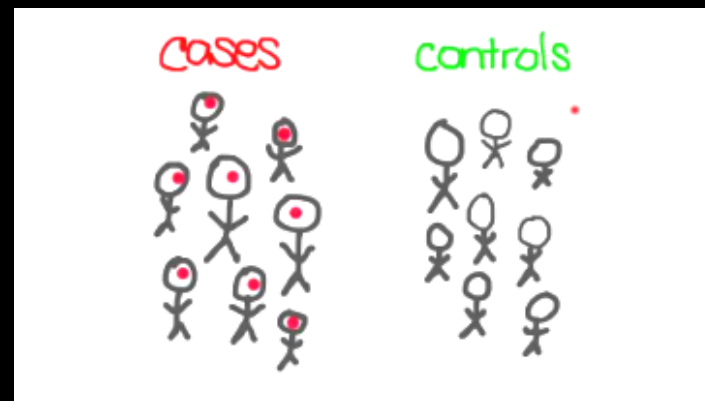


**We're going to**

**have fun**



Ministry of Agriculture  
Indonesia



# *Application of Case-Control Study in the Outbreak Setting*

Training for Veterinarian/Veterinary Officer

Dhony, Dwi, Erna  
(Indonesia Trainer Team)

## LEARNING OBJECTIVES:

To assess risk factors for FMD using a case-control study and that will lead appropriate local control measures of outbreak.

By the end of this training, trainees will be able to:

1. Understand the principles of case-control study.
2. Design, implement and analyze the case-control study in an outbreak situation.
3. Practice the use of Epicollect5 and Statulator as tools in the case-control study.

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

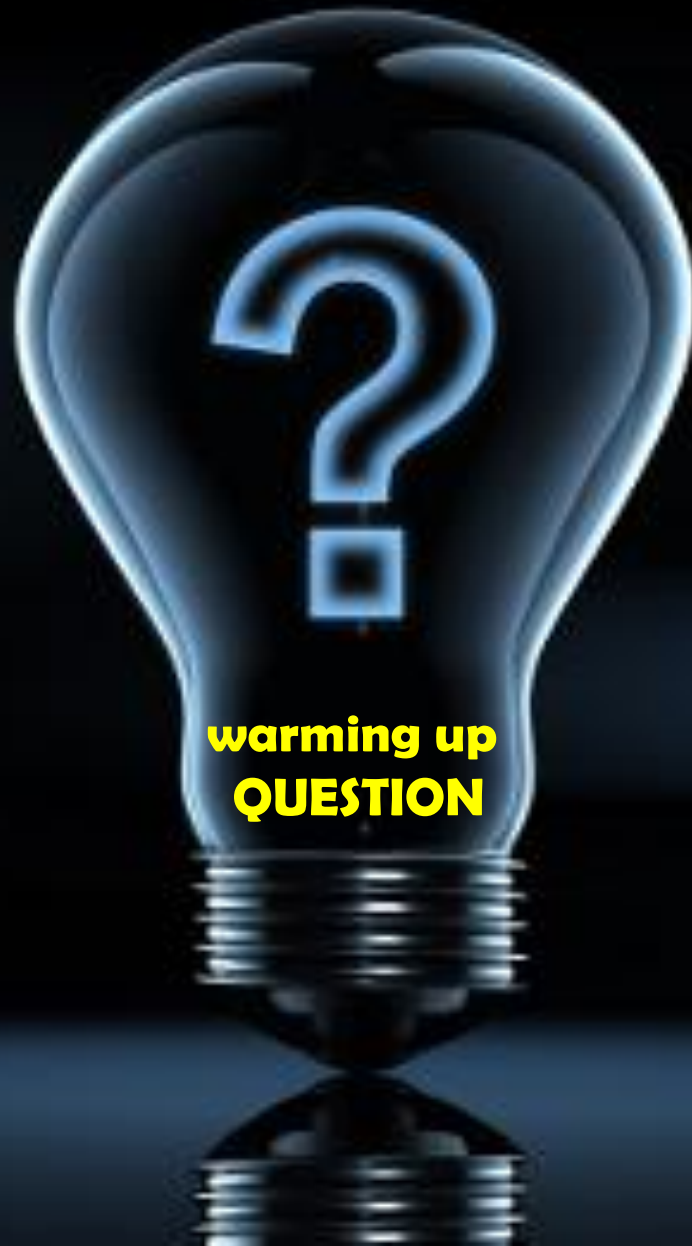
## TARGET THE AUDIENCE:

