Heart patient safety/efficiency activity

1. Who is working on this activity? 2-4 people in a team.

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2. A “false negative” would be a case where someone with heart disease is not recognized as such. Write down 3 reasons why a false negative result is/could be bad for a patient, hospital, community or health system.

False negative predictions of heart disease can have serious consequences for patients, hospitals, and the wider health system. For patients, it can lead to delays in treatment, allowing the disease to progress undetected, potentially leading to heart attack or even death. If diagnostic errors harm patients and undermine confidence in the healthcare system, hospitals can face legal liability and lose trust. On a larger scale, false negatives lead to higher healthcare costs because undiagnosed patients may subsequently require more intensive care, emergency intervention, and long-term support, placing a greater burden on public health resources.

3. A “false positive” would be a case where someone without heart disease is diagnosed as suffering from heart disease. Write down 3 reasons why a false positive result is/could be bad for a patient, hospital, community or health system.

False positives in heart disease diagnosis, where people without heart disease are incorrectly diagnosed as having heart disease, can lead to serious problems such as unnecessary stress and treatment for patients, increased health care costs and strained resources, and public trust and pressure. False positives may cause unnecessary anxiety for patients, leading to unnecessary tests, treatments, or lifestyle changes, which may lead to physical side effects or complications from unnecessary surgery. False positives waste hospital resources such as time, equipment, and personnel that could be used for actual patients, increasing the cost of care to individuals and the system. Widespread false positives can erode trust in diagnoses, leading people to question medical advice and delay treatment, while diverting resources from patients in need of care.

4. Safety can be defined as the fraction of patients with heart disease that are actually recognized as such.
   Write down a formula to calculate safety?
   How are false negatives related to safety?

Safety = True Positives / (True Positives + False Negatives)
True positive patients were those correctly identified as having heart disease.
False negatives are patients who have heart disease but were not identified.
False negatives are inversely proportional to safety. As false negatives increase, safety decreases because more heart disease cases are missed, reducing correct diagnosis and overall system safety.

5. Efficiency can be defined as the fraction of patients without heart disease that are recognized as such.
   Write down a formula to calculate efficiency?
   How are false positives related to efficiency?

Efficiency = True Negatives / (True Negatives + False Positives)
True negatives are patients correctly identified as not having heart disease
A false positive is when a patient is incorrectly diagnosed with heart disease
False positives are inversely proportional to efficiency. As false positives increase, efficiency decreases because more healthy patients are incorrectly diagnosed.

6. If you had to design a system for a hospital, would you find it more important to have high safety or high efficiency? Explain why.

When designing hospital systems, prioritizing high safety over high efficiency is crucial. Ensuring that heart disease patients receive an accurate diagnosis is vital for prompt treatment and reducing the risk of severe complications or death. While the efficiency of accurately identifying patients without heart disease is valuable, the consequences of missing a diagnosis of heart disease (false negatives) are much more dangerous than incorrectly diagnosing healthy patients (false positives). In healthcare, avoiding missed serious illnesses is often more important than reducing unnecessary treatments.

7. Now, imagine we have 1000 patients in total. 400 of them have heart disease and 600 don't. Out of those who have heart disease, 380 were kept in the hospital and 20 were sent home (because the heart disease was not recognized). Out of those without heart disease, 200 were kept in the hospital and 400 were sent home.

Fill out a confusion matrix for this situation.

	Predicted to not have heart disease	Predicted to have heart disease
Doesn't have heart disease	Num true negatives: **400**	Num false positives: **200**
Has heart disease	Num false negatives: **20**	Num true positives: **380**

8. Calculate safety and efficiency for this situation.

The safety of this scenario is 0.95, which means that 95% of heart disease patients are correctly diagnosed. The effective rate was 0.67, showing that 67% of patients without heart disease were correctly identified.

9. To improve safety, which number(s) would have to change?

To improve safety, the number of false negatives needs to be reduced, meaning fewer heart disease patients are sent home without a diagnosis. Additionally, increasing the number of true positives (correctly diagnosed heart disease patients) will also improve safety. Both adjustments will ensure more accurate identification of heart disease cases.

10. Calculate overall accuracy (#correct diagnoses/ #total patients)

The overall accuracy for this condition was 0.78, meaning 78% of patients were correctly diagnosed.

11. Could you decrease safety, and still increase overall accuracy? Try to find a set of numbers that would create that situation.

Fill out a confusion matrix for this situation.

	Predicted to not have heart disease	Predicted to have heart disease
Doesn't have heart disease	Num true negatives: **480**	Num false positives: **120**

Has heart disease	Num false negatives: **40**	Num true positives: **360**

Calculate safety, efficiency and accuracy for the numbers you came up with.
Safety: 90%
Efficiency: 80%
Accuracy: 84%