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Point/Counterpoint: The Quest for Clean Competition in Sports.
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Guests: Dr. Geoffrey Baird is the Laboratory Medical Director of North West Hospital in Seattle. Dr. Larry Bowers is the Chief Science Officer for the United States Anti-Doping Agency in Colorado Springs.

Bob Barrett: This is a podcast from C*linical Chemistry,* sponsored by the Department of Laboratory Medicine at Boston Children's Hospital. I am Bob Barrett.

Using prohibited substances to enhance performance in sports, often referred to as doping, is a practice that's been with us all of recorded history. In ancient time, athletes or combatants were often supplied diets and supplements considered beneficial to enhance their performance.

The issue of sports doping has gained widespread attention over the past two decades, and the public seems to be continually reminded about athletes who dope and the potential growing problem of doping at all levels of competition. The major argument for anti-doping programs is that it levels the playing field, but it could also be argued that that could be achieved by removing all bans for all athletes.

In a point/counterpoint pair of articles in the October 2014 issue of *Clinical Chemistry,* Dr. Larry Bowers and Dr. Geoffrey Baird provide thoughtfully different opinions on this issue.

Dr. Larry Bowers is the Chief Science Officer of the United States Anti-Doping Agency in Colorado Springs. Dr. Bowers, we'll start with you. You have probably been asked any number of times, why not just let everybody use what ever drugs and methods they want, and then the playing field will be level. Now how do you react to those questions?

Dr. Larry Bowers: Well, the biggest flaw with that question is the assumption that it would somehow level the playing field. Just as an example if two people have natural hematocrits of 42% and 48%, and you allow both of them to increase their hematocrit to 52%, the person with the 42% hematocrit gets much more benefits than the other person does.

So pharmacological anarchy doesn't level the playing field, it just changes it, and it changes it in a potentially dangerous way. For example, an athlete could be coerced into what essentially would be unregulated human experiment.

To make this point even clearer, there is a great article in the July 1997 issue of *Clinical Chemistry* about the use of anabolic steroids in the East German women, and the long-term health effects of that have been documented in a number of television and other events.

Bob Barrett: Many people claim that testing is ineffective because the percentage of the positive test is very small. Why is testing still important?

Dr. Larry Bowers: Well most people who count positive test have the mindset that anti-doping program consists only of testing. The real role of an anti-doping program is to prevent individuals from making the decision to dope in the first place. Testing is, and will continue to be, an important component of the program, because it represents a potential cost for violating the rules.

But the program also needs to provide education on the health risks of doping and a good program also incorporates information gathered about doping practices in order to strategically use its resources. So testing is important, it is just not the only thing.

Bob Barrett: Deterrence has become relatively new area of focus for USADA; what role do you think the deterrence model will play in the future of anti-doping?

Dr. Larry Bowers: Well the goal in any anti-doping program, as I said, is to achieve compliance with the rules. And the athletes themselves have an important role in that process. The athletes need to develop an active community that supports clean sport. That's why the USADA investigation into cycling was so important. It gives the cycling the opportunity to change the culture and to embrace clean sport. We'll see if that happens, but it can be done.

The change in attitude among baseball players and their support in enacting tougher anti-doping rules in the aftermath of the Biogenesis scandal is a good example of how athletes can be part of the solution. For those athletes who are tempted to use performance enhancing substances, the perceptual deterrence model provides a useful framework for developing an anti-doping program. Perceptual deterrence assumes that the decision to dope is a rational choice based on the rewards and costs.

The three biggest factors that impact the cost are the perceived certainty of being caught, the perceived severity of the sanction and perceived celerity or timeliness of the sanction. Certainty, severity, celerity, all need to be incorporated into the program. We don't have time here to

delve into all of these, but let me give you a couple of examples.

There are two types of sanctions. Formal sanctions, which are for example the loss of eligibility to participate imposed by the sports governance structure, and informal sanctions which can be disapproval expressed by family, friends, team mates and significant others. Interestingly, research shows that the informal sanctions can be viewed as more costly than the formal sanctions, and the anti-doping program needs to make the athletes aware of all of the costs of doping in its application of the perceptual deterrence model.