Veterinarian as a Veterinary Officer in:

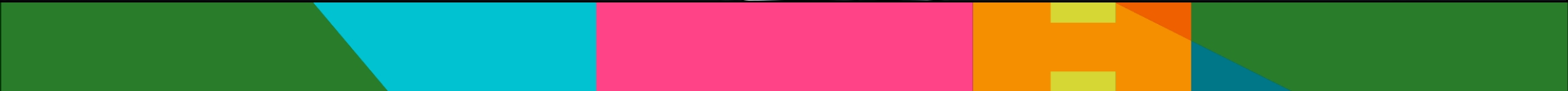
- Disease Investigation Center
- The Center for Veterinary Biological Product
- Provincial Office
- District Office







**warming up**  
**QUESTION**



**SHARE  
YOUR  
EXPERIENCE**



## *QUESTION 1*

Do you have any experience on outbreak investigation? in particular the epidemiological part of investigation.

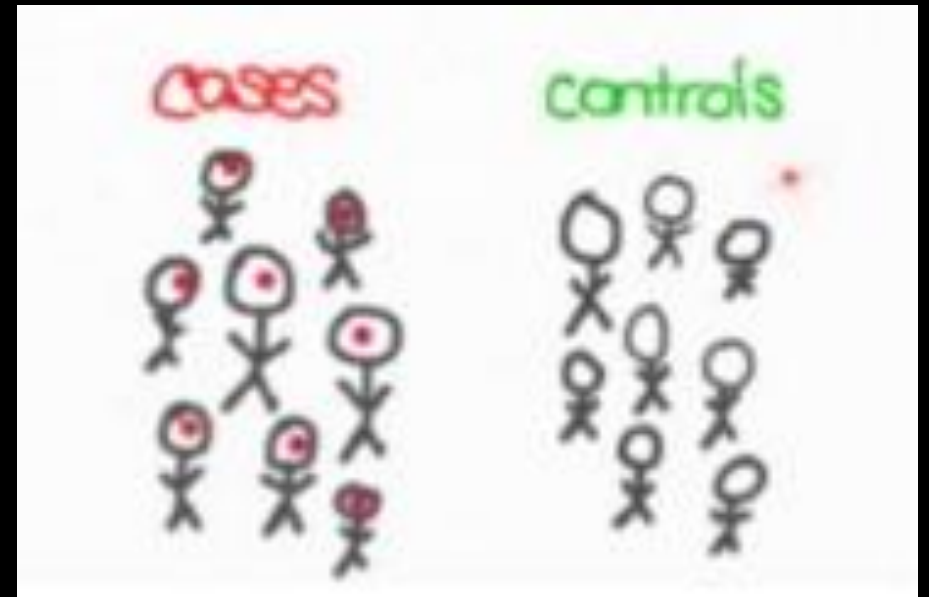
## QUESTION 2

What do you know about FMD risk factors?



### QUESTION 3

What approach to further study risk factors in outbreak situation?





*CASE CONTROL STUDY*

**THE FUN STARTS  
HERE**



# instructions



LOADING...



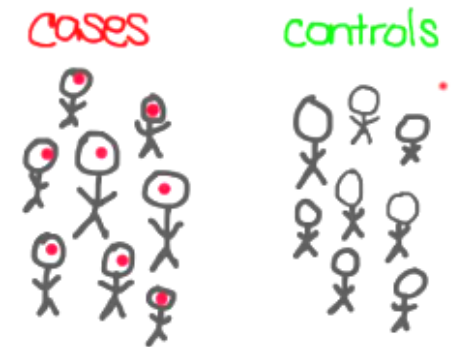
# Principle of case-control study :

**RISK FACTOR**

*Free grazing  
Water source  
Vaccination status  
Bring in animal*

**HYPOTHESIS**

*“Farms with free grazing practice  
are more likely to have FMD infection  
than farm without free grazing practice “*



*Case is farm with at least  
1 cattle showing FMD sign*

*Control is farm without  
any FMD sign*



***Play the video***



Principle of case-control study :



*Video*



*(content of the video. This slide will not show)*

Principle of case-control study :

a. Risk factor/exposure

- Identify the potential risk factors from mapping & tracing step.
- Mapping step → Develop causal hypothesis
- Tracing step → Sharpen and focus hypothesis.

