required statistics automatically, and populates the input fields.

5.1 Downloading the Template

At the bottom of the data entry cards, just above the Calculate button, there is a row reading **"Or populate data from file"**. Click the yellow **"Upload Excel / CSV"** button to expand the upload panel.

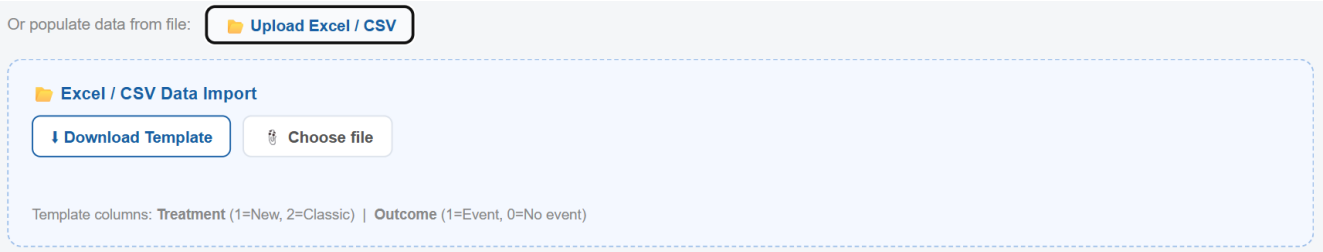

Figure 5. Upload panel showing Download Template, Choose file, and status line.

Click **"Download Template"** to save the appropriate Excel file to your computer. Two templates are available:

- **TRUST_Template_proportion.xlsx** — used for Proportion, Odds Ratio, and Risk Ratio calculators (binary outcomes)
- **TRUST_Template_quantitative.xlsx** — used for Quantitative calculators (continuous outcomes)

5.2 Filling in the Template

TRUST Research Center — Calculator Data TemplateTRUST Research Center —

1. Do NOT change the column headers in row 7.
2. Treatment: 1 = New Treatment, 2 = Classic Treatment
3. Outcome: 1 = event occurred, 0 = did not occur

Treatment	Outcome
1	1
1	1
1	0
1	0
1	0
2	1
2	1
2	0
2	0
2	0

New Treatment

Classic Treatment

Figure 6. Excel template layout — instruction rows (gray) followed by the data header row (blue) and patient rows.

Column	Value	Meaning
Treatment	1	New treatment (experimental group)
Treatment	2	Classic treatment (control group)
Outcome (binary)	1	Event occurred (e.g. recovery, complication)
Outcome (binary)	0	Event did not occur
Measurement (quant)	Numeric	Measured value (e.g. 87.4, 120.5)

You may leave the instruction rows in the file when uploading — the calculator skips any row where the Treatment column is not 1 or 2.

5.3 Uploading the File

After filling in the template, save it as **.xlsx** or **.csv**. Then:

- 1. Open the upload panel by clicking "Upload Excel / CSV".
- 2. Click **"Choose file"** and select your saved file.
- 3. The calculator reads the file, computes statistics, and populates all input fields automatically.
- 4. A green status line confirms the loaded data: e.g. ✓ *Loaded: Classic n=200 (events=170, 85.0%), New n=200 (events=160, 80.0%)*
- 5. Review the populated fields, then click **"Calculate"**.

If the status line shows a red error message, check that: (a) the Treatment column contains only 1 or 2, (b) the Outcome column contains only 0 or 1 (binary) or a number (quantitative), and (c) the file is not open in Excel at the same time.

6. Understanding the Results

After clicking Calculate, the results section appears below the data entry cards. It is divided into:

- **Key metrics** — mean/ratio difference, standard error, Z/t-value
- **95% Confidence interval tables** — bilateral (two-tailed) and unilateral (one-tailed), p-value, and significance
- **CI plots** — visual forest-plot style display with decision badge

