



EBM Calculator

Formulas for Effect Estimates

	Outcome	No Outcome	Total
(+)	<i>a</i>	<i>b</i>	<i>a + b</i>
(-)	<i>c</i>	<i>d</i>	<i>c + d</i>
Total	<i>a + c</i>	<i>b + d</i>	<i>a + b + c + d</i>

$z = 1.959964$ for 95% CI

Experimental Event Rate

$$\text{EER} = \frac{a}{a + b}$$

Control Event Rate

$$\text{CER} = \frac{c}{c + d}$$

Absolute Risk Reduction

$$\text{ARR} = \text{CER} - \text{EER}$$

Confidence Interval (Wilson score bounds with error propagation)

$$\text{Lower Bound: } \text{ARR} - z \cdot \sqrt{\frac{u_2(1-u_2)}{r_1} + \frac{w_1(1-w_1)}{r_2}}$$

$$\text{Upper Bound: } \text{ARR} + z \cdot \sqrt{\frac{u_1(1-u_1)}{r_2} + \frac{w_2(1-w_2)}{r_1}}$$

where...

$$r_1 = a + b, \quad r_2 = c + d$$

$$u_1 = \frac{2c + z^2 + z \sqrt{\frac{4(c \cdot d)}{r_2} + z^2}}{2r_2 + 2z^2}$$

$$u_2 = \frac{2a + z^2 + z \sqrt{\frac{4(a \cdot b)}{r_1} + z^2}}{2r_1 + 2z^2}$$

$$w_1 = \frac{2c + z^2 - z \sqrt{\frac{4(c \cdot d)}{r_2} + z^2}}{2r_2 + 2z^2}$$

$$w_2 = \frac{2a + z^2 - z \sqrt{\frac{4(a \cdot b)}{r_1} + z^2}}{2r_1 + 2z^2}$$

Risk Ratio

$$\text{RR} = \frac{\text{EER}}{\text{CER}}$$

Confidence Interval (Log-normal, Zhou)

$$\text{Lower Bound: } \exp \left(\ln(\text{RR}) - z \cdot \sqrt{\left(\frac{1}{a} - \frac{1}{a+b} \right) + \left(\frac{1}{c} - \frac{1}{c+d} \right)} \right)$$

$$\text{Upper Bound: } \exp \left(\ln(\text{RR}) + z \cdot \sqrt{\left(\frac{1}{a} - \frac{1}{a+b} \right) + \left(\frac{1}{c} - \frac{1}{c+d} \right)} \right)$$

Relative Risk Reduction

$$RRR = 1 - RR$$

Confidence Interval (Derived from Log-normal RR)

$$\text{Lower Bound: } 1 - \exp \left(\ln(RR) + z \cdot \sqrt{\left(\frac{1}{a} - \frac{1}{a+b} \right) + \left(\frac{1}{c} - \frac{1}{c+d} \right)} \right)$$

$$\text{Upper Bound: } 1 - \exp \left(\ln(RR) - z \cdot \sqrt{\left(\frac{1}{a} - \frac{1}{a+b} \right) + \left(\frac{1}{c} - \frac{1}{c+d} \right)} \right)$$

Odds Ratio

$$OR = \frac{ad}{cb}$$

Confidence Interval (Log-normal)

$$\text{Lower Bound: } \exp \left(\ln(OR) - z \cdot \sqrt{\frac{1}{a} + \frac{1}{b} + \frac{1}{c} + \frac{1}{d}} \right)$$

$$\text{Upper Bound: } \exp \left(\ln(OR) + z \cdot \sqrt{\frac{1}{a} + \frac{1}{b} + \frac{1}{c} + \frac{1}{d}} \right)$$

Formulas for Diagnostic Tests

	Disease	No Disease	Total
(+)	a	b	$a + b$
(-)	c	d	$c + d$
Total	$a + c$	$b + d$	$a + b + c + d$

