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The Online R-FETPV 1st Module : Basic Epidemiology and Surveillance Data Analysis

5 April -28 May 2021



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Three basic observational studies and their uses in epidemiology

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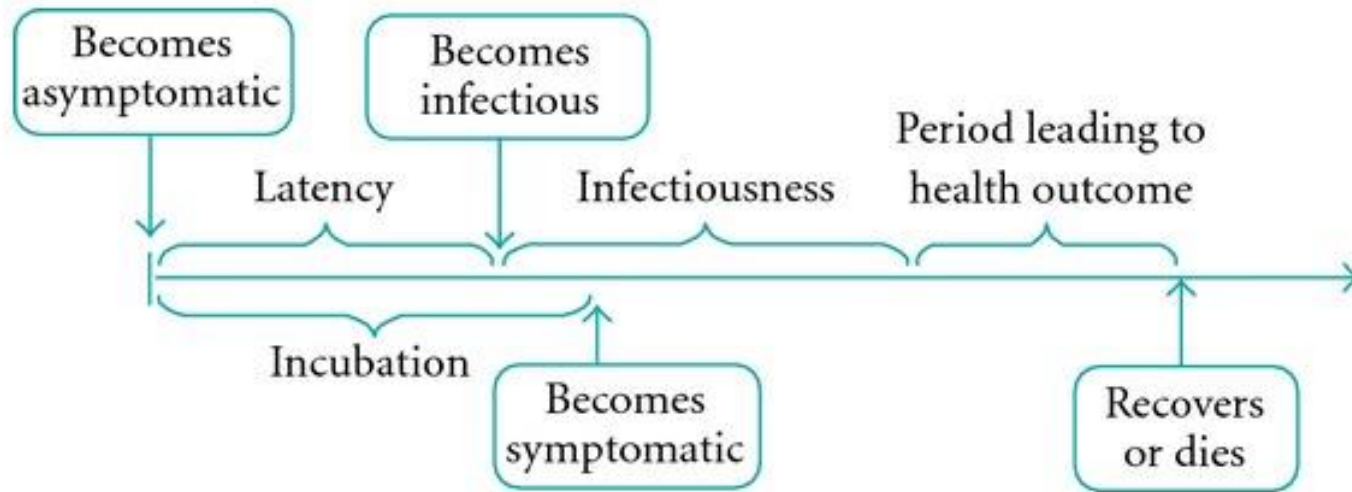
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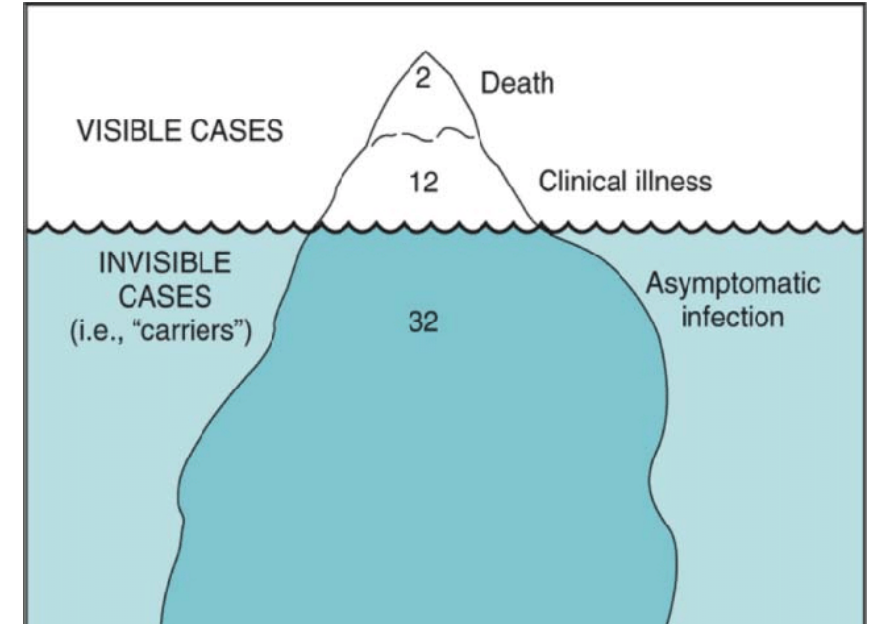


