Survey design and sampling procedures in livestock populations: An introduction

Training on parasitic foodborne diseases

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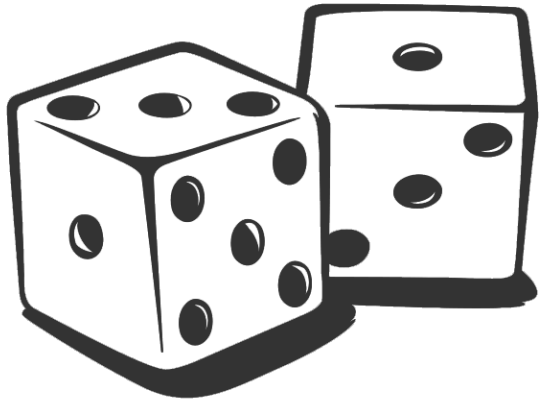

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1. Survey design

Some definitions

Epidemiolgy

- the study of disease in populations
- epidemiology is basically concerned with the reasons why individuals in a population became diseased in the first place e.g. *Trichinella* in pigs and humans

Versus

Classical medicine: to find cures for diseases in individuals already affected
e.g. medical treatment for humans affected with *Trichinella*

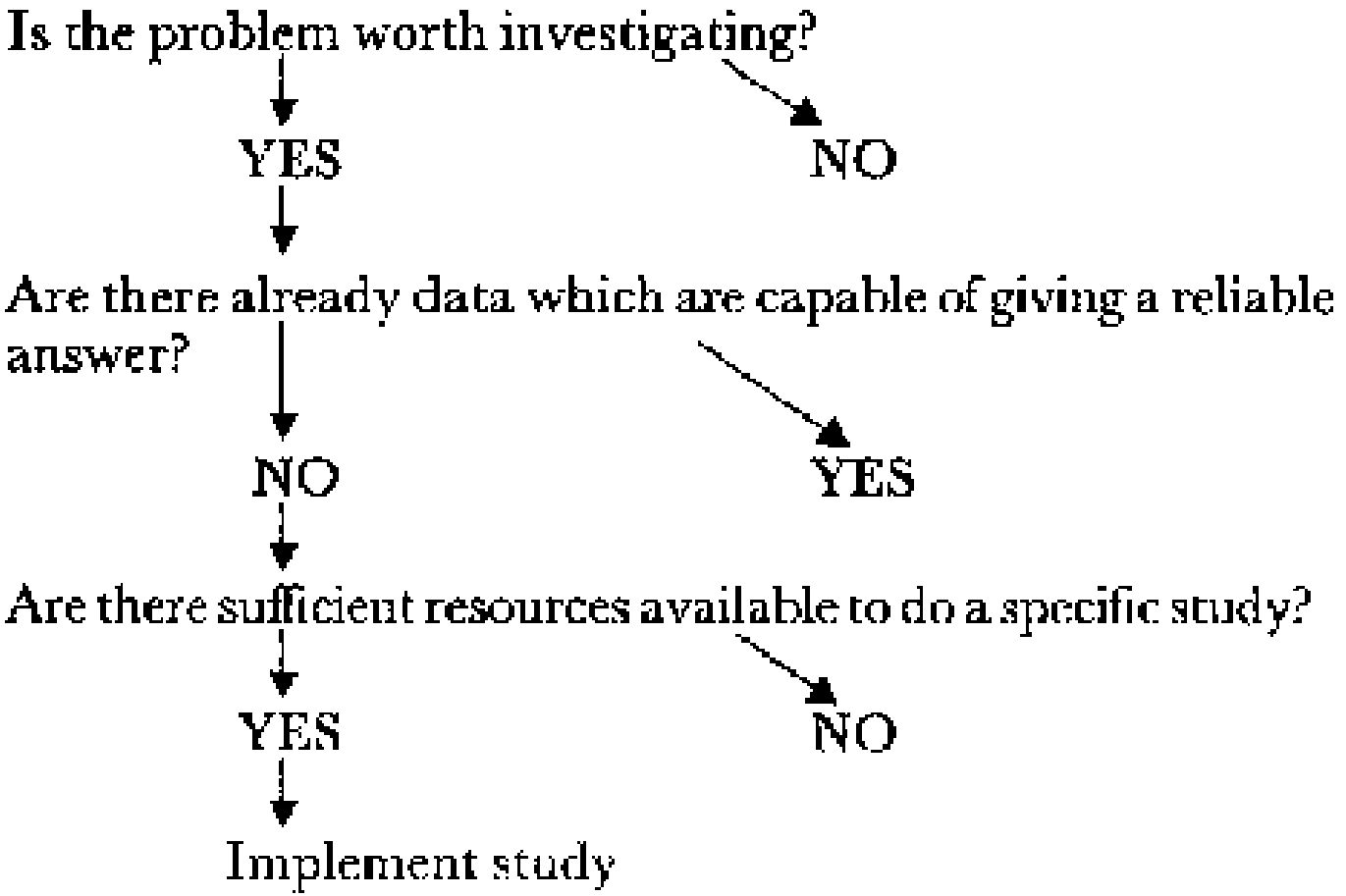
Some definitions

POPULATION

- the complete collection of individuals that have some particular characteristic(s) in common e.g.
  - All pigs of Laos
- Various sub-populations possible
  - Pigs of Savannakhet
    - All local breed pigs in Savannakhet
      - All local breed pigs in Savannakhet older 3months
        - All local breed pigs in SVK >3m which are free rooming
          - All sows …
            - All pregnant sows …
- One Health context
  - Zoonoses: Various populations
    Pigs and people affected or at risk for *Trichinella*

