

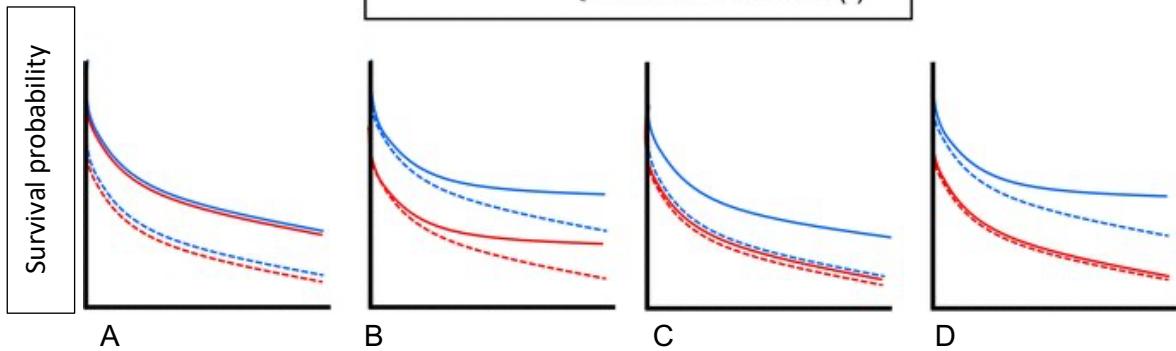
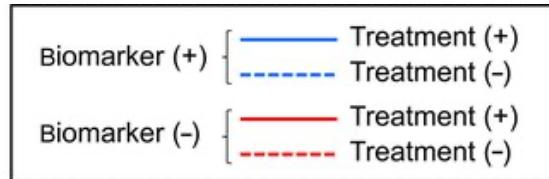
BIO-491 New tools & research strategies in personalized health
Master course 2025 – Mock Exam

1. What indicates the Number Needed to Treat and why it is a critically important value in medicine:

- This is the number of patients needed to be treated for a treatment to be cost-effective.
- This is the number of patients you need to treat to prevent one additional bad outcome.
- This is the number of patients to treat to show superior effects compared to another treatment.
- This is the number of treated patients who show side effects.

2. Which survival curve(s) define(s) a biomarker which is both predictive and prognostic?

- A.
- B and D.
- C and D.
- D.



3. Under what conditions can human biological material and/or personal data be used for research purposes?

- Vulnerable persons cannot be involved in research on human biological material and/or personal data.
- Human biological material and/or personal data must be used and shared without any restriction.
- Human biological material and/or personal data cannot be collected from minors.
- The person providing human biological material and/or personal data is informed of the use for research purposes and gives consent.

4. Which country was cited as having a national genome program integrated with clinical systems?

- Estonia
- Switzerland
- Brazil
- New Zealand

5. Which of the following best explains why data from Electronic Health Records (EHRs) can be challenging to use in clinical research?

- EHR data is consistently formatted and rarely requires cleaning.
- Data entries follow a centralized protocol, ensuring high uniformity across institutions.
- EHRs often include incomplete, heterogeneous, and inconsistently structured information from various sources.
- Temporal sequences are always clearly encoded and require no preprocessing.

6. Why is the concept of 'data to information' critical in medical informatics?

- Data is always reliable without processing.
- Raw data alone is sufficient for clinical use.
- Interpretation transforms raw data into meaningful information.
- Only AI can make use of raw data.

7. How can rectal organoids contribute to the treatment of cystic fibrosis?

- They provide a medium for testing the efficacy of CFTR modulators.
- They cure cystic fibrosis when transplanted into patients.
- They are used to physically clear mucus accumulation in patients.
- They function as artificial organs in the body.

8. What are the main characteristics of medical data?

- Medical data are generally multimodal.
- Medical data is often temporal.
- Medical data is often sparse.
- All answers are correct.

9. What significant event in 2001 marked a milestone in precision medicine?

- The invention of the first wearable health monitor.
- The complete sequencing of the human genome.
- The establishment of the first biobank.
- The launch of the first health-related mobile app.

10. What is a primary advantage of digital epidemiology in low-income countries?

- It is more expensive but more comprehensive.
- It provides slower but more accurate data.
- It is less reliable but more accessible.
- It offers an affordable alternative.

11. The Non-Invasive Prenatal Test (NIPT) allows for the detection of abnormal chromosomes in the blood of a pregnant mother. Evaluate the accuracy of the following statements:

- Cancer in the mother can't be detected using this test.
- Abnormal chromosome types, e.g., chromosome 21, can only detect an additional chromosome.
- This is only a test for research; it has never been implemented and reimbursed by health insurance.
- NIPT can accurately predict the due date of the baby.

12. What is the main function of polygenic risk scores (PRS)?

- To determine ancestry composition of individuals.
- To calculate lifetime risk based on a single mutation.
- To combine many common variants to estimate disease risk.
- To replace clinical testing with direct-to-consumer kits.

13. Why is post-coordination in medical ontologies useful?

- It allows combining multiple concepts for more accurate representation.
- It simplifies every data model.
- It prevents mapping to standards.
- It only applies to genomics.

14. What does the term "Interoperability" refer to in the context of healthcare data?

- The ability to produce data that can be exchanged and reused with digital processes.
- The operation of medical devices without human intervention.
- The competition between healthcare providers.
- The financial aspects of healthcare data management.

15. What does medical data being "multimodal" imply?

- It is always structured and easy to analyze.
- It consists of text, numbers, images, and signals such as ECG and EEG.
- It can only be analyzed by advanced AI algorithms.
- It is restricted to patient health records.

16. The type of payer system is critical for implementing personalized health technologies in healthcare systems. Which of the following systems can be expected to provide the best basis for offering access to the whole population in Switzerland?