Part 1

Natural of disease



Andrés Uribe-Sánchez, et.al., 2011



Ravi Sankar Reddy, et.al., 2017

Content/Outline

Review the use of

- Cross-sectional study
- Case-control study
- Cohort study
- What? When? Why? How?
- Strengths vs weaknesses
- Field application with examples

Basic questions

- What is the health problem? → **Disease**
- Who are risk populations? → **Animal**
- When did the problem occur? → **Time**
- Where is the problem area? → **Place**
- Why/How did it occur? → **Cause/Factor**

Acknowledgements



Dr. Sangeeta Rao



Dr. Annette M. Bachand



You are interested in finding out the 'factors' (significant exposures) associated with disease 'X':

association

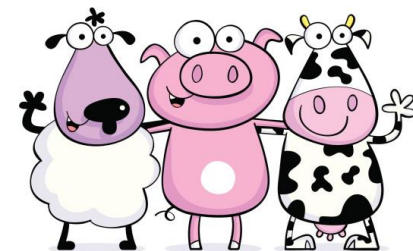
Factor/ exposure

Disease outcome
in the population

Requires appropriate
study design



Analytical approaches



Epidemiological research designs

Analytic Epidemiology

Descriptive Studies

Surveys & Outbreak Investigations

Surveillance & Monitoring Programs

Experimental Studies

Field Trial

Clinical Trial
(Randomized Controlled Trial)

Community Trial
(Public Health)

