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Efficacy and Cost of Testing for Illegal Medication in Horses

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Abstract

The rate of use of illegal medication in racehorses in uncontrolled environments appears to run from 12 to 20 per cent or more. When effective drug testing is introduced along with effective sanctions the incidence of illegal medication may be expected to drop to between 0.3 and 3.0 per 1000 samples tested. Similarly, with effective sanctions the rate of use of 'problem' drugs can be reduced to virtually zero for long periods when effective test methods for them are introduced. In the United States phenylbutazone in samples does not appear to reduce the efficacy of testing. The cost of testing in the United States varies from $3 per sample in Montana to $75 per sample in Washington state. Based on these figures, the cost to call an individual 'positive' varies from approximately $2000 in Montana to $188 000 in Washington. This cost, however, reflects the cost of medication control over many more horses that would contain illegal medications otherwise. But apparently there is always a tendency for horsemen to 'probe' the system by trying new medications so a certain incidence of illegal medication is inevitable. The positive call rates in North America are apparently therefore a function of the efficacy of testing, the severity of penalties, and the adaptability of the testing laboratory as medication patterns change.

Introduction

Until recently no reliable information was available on the effectiveness or cost of testing for illegal drugs.[1] However, over the last 3 years we have been conducting a survey on the effectiveness of medication testing and can now answer some of the questions that often arise.[2] In addition to our own work, data from the Horseracing Forensic Laboratory (formerly Racecourse Security Services Limited Laboratories) in England on drug testing (for Britain, Trinidad and Tobago, and Iran)[3] and a cost analysis by the state of New York have thrown further light on this subject.

Our inquiry into the effectiveness of drug testing arose in response to suggestions that phenylbutazone 'masks', or interferes with, the detection of other drugs in post-race urines.[4–5] In contrast to these suggestions, our own experience seemed to indicate that phenylbutazone's interference with the detection of other medications was minimal and virtually insignificant.[4] To clarify these conflicting opinions we conducted a survey of 'positive call' rates for illegal medications in North America. Our rationale was that if the use of phenylbutazone was indeed interfering with the detection of illegal medications the positive call rates for illegal drugs would be lower in states that allowed it.

This report, then, deals with: the efficacy of testing; the effect of phenylbutazone on positive call rates; the costs of testing; the cost-effectiveness of testing; the role of sanctions; the scientific adaptability of the drug-testing laboratory. Call rates for illegal drugs appear to be a function of the efficacy of testing, the severity of penalties, and the adaptability of the testing laboratory.