- The health system that is currently in place with the possibility to change the insurer every year.
- A system with cantonal state insurers that are closer to the customers.
- National and multi-year payer systems.
- Compulsory supplementary private insurance for personalized health.

17. What is the primary goal of precision medicine?

- To create a one-size-fits-all treatment plan for all patients.
- To increase the pharmaceutical industry's profits.
- To tailor disease treatment and prevention to individuals by considering their genetic variability and environment.
- To phase out traditional medical treatments.

18. The cost of the Human Genome Project has changed significantly since the completion of the first human genome. How has the cost evolved?

- Reduced linearly over the years.
- Exponentially reduced over the years.
- Has not changed over the years.
- Increased due to inflation.

19. What are organoids primarily used for in personalized medicine?

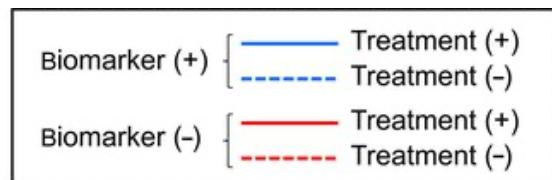
- To replicate and replace organs in transplant procedures.
- To act as a validation tool for therapeutic decisions.
- To completely eliminate the need for animal testing.
- To serve as permanent implants in patients.

20. A stroke patient with a severe upper extremity paresis comes to a rehabilitation for innovative treatment strategies with brain stimulation, the patient provides an MRI scan that shows severe damage to the cortico-spinal tract (CST) due to the stroke. What strategy for non-invasive brain stimulation would you suggest?

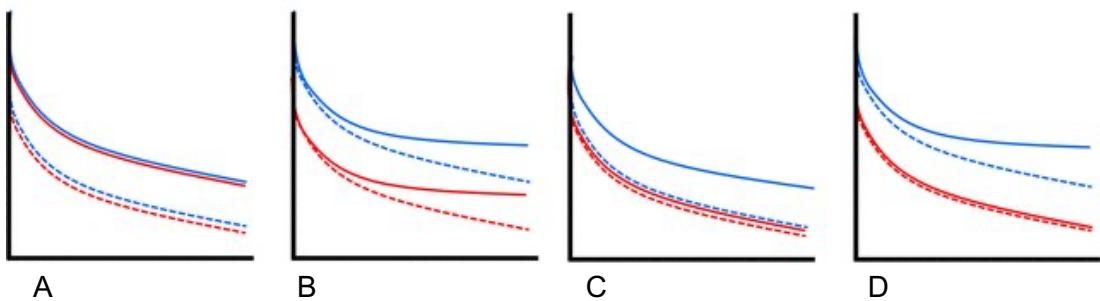
- Plasticity-enhancing brain stimulation should be applied to the primary motor cortex of the lesioned hemisphere.
- Inhibitory brain stimulation should be applied to the primary motor cortex of the lesioned hemisphere.
- Plasticity-enhancing brain stimulation should be applied to the ventral premotor motor cortex of the lesioned hemisphere.
- Bi-hemispheric plasticity-enhancing stimulation should be applied to the medial frontal cortices.

21. Which survival curve(s) define(s) a predictive biomarker?

- A.
- B and D.
- C and D.
- D.



Survival probability



22. Regarding the usefulness of biopsy in cancer management, which of the following is correct?

- Biopsy is essential for diagnosis, in particular to assess the stage of the disease.
- Biopsy is essential for diagnosis, in particular to assess the grade of the disease.
- Biopsy of a metastasis never identifies the organ of origin of the cancer in question.
- A biopsy is not essential, as most treatments are the same regardless of the cancer of origin.

23. Diet is a key determinant of human health. Yet, it is difficult to precisely capture the relationship between food intake and human health outcomes. Which of the listed reasons is incorrect?

- The food environment of human beings is very complex and constantly changing.
- The complex gene-diet interactions imply that we are not all equal with respect to the health consequences of any given diet.
- The increasing availability and consumption of ultra-processed foods complexifies the determination of causal relationships between diet and health in humans.
- It is very difficult to measure thousands of genetic markers, yet it is much easier and not very cumbersome to assess chronic dietary exposure in humans.

24. Health insurers in Switzerland use various factors to differentiate insurance premiums. Which of the following factors influences the premium level in compulsory health insurance?

- Gender.
- Place of residence.
- Place of birth.
- Health status.

25. What is a benefit of the decentralized model in digital proximity tracing during COVID-19?

- Data accessibility, as central servers manage all contact and exposure data.
- Control, as all contact and exposure data is managed by public health authority
- Privacy, as contact data stays on the device and decisions about notification are made locally.
- Speed, as all user data is shared publicly.

26. Genome-wide association studies have identified numerous genetic variants associated with the risk of obesity in humans, thereby allowing to assign a polygenic risk score for obesity. Which of the following statements is correct (only one response is correct):

- It is not useful to try to follow dietary recommendations if one has a high polygenic risk for obesity.
- Obesogenic environments play a key role in increasing the risk of obesity in the general population.
- People with low genetic risk for obesity are very unlikely to ever become overweight during adulthood.
- It is necessary to understand the precise molecular mechanisms underlying these genetic associations before starting preventive measures targeting people at high genetic risk.

27. What are the ethical principles of research involving human participants?

- The principles of respect for persons, beneficence and justice.
- The principles of fair competition and respect between researchers.
- The principle according to which the interests of research take precedence over the interests of research participants.
- The principle of the commercial value of research.

28. Which of the following ethical issues arise specifically in the context of human genome research?

- The respect of animals involved in research.
- The return of individual research results to research participants.
- The protection of the interests of researchers.
- The implications of research for the environment.