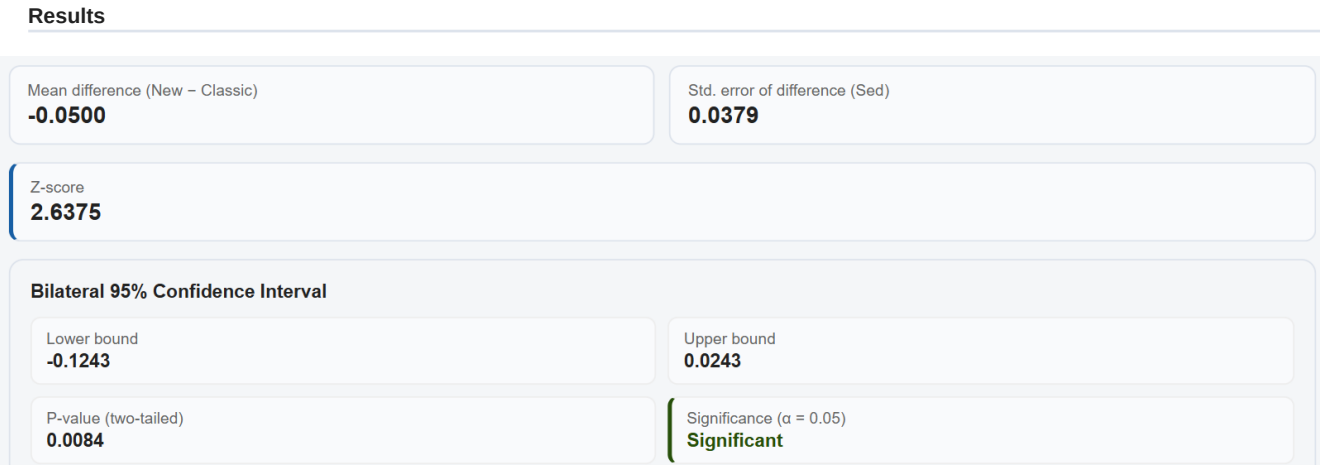

Figure 7. Results section — metrics row, bilateral CI block with p-value and significance.

6.1 Key Metrics

Three metric cards are shown at the top of the results:

Metric	Formula	Interpretation
Mean difference (Proportion / Quant)	p_new - p_classic (or mean_new - mean_classic)	Positive = new treatment higher; negative = new treatment lower
Std. error of difference (Sed)	sqrt(p1(1-p1)/n1 + p2(1-p2)/n2) or sqrt(SD1²/n1 + SD2²/n2)	Precision of the difference estimate; smaller = more precise
Z-value / t-value	(difference - margin) / Sed	How many standard errors the difference is from the margin; used to compute p-value

6.2 Confidence Intervals

Two CI blocks are shown — **Bilateral 95% CI** (two-tailed, z=1.96) and **Unilateral 95% CI** (one-tailed, z=1.645):

- **Lower bound** and **Upper bound** — the confidence limits of the treatment difference.
- For **Non-inferiority**: compare the relevant bound to the NIF margin. For a *good outcome*, the lower bound must lie above the margin. For a *bad outcome*, the upper bound must lie below the margin.
- For **Equivalence**: both bounds must lie inside the equivalence limits (between –|δ| and +|δ|).
- For **OR/RR**: bounds are on the ratio scale (values around 1.0). The CI is exponentiated from the log scale.

6.3 P-values and Significance

Each CI block shows a **p-value** and a colour-coded **Significance** cell:

Calculator type	Bilateral p-value	Unilateral p-value
Non-inferiority (Prop/OR/RR)	Two-tailed: 2×(1-Φ(|Z|))	One-tailed: 1-Φ(|Z|)
Non-inferiority (Quant)	Two-tailed: 2×(1-T(|t|, df))	One-tailed: 1-T(|t|, df)

Equivalence (all types)	Max of two two-tailed p-values (one per limit)	Max of two one-tailed p-values (one per limit)

> Significance is flagged in green ("Significant") when p < 0.05, and in red ("Non-significant") when p ≥ 0.05. The threshold is fixed at α = 0.05

6.4 CI Plot and Decision Badge

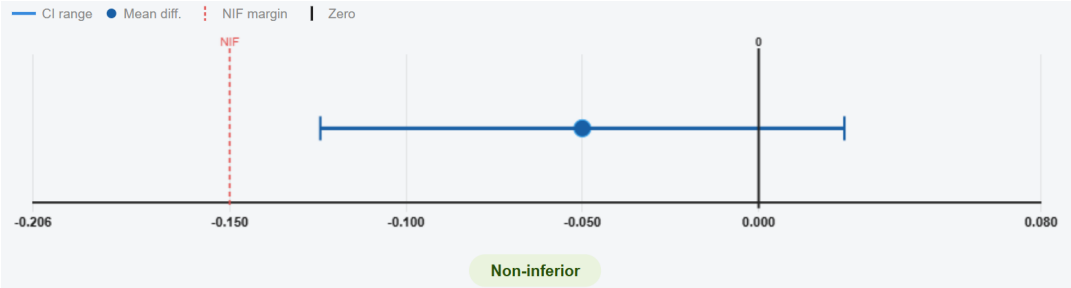

Figure 8. CI forest plot — blue line = CI range, filled circle = mean difference, red dashed = NIF margin, solid black = null (zero).

The plot shows your CI in context of the margin and null value. Below the plot is a coloured **decision badge** and a plain-language interpretation box:

Badge colour	Decision	Meaning
Green	Non-inferior / Equivalent	CI fully inside the acceptable zone; claim can be made
Red	Inferior / Not equivalent	CI entirely beyond the null; unusual result warranting clinical review
Blue	Significantly superior	New treatment is better than classic by a statistically significant margin
Amber	NIF limit bypassed	CI crosses or lies beyond the margin in the wrong direction