There are also a number of things that can be done to impact an athlete's perception that they could be caught. One of the most important is the possibility to be tested at any time without out notice. In the USADA program, about two thirds of our testing is carried out with no notice, as opposed to that at a competition.

Bob Barrett: USADA is a founding member of the Partnership for Clean Competition which helps to fund independent scientific research. Why is research important in deterrence, and how has the research that's been done in anti-doping helped the broader scientific community?

Dr. Larry Bowers: The perceived certainty of being caught is the most important of the three factors that I just discussed about the cost of breaking the rules. We have to ensure that people who violate the rules can be caught.

There are new pharmaceutical substances being produced every day that have great benefit to people with illnesses, but that also have the potential for misuse. The anti-doping community is working with the pharmaceutical industry to develop tests for these substances before they are approved for human use. This cooperation is a large step forward for anti-doping.

Also, people change their perceptions over time, based on their experience within the system. In the case of doping, athletes and their unethical advisers change the routes of administration and dosages in order to avoid detection. So research into more sensitive methods and innovative approaches to detection is an important contributor to the continuing deterrence.

My background in clinical chemistry and toxicology has been very important in my understanding of doping substances and methods and how to detect them. Similarly, methods and approaches developed for anti-doping purposes can benefit the clinical chemistry, toxicology, and endocrinology, hematology, and pharmacology communities.

One example would be the inter-laboratory validation of an IGF1 Assay using LC-MS/MS that was recently published in *Clinical Chemistry*. As part of that project, we've interacted with National Institutes for Science and Technology and expect that they will provide reference materials and stable labeled internal standards for IGF1 that will benefit the clinical testing community.

A second example is the development of the so-called predicative model, also known within the anti-doping community as the athlete biological passport, for analyzing serial measurements in an individual to determine their intra individual reference range which has applicability into the clinical chemistry and clinical drug trail areas.

Bob Barrett: Well finally Dr. Bowers, what other kinds of innovative approaches are being implemented in anti-doping testing?

Dr. Larry Bowers: One of relatively recent additions to the anti-doping field has been the use of investigations. The first sanctions given, that were not based on laboratory test result, but rather on documentation of rule violations, arose out of the BALCO scandal in 2003. Tips, substantial assistance, and information from law enforcement, have all been used not only to sanction athletes but also to target our testing.

We have also been storing athlete urine samples for up to 8 years. When new technology for detection of substances or methods becomes available, we can retest the samples using the new test. This increases athletes' uncertainly about their ability to beat the test and thus increases deterrence.

I mentioned the use of intra individual reference ranges for monitoring hematological parameters and urinary steroid profiles. Being able to predict, for example, what the testosterone to epitestosterone ratio should be based on that individual's previous results has been very effective in applying other analytical technology and scheduling additional sample collections and improving anti-doping rule violations.

We are activity working on incorporating alternate biological samples such as oral fluid and dry blood and plasma spots into our testing menus. Alternative samples promise to provide less expensive and less invasive collections that should translate into more testing. These scientific advances must be incorporated into prevention strategies in order to maximize their impact. Anti-doping programs will continue to require innovative inter-disciplinary approaches in order to be successful.

Bob Barrett: Thanks so much Dr. Bowers. And now for a very different viewpoint, here is Dr. Geoffrey Baird, Laboratory Medical Director of the Northwest Hospital in Seattle, Washington and the Director of the University of Washington's clinical chemistry post doctoral fellowship program.

Dr. Baird, it looks like your article is a pretty strong in indictment of current anti-doping testing practices. Why did you write this article in the first place and are you essentially saying that we just shouldn't be testing any athletes for any performance enhancing drugs?

Dr. Geoffrey Baird: Well, that's an interesting question. I think the genesis of all of this is that at my heart I am just a heart-broken sports fan,a and that's where all of this started. I, as a kid, was very interested in sports, I collected baseball cards, followed all the baseball players, was interested in cycling, followed the Tour de France every year when it happened, always made sure I watched the end of it on Bastille Day.

And then as I grew up, what I learned was that almost of all of my heroes in sports were frauds, and this became very upsetting for me. And then as I got into the field of clinical chemistry, my first experiences were working in drug testing labs and I learned a little bit more about the practice of all this. And I just didn't understand the disconnect between what people thought was being shown by drug testing labs and what was actually happening.

