Confidence Interval (CI)
A confidence interval provides a range of plausible values for a statistic, like RR or OR, based on sample data. The CI gives an idea about:

Statistical Significance: Does the interval include the reference point (1 for relative risk / odd ratio)?

Precision: Is the range wide (less precise) or narrow (more precise)?

Significance of Confidence Interval and Reference Point

- **Relative Risk (RR)** or **Odds Ratio (OR)** measures associations in studies.
    - Reference Point: **1** (unlike t-tests where the reference point is **0**).
        - **RR = 1**: No association.
        - **RR > 1**: Indicates a risk factor (positive association).
        - **RR < 1**: Indicates a protective factor (negative association).

1. Confidence Intervals and Statistical Significance
Key Rule:

If the CI includes 1, the result is not statistically significant.
If the CI does not include 1, the result is statistically significant.

Examples:

Family History and Hypertension
RR = 3, CI = 0.3–5
The CI includes 1, so the association is not statistically significant.
Interpretation: Family history might not play a significant role in causing hypertension.

Aspirin and Ischemic Heart Disease (IHD)
RR = 0.5, CI = 0.2–0.9
The CI does not include 1, so the result is statistically significant.
Interpretation: Aspirin is a protective factor that reduces the risk of IHD.

Smoking and Lung Cancer
RR = 6, CI = 4–8
The CI does not include 1, so the result is statistically significant.

Interpretation: Smoking is a strong risk factor for lung cancer.

2. Width of Confidence Interval and Precision
Key Rule:

A narrow CI indicates more precision and confidence in the result.
A wide CI shows less precision, which could be due to smaller sample sizes or variability in data.
Examples:

Two Studies on Obesity and Diabetes:
Study A: RR = 3, CI = 2.8–3.2 (Narrow CI)
Study B: RR = 3, CI = 1.5–6 (Wide CI)
Study A's CI is narrow, meaning the result is precise and reliable.
Study B's CI is wide, so the estimate is less reliable due to greater variability.

RR = 5 in Two Scenarios:
Case 1: CI = 4–6
The interval is narrow, indicating high confidence in the RR estimate.

Case 2: CI = 2–20
The interval is wide, showing uncertainty in the exact RR value.

3. Strength of Risk Factor
Key Rule:

The further the RR or OR is from 1, the stronger the association.
Both the direction (greater or less than 1) and magnitude of the value matter.
Examples:

Exposure to a Hazard:
RR = 2: The risk of the outcome is 2 times higher in the exposed group than in the unexposed group.

RR = 20: The risk of the outcome is 20 times higher in the exposed group, which is much stronger than RR = 2.

Protective Factor Example:
RR = 0.8: Indicates a slight protective effect (20% reduced risk).

RR = 0.2: Indicates a strong protective effect (80% reduced risk).

4. Real-Life Applications

Scenario 1: Effect of Medication on Disease Risk

A new drug is tested for reducing stroke risk:
RR = 0.7, CI = 0.6–0.9
The CI does not include 1, so the result is statistically significant.
Interpretation: The drug reduces stroke risk by 30%.

Scenario 2: Air Pollution and Asthma Risk

A study examines the link between air pollution and asthma:

RR = 1.8, CI = 0.9–3.2
The CI includes 1, so the result is not statistically significant.
Interpretation: We cannot conclusively say that air pollution increases asthma risk.
Scenario 3: Diet and Heart Disease

Research on a high-fiber diet for heart disease:

RR = 0.4, CI = 0.2–0.8
The CI does not include 1, so the result is statistically significant.
Interpretation: A high-fiber diet reduces heart disease risk by 60%.

5. Chi-Square and Confounding Factors
The chi-square test determines if there's an association between two categorical variables.
However:

Confounding Factors:
Example: Studying smoking (yes/no) and lung cancer might be confounded by age. Older individuals are both more likely to smoke and more likely to develop cancer.
Confounders