



WRITTEN EXAMINATION IN Infectious Disease Epidemiology

Master of Public Health

January 14th 2014 09:00-13:00

(4 hours)

Examination guidance

It is allowed to bring written material including text books and course notes. Access to the internet and bringing your own computer or calculator is not allowed.

Mobile phones must be turned off and put away during the examination.

You may answer in English or Danish.

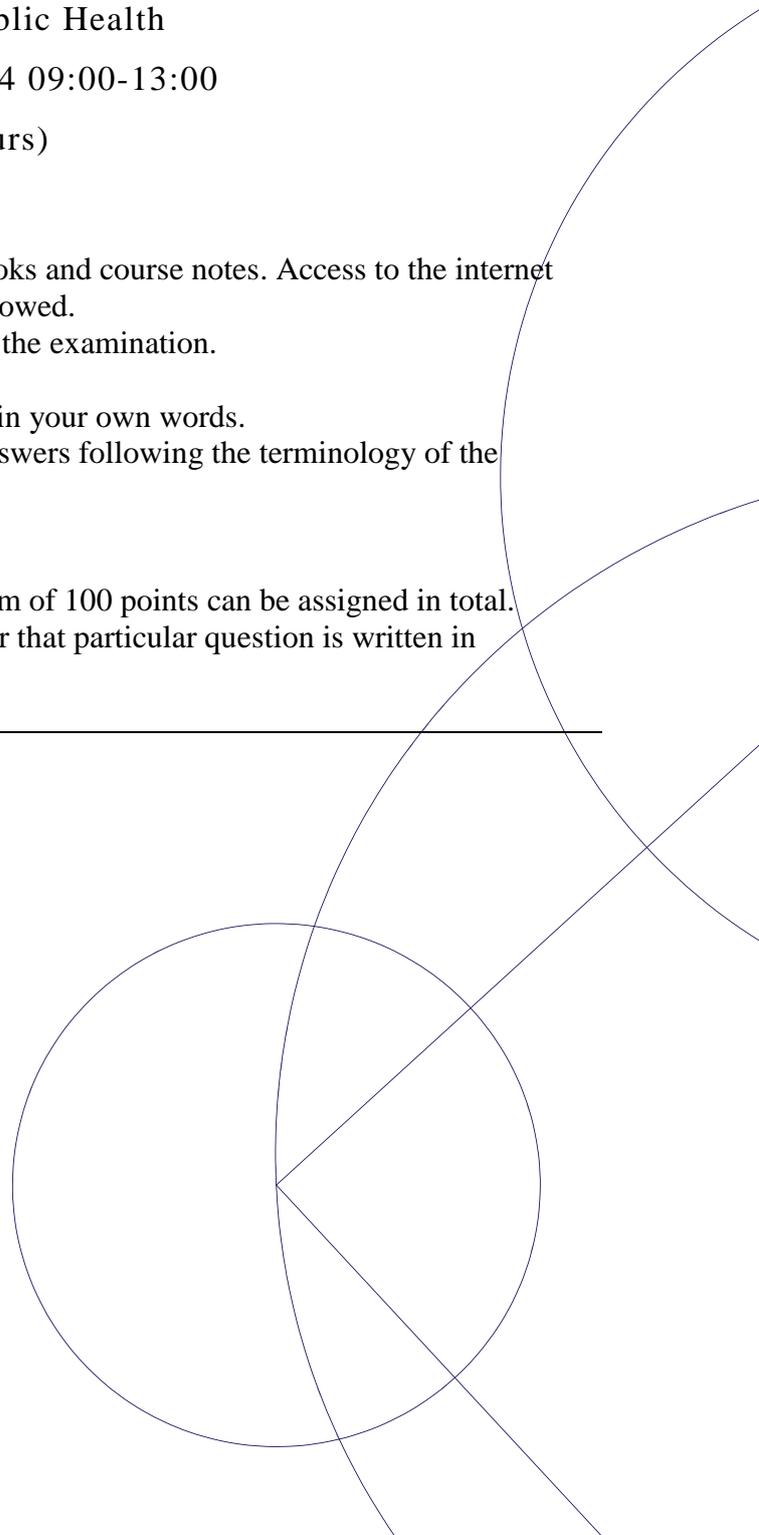
If you do not know a particular technical term, explain in your own words.