Objectives and hypothesis of survey

- Define the objective
  - Specify the disease
  - Specify the population (Who is affected)
  - Unit of interest
    - Village, herd, individual
  - What you like to calculate
  - Prospective for response
  - Define the sectors involved and their interest (e.g. in case of zoonoses)
  - Exclude complicated study hypothesis



Objective of the survey

What do you want to know:

- Production performance, e.g. weight gain
- Animal population, e.g. census
- Disease related
  - Occurrence
  - Disease spread
  - Risk factors
  - Zoonoses occurrence
    - Various populations of interest, e.g. pigs and community members at risk

Types of epidemiological studies

- Prospective studies
- Retrospective studies
- Cross-sectional studies

Types of epidemiological studies

- **Prospective studies**
  - look forward over a period of time
  - E.g.
    - May 2017 to April 2018
    - Slaughterhouse survey in pig carcasses
    - Hospital survey of *Trichinella* cases in humans

  Advantage: precise data on disease occurrence over time, determination of seasonal factors

  Disadvantage: often difficult to obtain, response bias

Types of epidemiological studies

- **Retrospective studies**

  - look backward over a period of time
    - E.g. May 2015 to April 2016
    - Historical slaughterhouse records from meat inspection on *Trichinella* in pig carcasses
    - Historical hospital survey of *Trichinella* cases in humans

Advantage:	precise data on disease occurrence over time, determination of seasonal factors
Disadvantage:	historical data often difficult to obtain or not reliable

Types of epidemiological studies

- **Cross sectional studies/surveys**
  - Provide point estimates of disease occurrence over a limited period of time
  - E.g. serological pig farm screening in SVK to assess the presence of *Trichinella* in pigs
    - June 2016

  Advantage: Point estimated for disease occurrence
  Disadvantage: No seasonal effects, can be costly

  2 types of cross sectional studies
  - Census
    - Every unit of interest (e.g. pig) of population is sampled

  - Sample surveys

Types of epidemiological studies

2 types of cross sectional studies

- Census
  - Every unit of interest (e.g. pig) of population is sampled

  Advantage: precise in small populations

  Disadvantage: very costly

  Example: BSE control in EU

- Sample surveys

  Advantage: cheaper, doable, in particular in low-income countries

  Disadvantage: may not represent the real situation

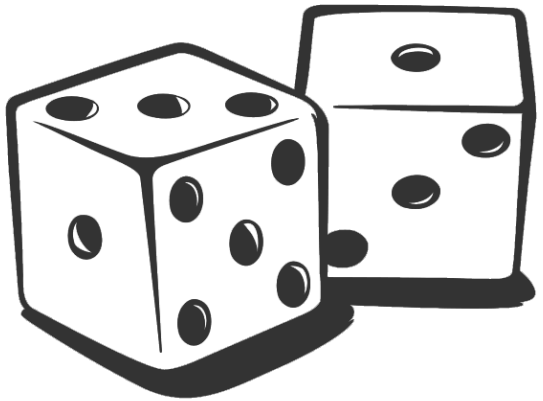
2. Sampling procedures

Random sampling – some basics

- Impossible to sample all member of a population (census)
- Instead a smaller group is selected (sample) and tested

Types of sampling:

1. Non-probability sampling
2. Probability sampling (random sampling)



Random sampling – some basics

1. Non-probability sampling

- Probability of a member of the population to be selected unknown

Plus: Usually easier to perform and cheaper

Contra: Not representative, cannot provide prevalence estimates

Convenience sampling:

- 100 head dairy herd surveyed for occurrences of lameness
- We select first 10 cows entering the shed as we don't want to wait

What is the possible bias here?

Purposively sampling:

- Cattle are selected for a specific purpose (e.g. only sick cattle)
- Used for specific study of specific diseases e.g. what the range of pathogens in sick cattle

Random sampling – some basics

1. Non-probability sampling

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Purposively sampling:

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- Used for specific study of specific disease

Specific examples:

- Pig farm: only pigs in free rooming system are tested for *Trichinella* villages are selected based on PRA results (actual NUoL survey on *Trichinella* in pigs)
- Humans: overweight person are checked for increased heart failure risks

Random sampling – some basics

2. Probability sampling

- Probability of a member of the population to be selected is known
- Every member has the same chance to be selected

Plus: Representative, allow to provide prevalence estimates
and
also confidence intervals (showing how confident we are that our estimates are correct)

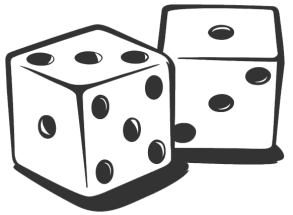
Contra: Time consuming, expensive and logistically much more demanding

Random sampling – some basics

Techniques for probability sampling:

Physical randomisation – most simple approach

- Physical objects are used to draw random numbers
- E.g. dice or cards



Example:

- ❑ 100 head dairy herd with lameness
- ❑ Prepared 100 cards (use ear tag numbers) for each member of the population
- ❑ Select 10 cards randomly

Random numbers

- Computerised random numbers are used
- Still would need allocation of all 100 cows to certain numbers, 1 2 3… 100

Random sampling – some basics

Techniques for probability sampling:

Systematic random sampling

- Alternative techniques when members of the population are difficult to identify or list but a certain order exists

Example:

- ❑ 100 head dairy herd with lameness
- ❑ Population size N divided by the desired sample size n, 100/10 = 10
- ❑ Select every 10^{th} cow

Random sampling – some basics

Example for systematic sampling technique

No of lactating cows	Cow to be selected
1 - 3	All
4 - 8	Every second
9 - 20	Every third

Exclusion criteria:

- Clinically sick and cows wih visible udder injuries
- Known non-compliant animals (e.g. poor temperament)

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