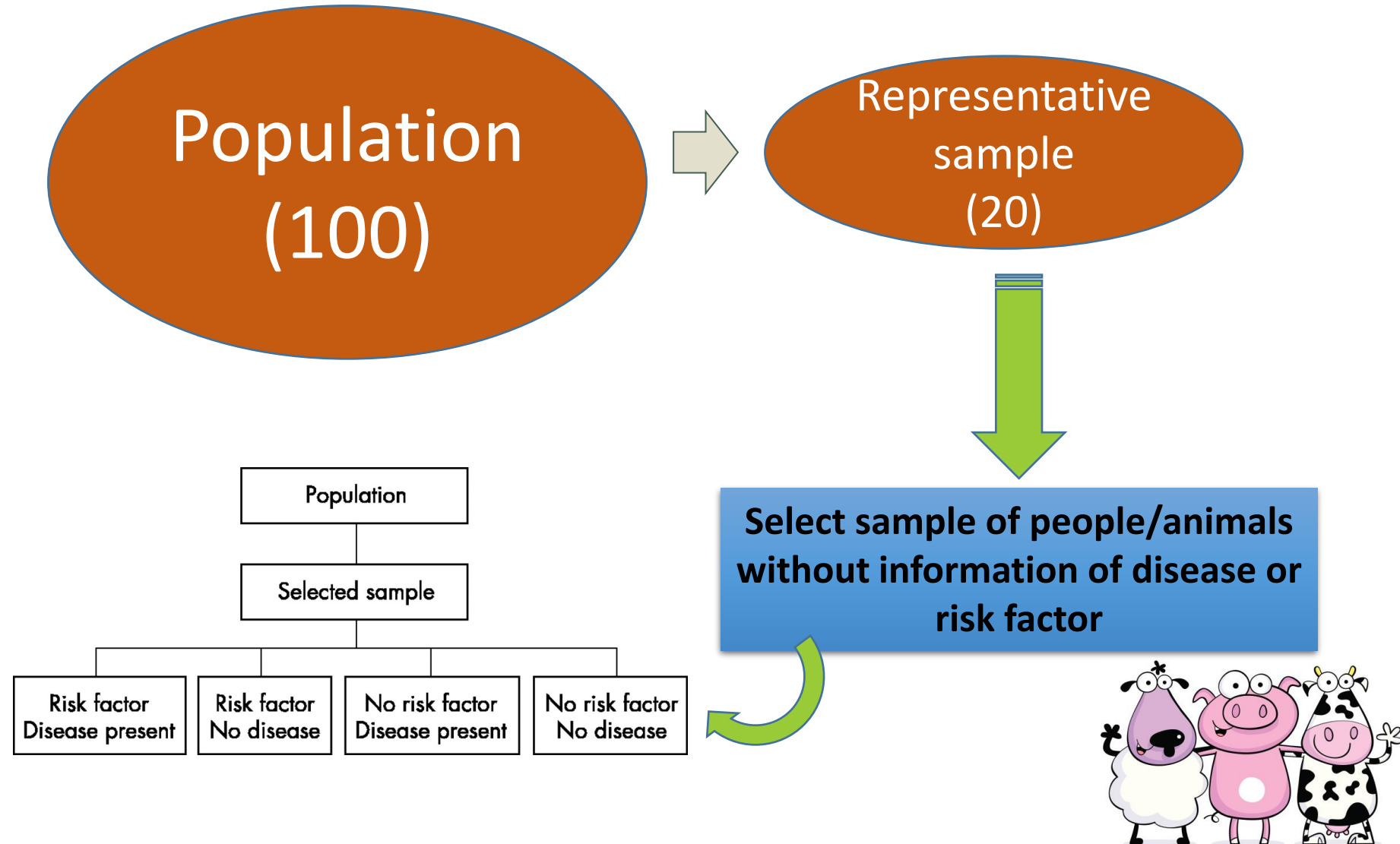
Observational Studies

Cross-sectional
(Prevalence Survey)

Case-Control
(Retrospective)

Cohort
(Prospective)

Cross-sectional study



Cross-sectional study

Capture information based on data gathered for a specific point/interval in time

Without information of disease or risk factor at the beginning

Advantage

- Fairly quick
- Lower cost
- Multiple risk factors and outcome
- Unlikely to become obsolete before completion
- No data/sample is lost during the study

Disadvantage

- Rare exposures and outcome: not ideal
- Only prevalence
- May need large sample size
- Unknown if exposure or outcome came first

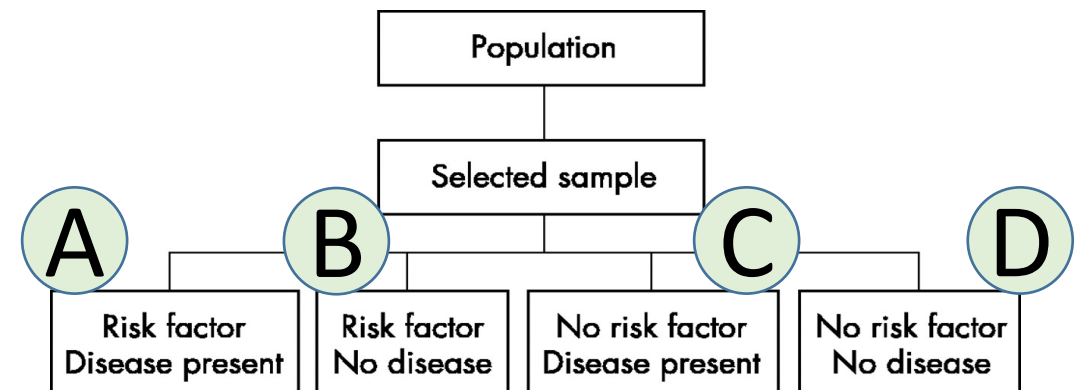
Animal	Rabies status	Stray
A	+	✓
B	+	✓
C	-	x
D	-	✓
E	-	✓
F	+	x
G	+	x

- Determine disease status (positive or negative)
- Determine risk factor history – usually just at the time the sample is collected



2x2 Table

Risk factor	Dz positive (Cases)	Dz negative (Controls)	
Risk factor (+) (exposed)	A B	D E	n_{R+}
No risk factor (-) (not exposed)	C F G	D	n_{R-}
	n_{D+}	n_{D-}	20 n



What will we get?

Prevalence is a proportion

Number of cases observed at time t

Total number of individuals at risk at time t

Descriptive: Percentage of Age, Sex, disease, risk factors etc.