b. Hypotheses

- An assumption/prediction about the relationship (risk factors VS FMD occurrence)

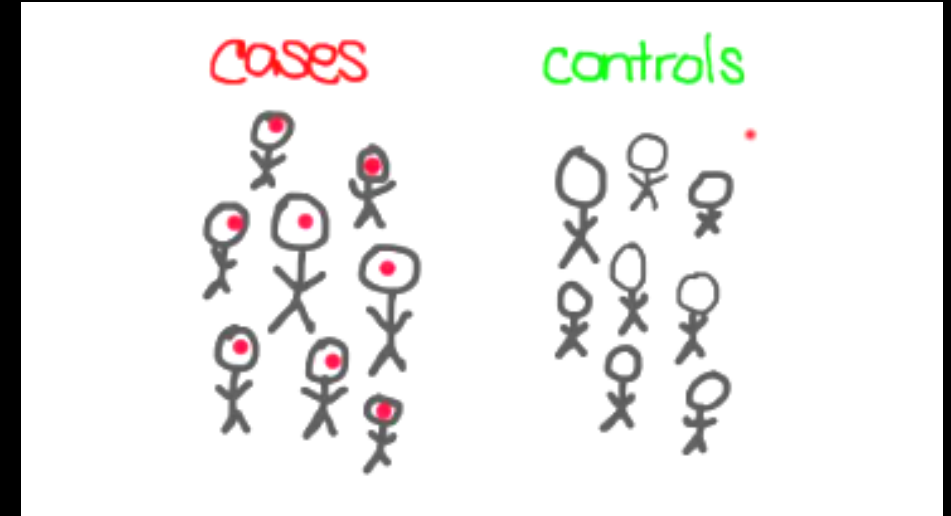
c. Case and control group

- Test the hypothesis using analytical technique
- Define and select case & control group



## STEPS OF CASE-CONTROL STUDY

1. Define a study population
2. Define and select the case and control
3. Preparing questionnaire
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5. Cleaning data
6. Summarizing data on risk factor and outcome
7. Analyze by measure the association between putative risk-factor and outcome by calculate the OR, 95%CI, and p-value (using Statulator)



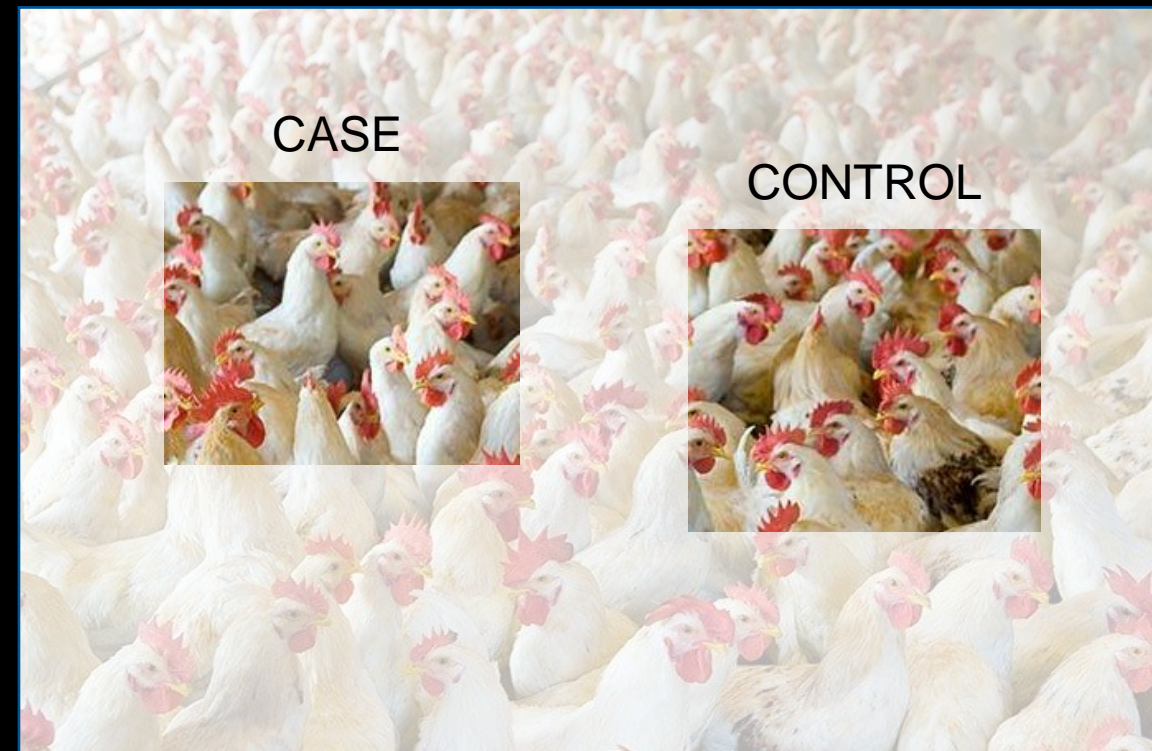
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6/7/2021

