

Calculated Risks

Many high schools now have drug-testing programs for athletes. The main goal of these programs is to reduce the use of banned substances by students who play sports. It is not practical to test every athlete for drug use regularly. Instead, school administrators give drug tests to randomly selected student athletes at unannounced times during the school year. Students who test positive face serious consequences, including letters to their parents, required counseling, and suspension from athletic participation.

Drug tests are not perfect. Sometimes the tests say the athletes took a banned substance when they did not. This is known as a *false positive*. Other times, drug tests say that athletes are “clean” when they did take a banned substance. This is called a *false negative*.

It is known from past experience that about 16% of the high school student athletes in a large school district have taken a banned substance. The drug test used by this district has a false positive rate of 5% and a false negative rate of 10%.

1. What is the probability that a randomly selected athlete tests positive for banned substances?
2. If two athletes are randomly selected, what is the probability that at least one of them tests positive?
3. If a randomly chosen athlete tests positive, what is the probability that the student did not take a banned substance? Based on your answer, do you think that an athlete who tests positive should be suspended from athletic competition for a year? Why or why not?
4. If a randomly chosen athlete tests negative, what is the probability that the student took a banned substance? Explain why it makes sense for the drug-testing process to be designed so that this probability is less than the one you found in Question 3?
5. The district decides to immediately retest any athlete who tests positive. Assume the results of an athlete’s two tests are independent. Find the probability that a student who gets a positive result on both tests actually took a banned substance. Based on your answer, do you think that an athlete who tests positive twice should be suspended from athletic competition for a year? Why or why not?