$z = 1.959964$ for 95% CI

Sensitivity

$$\text{Sensitivity} = \frac{a}{a + c}$$

Confidence Interval (Wilson Score)

$$\text{Lower Bound: } \frac{(2 \cdot a) + z^2 - z \cdot \sqrt{\left(\frac{4ac}{a+c}\right) + z^2}}{2 \cdot (a + c) + 2z^2}$$

$$\text{Upper Bound: } \frac{(2 \cdot a) + z^2 + z \cdot \sqrt{\left(\frac{4ac}{a+c}\right) + z^2}}{2 \cdot (a + c) + 2z^2}$$

Specificity

$$\text{Specificity} = \frac{d}{b + d}$$

Confidence Interval (Wilson Score)

$$\text{Lower Bound: } \frac{(2 \cdot d) + z^2 - z \cdot \sqrt{\left(\frac{4db}{b+d}\right) + z^2}}{2 \cdot (b + d) + 2z^2}$$

$$\text{Upper Bound: } \frac{(2 \cdot d) + z^2 + z \cdot \sqrt{\left(\frac{4db}{b+d}\right) + z^2}}{2 \cdot (b + d) + 2z^2}$$

Positive Likelihood Ratio

$$LR(+)=\frac{\text{Sensitivity}}{1-\text{Specificity}}=\frac{a/(a+c)}{b/(b+d)}$$

Confidence Interval (Log-normal, Zhou)

$$\text{Lower Bound: } \exp\left(\ln\left(\frac{(b+d)\cdot a}{(a+c)\cdot b}\right)-z\cdot\sqrt{\left(\frac{c}{a\cdot(a+c)}\right)+\left(\frac{d}{b\cdot(b+d)}\right)}\right)$$

$$\text{Upper Bound: } \exp\left(\ln\left(\frac{(b+d)\cdot a}{(a+c)\cdot b}\right)+z\cdot\sqrt{\left(\frac{c}{a\cdot(a+c)}\right)+\left(\frac{d}{b\cdot(b+d)}\right)}\right)$$

Negative Likelihood Ratio

$$LR(-)=\frac{1-\text{Sensitivity}}{\text{Specificity}}=\frac{c/(a+c)}{d/(b+d)}$$

Confidence Interval (Log-normal, Zhou)

$$\text{Lower Bound: } \exp\left(\ln\left(\frac{(b+d)\cdot c}{(a+c)\cdot d}\right)-z\cdot\sqrt{\left(\frac{a}{c\cdot(a+c)}\right)+\left(\frac{b}{d\cdot(b+d)}\right)}\right)$$

$$\text{Upper Bound: } \exp\left(\ln\left(\frac{(b+d)\cdot c}{(a+c)\cdot d}\right)+z\cdot\sqrt{\left(\frac{a}{c\cdot(a+c)}\right)+\left(\frac{b}{d\cdot(b+d)}\right)}\right)$$

Positive Predictive Value

$$PPV=\frac{a}{a+b}$$

Confidence Interval (Wilson Score)

$$\text{Lower Bound: } \frac{(2\cdot a)+z^2-z\cdot\sqrt{\left(\frac{4ab}{a+b}\right)+z^2}}{2\cdot(a+b)+2z^2}$$

$$\text{Upper Bound: } \frac{(2\cdot a)+z^2+z\cdot\sqrt{\left(\frac{4ab}{a+b}\right)+z^2}}{2\cdot(a+b)+2z^2}$$

Negative Predictive Value

$$\text{NPV} = \frac{d}{c + d}$$

Confidence Interval (Wilson Score)

$$\text{Lower Bound: } \frac{(2 \cdot d) + z^2 - z \cdot \sqrt{\left(\frac{4dc}{c+d}\right) + z^2}}{2 \cdot (c + d) + 2z^2}$$

$$\text{Upper Bound: } \frac{(2 \cdot d) + z^2 + z \cdot \sqrt{\left(\frac{4dc}{c+d}\right) + z^2}}{2 \cdot (c + d) + 2z^2}$$

References

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