Epicollect5 - FormBuilder

OutbreakInvestigation

Household Data

In this section, you will fill in household information within respective village. Click "Next" to proceed

Investigation information

Investigator Name

Investigation date \*yyyy-mm-dd for iOS user

Form ID

Household information

<https://five.epicollect.net/myprojects/outbreakinvestigation/formbuilder#>

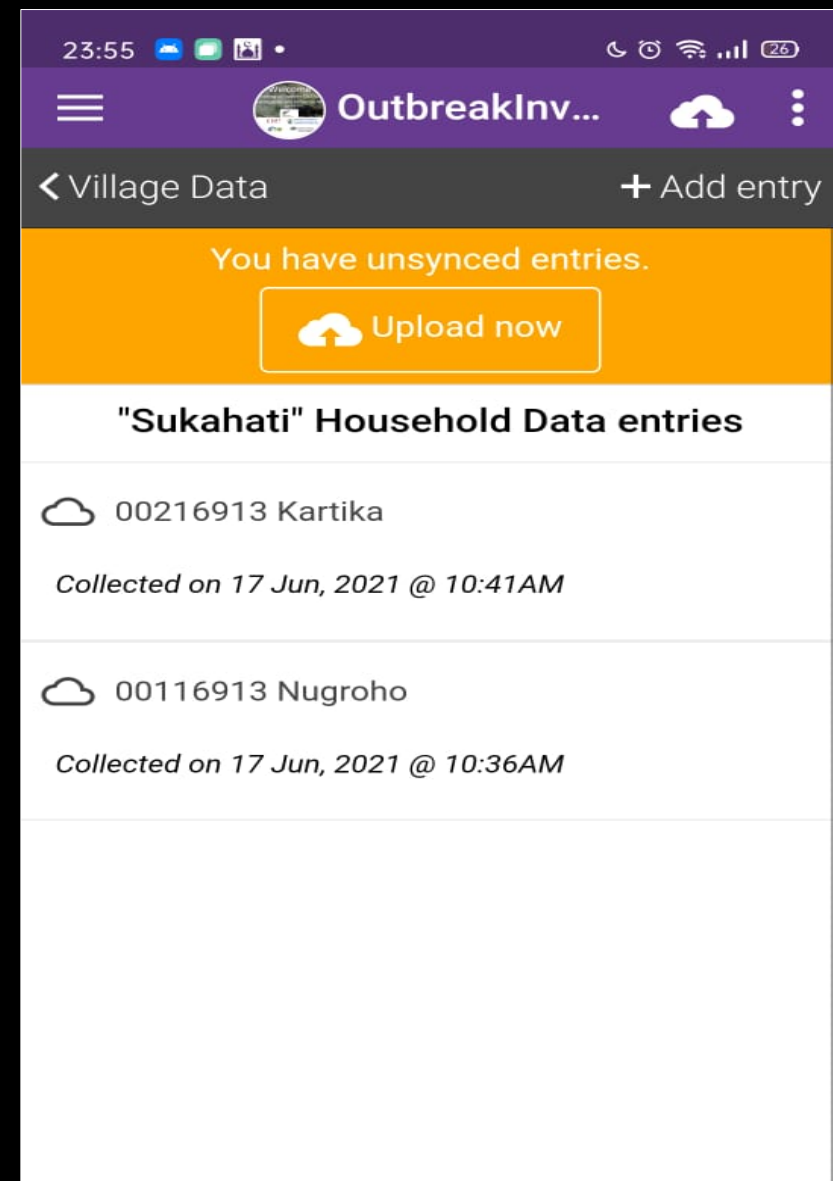
1/6





# STEPS OF CASE-CONTROL STUDY

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	HH_ID	Survey_Date	Village_Ion	Village_Iar	FMD	FMD_onset_date	Total_cattle	Total_buffalo	Total_goat	Total_pig	FMD_cattle	FMD_buffalo	FMD_goat	FMD_pig	Free_grazing	Share_veter_source	Vaccinate	Bring_in_animal
1	1	09-12-21	105.809485	14.78644518	1	20-11-21	10	5	0	0	10	3	0	0	1	1	1	1
2	2	09-12-21	105.810759	14.78536329	1	26-11-21	6	1	0	0	2	0	0	0	1	1	0	1
3	3	09-12-21	NA	NA	0	NA	14	2	0	4	0	0	0	0	1	1	1	0
4	4	09-12-21	NA	NA	0	NA	4	0	0	0	0	0	0	0	1	1	1	1
5	5	09-12-21	NA	NA	0	NA	12	3	0	0	0	0	0	0	1	0	1	0
6	6	09-12-21	105.8100328	14.78375732	1	23-11-21	6	0	0	0	6	0	0	0	1	1	0	1
7	7	09-12-21	105.8124144	14.78550069	1	23-11-21	8	0	0	0	6	0	0	0	0	0	0	0
8	8	09-12-21	NA	NA	0	NA	3	0	0	0	0	0	0	0	1	1	0	0
9	9	09-12-21	105.8126788	14.78532341	1	01-12-21	9	2	0	0	9	0	0	0	1	1	1	1
10	10	09-12-21	NA	NA	0	NA	22	2	0	0	0	0	0	0	1	1	0	1
11	11	09-12-21	105.794417	14.79303874	1	01-12-21	4	0	15	0	4	0	0	0	1	1	0	1
12	12	09-12-21	105.8077588	14.78674426	1	02-12-21	12	0	0	0	12	0	0	0	1	1	1	1
13	13	09-12-21	NA	NA	0	NA	0	0	0	0	0	0	0	0	1	1	0	0