Emphasize a clear disposition, lingual accuracy, and answers following the terminology of the course.

Practical information

The exam consists of 11 questions for which a maximum of 100 points can be assigned in total.

Under each question the maximum number of points for that particular question is written in parenthesis.

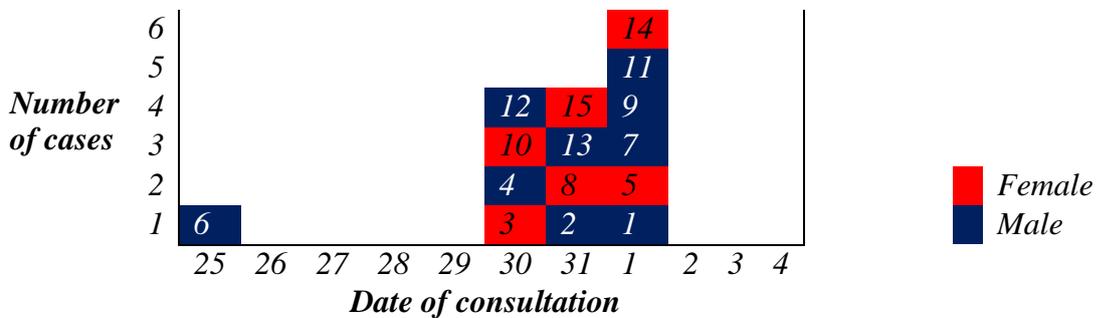


1) In early January 2014 a Copenhagen based doctor on call suspects that she has attended an unusual high number of patients with gastrointestinal symptoms. On 4 January 2014 she contacts epidemiologists at Statens Serum Institut, who confirms that an outbreak of gastroenteritis is going on in the Copenhagen area. From her own records the doctor on call can determine the date of consultation, the sex, and the age of the patients with gastrointestinal symptoms she attended. The data is shown below. Use the data in the table to draw an epidemic curve of the patients attended by the doctor on call

(9 points)

Patient number	Sex	Age in years	Date of consultation
1	Male	29	1 January 2014
2	Male	43	31 December 2013
3	Female	3	30 December 2013
4	Male	2	30 December 2013
5	Female	32	1 January 2014
6	Male	59	25 December 2013
7	Male	2	1 January 2014
8	Female	54	31 December 2013
9	Male	31	1 January 2014
10	Female	6	30 December 2013
11	Male	28	1 January 2014
12	Male	61	30 December 2013
13	Male	37	31 December 2013
14	Female	8	1 January 2014
15	Female	34	31 December 2013

One suggested epidemic curve indicating the date of consultation, the patient number and the sex of the patients. Other good suggestions are accepted.



- 2) Which type of source is the epidemic curve indicative of?

(7 points)

The shape of the epidemic curve is indicative of a point source rather than a continuous or propagated source because it seems that all cases were infected around the same point in time.

- 3) Use the data in the table to calculate the odds ratio with belonging 95% confidence interval of being 30 years or older as opposed to younger than 30 years in men compared with women. Use women as the reference group.

(14 points)

	<30	≥30	Total
Men	4	5	9
Women	3	3	6
Total	8	7	15

$$Odds_{men} = 5/4 = 1.25$$

$$Odds_{women} = 3/3 = 1$$

$$Odds\ ratio = 1.25/1 = 1.25$$

Error factor:

$$1/5 + 1/4 + 1/3 + 1/3 = 1.12$$

$$\sqrt{1.12} = 1.06$$

$$1.96 \times 1.06 = 2.07$$

$$e^{2.07} = 7.93$$

$$LCL = 1.25/7.93 = 0.16$$

$$UCL = 1.25 \times 7.93 = 9.92$$

- 4) How would you interpret this odds ratio and belonging 95% confidence interval?

(9 points)

An odds ratio of 1.25 tells us that the odds of being 30 years or older is 25% higher among men than among women. The confidence interval, however, tells us that the true odds ratio value with 95% certainty lies within ranges from 0.16 to 9.92, meaning that the odds of being 30 years or older range from being 84% lower to 892% higher among men compared with women. The confidence interval includes 1 why there is no statistical significant difference in the odds of being 30 years or older among men and women.

