In Denmark it is mandatory to report detected cases of gonorrhea to Statens Serum Institut (SSI). Routine surveillance of reported cases indicates that an epidemic occurred in Denmark during 2012. Gonorrhea is a sexually communicable infection caused by a bacterium.

1) Discuss whether such surveillance is indicator or event based, and whether the surveillance is active or passive seen from the perspective of SSI.

   (9 points)

   Because the indications of an epidemic is discovered by routinely analyzing mandatory notification systems rather than through news media, rumors etc. the surveillance is indicator based. Seen from the perspective of SSI, the surveillance is passive because the notification data is provider initiated.

2) Make a brief proposal for what kind of treatment should be given to gonorrhea cases, and suggestions on how to prevent gonorrhea from spreading.

   (7 points)

   Because gonorrhea is caused by bacteria it is treated with antibiotics. Some students may know that antibiotic resistance is a widespread problem in treating gonorrhea. Gonorrhea spread is prevented by condom use, sexual abstinence or monogamous sexual relationship with an uninfected partner.

A cross-sectional study of risk factors for testing positive for Helicobacter pylori infection in Greenlandic school children yielded the below figures. Helicobacter pylori infection is transmissible among children.

	Positive	**Negative**	**Total**
Boy	42	58	100
Girl	29	64	93
Total	71	122	193

3) Use the data in the table to calculate the odds ratio of testing positive for Helicobacter pylori infection in boys compared with girls. Use girls as the reference group. Do not calculate a belonging confidence interval.

   (7 points)

   $Odds_{boy} = 42/58 = 0.72$
   $Odds_{girl} = 29/64 = 0.45$
   $OR = 1.60$

4) Calculate a 95% confidence interval belonging to the odds ratio, assuming a scale-parameter of 1.2. The confidence interval is calculated using the following formula:

   Scale-corrected SE (ln(OR)) = scale x (√ ((1/a) + (1/b) + (1/c) + (1/d)))
   Confidence interval = exp(ln(OR) ± 1.96 x scale-corrected SE (ln(OR))

   (13 points)

   Ln (OR) = 0.47

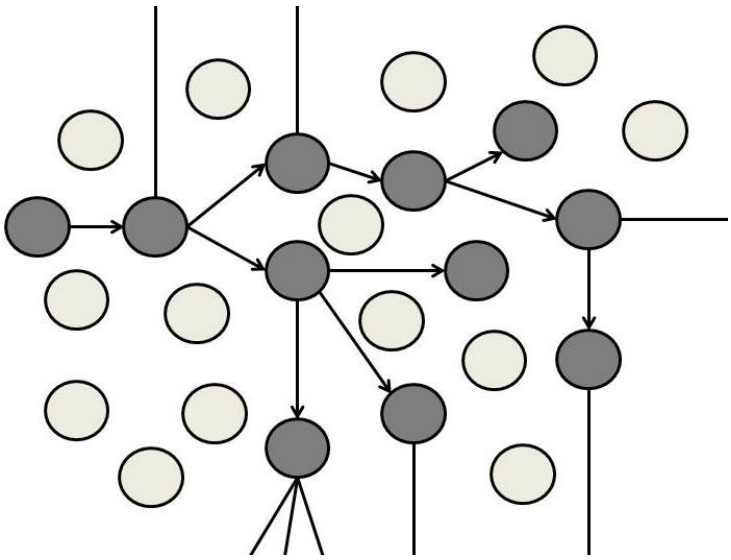
SE (ln(OR)) = √ ((1/42) + (1/58) + (1/29) + (1/64)) = 0.30
Scale = 1.2
Scale-corrected SE (ln(OR)) = 0.30 x 1.2 = 0.36
Lower confidence limit = exp(ln(OR) - 1.96 x 0.36) = 0.79
Upper confidence limit = exp(ln(OR) + 1.96 x 0.36) = 3.25

5) How would you interpret the above calculated odds ratio and belonging confidence interval, and what may a scale parameter of 1.2 indicate in this study?

   (9 points)

   The odds of testing positive for Helicobacter pylori is 60% increased among boys compared with girls. Alternatively it may be said that the odds of being a boy is 60% higher in those who test positive for Helicobacter pylori compared with those who test negative. With 95% certainty the true OR value lies within ranges from 0.79 to 3.25. A scale parameter of 1.2 may indicate that the fit of the model is not optimal. The suboptimal model fit may be due to observations being correlated. In this study correlations may be present because Helicobacter pylori infection is transmissible among children.

Below, the epidemic spread of influenza in susceptible employees working closely together in an office is illustrated. Circles represent different individuals, dark grey filling represents individuals who are infected, and light grey filling represents individuals who are not infected.



6) Use the illustration to calculate the basic reproductive rate (R_0) of influenza in the office employees.

   (9 points)

   You sum up the number of cases directly infected (the number of arrows), and divide it by the total number of cases (dark grey circles), i.e. R_0 = 18/11 = 1.64.

7) How do you interpret the above calculated basic reproductive rate?

   (7 points)

The basic reproductive rate represents the average number of individuals directly infected by an infectious individual introduced into a susceptible population i.e. the potential of the infection to spread. An R_0 of 1.64 means that 1.64 individuals are directly infected by an infectious individual during his/her entire infectious period, and that the influenza spread therefore is epidemic in the office. Influenza is known to occur in epidemics, why one would believe that the epidemic wanes over time.

It is estimated that a vaccine against HIV/AIDS will be available within the next 20 years. When available, one schedule would be to offer vaccination free of charge to high-risk groups in Denmark.

8) Briefly give examples of important considerations before implementing this vaccination program.

   (9 points)

   - *Is HIV/AIDS a serious public health problem? It is serious but infrequent.*
   - *Is the vaccine effective? Should be estimated in pre-licensure RCT studies and post-licensure cohort studies.*
   - *What is the long-term effect of the vaccine?*
   - *Is it cost effective to vaccinate? What is the cost per QALY*
   - *Does the vaccine have side effects? Should be evaluated in pre-licensure RCT studies and post-licensure cohort studies.*
   - *Does vaccination have ethical implications? Does vaccination lead to decreased use of condom with increased spread of sexually communicable diseases*
   - *What is the attitude of the target groups towards vaccination?*
   - *Vaccine coverage may be low. It is intended for hard-to-reach high-risk groups*

9) What is meant by vaccine effectiveness, and which study designs may be used in estimating the vaccine effectiveness?

   (10 points)

   Vaccine effectiveness is an estimate of the protection against the targeted infection when the vaccine is used in real-life post licensure. In real-life vaccines may be given with incorrect intervals or to non-healthy individuals, and those who are vaccinated may differ from those who are not (selection bias). Vaccine effectiveness is measured post-licensure using a cohort, case-control or screening design. The screening method is done using surveillance data with known vaccine coverage in the background population.

10) Imagine a randomized placebo-controlled trial of the future HIV/AIDS vaccine provide the results in the below 2x2 table. Use the table to calculate the efficacy of the HIV/AIDS vaccine.

    (9 points)

	HIV/AIDS	**Healthy**	**Total**
Vaccination	4	145	149
Placebo	6	102	108
Total	12	247	257

$Risk_{vaccination}$ = 4/149 = 0.027
$Risk_{placebo}$= 6/108 = 0.056
$RR_{vaccination}$ = 0.483
VE = (1 – RR) x 100 = 51.7%

11) Would you recommend implementing the future HIV/AIDS vaccine to certain risk groups in Denmark? Take into account your examples of important considerations as well the above calculated vaccine efficacy.

(11 points)

Is the recommendation reasonable and relevant?