14	14	09-12-21	105.8140639	14.78333665	1	02-12-21	15	1	0	0	6	0	0	0	1	1	1	1
15	15	09-12-21	105.8105387	14.78723502	1	02-12-21	5	0	0	0	3	0	0	0	1	1	0	1
16	16	09-12-21	105.8127036	14.78851038	1	03-12-21	11	3	0	2	3	0	0	0	1	1	0	1
17	17	09-12-21	105.8124363	14.78703912	1	03-12-21	8	0	0	0	8	0	0	0	0	0	0	0
18	18	09-12-21	105.806472	14.78520474	1	03-12-21	7	1	10	0	4	0	0	0	1	1	0	1
19	19	09-12-21	NA	NA	0	NA	0	0	0	0	0	0	0	0	1	1	1	1
20	20	09-12-21	105.8083705	14.78803826	1	03-12-21	10	0	0	0	2	0	0	0	1	1	0	0
21	21	09-12-21	NA	NA	0	NA	8	0	0	0	0	0	0	0	1	1	0	0
22	22	09-12-21	105.8097266	14.79011559	1	04-12-21	5	1	0	0	2	0	0	0	1	1	0	1
23	23	09-12-21	105.7922662	14.79405223	1	04-12-21	5	0	0	1	2	0	0	0	1	1	1	1
24	24	09-12-21	105.7942187	14.79357318	1	04-12-21	7	0	0	0	2	0	0	0	1	1	1	1
25	25	09-12-21	105.8132244	14.78323117	1	04-12-21	2	0	0	0	2	0	0	0	1	1	0	0
26	26	09-12-21	105.8104349	14.78911414	1	04-12-21	12	1	8	0	12	0	0	0	1	1	0	0
27	27	09-12-21	105.8073895	14.78881584	1	04-12-21	17	2	0	0	9	0	0	0	1	1	0	1
28	28	09-12-21	105.7940718	14.79474177	1	04-12-21	32	0	0	0	13	0	0	0	1	1	0	1
29	29	09-12-21	105.7956954	14.79319147	1	05-12-21	8	0	0	1	8	0	0	0	1	0	0	0
30	30	09-12-21	105.7960846	14.79422248	1	05-12-21	0	3	0	0	0	1	0	0	1	1	1	1
31	31	09-12-21	105.796837	14.79447239	1	06-12-21	12	0	0	0	12	0	0	0	1	1	0	0
32	32	09-12-21	105.792435	14.79274686	1	07-12-21	4	1	0	0	4	0	0	0	1	1	0	1
33	33	09-12-21	105.7927328	14.79277234	1	08-12-21	9	0	20	0	6	0	0	0	1	1	0	1
34	34	09-12-21	NA	NA	0	NA	25	1	22	0	0	0	0	0	0	1	1	1
35	35	09-12-21	NA	NA	0	NA	7	1	0	3	0	0	0	0	1	1	0	1
36	36	09-12-21	NA	NA	0	NA	0	0	0	0	0	0	0	0	1	1	0	1



