

Exam question proposals – HMED4100

2021

Dear students, it's time to bring this course to its culmination. I hope you are all doing well and that you are a little bit wiser now than three months ago. I hope you find the following exam

You can deliver the exam in English, Norwegian, Danish, and Swedish.

Remember to read the questions.

Start answering each main question (1-4) with a new page

You can refer to other answers if they are part of the same question number (e.g. 2c to 2a), but not between different question numbers (e.g. 2c and 1a).

I have put a suggested amount of length for each question. These are only suggested lengths, but they give you an indication of what I expect.

You may use any source of references you like. Contrary to what I alluded to in the on the Q&A, **you must use citations**. Citing style is up to you, but you must be consistent. On questions marked with an asterisk* you are not required to have any citations, as these questions are more about logic and reasoning than facts and information.

The exam is an **individual effort**, so please do not cooperate with other students when writing your assignment.

You should not wait until the last second with uploading unless you like to live dangerously.

Good luck!

Each main question (1,2,3 and 4) are graded separately. The final grade depends on the average of these 4 grades. For each main question, the order which the candidates are graded is randomized for each question.

Key for grading:

- If all grades are the same, the final grade reflects is set accordingly.
- One deviation from the above will generally get the dominant grade
- Two deviations (BBCC or BBBD) are reassessed to see if the general impression was good or bad within each grade. Should round towards C when in doubt
- Greater differences are

Within each main question, sub-questions are graded separately, but the final grade is based on a general impression of the answer. Easy questions are given smaller weight.

1- Diabetes and HbA1c

<https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0242415&type=printable>

A) Explain how blood sugar levels are regulated. How does it go up and how does it go down? What organs or tissues are involved? (4-8 sentences)

The stomach pancreas and liver. **Glucose** gets absorbed in the small intestine; **insulin** is released from the **pancreas** leading to storage of glucose in the liver in the form of **glycogen**. Glucagon has the opposite effect, prompting the **liver** to release glucose from its stored glycogen deposits as glucose.

B) Explain differences between diabetes type 1 and diabetes type 2. (4-8 sentences)

Type 1: Autoimmune destruction of beta cells leading to impaired insulin production. Something you are born with. Insulin treatment.

Type 2: Reduced insulin sensitivity in tissues. Genetic and lifestyle.

The blood test HbA1c gives you an average blood sugar value for the last 8 weeks and is an important test for diagnosing Diabetes type 1 and diabetes type 2.

(The following numbers are not necessarily correct for the real world.)

The population at risk of Diabetes type 2 is dependent on age, genetics etc. Let's assume this population to be 2 000 000 people. In this population, you expect to find 80 000 people with undiagnosed diabetes type 2. A threshold for a positive test when HbA1c is above 48 mmol/mol is assumed to have a sensitivity of 50% and a specificity of 97%

C) Calculate positive and negative predictive values of this test (and show your work). Explain what the terms positive predictive value and negative predictive value means.* (1-3 sentences)

		Disease		
		+	-	
Test	+	40000	57600	97600
	-	40000	1862400	1902400
		80000	1920000	2000000

Prevalence	4.000%	PPV	41%
Sensitivity	50%	NPV	97.9%
Specificity	97%	ACC	98.0%

E: Correct definitions of PPV and NPV

C: Calculation wrong in some minor way

Setting the threshold to 42 mmol/mol will give you the sensitivity of 75% and the specificity of 89%

D) Explain why sensitivity becomes higher and specificity lower when you lower the threshold to 42 mmol/mol.* (1-3 sentences)

Lowering the threshold will include some of the diseased people with lower HbA1c, giving a higher sensitivity. It also includes a higher percentage of healthy people, lowering specificity

As only awarded if the higher sensitivity is explained. The prevalence of the disease doesn't change

E) Calculate positive and negative predictive values for the test with this threshold. How and why do these values differ from the threshold of 48 mmol/mol?* (1-3 sentences)

Lower PPV, higher NPV, because PPV are dependent on Specificity when prevalence is fixed.

