Case-control study

NEW ZEALAND
FOREIGN AFFAIRS & TRADE

- Hypothesis development
- Principles of case-control study
- Odds ratio
- Quiz

Hypothesis development

"**Descriptive epidemiology often provides some clues for hypotheses development. For example,**

- **If the epidemic curve points to a narrow period of exposure, ask what events occurred around that time.**
- **If animal in a particular area have the highest attack rates**
- **If some groups with particular characteristics are at greatest risk.**

Such questions about the data could lead to hypotheses that can be tested.

Let's watch a video below for a more in-depth explanation of hypothesis development

Click ▶ to play the video"

Investigate the outbreak

Develop hypotheses about the nature of exposure

- Generate hypotheses from descriptive investigation (animal, place, time)
- Literature search
- Subjective observations by the producer and other professionals are often useful
- Prioritise by their likelihood and focus on those with the highest priority until they are either more fully supported or refuted

Note: The hypotheses should address the source of the agent, the mode of transmission, and the exposures that caused the disease.

Also, the hypotheses should be proposed in a way that can be tested!

CONTINUE

Principles of case-control study

"With case-control study, you test your hypotheses by using a comparison group to quantify relationships between various exposures and the disease. Case-control studies compare animal with a disease (case-animals) with a group of the animal without the disease (controls). Here, the objective was to understand the risk factors. Then, appropriate control measures can be applied.

Let's watch a video below for more in-depth explanation of hypothesis development

Click ▶ to play the video"

Case-control study

Retrospective (what happened?)

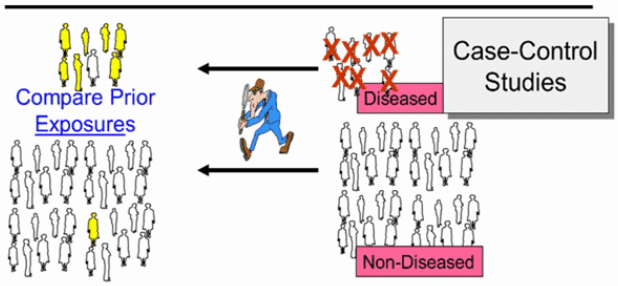
Define & identify cases from source population

Commonly, sample controls (non-cases) from source population, e.g. randomly

Quality depends on

- Selection of controls (from the population that gave rise to cases)
- Case and control definitions

Collect exposure history



Case-control studies provide good evidence, but their validity rely on carefully choosing cases and controls. Hence, it wouldn't be the approach of choice on the first day of an outbreak investigation.

A case-control study is usually conducted at a later stage in the investigation, to confirm hypotheses made at the descriptive stage.

CONTINUE

Odds ratio

"In a case-control study, you cannot calculate attack rates because you do not have the total number of animals that were and were not exposed to the source of the disease of interest.

Without attack rates, you cannot calculate relative risk (RR); instead, the measure of association you use in a case study is an odds ratio (OR)"

Odds ratio (OR)

		Disease		Total
		D+	D-	
Exposure	E+	a	b	a + b
	E-	c	d	c + d
Total		a + c	b + d	N

Odds of exposure in cases a/c

Odds of exposure in controls b/d

$$OR = \frac{a/c}{b/d} = \frac{a*d}{b*c}$$

Interpretation

- OR=1 no difference
- OR > 1
  - Disease associated with increased odds of exposure

  Ex. OR=2 the odds of exposure in the cases were twice the odds of exposure in the controls
- OR < 1
  - Protective factor associated with decreased odds of exposure

  Ex. OR=0.5 the odds of exposure in the cases were half the odds of exposure in the controls