# STEPS OF CASE-CONTROL STUDY

1. Define a study population
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Count of Free_grazing	Column Labels			
Row Labels		0	1	Grand Total
0		8	2	10
1		17	23	40
Grand Total		25	25	50

Count of Share_water_sou	Column Labels			
Row Labels		0	1	Grand Total
0		6	3	9
1		19	22	41
Grand Total		25	25	50



# STEPS OF CASE-CONTROL STUDY

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2. Define and select the case and control
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Odds ratio:	5.41
95% Confidence interval:	(1.02, 28.79)
Chi-square test:	4.50
Degree of freedom:	1
P-value:	0.034

## Interpretation

The **odds ratio** indicates that the exposure positive group has 5.41 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 1.02 and 28.79. Since the odds ratio confidence interval does not include the null value (i.e. 1), and the p-value (0.034) 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.




Generate report



# ANALYSIS OF CASE-CONTROL DATA

3 parameters have to consider are:

1. Odds ratio (OR)
2. The 95% Confidence Interval (CI)
3. p-Value

Odds ratio:	5.41 
95% Confidence interval:	(1.02, 28.79) 
Chi-square test:	4.50
Degree of freedom:	1
P-value:	0.034 



1. Odds ratio (OR) as measure of association between putative risk-factor and outcome.

- $OR=1 \rightarrow$  no difference
- $OR>1 \rightarrow$  disease associated with increased odds of exposure


Example:

*$OR=2$ , the odds of exposure in the case group were twice the odds of exposure in the controls group*

- $OR<1 \rightarrow$  protective factor associated with decreased odds of exposure

Example:

*$OR=0.5$ , the odds of exposure in the case group were half the odds of exposure in the controls group*

Odds ratio:	5.41 
95% Confidence interval:	(1.02, 28.79)
Chi-square test:	4.50
Degree of freedom:	1
P-value:	0.034



*The odds ratio indicates that the bring in new animal farm group has **5.41** times the odds of getting FMD infection than the do not bring in new animal farm group.*

*Also, we are 95% confident that the odds ratio in the population (from where the sample was obtained) would be between **1.02 and 28.79**.*

*Since the odds ratio confidence interval does not include the null value (i.e. 1), and the p-value (**0.034**) is less than 0.05, the conventionally used criterion to evaluate p-values, the association between bring in new animal and getting FMD infection is statistically significant at 5% level of significance.*

2. The 95% Confidence Interval (CI) is a range of values that you can be 95% confident contains the true mean of the population.

- The odds ratio and its 95% confidence limits were calculated to measure the magnitude of the association
- If the 95% CI includes the value 1, there is no difference between groups.  
Example: 95% CI (0.9, 1.05)

Odds ratio:	5.41 
95% Confidence interval:	(1.02, 28.79) 
Chi-square test:	4.50
Degree of freedom:	1
P-value:	0.034

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3. p-Value is the probability of obtaining results at least as extreme as the observed results of a statistical hypothesis test, assuming that the null hypothesis is correct.
- $P\text{-value} < 0.05$  indicates a statistically significant association difference between groups.
  - $P > 0.05$  indicates there is not a statistically significant association difference between groups.

Odds ratio:	5.41 ◀
95% Confidence interval:	(1.02, 28.79) ◀
Chi-square test:	4.50
Degree of freedom:	1
P-value:	0.034 ◀

*The odds ratio indicates that the bring in new animal farm group has **5.41** times the odds of getting FMD infection than the do not bring in new animal farm group.*

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# OR, 95% CI, p-Value??

Statulator: Chi-square Test

<http://statulator.com/stat/chisq.html>

### Chi-square Test

- ✓ Conducts the chi-square test for a  $2 \times 2$  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 articles.