6.5 Equivalence Calculators — Two Z/t-values

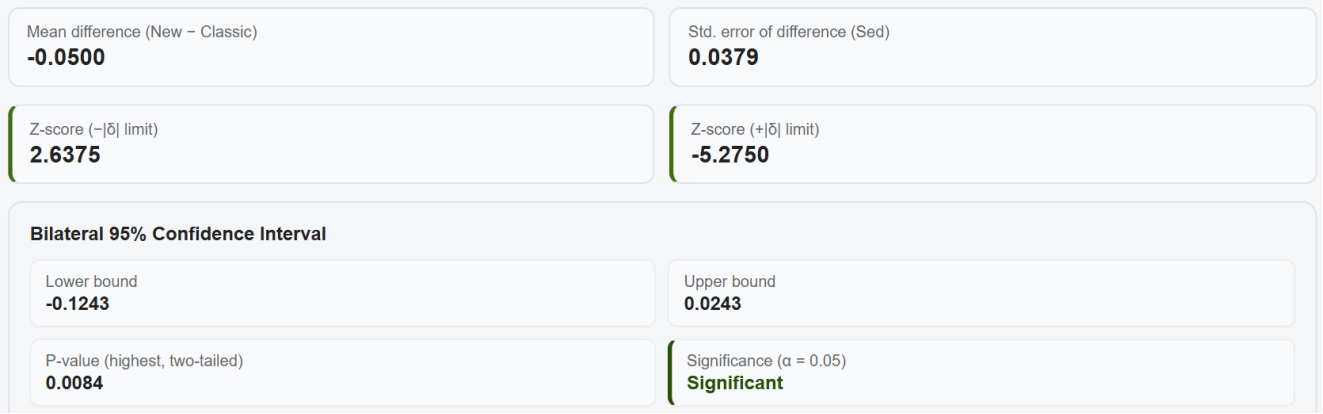

Figure 9. Equivalence results — two Z-scores (one per limit), and the highest p-value reported for the CI.

For **Equivalence** calculators, two test statistics are shown side by side:

- **Z/t-value for −|δ| limit**: tests whether the CI lower bound exceeds the lower equivalence limit.
- **Z/t-value for +|δ| limit**: tests whether the CI upper bound is below the upper equivalence limit.

The **reported p-value is the higher** of the two individual p-values. This is the conservative approach: *both* limits must be cleared for equivalence to be declared. If even one p-value is > 0.05, equivalence cannot be claimed.

> To declare equivalence: the highest p-value must be < 0.05. This means both the lower and upper CI bounds lie within the equivalence zone simultaneously.

7. Exporting the PDF Report

After running the calculation, an **"Export Report as PDF"** button appears at the bottom of the results section. Clicking it opens a formatted report in a new browser tab.

The generated report contains:

1. **Input Data:** A table of the entered values (proportions, N, means, SD, event counts) for both treatment groups, plus the margin or equivalence limits.
2. **Numerical Results:** Mean/ratio difference, standard error, Z/t-value(s), and a CI table with lower and upper bounds, p-values, and significance for both the bilateral and unilateral intervals.
3. **CI Plots & Interpretation:** High-resolution (8× scale) forest plots for both bilateral and unilateral CIs, each followed by the coloured decision badge and plain-language interpretation.

In the browser's print dialog, choose **Save as PDF** to download. The report is formatted for **A4 paper** in portrait orientation.

> If the report opens as "about:blank" in the URL bar and you see page numbers at the bottom, this is normal — it is the print-preview window. Simply select File → Print → Save as PDF.

8. Quick Reference — All 8 Calculators

Calculator	Required inputs	Margin/limit entry	Test statistic
NI Proportion	p1+N1, p2+N2 (or events+N)	Single margin; negative (good) or positive (bad)	Z-score
EQ Proportion	p1+N1, p2+N2 (or events+N)	Single value → auto symmetric ±|δ|	Two Z-scores; max p reported
NI Quantitative	mean1, SD1, N1, mean2, SD2, N2	Single margin; negative (better↑) or positive (worse↑)	t-value (df=n1+n2-2)
EQ Quantitative	mean1, SD1, N1, mean2, SD2, N2	Single value → auto symmetric ±|δ|	Two t-values; max p reported
NI Odds Ratio	events1+N1, events2+N2	Ratio margin: <1 (good outcome) or >1 (bad outcome)	Z-score on ln(OR)
EQ Odds Ratio	events1+N1, events2+N2	Ratio → auto invert: e.g. 1.25 → 0.80 & 1.25	Two Z-scores on ln(OR); max p
NI Risk Ratio	events1+N1, events2+N2	Ratio margin: <1 (good) or >1 (bad)	Z-score on ln(RR)
EQ Risk Ratio	events1+N1, events2+N2	Ratio → auto invert: e.g. 1.25 → 0.80 & 1.25	Two Z-scores on ln(RR); max p

Tips for Accurate Results

- Always select the correct **outcome type** (good/bad or better/worse when higher) before entering the margin — it enforces the correct sign.
- For proportions, entering the raw counts (events + N) is equivalent to entering the proportion directly. Use whichever your data source provides.
- For OR/RR, events must be **strictly less than N** — there cannot be zero non-events.
- Use the **unilateral CI** for the primary regulatory non-inferiority decision (the one-sided test is the standard for NI trials). Use the bilateral CI for secondary reporting.
- For equivalence, always report the **highest p-value** of the two tests — this is the binding one.
- The Excel upload is designed for **individual patient data**. If you only have summary data (already computed proportions, means, SDs), enter them manually in the input fields.