Analytic (association)

- ⊙ Relative risk or Risk ratio (RR) or **prevalence risk**
- ⊙ Odds ratio (OR) or **prevalence OR**

		Outcome	
		Yes	No
Exposure	Yes	A	B
	No	C	D

$$RR = \frac{a / (a + b)}{c / (c + d)}$$

Cross-sectional
Cohort

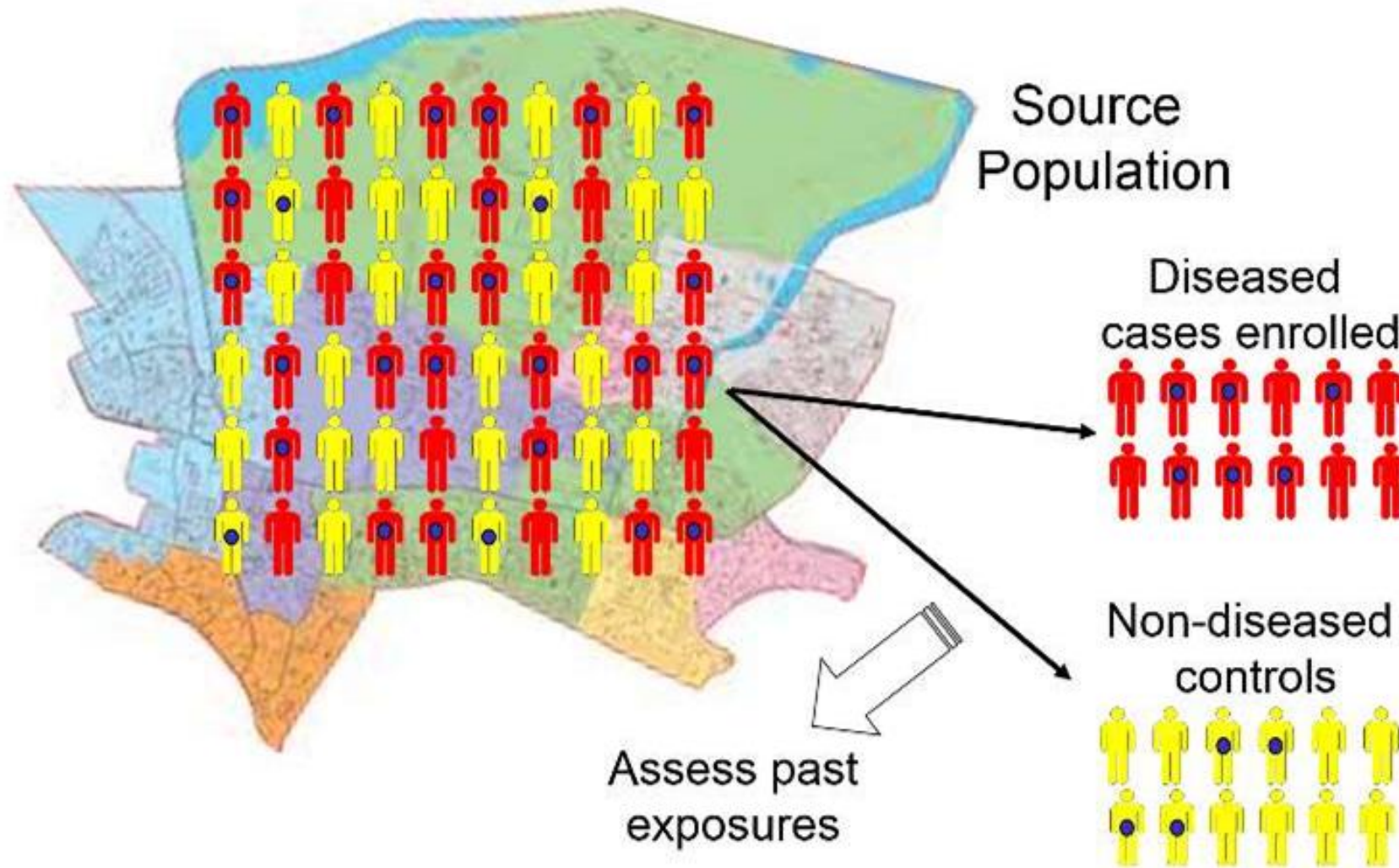
$$OR = \frac{(A * D)}{(B * C)}$$

Cross-sectional
Case-Control

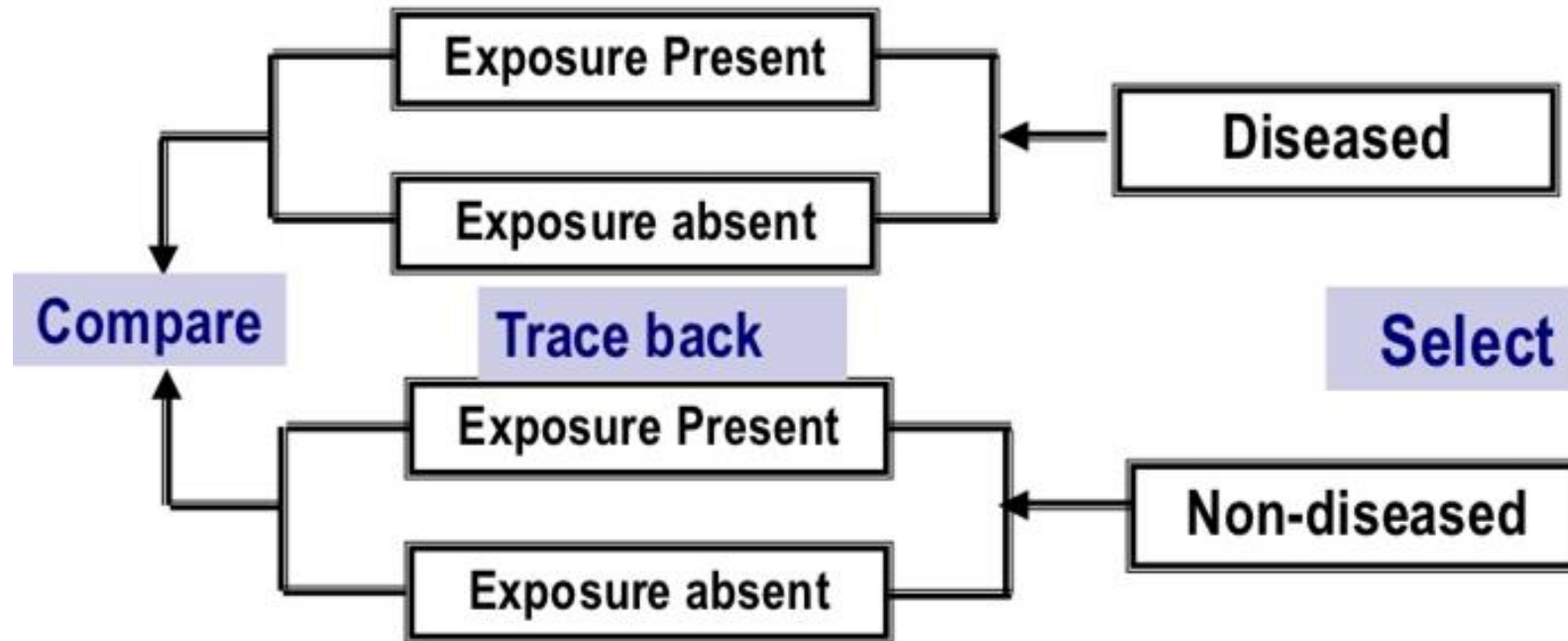


Part 2

Case-control study



Case-control study



Case control study proceed from effect to the cause

Case-control study

Advantage

- Efficient for rare diseases or diseases
- No data/sample is lost during the study
- less costly and less time-consuming
 - Know which one comes first

Disadvantage

- Inefficient for rare exposures
- Subject to selection bias and observation bias
- Difficult to find proper control group
 - Not for multiple diseases
 - May get incidence

Identification of Cases

- Select people with confirmed disease
 - using a standard case definition as *cases*
- In animal health setting, cases often identified by surveillance or outbreak investigation
- Need case definition
- Incident (new) rather than prevalent (pre-existing) cases

'Control' selection

- Select people without confirmed disease as *controls*
- No optimal control group for all situations
- Controls should...
 - Not have the disease being studied
 - Represent population from which cases arose
 - Represent persons who, if developed disease, would have been a case in the study
 - Be selected independently of exposure

Approach

- Interview owners to obtain histories of potential exposure to risk factors
 - e.g. Direct contact with poultry or birds in the past two weeks
- Numbers of cases and controls are usually equal but sometimes 2x or 3x more controls
- Matched case-control studies