CONTINUE

Statulator tools

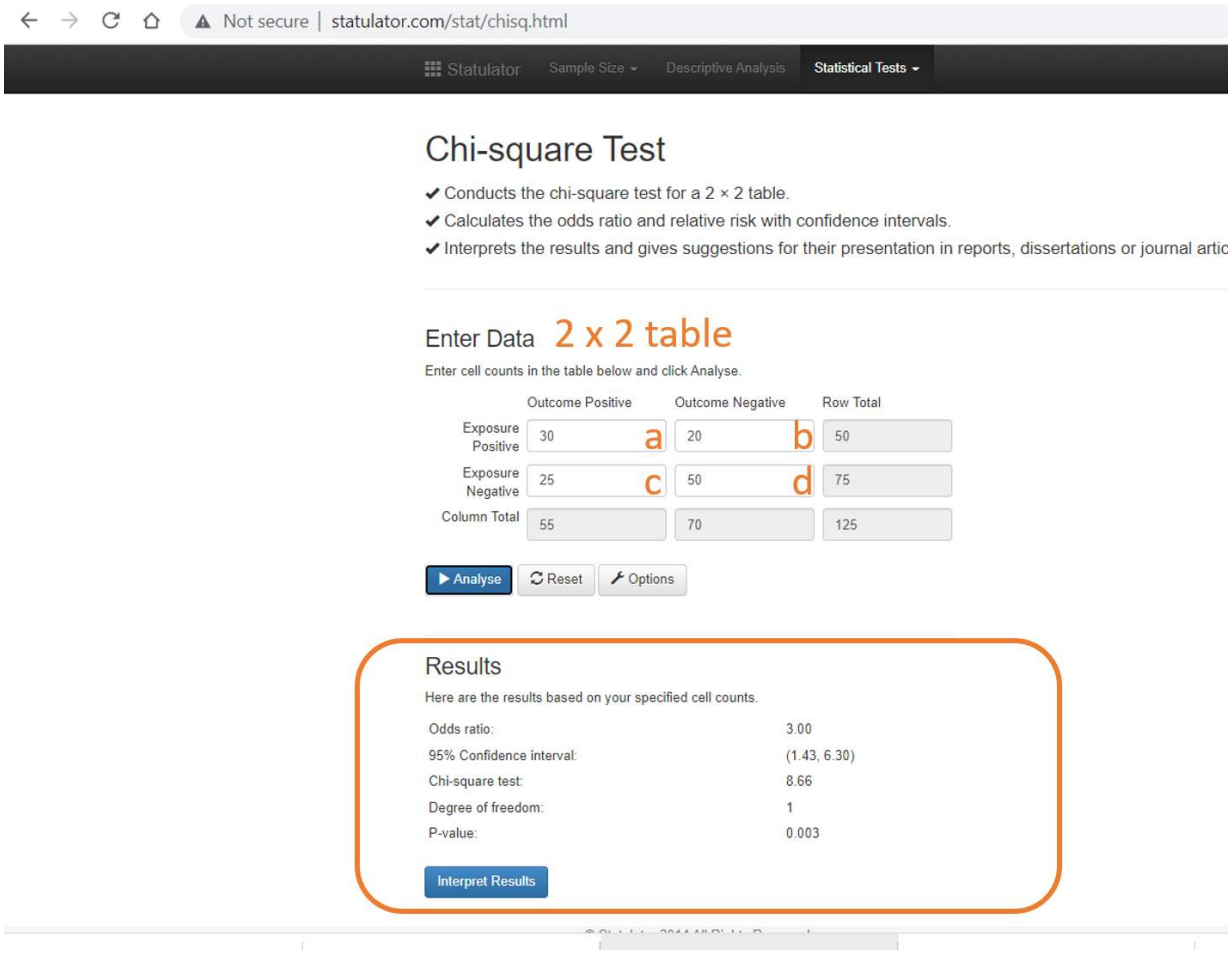
"Statulator is a free online statistical calculator that help to perform statistical analyses and interprets the results. We will make use of it to calculate odds ratio with statistical results

> **For more information and reference for Statulator. Click here.**"

Try it for yourself

1. Go to Statulator website http://statulator.com/stat/chisq.html.
2. Insert number accoring to 2 x 2 table described in the previous Video.
3. Click "▶ **Analyse**" for odds ratio calculation.
4. Observe displayed results and click "**Interpret Results**" for interpretation.

See Figure below for guideline.


Not secure | statulator.com/stat/chisq.html
Statulator
Sample Size
Descriptive Analysis
Statistical Tests
Chi-square Test
✔ Conducts the chi-square test for a 2 × 2 table.
✔ Calculates the odds ratio and relative risk with confidence intervals.
✔ Interprets the results and gives suggestions for their presentation in reports, dissertations or journal artic
Enter Data 2 x 2 table
Enter cell counts in the table below and click Analyse.
Outcome Positive
Outcome Negative
Row Total
Exposure Positive
30
a
20
b
50
Exposure Negative
25
c
50
d
75
Column Total
55
70
125
Analyse
Reset
Options
Results
Here are the results based on your specified cell counts.
Odds ratio: 3.00
95% Confidence interval: (1.43, 6.30)
Chi-square test: 8.66
Degree of freedom: 1
P-value: 0.003
Interpret Results

CONTINUE

Quiz

"A study was conducted in horse studs to identify possible causes of Streptococcosis. Plain wood fencing was suspected to be a risk factor for outbreaks, as opposed to electric fencing. Cases and controls were selected from respondents to a previous survey who indicated they would be willing to participate in a study on strangles.

In total, 24 studs with occurrence of strangles and 30 without were recruited; 12 of the case studs and 5 of the control studs had plain wood fencing.

Answer the following question."

What is the exposure, and what is the outcome of this study

- ○ Streptococcosis is exposure, fencing is outcome
- ○ Streptococcosis is outcome, fencing is exposure

- ○ None of the above

SUBMIT

What is the calculated odds ratio (Hint: you can make use of statulator tool)

- ○ 0.5
- ○ 1
- ○ 5
- ○ None of the above

SUBMIT

What is your interpretation of odds ratio?

- Plain wood fencing is a protective factor for streptococcosis in horses.
- No difference between odds of streptococcosis in horses exposed to plain wood fencing and horses exposed to electric fencing.
- The odds of streptococcosis in horses exposed to plain wood fencing is 5 times the odds in horses exposed to electric fencing.
- None of the above

SUBMIT

CONTINUE

Check your answer

Enter Data

Enter cell counts in the table below and click Analyse.

	Outcome Positive	Outcome Negative	Row Total
Exposure Positive	12	5	17
Exposure Negative	12	25	37
Column Total	24	30	54

▶ Analyse | Reset | Options

Results

Here are the results based on your specified cell counts.

Odds ratio:	5.00
95% Confidence interval:	(1.43, 17.45)
Chi-square test:	6.87
Degree of freedom:	1
P-value:	0.009

Interpret Results

Interpretation

The odds ratio indicates that the exposure positive group has 5.00 times the odds of the outcome than the exposure negative group. Also, we are 95% confident that the odds ratio in the population (from where the sample was obtained) would be between 1.43 and 17.45.

Since the odds ratio confidence interval does not include the null value (i.e. 1), and the p-value (0.009) is less than 0.05, the conventionally used criterion to evaluate p-values, the association between exposure and outcome is statistically significant at 5% level of significance.

Congratulations - end of lesson reached

Go back to our outbreak scenario (Event 7) and complete Task 4

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ah.w animal health works

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