Table 1. *Hard-drug positive test results in North America*

Jurisdiction	Mean yearly values					Range (hard drugs)	Years	Phenylbutazone rule
	Urine samples	Medications reported	Soft drugs*	Hard drugs†	Hard drugs per 1000 samples (± SD)			
Arizona	3 300.0	6.0‡	4.0‡	2.0	0.6 ± 0.4	0.3 – 1.2	1978 – 82	Changed to 2 μg/ml, May 1981
Arkansas	652.4	3.0	1.4	1.6	2.5 ± 2.7	0.0 – 6.6	1977 – 81	Not allowed
California	19 903.3	24 320.1	24 311.4	8.7	0.4 ± 0.1	0.3 – 0.7	1975 – 81	Permitted
Canada	77 792.0	134.6	88.2	46.4	0.6 ± 0.2	0.4 – 1.0	1978 – 82	Not allowed
Colorado	3 447.5	5.0‡	0.5‡	4.5	1.3 ± 0.5	0.5 – 1.8	1976 – 81	Permitted
Delaware	596.2	2.6‡	0.0‡	2.6	4.4 ± 5.2	0.0 – 13.2	1978 – 82	Not allowed after 1980
Florida	11 172.1	45.9‡	36.1‡	9.7	0.8 ± 1.1	0.1 – 3.2	1977 – 83	Rule changed over period
Idaho	1 465.7	8.7	6.3	2.3	1.6 ± 2.6	0.0 – 4.5	1979 – 81	Not allowed
Illinois	14 625.0	32.2	8.2	24.0	1.6 ± 1.1	0.3 – 2.7	1980 – 83	¶
Kentucky	8 922.1	4 746.7	4 721.0	25.7	2.9 ± 1.7	0.6 – 5.8	1976 – 82	Permitted
Louisiana	7 105.5	48.2‡	28.0‡	20.2	2.8 ± 1.8	1.1 – 4.9	1979 – 82	Permitted
Maine	2 110.9	7.0	3.5	3.5	1.7 ¶	¶	1975 – 82	¶
Maryland	11 601.3	24.7‡	11.3‡	13.3	1.1 ± 0.9	0.3 – 2.7	1978 – 83	Not allowed after 1980
Massachusetts	6 245.8	14.4‡	3.1‡	11.3	1.9 ± 1.5	0.7 – 5.5	1975 – 83	Permitted
Michigan	9 070.8	32.2‡	26.8‡	5.5	0.6 ± 0.3	0.2 – 1.0	1977,78,80,82	Permitted
Montana	1 098.0	3.7	2.0	1.7	1.5 ± 1.9	0.0 – 4.8	1976 – 81	¶
Nebraska	2 938.0	2 746.2	2 743.4	2.8	1.0 ± 0.7	0.0 – 1.9	1978 – 82	Permitted
New Jersey	19 409.8	43.0	38.4	4.6	0.2 ± 0.1	0.1 – 0.4	1978 – 82	Not allowed
New York§	224 024.3	167.7	106.0	58.7	0.3 ± 0.1	0.4 – 1.0	1981 – 83	Trace (approx. 2 μg/ml in plasma)
Ohio	15 564.4	30.8‡	14.9‡	15.9	1.0 ± 1.0	0.0 – 2.5	1975 – 83	Permitted
Pennsylvania	20 679.7	282.3	237.7	44.7	2.2 ± 0.4	1.8 – 2.5	1979 – 81	Rule changed frequently
Puerto Rico	2 121.8	7.4	4.6	2.8	1.4 ± 0.3	1.0 – 1.9	1978 – 82	Not allowed
Rhode Island	1 845.4	13.6	12.0	1.6	0.9 ± 0.7	0.0 – 1.6	1974 – 78	Rule changed over period
South Dakota	413.2	2.7	0.0	2.7	6.5 ± 6.8	0.0 – 14.8	1976 – 81	¶
Washington	3 412.4	14.6‡	13.4‡	1.2	0.4 ± 0.3	0.0 – 0.9	1977 – 81	Permitted
West Virginia	7 647.9	25.4‡	14.6‡	10.9	1.5 ± 1.3	0.3 – 3.4	1976, 78 – 83	Permitted
Wyoming	124.0	0.3‡	0.2‡	0.2	1.6 ± 2.4	0.0 – 6.0	1976 – 81	Permitted

* *NSAIDs (non-steroidal anti-inflammatory drugs), diuretics, antibiotics, steroids*
† *Stimulants, depressants, narcotics, tranquilizers, local anesthetics*
‡ *Does not include phenylbutazone.*
§ *Pre- and post-race blood and urine samples*
¶ *Not available*

Materials and Methods

In 1982 letters were sent to all racing jurisdictions in North America requesting: information on their medication rules; a list of positive test results for each of the previous five years; the total number of urine samples tested for those years. Of 28 racing jurisdictions polled, 27 responded with complete or partial data [Table 1].

To ensure accurate, fair comparisons between jurisdictions only drugs considered illegal in all jurisdictions were compared. These were stimulants, depressants, local anesthetics, tranquilizers, and narcotic analgesics. All jurisdictions ban use of these drugs at any detectable level. We designated drugs that were illegal in all jurisdictions 'hard drugs' and medications prohibited by some jurisdictions but not others 'soft drugs'.

For each jurisdiction, for each year reported, a positive test result of hard drugs per 1000 urine samples analyzed was calculated and a mean of the rates over the years reported was produced for each jurisdiction. The data on samples from all pari-mutuel racing tracks (thoroughbreds, standardbreds, quarter horses) was included.

A preliminary analysis of this data was sent to each participating jurisdiction with a request that they review our analysis. Michigan and Canada responded to this request. There were only minor differences between our analysis of the data and theirs and we have published their analysis of their own data. However both authorities expressed reservations about our approach to this problem. [The final compilation is presented in Table 1.]

