

Analyzing Probability and Chance in HIV Testing

Globally, prevalence of HIV in prisons is between 2 and 50 times the HIV rate of the general population. In 2010, about **20,000** of the **1,570,000** inmates in state and federal prisons in the US were HIV+.

1. What is the probability that a prisoner is HIV+? **Show work, leave as a decimal, and round to 4 decimal places.**
2. What is the probability that a prisoner is HIV-? **Show work, leave as a decimal, and round to 4 decimal places.**

About half of US states test every inmate for HIV on admission or during incarceration. Voluntary testing programs are often ineffective because prisoners do not want to admit to high-risk behaviors. Controlled laboratory testing determined the sensitivity and specificity of the OraQuick Advance HIV test using saliva.

Sensitivity = probability that the test correctly identifies someone who is HIV+ as positive = $98.4\% = .984$

An HIV+ person who tests negative is a *false negative*. The probability of a false negative is $1 - .984 = .016$

Specificity = probability that the test correctly identifies someone who is HIV- as negative = $99.6\% = .996$

3. An HIV- person who tests positive is a *false positive*. What is the probability? **Show work and leave as a decimal.**
4. Suppose we have a prison with 100,000 prisoners. Complete the number of people in each of the 6 cells in the decision matrix using the above probabilities. **Show work and round to whole numbers of people.**

	Test +	Test -	Total
Person is HIV+	True positive people: Hint: Use your response in 1. x 100,000 to find the number of HIV+ people. Then take that number x the probability they correctly test +. Show work.	False negative people:	Total HIV+ people:
Person is HIV-	False positive people: Hint: Use your response in 2. x 100,000 to find the number of HIV- people. Then take that number x the probability they incorrectly test +. Show work.	True negative people:	Total HIV- people:
Total	Total people who test positive:	Total people who test negative:	~100,000

5. Approximately what percentage of prisoners who test positive is not actually HIV+ (i.e. false positives)? **Show work and round to one decimal place.**
6. A retail version of OraQuick costs \$30 and gives results in about 20 to 40 minutes. Given this and your statistical analyses, would you support mandatory HIV testing of newly admitted prison inmates? Respond with your answer and also summarize the strongest argument from the “yes” and “no” sides.