I think that what has upset me the most is that folks in the public have seen what we were doing in clinical chemistry labs as confirmation that every thing is just fine because such a overwhelming majority of athletes pass all of these tests, yet it seems that so many of the folks in sports were actually doing these things that they shouldn't be doing. So that's why I wrote the article. I was upset with our role in this and I came to believe that I think in clinical chemistry we might be lending something sort of a stamp of approval to some types of sports where it certainly doesn't seem to be any stamp of approval that is warranted.

I am not saying that we shouldn't be doing testing, but I think it's something that we need to talk about as a society, whether or not a clinic chemistry lab is the best method to enhance fairness. So that's what the article is about.

Bob Barrett: Let's talk about it some more? What do you think are the major shortcomings of anti-doping test as it's practiced today?

Dr. Geoffrey Baird: I think, as I mentioned in the article, one of the major shortcomings is the problem that is posited by Bayes' Theorem, which is if you're testing in either a very high pre-

test probability situation or a very low pre-test probability situation, using a test that doesn't have extremely high sensitivity or specificity, is doomed to give you either false negatives or false positives, depending on which situation you're looking at, and that is situation here.

It's my understanding, and I believe this to be true, that one of the biggest fears in the anti-doping community is falsely accusing someone of doping, and so the tests are set to be very, very highly specific, and you must lose sensitivity if you gain in specificity, and so what we end up doing is letting a lot of people get off scot-free.

So we have a lot false negatives. Add in the fact that people actively evade this, and that there are clinical chemists much smarter than I am who are working for the athletes who are doping, it really just seems that it's futile in many ways. So the Bayesian problem is one of the shortcomings, and another one is that, simply put, it just simply not working and we have evidence of that.

Lance Armstrong is one of the key examples of that. We saw him over and over and over again deny ever doing anything wrong. He was the hero and then what happened, well he ended up admitting to what everyone sort of expected that he had been doing it all along, and so we have a lot of evidence that is just not working.

Bob Barrett: OK, there must be some positive aspects to anti-doping testing, what about those?

Dr. Geoffrey Baird: Well, I do think there are some and I would agree with the folks who are doing the anti-doping testing, that some of the things that they say are true. So for one thing I do think that it to some degree levels the playing field. I think there are some people who don't do this, who don't dope, simply because there is a deterrent affect. However, I do not think that determent affect is that strong.

You'll see in the articles that there is some indication of what the overall rate of doping is. I don't know what it is across all sports, but it's higher among some sports than others, but maybe it's not the majority of athletes which may mean that actually the anti-doping testing is working as a deterrent. However, I would wonder if the overall rate of people using performance enhancing substances which maybe a small minority is the same if you look at the people who consistently win in activities.

It maybe in some -- there are some evidence in cycling anyway s-- that the rates of doping in those who actually win their activities maybe very, very, very high. Anecdotally from friends of mine who have been in competitive cycling,

and running, and weightlifting, I am led to believe that essentially everyone who wins some of these sports are doping.

So it's not entirely great thing, but there maybe some deterrent effect and there maybe some aspect in ensuring that it is fair that we don't want in athletics, people to get an unfair head start in a race, and so it may have a small effect. But I don't think it has the complete effect that we might hope for and my question is, is that if we don't have a complete effect then what are we really doing because the folks who clearly, as in Lance Armstrong's case, the folks who are doing all of this performance enhancing substance use, they are the ones who are winning, still, and they are the ones who are getting the sports contract and they are the ones who are showing up as heroes for our children etcetera. So I am not sure if having a little bit of success is really enough, and so that's one of the reasons why I question should we be doing at all.

Bob Barrett: Well, it seems pretty obvious that you personally feel that anti-doping testing is futile; what if we stopped? What if we stopped doing the testing? What kind of message does that send to athletes and fans and kids who aspire to be athletes?

