The Quest for Clean Competition in Sports: Are We the Dopes?

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A 2011 Q&A article published in Clinical Chemistry (1) covered the recent state of affairs and the outlook for future efforts to combat the use of illicit or performance-enhancing drugs in sports (i.e., doping). The interviewees in that article made several poignant admissions: that the rate of detection for doping is <100% (and maybe far less), that deterrent measures need to be stronger yet fair, and that future additions to the pharmacopoeia of doping agents will seriously challenge our ability to provide reliable and comprehensive testing.

Given these challenges, it may be time for our society to reconsider the purpose of antidoping testing, and for those of us in the clinical chemistry community to question whether we should be doing this testing at all.

One of the most important principles of laboratory testing is the statistical concept implied by the Bayes theorem: the likelihood of a finding being true is related to the pretest probability of truth times the likelihood ratio associated with the test. Thus, in the case of a drug test, if it is tremendously unlikely that the subject is using the drug, a positive drug test result is most likely a false positive. Conversely, if a subject is highly likely to be using a drug, a negative drug test result is most likely a false negative. Consider, for example, a hypothetical screening population in which 90% of athletes use a banned substance. Bayesian analysis tells us that, even if the test used for the banned substance is 95% sensitive and 95% specific for detection, more than 32% of the negative tests are false negatives. Because antidoping testing is often designed to afford higher specificity at the cost of lower sensitivity to lower the probability of false-positive results, and because athletes are known to actively evade detection, the problem of false negatives could be worse, depending on the prevalence of doping.

In the context of antidoping measures, therefore, if the true prevalence of doping is very high, then the results of testing are not terribly informative. The problem, however, is that no one knows the true prevalence of doping, and it is difficult to measure. Compounding the problem, some organizations have a vested interest in finding a low prevalence. Professional sports associations worry about their public images, and the World Antidoping Agency (WADA) may worry about justifying its existence. But mounting evidence (the recent admissions of cyclist Lance Armstrong (2), the words of cyclist Floyd Landis (3), and the US government’s Mitchell report (4) on baseball doping, to name a few sources) indicates that the pretest probability of doping, at least in some sports, is very high. For example, Sottas et al. (5) found that the prevalence of doping resulting in increased hematocrit was at least 46%–48% in one unnamed country’s track and field athletes. The methods used in that study generated conservative estimates, however, and focused on only one type of doping (increasing hematocrit by transfusion or erythropoietin abuse), so the cumulative prevalence of all types of doping in this cohort is almost surely higher. The prevalence of doping is probably not 100% in these athletes, but how high does it really need to get before we decide that testing, in Bayesian terms, is futile?

That antidoping measures are futile is not a contentious proposition. Rather, it is only the degree of futility that is debatable, because it is well known that some athletes get away with doping despite all our efforts to catch them. Are the approximately 50% of athletes from Sottas et al.’s “Country A” (5) who presumably dope disqualified consistently from track and field competitions? Probably not. Are the athletes who get caught using banned substances in cycling’s Tour de France, or the numerous other athletes who test positive for doping agents each year, caught during their first episode of abuse? The answer must be no, as it clearly was for Lance Armstrong and Floyd Landis. Rather, many athletes probably abuse drugs for months or years before they are caught, all the while passing doping tests. Their eventual identification more likely reflects poor test sensitivity or a lapse in their evasion efforts rather than a victory for our detec-
tion efforts. If this is true, and the Armstrong and Landis cases suggest that it is, it hardly seems worth the effort to run a multimillion-dollar testing campaign to catch only those who carelessly neglect to follow their prescribed evasion regimen, or those who cannot afford the expensive evasion regimen in the first place.

Another argument that could be levied against antidoping efforts is that they are terribly underfunded to meet their goal. Although the appropriate course of action to take in response to this fact is debatable, that it is a fact is clear. At $28 million, contributions to the WADA operation for 2010 (6) were substantially smaller than the $32 million 2010 salary of Alex Rodriguez, a star baseball player on the New York Yankees. Notably, Rodriguez had already admitted to years of steroid abuse in 2009, yet it took Major League Baseball 4 more years to suspend him, and then only for a year. Thus we must ask, in the battle against the shadowy cabal of drug manufacturers and analytical laboratories backed by the billions of dollars controlled by chemically enhanced athletes and their sponsors, how could we expect that our underfunded antidoping efforts could ever succeed? David may once have slain Goliath, but the smart shekels that day were certainly riding on Goliath.

Outside of any statistical or financial arguments, it is clear that our society needs to consider carefully the purpose of antidoping testing. The interviewees in the Clinical Chemistry Q&A article (1) all agreed that deterrence is the primary intent of testing, and Julie Chu, the elite athlete, indicated that ensuring fairness is a second goal. How successful antidoping efforts have been in deterring use and ensuring fairness, however, is not clear. If Floyd Landis is to be believed, antidoping testing has little or no deterrent effect, since he believes that many or most athletes at his elite level in cycling use banned substances. Rather than deterring use, testing is more likely driving the development of a cottage industry peddling sophisticated evasion schemes and ever more difficult-to-detect drugs and enhancement regimens. Deciding whether antidoping testing ensures fairness, on the other hand, may be a more appropriate task for philosophers than for clinical chemists. It does not seem fair to let someone take drugs to get a head start in a race, for sure, but how fair is it that athletes in the developed world can afford expensive, legal nutrition and training regimens that competitive athletes from the Third World cannot? How fair is it to punish someone who used a banned substance inadvertently? How fair is it that our government named Arnold Schwarzenegger, an admitted steroid abuser, to be the US’s top physical fitness spokesperson (7)? These issues are probably better suited to be items for discussion in our social studies classrooms rather than the raisons d’être for our clinical laboratories.

So, what should we do about antidoping testing? I see two ways forward. One is to keep doing business as usual. If we do this, we will continue to catch a rare superathlete and numerous lesser athletes, weather periodic storms of controversy when an entire sport comes under scrutiny because a famous athlete tells all, and then start all over again when the next novel drug is introduced to the market. In my mind, though, this makes us in the clinical chemistry world the dopes, as we would be fighting a battle we cannot possibly win.

As an alternative, what would happen if we just stopped doing antidoping testing altogether? Rates of doping in sports would probably increase, but then again, the rates cannot go over 100%, and they might be close to that already. Would we be sending the wrong message to our children? Maybe, but discouraging our children from pursuing athletics with the vigor and pharmaceutical enhancements required for professional success cannot be a bad message to deliver, if only based on any individual’s likelihood of success in professional athletics. More significant to the sporting industry, though: if we offered amnesty in exchange for admissions of doping and every doping athlete was identified as such, would people still pay thousands of dollars to watch competitions in which pharmacology trumps physiology every time? Maybe so, but at least then we would know that we were getting what we paid for, which is exactly the quality of athletics that our society deserves.

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