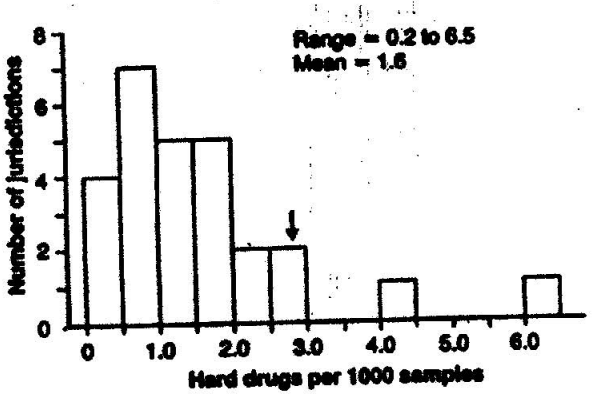
The only effective way to classify the data was: (1) 'no phenylbutazone' jurisdictions; (2) 'trace of phenylbutazone' jurisdictions; (3) jurisdictions permitting phenylbutazone in amounts consistent with a 24-hour no-medication rule. [Table 2 shows these three groupings.]

Results and Discussion

Positive call rates

A frequency distribution of the positive test results for hard medications for North American jurisdictions is shown in Figure 1. The lowest positive call rate was New Jersey's (0.2 per 1000 samples). The modal positive test result was between 0.5 and 1.0 per 1000 samples tested. Two jurisdictions had positive test results above 3.0 per 1000: the highest was for South Dakota (6.5 per 1000) due largely to 10 positive tests for butorphanol in 1979.

Figure 1 *Frequency distribution of hard-drug positive test results for 27 North American jurisdictions. The arrow represents the Kentucky positive call rate.*



In addition, racing medication statistics from Great Britain and certain other overseas jurisdictions whose samples were tested by the Horseracing Forensic Laboratory were analyzed [Table 3].[5] The total number of medication reports was small and most were for hard medications. Hard-drug positive test results varied from 0.7 per 1000 for Greece to a high of 122 per 1000 for Iran.

The hard-drug positive call rate for Iran was higher than for any other racing jurisdiction worldwide. If one assumes that the Iranian rate reflects use of medication in a relatively uncontrolled environment it would appear that, without effective sanctions, 12 per cent or more of horses will be illegally medicated.

Effect of phenylbutazone on positive call rates

Canada is a major racing jurisdiction that has never permitted detectable amounts of phenylbutazone or its metabolites in post-race urine samples. In Canada veterinarians are advised not to administer phenylbutazone within 96 hours of post time. This is a stringent regulation and is likely stricter than the regulations in most American racing states. However, New Jersey, Arkansas, Idaho, and Puerto Rico have medica-

Table 2 *Hard-drug positive test results in jurisdictions that allow differing amounts of phenylbutazone*

Jurisdiction	Hard drugs per 1000 samples*	Samples tested per year
No phenylbutazone		
Canada	0.6	77 792
Arkansas	2.5	652
Idaho	1.6	1 466
New Jersey	0.2	19 410
Puerto Rico	1.4	2 122
Mean	1.3 ± 0.9	
Total		101 440
Trace in urine, or (approximately) 2 μg/ml in plasma (NASRC guidelines)		
New York †	0.25	224 024
24-hour rule or higher level		
California	0.4	19 903
Colorado	1.3	3 447
Kentucky	2.0	8 922
Louisiana	1.0	7 105
Massachusetts	1.8	6 246
Michigan	1.9	9 071
Nebraska	0.6	2 938
Ohio ‡	1.0	28 630
Washington	0.5	3 412
Mean	1.3 ± 1.0	
Total	0.4	89 703

* *Mean yearly values. Hard drugs are stimulants, depressants, narcotics, tranquilizers, local anesthetics.*

† *Pre- and post-race blood and urine samples*

‡ *1975–1980 only*

tion rules more stringent than the National Association of State Racing Commissioners (NASRC) guidelines. Together, these states (along with Canada) form the principal no-medication jurisdictions [Table 2]. These jurisdictions had a mean of 1.3 ± 0.9 hard-drug positives per 1000 samples tested (and they tested approximately 100 000 samples a year).

