# The Odds Ratio

| | Dz | Non Dz |
|---|---|---|
| Exposed | A | B |
| Not Exposed | C | D |

**Odds = p / (1-p)**

The probability of having the disease among those exposed is A / (A+B)

The Odds of having the disease among those exposed =

$$\frac{\text{P (Dz among exposed)}}{\text{1-P (Dz among exposed)}}$$

Plugging in:
Odds of having the Dz among exposed = [A / (A+B)] / {1- [A / (A+B)]} = A / B

Similarly,
The Probability of having the Dz among those not exposed is C / (C+D)

The Odds of having the Dz among those not exposed =

$$\frac{\text{P (Dz among those not exposed)}}{\text{1-P (Dz among those not exposed)}}$$

Plugging in:
Odds of having the Dz among not exposed = [C / (C+D)] / {1- [C / (C+D)]} = C / D

The ODDS RATIO of Dz (or the Ratio of the Odds of Dz) =

$$\frac{\text{Odds of Dz among exposed}}{\text{Odds of Dz among not exposed}}$$

Plugging in, OR = [A / B] / [C / D] = A*D / B*C = AC*BD

**95% Confidence Interval (CI) for the OR, testing $H_O$: OR=1 $H_A$: OR≠1**

$$\textbf{Lower 95\% CI of OR} = e^{\ln(OR)-1.96\sqrt{\frac{1}{A}+\frac{1}{B}+\frac{1}{C}+\frac{1}{D}}}$$

$$\textbf{Upper 95\% CI of OR} = e^{\ln(OR)+1.96\sqrt{\frac{1}{A}+\frac{1}{B}+\frac{1}{C}+\frac{1}{D}}}$$

Dragomir

# The Relative Risk for Cohort Studies

| | Diseased | Non Diseased |
|---|---|---|
| **Exposed** | A | B |
| ***Not Exposed*** | C | D |

## For the at risk group (Exposed) calculate the Incidence of Dz:

$$\text{Probability of developing the disease among the Risk Group} = \frac{\text{No. of Disease Developed (Cases) when suffered the risk (Exposed)}}{\text{Total No. in Risk Group}} = \frac{A}{A+B}$$

## For the not at risk group (Not Exposed) calculate Incidence of Dz:

$$\text{Probability of developing the disease among the NonRisk Group} = \frac{\text{No. of Disease Developed (Cases) when not suffered the risk (NonExposed)}}{\text{Total No. in NonRisk Group}} = \frac{C}{C+D}$$

## Relative Risk (RR):

$$\text{RR} = \text{Relative Risk} = \frac{\text{Probability of developing the disease among the Risk Group}}{\text{Probability of developing the disease among the NonRisk Group}} = \frac{\frac{A}{A+B}}{\frac{C}{C+D}} = \frac{A(C+D)}{C(A+B)}$$

## 95% Confidence Interval (CI) for the RR, testing $H_O$: RR=1 $H_A$: RR≠1

$$\text{Lower 95\% CI of RR} = e^{\ln(RR) - 1.96\sqrt{\left(\frac{1}{A}-\frac{1}{A+B}\right)+\left(\frac{1}{C}-\frac{1}{C+D}\right)}} = e^{\ln(RR) - 1.96\sqrt{\left(\frac{\frac{B}{A}}{A+B}\right)+\left(\frac{\frac{D}{C}}{C+D}\right)}}$$

$$\text{Upper 95\% CI of RR} = e^{\ln(RR) + 1.96\sqrt{\left(\frac{1}{A}-\frac{1}{A+B}\right)+\left(\frac{1}{C}-\frac{1}{C+D}\right)}} = e^{\ln(RR) + 1.96\sqrt{\left(\frac{\frac{B}{A}}{A+B}\right)+\left(\frac{\frac{D}{C}}{C+D}\right)}}$$

# Odds Ratio for Cohort Studies

$$\text{Odds that Exposed person develops disease} = \frac{\text{Probability of developing the disease among the Risk Group}}{1 - \text{Probability of developing the disease among the Risk Group}} = \frac{\frac{A}{A+B}}{1-\frac{A}{A+B}} = \frac{A}{B}$$

$$\text{Odds that NonExposed person develops disease} = \frac{\text{Probability of developing the disease among the NonRisk Group}}{1 - \text{Probability of developing the disease among the NonRisk Group}} = \frac{\frac{C}{C+D}}{1-\frac{C}{C+D}} = \frac{C}{D}$$

## Odds Ratio of Dz (OR):

$$\text{OR} = \text{Odds Ratio} = \frac{\text{Odds that Exposed person develops disease}}{\text{Odds that NonExposed person develops disease}} = \frac{A/B}{C/D} = \frac{A*D}{B*C}$$

## 95% Confidence Interval (CI) for the OR, testing $H_O$: OR=1 $H_A$: OR≠1

$$\text{Lower 95\% CI of OR} = e^{\ln(OR)-1.96\sqrt{\frac{1}{A}+\frac{1}{B}+\frac{1}{C}+\frac{1}{D}}}$$

$$\text{Upper 95\% CI of OR} = e^{\ln(OR)+1.96\sqrt{\frac{1}{A}+\frac{1}{B}+\frac{1}{C}+\frac{1}{D}}}$$

# The Odds Ratio in Case-Control Studies

| | Exposed | Not Exposed |
|---|---|---|
| Cases | A | B |
| Controls | C | D |

**Odds = p / (1-p)**

Probability of having been exposed among cases = A / (A+B)

The Odds of having been exposed among cases =

$$\frac{\text{P (having been exposed among cases)}}{\text{1-P (having been exposed among cases)}}$$

Plugging in:
Odds of having been exposed among cases = [A / (A+B)] / {1- [A / (A+B)]} = A / B

Similarly,
The Probability of having been exposed among controls = C / (C+D)

The Odds of having been exposed among controls =

$$\frac{\text{P (having been exposed among controls)}}{\text{1-P (having been exposed among controls)}}$$

Plugging in:
Odds of having been exposed among controls = [C / (C+D)] / {1- [C / (C+D)]} = C / D

The Case-Control ODDS RATIO (or the Ratio of the Odds) =

$$\frac{\text{Odds of having been exposed among cases}}{\text{Odds of having been exposed among controls}}$$

The ODDS RATIO of Exposure: OR = [A / B] / [C / D] = A*D / B*C = AC*BD

**95% Confidence Interval (CI) for the OR, testing $H_O$: OR=1 $H_A$: OR≠1**

$$\textbf{Lower 95\% CI of OR} = e^{\ln(OR)-1.96\sqrt{\frac{1}{A}+\frac{1}{B}+\frac{1}{C}+\frac{1}{D}}}$$

$$\textbf{Upper 95\% CI of OR} = e^{\ln(OR)+1.96\sqrt{\frac{1}{A}+\frac{1}{B}+\frac{1}{C}+\frac{1}{D}}}$$