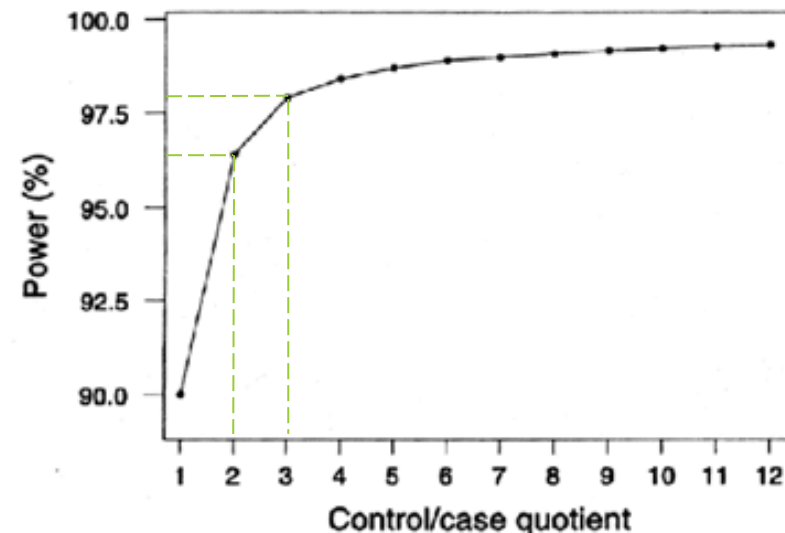
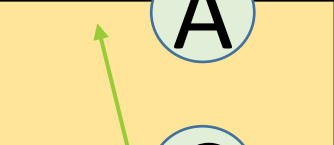
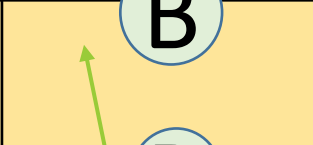
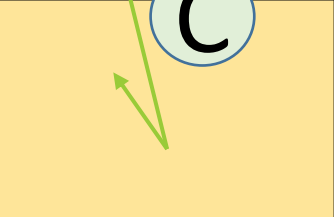
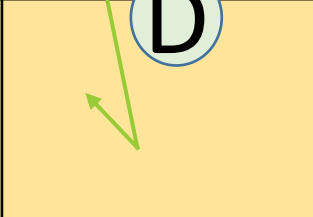


Figure 6.2 Power against control/case quotient. This shows the power to detect an approximate relative risk of 2 when the risk factor has a prevalence of 30%, a two-sided 5% significance test is to be used and 188 cases are available.

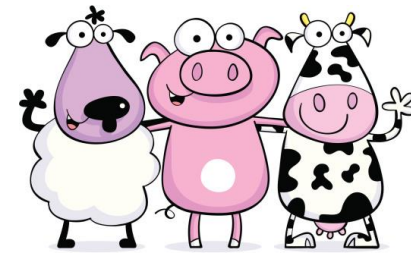
Case-control study

2x2 Table

Risk factor	Dz positive (Cases)	Dz negative (Controls)	
Risk factor (+) (exposed)	 A	 B	n_{R+}
No risk factor (-) (not exposed)	 C	 D	n_{R-}
	n_{D+}	n_{D-}	

Animal	AI status (30 June)	Contact wild birds (20 June)
A	+	✓
B	+	✓
C	-	x
D	-	✓
E	-	✓
F	+	x
G	+	x

- Determine disease status (positive or negative)
- Determine risk factor history – going back in time



What will we get?

Prevalence is a proportion

Number of cases observed at time t

Total number of individuals at risk at time t

Descriptive: Percentage of Age, Sex, disease, risk factors etc.

Analytic (association)

- ⊙ Relative risk or Risk ratio (RR) or **prevalence risk**
- ⊙ Odds ratio (OR) or **prevalence OR**

		Outcome	
		Yes	No
Exposure	Yes	A	B
	No	C	D

$$RR = \frac{a / (a + b)}{c / (c + d)}$$

Cross-sectional
Cohort

$$OR = \frac{(A * D)}{(B * C)}$$

Cross-sectional
Case-Control



Part 3

PROSPECTIVE COHORT (CONCURRENT COHORT)

* FOLLOWED FORWARD in TIME *


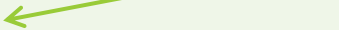

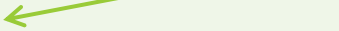
2018



2028



Cohort study

Risk factor	AI positive	AI negative
Contact with poultry or birds (+) (exposed)		n_{F+} 
No Contact with poultry or birds (-) (not exposed)		n_{F-} 

Cohort study

Advantage

- Efficient for rare exposure
 - Fewer recall problem
- Know that exposure came first
 - Incidence

Disadvantage

- Usually long
- May need large sample size
 - High cost
- Rare outcome is not ideal
- May become obsolete before completion

What will we get?