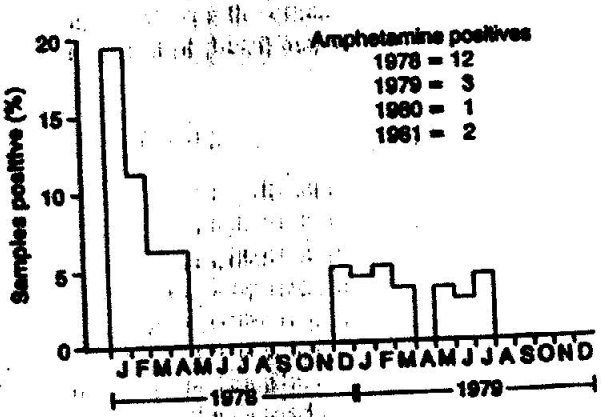
More liberal than these strict no-medication rules (but still relatively conservative) the industry standard in the United States since 1980 has been the NASRC guidelines. Rules based on these guidelines permit only phenylbutazone, though not at plasma concentrations exceeding 2 μg/ml. New York is a major American racing jurisdiction whose phenylbutazone standard reportedly conformed approximately to the NASRC guidelines for the period of this survey.

Jurisdictions that permitted phenylbutazone amounts above those stipulated by the NASRC guidelines tested altogether approximately 90 000 samples a year. The mean positive test rate in these jurisdictions was 1.3 ± 1.0 per 1000 samples tested. The positive test rate was similar to that of the no-medication jurisdictions. These results refute the hypothesis that phenylbutazone in horses at the time of racing interferes with the efficacy of drug testing and effective control of illegal medication.

Efficacy of testing

The data from the Horseracing Forensic Laboratory suggests that when effective drug testing is introduced along with appropriate penalties it can, within weeks, reduce the illegal use of medication to virtually zero for long periods. For example, Moss and Haywood reported that when testing for medications was introduced in Trinidad and Tobago the positive test results (initially around 19 per cent) decreased within 5 months to 0 per cent [Figure 2].[3] Similarly,

Figure 2 *Positive call rate of Trinidad and Tobago after introduction of routine testing*[3]



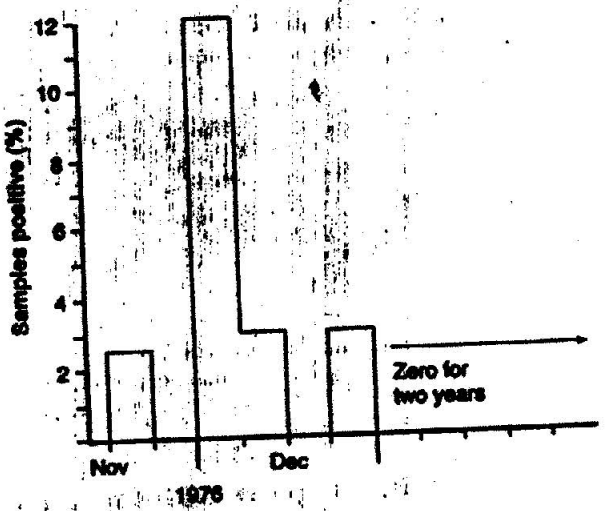
when screening for anabolic steroids was introduced in Britain positive test results decreased from approximately 12 per cent to 0 per cent within weeks—and remained at 0 per cent for 2 years [Figure 3].[3] So while more than 10 per cent of horses will be illegally med-

Table 3 *Hard-drug positive test results outside North America*[3]

Jurisdiction	Mean yearly values					Range (hard drugs)	Years	Phenylbutazone rule
	Urine samples	Medications reported	Soft drugs*	Hard drugs†	Hard drugs per 1000 samples (± SD)			
Great Britain	5219.8	27.8	4.4	23.4	4.6 ± 4.4	1.7 – 12.4	1977 – 81	Not allowed
Greece	833.0	3.2	2.6	0.6	0.7 ± 1.1	0.0 – 2.1	1977 – 81	¶
Iran	106.3	32.3	19.3	13.0	122.3 ± 79.8	0.0 – 156.1	1978 – 80	¶
Trinidad and Tobago	428.8	9.3	1.8	7.5	17.9 ± 11.0	9.8 – 34.1	1978 – 81	¶

* *NSAIDs (non-steroidal anti-inflammatory drugs), diuretics, antibiotics, steroids*
† *Stimulants, depressants, narcotics, tranquilizers, local anesthetics*
¶ *Not available*

Figure 3 *Weekly positive call rate of the British Jockey Club for anabolic steroids after testing for them was introduced*[3]



icated without regulation, introducing testing with appropriate sanctions can reduce this to almost 0 per cent (or in some cases, to 0 per cent) in a short period.