Dr. Geoffrey Baird: Well, that's a really interesting question. I live in a state that recently, Washington state, that recently legalized the recreational use of marijuana and so in Colorado that also happened. And one of the questions that had risen at that time was well is that message we are now sending to our children that it's all okay and drug use is just fine. And I think the experience so far in Washington and Colorado has been that the sky has not fallen and that it hasn't really be any large open season on drug use with people going and smoking marijuana every where.

So I definitely think that if just stopped doing the testing, I think that the athletes and fans would get several explicit messages; one to the athletes, I think they would have to see is that the society has definitely made a decision about how we feel about this and that it would certainly not be any sense of permission or congratulations for doing this, but I think more of an indictment of the practice. I think once it was clear that we have sort of given up on this, which I think is what I am indicating, than that's about as strong indictment as we can give and I think it will be up to the athletes to prove to us as a society that they are worthy of our adulation and our attention etcetera.

As far as the fans what would it mean? I can't say. I do know that certain times, let's say in horse racing, in competitive horse racing they actually do list some of the

drugs, like for example furosemide--Lasix. When a horse is taking that for a race, they just list it on the daily racing program and people just take that into account and then make their bets or derive their enjoyment from the race knowing that information and it doesn't seem to keep people away from the horse racing track at all.

Now, maybe it's a bit cynical to think of human athletes as horses, but that's a bit how it's gotten in terms of Olympics and in terms of a footrace, and I think people would simply just change the way that they thought about those sorts of events. Maybe someone wouldn't be as interested in spending a $1000 on a ticket to an NBA final or a Super Bowl or something like that once they knew that everyone out there was essentially an expression of pharmacology rather than physiology.

Bob Barrett: Boy, if you listed everything Barry Bonds takes, his baseball card wouldn't be big enough!

Dr. Geoffrey Baird: Yes. Another reason why I felt this way is honestly in specific to Barry Bonds, I remember very explicitly when I was a child trading baseball cards and one of my friend's favorite baseball players was Barry Bonds and he had tons of his -- he used to collect his rookie card.

And Barry Bonds, like Mark McGwire, was this tall skinny guy, and then as he got better and better you saw him get to the point where his neck was bigger around than my leg, and something had -- fishy had to be going on there and it became pretty obvious what was going on.

Bob Barrett: There are those out there who say that anti-doping testing has kept our sports fair and our athletes safe. What would you say to them?

Dr. Geoffrey Baird: What I would say to them is I would say "somewhat," because that is true. I would bet you that there was someone out there who feels some deterrence. There are probably people out there for whom the Americans'--the entire government's--anti-drug policy has kept them from using drugs too, simply because it's wrong.

Deterrent policies are somewhat affective, but the question we have to ask ourselves is that enough? Is having a policy that keeps some people from doing it, but still allows a small group who end up being the ones who mostly succeed, is that a fair policy? I don't think that that's fair, and so I would say that keeping things a little bit fair or a little bit safe isn't the same as keeping them entirely fair and entirely safe.

What I am suggesting might actually make things say, less safe, if more people did performance enhancing, but as I said maybe people were already doing it so much that it's already not terribly safe and it wouldn't get any less safe. Also, being a professional athlete for your life, if you look at the life expectancies of NFL players, etcetera, it's already not very safe, and so I don't think that stopping doing anti-doping testing would necessarily make things any less safe.

And as for the question overall whether or not any of this has any impact on fairness, I'd like for people to read my article, to read Dr. Bowers' article, and decide for themselves and talk about it with their friends and their loved ones and their fellow sports fans, maybe while watching a sporting event, and try to figure out themselves if fairness has anything to do with it. I don't think that clinical chemistry laboratories are the best place to enforce an ideal like fairness.

I think our social studies classrooms, I think that our public forums, our newspapers, etcetera, that's where we should be thinking about fairness, as opposed to artificially putting on some label of precision with a laboratory test result that really doesn't get it what is at the intrinsic sort of core of what fairness really is.

Bob Barrett: Dr. Geoffrey Baird is the Laboratory Medical Director of Northwest Hospital in Seattle. Earlier we heard form Dr. Larry Bowers, the Chief Science Officer for the United States Anti-Doping Agency in Colorado Springs.

Their point and counterpoint articles on doping in sports appeared in the October 2014 issue of *Clinical Chemistry*.

I am Bob Barrett. Thanks for listening!