#### Enter Data

Enter cell counts in the table below and click Analyse.

	Outcome Positive	Outcome Negative	Row Total
Exposure Positive	30	20	50
Exposure Negative	25	50	75
Column Total	55	70	125

[Analyse](#) [Reset](#) [Options](#)

1

Odds ratio:	5.41
95% Confidence interval:	(1.02, 28.79)
Chi-square test:	4.50
Degree of freedom:	1
P-value:	0.034

2

## Interpretation

The **odds ratio** indicates that the exposure positive group has 5.41 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 1.02 and 28.79. Since the odds ratio confidence interval does not include the null value (i.e. 1), and the p-value (0.034) 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.

[Generate report](#)

3



# Practice

1. *Data collection*
2. *Data analysis*



Our handouts, Have you read it yet?



HANDOUT\_1\_Epicollect5



HANDOUT\_2\_Pivot Table



HANDOUT\_3\_Statulator

## Collecting information exercise using **Epicollect5**

1. Search for project “**Outbreakinvestigation**” from Epicollect5 apps.
2. Complete at least one village-level questionnaire. You can make up your own data.
3. Complete at least two household-level questionnaires within the village that you have created earlier in point 1. Again, you can make up your own data.

\*Please put your name as outbreak investigator so we can identify you on the Epicollect5 database

\*Trainee will be distributed into 4 small room with one facilitator

\*After 10 minutes to practice, trainee will come back to main room



## Analyzing data using **Statulator**

1. You identified 25 households with FMD cases and randomly select 25 households with no FMD cases as controls. You assigned teams to visit and interview household member who look after the animals.
2. Assuming that **ToT\_scenario\_case\_control** dataset was from case-control study, extracted from the Epicollect5 database, and cleaned by investigation team (see next slide).



ToT\_scenario\_case\_control - Microsoft Excel

A54																		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	HH_ID	Survey_Date	Village_Ion	Village_Jat	FMD	FMD_onset_date	Total_cattle	Total_buffalo	Total_goat	Total_pig	FMD_cattle	FMD_buffalo	FMD_goat	FMD_pig	Free_grazing	Share_water_source	Vaccinate	Bring_in_animal
2	1	09-12-21	105.8091465	14.78644518	1	20-11-21	10	5	0	0	10	3	0	0	1	1	1	1
3	2	09-12-21	105.810759	14.78536929	1	26-11-21	6	1	0	0	2	0	0	0	1	1	0	1
4	3	09-12-21	NA	NA	0	NA	14	2	0	4	0	0	0	0	1	1	1	0
5	4	09-12-21	NA	NA	0	NA	4	0	0	0	0	0	0	0	1	1	1	1
6	5	09-12-21	NA	NA	0	NA	12	3	0	0	0	0	0	0	1	0	1	0
7	6	09-12-21	105.8100328	14.78375732	1	29-11-21	6	0	0	0	6	0	0	0	1	1	0	1
8	7	09-12-21	105.8124144	14.78558069	1	29-11-21	8	0	0	0	6	0	0	0	0	0	0	0
9	8	09-12-21	NA	NA	0	NA	3	0	0	0	0	0	0	0	1	1	0	0
10	9	09-12-21	105.8126768	14.78592341	1	01-12-21	9	2	0	0	9	0	0	0	1	1	1	1
11	10	09-12-21	NA	NA	0	NA	22	2	0	0	0	0	0	0	1	1	0	1
12	11	09-12-21	105.794417	14.79309874	1	01-12-21	4	0	15	0	4	0	0	0	1	1	0	1
13	12	09-12-21	105.8077588	14.78674426	1	02-12-21	12	0	0	0	12	0	0	0	1	1	1	1
14	13	09-12-21	NA	NA	0	NA	0	0	0	0	0	0	0	0	1	1	0	0
15	14	09-12-21	105.8140639	14.78333865	1	02-12-21	15	1	0	0	6	0	0	0	1	1	1	1
16	15	09-12-21	105.8105387	14.78723502	1	02-12-21	5	0	0	0	3	0	0	0	1	1	0	1
17	16	09-12-21	105.8127096	14.78851098	1	03-12-21	11	3	0	2	3	0	0	0	1	1	0	1
18	17	09-12-21	105.8124363	14.78709912	1	03-12-21	8	0	0	0	8	0	0	0	0	0	0	0
19	18	09-12-21	105.806472	14.78920474	1	03-12-21	7	1	10	0	4	0	0	0	1	1	0	1
20	19	09-12-21	NA	NA	0	NA	0	0	0	0	0	0	0	0	1	1	1	1
21	20	09-12-21	105.8093105	14.78803826	1	03-12-21	10	0	0	0	2	0	0	0	1	1	0	0
22	21	09-12-21	NA	NA	0	NA	8	0	0	0	0	0	0	0	1	1	0	0
23	22	09-12-21	105.8097266	14.79011159	1	04-12-21	5	1	0	0	2	0	0	0	1	1	0	1
24	23	09-12-21	105.7922662	14.79405229	1	04-12-21	5	0	0	1	2	0	0	0	1	1	1	1
25	24	09-12-21	105.7942197	14.79357918	1	04-12-21	7	0	0	0	2	0	0	0	1	1	1	1
26	25	09-12-21	105.8132244	14.78323117	1	04-12-21	2	0	0	0	2	0	0	0	1	1	0	0
27	26	09-12-21	105.8132319	14.79311194	1	04-12-21	1	0	0	0	0	0	0	0	1	1	0	0
28	27	09-12-21	105.7940716	14.79474177	1	04-12-21	32	0	0	13	0	0	0	0	1	1	0	1
29	28	09-12-21	105.7956954	14.79319747	1	05-12-21	8	0	0	1	8	0	0	0	1	0	0	0
30	29	09-12-21	105.7960846	14.79422248	1	05-12-21	0	3	0	0	0	1	0	0	1	1	1	1
31	30	09-12-21	105.7968937	14.79447299	1	06-12-21	12	0	0	0	12	0	0	0	1	1	0	0
32	31	09-12-21	105.7922435	14.79274666	1	07-12-21	4	1	0	0	4	0	0	0	1	1	0	1
33	32	09-12-21	105.7921928	14.79211294	1	08-12-21	5	0	28	0	5	0	0	0	1	1	0	1
34	33	09-12-21	NA	NA	0	NA	25	1	22	0	0	0	0	0	0	1	1	1
35	34	09-12-21	NA	NA	0	NA	7	1	0	3	0	0	0	0	1	1	0	1
36	35	09-12-21	NA	NA	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Please download the ToT\_scenario\_case\_control dataset in chat box.