Role of sanctions

Sanctions are essential for effective medication control. The inability of adequate testing to reduce Iran's positive call rate was apparently due to the lack of effective sanctions in the disturbed political climate at the time of these tests. Similarly, an effect of less-than-adequate sanctions can be seen in the figures for Trinidad and Tobago. In this jurisdiction the rate of illegal drug use (approximately 19 per cent when they began sending samples to England) dropped during the first 5 months to zero. Afterwards, however, the rate crept up to a 'steady state' of 1.0 to 1.7 per cent and remained there throughout the survey.[3] This is apparently the level of illegal drug use that is likely to persist in Trinidad and Tobago given the attitudes of horsemen and the penalties the authority is willing to impose. The high 'baseline' positive call rate suggests that the penalty structure for this jurisdiction is different from those in North America.

A specific aspect of medication control which showed in the Trinidad and Tobago data was that the penalty for amphetamines was apparently not rigorous enough. In the first samples tested several amphetamine positives were 'called' and the use of amphetamine dropped to zero, as one would expect if the penalty was appropriate. However, use of amphetamines reappeared suggesting that the penalty was not sufficient to completely inhibit it.

Costs of testing

Recently the Legislative Commission on Expenditure and Review of the New York State Legislature reviewed the costs of testing for drugs in racehorses; 16 states provided information.[6] As shown in Table 4

Table 4 *Hard-drug positive test results, cost per sample, and cost per positive in 16 North American jurisdictions*

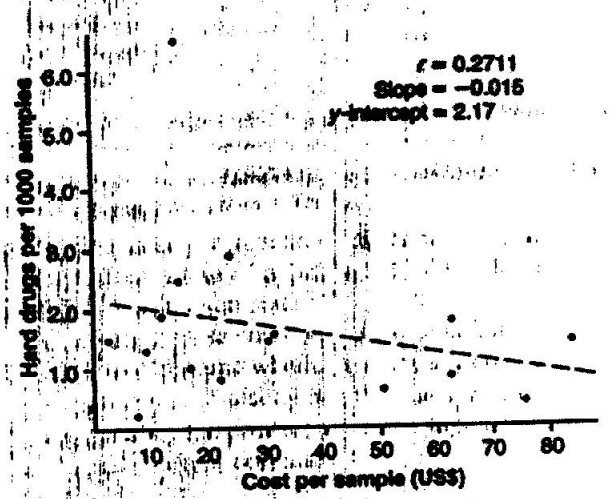
Jurisdiction	Cost per sample* (US$)	Hard drugs per 1000 samples*	Cost per positive (US$)
Arkansas	15.00	2.5	6 000
Canada	50.56	0.6	84 266
Colorado	9.15	1.3	7 038
Florida	62.88	0.8	78 600
Kentucky	24.59	2.9	8 479
Maine	63.17	1.7	37 158
Massachusetts	11.98	1.9	6 305
Montana	3.23	1.5	2 153
New Jersey	7.99	0.2	39 950
New York†	22.44	0.8	28 050
Ohio	17.25	1.0	17 250
Puerto Rico	83.94	1.4	59 957
South Dakota	15.34	6.5	2 360
Washington	75.56	0.4	188 900
West Virginia	29.90	1.5	19 933
Wyoming	30.79	1.6	19 243
Mean	32.73	1.6	37 852

* *Mean yearly values. Hard drugs are stimulants, depressants, narcotics, tranquilizers, local anesthetics*
† *For different period than in Tables 1–2*

the testing cost per sample in different states varies widely: from a low of approximately $3 in Montana to $75 in Washington state.

Comparing these costs with the data in Table 1 allowed us to determine whether there is any correlation between the cost of testing and the efficacy of testing (as measured by the positive call rate): Figure 4 shows there is no apparent correlation.

Figure 4 *Relationship between hard-drug positive test results and cost per sample*



We next determined the cost of each hard-drug positive called in the jurisdictions for which data was available. Based on the wide range of positive call rates, the wider range in costs, and the apparent lack of correlation between the two, one might expect an even wider range between the states for the cost of a hard-drug positive. Table 4 shows the cost to call a hard-drug positive varies from approximately $2000 in Montana to approximately $188 000 in Washington: a variation of almost 100-fold between states.