- 5) Epidemiologists at Statens Serum Institut decide to initiate a case-control study in search of possible sources of the gastroenteritis outbreak. From Danish registers they randomly choose two sex and age matched controls per identified case. Hereafter they interview cases and controls in person. In crude analyses of the data, odds ratios for two exposures are markedly increased for cases compared with controls. These exposures are ‘Having eaten shell fish’ and ‘Having celebrated New Year’s evening with a case’. In adjusted analyses including both exposures, one but not the other exposure shows a markedly increased odds ratio. Which epidemiologic phenomenon does this scenario describe, and why does it occur in this particular scenario?

(8 points)

The epidemiologic phenomenon described is confounding. In this particular scenario confounding occurs because only one of the two exposures is a true risk factor for gastroenteritis, and because this true risk factor is closely associated with the other exposure which is not a true risk factor for gastroenteritis. Therefore if not adjusted it will seem like both exposures are true risk factors, but when mutually adjusted only the true risk factor will show an increased odds for gastroenteritis.

- 6) To evaluate the findings of the case-control study, epidemiologists at Statens Serum Institut decide to conduct a case-case study. Briefly describe features of the case-case design, and discuss advantages/disadvantages of the case-case study compared with a conventional case-control study.

(10 points)

The case-case study compares risk factors for gastroenteritis during one outbreak with those during a previous outbreak. Thus, patients during a previous gastroenteritis outbreak are used as comparison group rather than a control group representing the background population. This design is only possible if similar exposure variables were collected during a previous outbreak. The case-case design has the advantage of saving time and effort in search of new controls. Comparing current with previous cases may reduce the risk of selection bias if population controls have another 'doctor-visit-proneness' than cases. On the other hand using previous cases may increase the risk of selection bias if they do not reasonably reflect exposure in the population.

- 7) In previous case-control studies of risk factors for gastroenteritis, epidemiologists from Statens Serum Institut noted that data were correlated within the compared exposure groups. Describe how such correlation may have affected the association between a given exposure and gastroenteritis.

(10 points)

The fact that data are correlated, regardless of whether the correlation occurs within or between the compared groups, does not affect the point estimate, but it affects the variance used to estimate the belonging confidence interval and p-value. Thus, the OR estimated in previous case-control studies will be right. However, because data are correlated within groups the precision of the odds in the groups are overestimated and the variance of the OR therefore becomes too small. This gives erroneously narrow confidence limits, which should be handled by introducing some overdispersion parameter.

- 8) Describe why epidemiologists at Statens Serum Institut cannot reliably estimate the risk of gastroenteritis using data collected for the previously described case-control study.

(8 points)

Risk denotes the number of people diseased divided by the total number of people in the exposure group. In the case-control design neither the number exposed nor the number diseased is known. The risk cannot be reliably estimated because in the case-control design the researchers decide how many controls should be selected per case, which in turn determines the risk.

9) Evaluate whether epidemiologists at Statens Serum Institut can estimate the below frequency measures using data collected for the previously described case-control study?

- Incidence of gastroenteritis among the those who did not eat shell fish
- Prevalence of eating shell fish among the controls without gastroenteritis
- Attack rate of gastroenteritis among the those who ate shell fish

(9 points)

- *The incidence of gastroenteritis cannot be estimated because the time at risk is not known*
- *The prevalence can be estimated because the controls should represent the background population*
- *The attack rate cannot be estimated because the exposed group is not known*

10) Gastroenteritis occurrence can be monitored through sentinel surveillance. Briefly, suggest how to set up sentinel surveillance of gastroenteritis in Denmark.

(7 points)

One suggestion would be to include a number of sentinel sites e.g. selected general practitioners, doctors on call, or children's wards and ask them to record the contact reason of all patients. That way the proportion of contacts attributable to gastroenteritis and trends herein can be monitored. Intensive care units will not be a good choice because mainly nosocomial gastroenteritis cases are treated here.

11) As of 31 December 2012 the Danish population comprised 5,602,628 people. During 2012 an estimated total of 413,555 people suffered from gastroenteritis. A total of 52,325 people died during 2012, of whom 269 died from gastroenteritis. Use the relevant figures to calculate the below measures

- the mortality from gastroenteritis in 2012
- the case-fatality from gastroenteritis in 2012

(9 points)

The total number of deaths is irrelevant information and should be disregarded. The calculations are the following:

- $MR = 269/5,602,628 = 0.0048\%$
- $CFR = 269/413,555 = 0.065\%$