		+	-	
Test	+	60000	211200	271200
	-	20000	1708800	1728800
		80000	1920000	2000000

Prev	4%	PPV	22%
Sens	75%	NPV	98.8%
Spec	89.0%	ACC	99.0%

The Norwegian guidelines use the threshold of 48 mmol/mol as a diagnostic criterion for Diabetes type 2. The threshold 42 mmol/mol is used to identify patients at risk of developing diabetes type 2.

F) Comment on why this categorization can be useful in a clinical setting, given the sensitivities and specificities of the test and pathophysiology of the disease (4-8 sentences)

Should comment on how the lower threshold gives fewer false negatives and more false positives.

Prediabetes can be followed more closely, start effort. Sub population with higher risk for CVD, etc

2- Colorectal Cancer

A) Describe the anatomy and main functions of the gastrointestinal tractus. (Up to ½ page with the style in this document)

Should know upper GI, small intestine, large intestine, anus. Which parts absorb what. What produces enzymes. For A: mention Terms like peristalsis, villi, microbiome.

B) What are some symptoms and signs of gastrointestinal cancer? What is the pathophysiological mechanism causing these symptoms? (1-3 sentences for each point)

Symptoms: Bleeding, change of bowel movement, weight loss, B-symptoms

As per communication on Canvas, other gastrointestinal cancers than colon cancers will also yield points.

A good tie-in to pathophysiology is required. Aetiology will not suffice.

C - Cites symptoms but does not explain in relation to cancer cells.

A – Cites all symptoms. Know cancer cells are more prone to bleeding and angiogenesis, obstruction causes most of the rest. (or comparable understanding of other cancers, e.g. Barrets oesophagus)

C) There are different ways to treat cancers (not just colorectal cancers). Give 4 examples and how they work (1-3 sentences for each point)

Radiation: Destroys DNA, targeted therapy

Cytostatic: Inhibits cell growth. Not very targeted.

Surgery: A cancer cell cannot grow if it's not in the body anymore.

Hormone blockers/immune modulators/angiogenesis inhibitors/something else. Appropriate description

An A-answer should include an explanation of how cancer cells divide rapidly or other cancer cell-related

D) There are different levels of prevention. What are these? Describe example of a preventive measure on each of these levels for preventing colon cancer. (4-8 sentences on each level)

D – Should know the 3 main levels

C – at least 2 good examples

B _ A god answer for primary, secondary and tertiary

A – 4 Good examples from all levels. Quarternary preventions: Preventing overdiagnosis, patient safety efforts, guidelines, standards for examinations and treatments, surgery registers etc.

E) When deciding to implement a cancer screening programme, one of the things you should consider are which age groups to include. What is the problem with including too young or too old patients? (4-8 sentences) *

Too young people: Pre-test probability low. Leads to overdiagnosis.

Too old people: Will not suffer much from the cancer cancer anyway.

Both: Bothersome/harmful procedures. High cost.

E – Gets some points across, some misunderstandings are ok.

C- Only one age group, but reflects well

A – Is able to reflect on the principles well. May include terms like lead-time bias

3 - Inflammation and antibiotic resistance (maximum 500-1000 words)

A) We can divide an immune response into two complimentary parts. What are they and how do they work together? (4-8 sentences)

The innate and adaptive immune system. The innate immune system is non-specific and quick acting. It governs the general inflammation process, attacking invaders, and removing damaged parts. The adaptive system is based around antibodies. It takes time to mobilize but is specific for the infectious agent and long lasting.

E - names the two different systems, and that one is quick acting and one is learned.

C – Should describe some elements of acute inflammation

A – Should mention antibodies as specific lasting elements

B) Antibiotics doesn't necessarily kill the bacteria. How can these antibiotics still be helpful? (1-3 sentences)

Bacteriostatic antibiotics slows or hinders replication of bacteria, slowing the progress of the infection and buys time for the immune system to mount its defense.

C – Some other reasonable answer

A – Gets the part about bacteriostatic antibiotics

C) What is antibiotic resistance, and what are drivers of antibiotic resistance? (Up to ½ page with the style in this document)

When exposed to antibiotics, strains of bacteria may become resistant through natural selection and evolution pressure, such that medicines previously effective to fight bacterial infections become ineffective.