Prevalence is a proportion

Number of cases observed at time t

Total number of individuals at risk at time t

Descriptive: Percentage of Age, Sex, disease, risk factors etc.

Analytic (association)

- ⊙ Relative risk or Risk ratio (RR) or **prevalence risk**
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		Outcome	
		Yes	No
Exposure	Yes	A	B
	No	C	D

$$RR = \frac{a / (a + b)}{c / (c + d)}$$

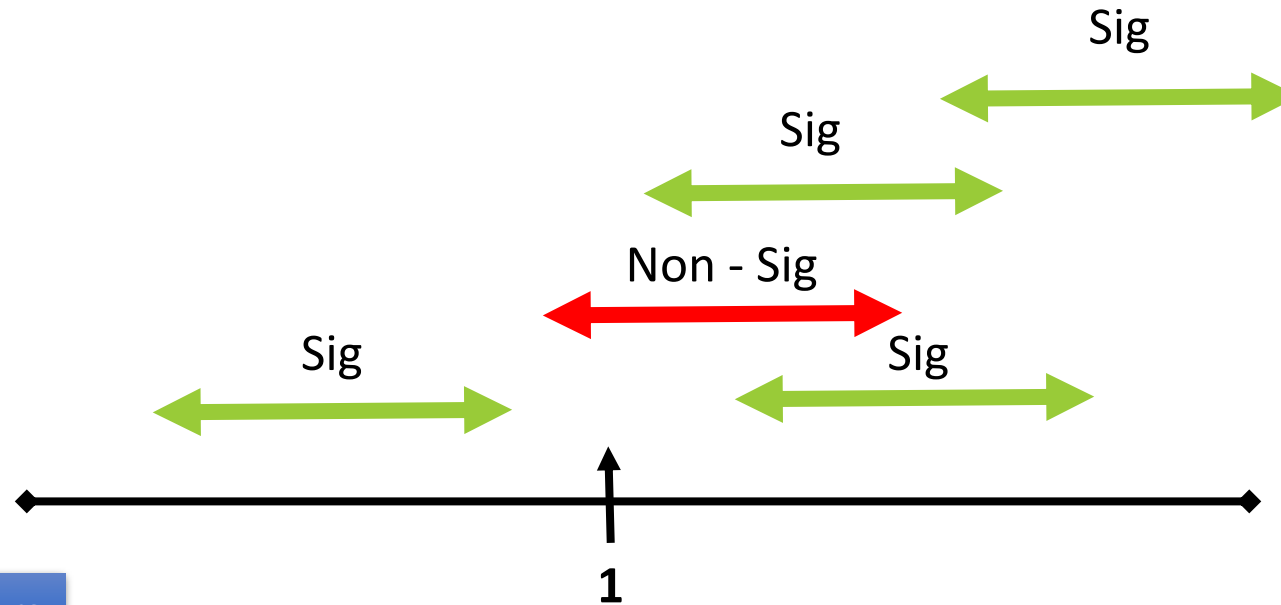
Cross-sectional
Cohort

$$OR = \frac{(A * D)}{(B * C)}$$

Cross-sectional
Case-Control

Interpretation of Confidence Interval of OR or RR:

- If the risk ratio is 1 (or close to 1), it suggests no difference or little difference in risk (incidence in each group is the same).
- A risk ratio > 1 suggests an increased risk of that outcome in the exposed group.
- A risk ratio < 1 suggests a reduced risk in the exposed group.



Epi calculators

http://www.openepi.com/Menu/OE_Menu.htm

<https://www.cdc.gov/epiinfo/index.html> (PC or Mobile application)

Microsoft Excel etc.



Longitudinal studies

Enroll cohort

