# Practical 2: Epidemiologic Measures II

## Objectives

At the end of Practical 1 students should be able to:

- Understand the distinction between prevalence and incidence

- Understand the need for denominators when measuring disease frequency

- Calculate and interpret different measures of disease frequency (prevalence, prevalence odds, risk/incidence, incidence odds, rate)

**At the end of Practical 2 students should be able to:**

- **Calculate and interpret different measures of disease frequency (prevalence, prevalence odds, risk/incidence, incidence odds, rate).**

- **Calculate and interpret ratios and difference figures.**

This practical returns to some of the questions you worked on in Practical 1.

## Question 1 (continuing from Q2 in Practical 1)

1. John Snow is considered one of the founders of modern epidemiology. He investigated several major outbreaks of cholera in London in the 1800s and provided evidence that access to a particular water source was associated with cholera deaths.

    In 1854, John Snow compared cholera deaths across areas of London supplied by different water providers (1). His findings are below.

| Local water provider | Population | Cholera deaths from 8 July to 26 Aug 1854 | Incidence risk per 100,000 people |
|---|---|---|---|
| **Southwark and Vauxhall Company (S&V)** | 167,654 | 844 | 503.4 |
| **Lambeth Company** | 19,133 | 18 | 94.1 |
| **Total** | 186,787 | 862 | 461.5 |

a. Calculate and interpret the incidence risk ratio (IRR) for cholera deaths by water provider
b. Calculate and interpret the incidence risk difference. Report this as deaths per 100,000 population.
c. What proportion (or percentage) of cholera deaths among people who had been supplied water by the S&V Company would be eliminated if these residents had been supplied by from the Lambeth Company instead? What is this measure called?
d. Comment on the 'exposure' definition. Is this meaningful? What are its limitations?
e. Asides from their water supplier, comment on how the residents of two neighbourhoods might be different in an urban area of a setting which your group is familiar with.

**More about John Snow:**

Watch Dr Ros Stanwell-Smith discussing John Snow here: http://www.londonlive.co.uk/news/2018-07-20/pump-reinstated-in-soho-to-remember-great-scientist,

Read more in the award-winning book "Ghost Map" by Steven Johnson, available in the LSHTM library:
https://lshtm.primo.exlibrisgroup.com/permalink/44HYG_INST/1g4gmr9/alma991000
315279703736

Read more here: https://www.lshtm.ac.uk/newsevents/news/2019/john-snow-memorial-pump-marking-historic-cholera-outbreak-reinstalled-its ;

Learn more about John Snow at the John Snow pub in Soho, where you can see a replica of the famous hand pump outside: 39 Broadwick St, London W1F 9QJ.

Watch the John Snow Society's annual Pumphandle Lecture, held every September at LSHTM: https://www.lshtm.ac.uk/newsevents/events/series/annual-lectures, followed by a visit to the John Snow pub.

## Question 2

2. In 2019, the Government of Nepal and UNICEF completed the sixth round of the nationally representative Multiple Indicator Cluster Survey (MICS). The questionnaire for women aged 15-49 included measures on social practices relating to menstruation.

   Chhaupadi is a practice observed in Nepal whereby women, girls and people who are menstruating are required to spend their nights in a separate house. Often these houses are unprotected huts, which creates a risk of substantial harm, including death.

Double Click on the icon above to download the table (the table is also saved on Moodle).

    a. Use the figures from the table to complete the following bar graph, and to calculate a prevalence ratio.
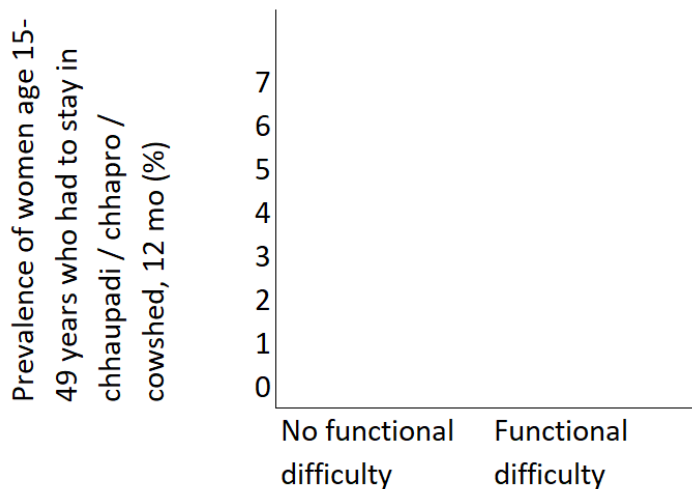


    How do you interpret the prevalence ratio?

    b. (Optional) Why do you think these two measures (i.e. functional ability and sleep exclusion) appear to be associated?