All use of antibiotics has the potential to drive antibiotic resistance, so unnecessary consumption of antibiotics should be avoided. For instance, overprescribing, i.e., using antibiotics against viral infections. Using antibiotics for prophylactic reasons is often questionable, and particularly when it comes to livestock. An antibiotic has been known to induce growth for livestock and has been used for this reason. Sometimes, inadequate use of antibiotics, as taking too short courses or inadequate doses could drive resistance, particularly relevant for tuberculosis. Lack of measures to prevent bacterial infections, such as basic hygiene or vaccines increases the need for antibiotics, and as such is a driver of antibiotic resistance. Globalization with easy travel over large distances is a factor in spreading antibiotic resistance from high prevalence areas to low prevalence areas.

D) Who are people at particular risk in a setting with antibiotic resistance, and why? (4-8 sentences)

Anyone who is at risk of having a bacterial infection. Potentially all of us, but elderly, infants and people with chronic disease are more likely to have bacterial infections in community settings. Particularly if they are living in unhygienic conditions, deprived of clean water and other sanitary measures. Antibiotic resistance is a big risk for any hospitalized patient, particularly if undergoing surgery, exposing the body to bacterial infection or patients receiving chemotherapy severely lowering the immune system. Patients with HIV or otherwise immunocompromised, including patients who use immune lowering drugs for autoimmune disease are at higher risk.

E) What measures can be taken to tackle the problem of antibiotic resistance? (Up to ½ page with the style in this document)

- Most important is to reduce the unnecessary use of antibiotics.
- Use of antibiotics should be prescription based, and doctors should follow guidelines
- Patient awareness programs
- Collective action with international/national organs surveilling antibiotic resistance, issuing goals for reduction of antibiotic consumption
- Minimize the use of antibiotics for livestock
- Preventive measures -hygiene/sanitary measures, vaccinations avoiding infections should be encouraged
- Incentive for industry to develop new antibiotics.

F) Explain how antibiotic resistance could have consequences for patients infected with covid-19. * (1-3 sentences)

Secondary bacterial infections pose a threat to patients affected by covid-19, particularly those who are hospitalized and especially those who are so severely affected that they need to be on a respirator. In an environment with a high load of resistant bacterial this bacterial infection could be difficult to treat.

4 - Of course you had to get some questions inspired by Covid-19.

Imagine a medicine for covid-19, that is effective in preventing severe infection if given early in the disease, but in some instances have severe side-effects. What would you say about the importance of sensitivity and specificity when testing SARS-CoV-2? * (1-3 sentences)

The specificity of the test becomes more important (higher PPV) as we don't want to expose uninfected individuals to the serious side effects of the drug.

Many answers confuse sensitivity and PPV, which is one of the big no-nos. Saying both are important awards some points, depending on how well the candidate arguments.

~~A mutated variant of the SARS-CoV-2 was recently reported. One feature of concern for new variants is whether the standard PCR tests will have reduced sensitivity for detecting this mutated version, as compared to the current variant. Why are we less concerned about the specificity of the test? * (1-3 sentences)~~

~~The test characteristic specificity is about how the test performs an uninfected population, so it will not be altered, until changes are made to the standard tests.~~

This question was misunderstood by all but one student. Many answers pointed to the need to want to stop the spread of a VOC, and that more false positives are acceptable. I understand that the majority chose this answer.

Even as we approach the second covid-19-winter. Evidence on non-pharmaceutical interventions to prevent covid-19 are still relatively scarce. What kind of evidence would we like to have more of? Comment on why this kind of evidence is difficult to produce. (Up to ½ page with the style in this document)

RCT is the preferred method for medical scientific evidence, as biases that may influence other types of studies is avoided. Unfortunately, RCTs are costly and time consuming. Many preventive measures could be difficult to blind or to randomize, and results may be context-dependent leading to problems of generalizability. Sometimes RCTs are not performed because of ethical considerations.