Count of Free_grazing	Column Labels			
Row Labels		0	1	Grand Total
0		8	2	10
1		17	23	40
<b>Grand Total</b>		<b>25</b>	<b>25</b>	<b>50</b>

Count of Share_water_sou	Column Labels			
Row Labels		0	1	Grand Total
0		6	3	9
1		19	22	41
<b>Grand Total</b>		<b>25</b>	<b>25</b>	<b>50</b>

Count of Vaccinate	Column Labels			
Row Labels		0	1	Grand Total
0		15	18	33
1		10	7	17
<b>Grand Total</b>		<b>25</b>	<b>25</b>	<b>50</b>

Count of Bring_in_animal	Column Labels			
Row Labels		0	1	Grand Total
0		14	7	21
1		11	18	29
<b>Grand Total</b>		<b>25</b>	<b>25</b>	<b>50</b>

- Table in the left side, **ToT\_scenario\_case\_control** dataset was summarized using pivot table by investigation team member (see step in HANDOUT\_3\_Statulator).
- Put in the number (in the table) into Statulator table (see the HANDOUT\_3\_Statulator).
- Trainee explain the result.
- Which risk factor is statistically significant association with FMD infection?





# SUMMARY



WHAT HAVE  
YOU LEARNED?





*(content of the zoom polling. Multiple choice questions. This slide will not show)*

1. What are Three principles that have to understand in case-control study?

*Answer: Risk factor, hypothesis, case& control*

2. Please select the steps in case-control study! Select one or more.

3. What are 3 parameters have to consider in analysis of case-control study?

*Answer: Odds ratio, 95% Confidence interval, p-Value*

4. What are the tools/programs that can be used in case-control study?

*Answer: Epicollect5, Statulator*

5. Which statement is correct? Select one or more.

(to be made)





## KEY MESSAGES CASE-CONTROL STUDY:

1. A later stage in the investigation.
2. To assess suspected risk factors that associate with the outbreak.
3. Affected by the selection of cases and controls.
4. Use an easy-to-use tool make your field work easier (Epicollect5 & Statulator)





**THANK YOU**