## Question 3

3. In 2013, epidemiologists conducted a study of alcohol use in Sehore, a rural district of Madhya Pradesh state in India(3). They enrolled a random sample of 3220 adults from the district and reported the following:

| Characteristic | Total n | n who drink alcohol | Prevalence of alcohol use | Prevalence ratio | Prevalence odds of alcohol use | Prevalence odds ratio |
|---|---|---|---|---|---|---|
| **Age (years)** | | | | | | |
| **18-29** | 905 | 139 | 0.154 | 1.0 [Ref] | 0.181 | 1.0 [Ref] |
| **30-49** | 1501 | 193 | 0.129 | | 0.148 | |
| **>=50** | 814 | 100 | 0.123 | | 0.140 | |
| **Gender** | | | | | | |
| **Female** | 1444 | 9 | 0.006 | 1.0 [Ref] | 0.006 | 1.0 [Ref] |
| **Male** | 1776 | 423 | 0.238 | | 0.312 | |

a. Calculate (to 2 decimal places) prevalence ratios for each characteristic. For each characteristic, use the first row as the reference group (i.e. Female, 18-29 years). Interpret the two prevalence ratios for age.

b. Repeat part a, using the prevalence odds instead of prevalence.

## Question 4

4. Sonkin et al (4) analysed the child mortality rate in UK for different modes of transport in 1985 and in 2003. Their findings are tabulated below.

| Mode of transport | Mortality rate during use of transport (per 100 million passenger-miles): 1985 | Mortality rate during use of transport (per 100 million passenger-miles): 2003 |
|---|---|---|
| In car | 0.4 | 0.1 |
| On foot | 10.8 | 2.7 |
| On cycle | 8.4 | 5.5 |

a. Compare the mortality rate for 'On Foot' in 1985 vs 'On Foot' in 2003. Which is of greater public health relevance: the mortality rate ratio or the mortality rate difference? Why?

b. Compare the mortality rate for 'On Cycle' in 2003 vs 'In Car' in 2003. Which is of greater public health relevance: the mortality rate ratio or the mortality rate difference? Why?

c. (Optional) Aside from their mode of transport, comment on how children who are driven may differ from children who walk or children who cycle in a setting which your group is familiar with.

Note that the analyses by Sonkin et al and Snow are both examples of ecologic studies. As such, the incidence and rate figures are not true incidence and rates. For this exercise though, we ask you to treat these analyses as if they were using individual-level data.

- Sonkin used data from a national survey to estimate the distance travelled by mode of travel for the denominators, and data from a separate register for mortality for the numerators. We don't actually know if the children who died were actually engaged in a given form of transport at the time of death, or how many passenger-miles each child travelled.

- Snow used 1851 census data for the population of each borough as the denominator, and a death registry from 1854 for cholera deaths for numerators. This same estimation method is used to calculate the "maternal mortality ratio" in the present day.

# References

1.      Snow J. On the mode of communication of cholera. 2nd ed. London, UK: John Churchill; 1855.

2.      Central Bureau of Statistics. Nepal Multiple Indicator Cluster Survey 2019, Final Report. Kathmandu, Nepal: Central Bureau of Statistics and UNICEF Nepal; 2019. https://www.unicef.org/nepal/media/11081/file/Nepal%20MICS%202019%20Final%20Report.pdf

3.      Rathod SD, Nadkarni A, Bhana A, Shidhaye R. Epidemiological features of alcohol use in rural India: a population-based cross-sectional study. BMJ Open. 2015 Dec;5(12):e009802.

4.      Sonkin B, Edwards P, Roberts I, Green J. Walking, cycling and transport safety: an analysis of child road deaths. J R Soc Med. 2006 Aug 1;99(8):402–5.