Cost-effectiveness

Is the calling of positives cost-effective considering the very high cost of positives in some jurisdictions? To answer this question we must estimate how much illegal medication there would be without effective control. The best answers we have come from Britain, Trinidad and Tobago, and Iran where horses were suddenly subjected to drug testing for the first time or at a higher level of competence: The initial illegal-drug detection rates were between 12 and 20 per cent. For anabolic steroids the rate dropped to zero within weeks. Broadly similar results were reported for Trinidad and Tobago but illegal use of

medication in Iran tended to stay high—probably because of ineffective sanctions. This data suggests that, with effective control, the incidence of illegal medication prevented could be as high as 10 to 20 per cent of runners and that costs should be judged not on the cost per positive but rather on the cost per incident of illegal medication averted. Costs are therefore better estimated as 'cost per test' than 'cost per positive'.

Laboratory flexibility

For most major racing jurisdictions a certain base level of positives apparently cannot be eliminated: Horsemen are evidently willing to 'try' the laboratory and to search for agents that will 'go through' the lab. Consequently the base level of positives depends on the laboratory's flexibility in developing new tests. With effective medication control the laboratory will call new and different medications, with few repeat positives. 'Repeat' hard-drug positives suggest that sanctions are inadequate; a pattern of no new positives suggests that the laboratory is not spreading its testing net widely enough.

Acknowledgments

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Discussion

MOSS Well you could, of course, interpret those results in a different way. You could interpret them by assuming that the cheap analysis was less effective and that you were, in fact, missing a larger number of positives because the screening procedure was not so good.

TOBIN For example, can you point to something in the figures that would support this?

MOSS I can't. I can't do that, but neither can you assert that they represent the level of actual doping offences. You're only dealing with the level of detected doping offences. It would not be unreasonable to suppose that the cheaper the analysis, the less efficient was the uncovering of actual doping offences.

TOBIN That's absolutely correct: I wouldn't make any correlation between the cost per test and the efficacy. It appears that a major factor is the severity of the sanctions in determining the eventual positive call rate. The call rate is independent of and quite unrelated to the cost of testing.

MOSS Yes, I understood you to say that it didn't appear to make much difference just how much you paid for analysis, the rate of positives was much the same. That's the rate of positives detected that you're speaking of—not the extent of abuse. It's an important distinction.

TOBIN The only indication of effective testing and control you might have from the data is that the laboratory would have a low level of positive calls, but would have a pattern of different positives appearing. In other words, you would have flexibility in the laboratory procedures and would continue to span the possible spectrum of drugs of abuse and discover horsemen using other medications. From a review of the data, there's an apparent tendency for horsemen to try other medications. You could have a laboratory charging very little, calling a few positives but not covering the full spectrum of drugs. I believe that's a part of the point that you're making. Is that correct?

MOSS Yes.

STEVENSON I'd like to question your basic premise of selecting one particular set of drugs when, in other jurisdictions where you do have other medication rules, the positives that you have selected against are, in fact, bona fide positives. Would you care to comment on the possibility that when certain drugs are permitted there may, in fact, be a greater likelihood of other drugs also being used?

TOBIN The study was designed to approach that question and inasmuch as I was able to analyze the data, there did not seem to be any pattern. When we split the jurisdictions into those that permitted the use of phenylbutazone and those that did not, the positive call rates did not appear to be sharply different. Does that answer your question or would you care to probe that answer further?

STEVENSON I was particularly concerned with the greater apparent incidence of narcotics which I believe are being tested for in most jurisdictions by radioimmunoassay-type methods. Seemingly that would have no bearing on the overall efficacy of testing but only means that there are sufficient funds available to perform those tests. And the higher incidence in certain individual jurisdictions in North America appears a little confusing, Tom. There's a high standard deviation on your results perhaps?

TOBIN There's a very high standard deviation on them.

STEVENSON Yes, I just find this a little confusing.

TOBIN If I may pick up where you left off right there. One of the things which I think merits further study is the role of sanctions and the severity of sanctions in the prevention of further appearances of instances of use of a particular drug. That would apply, perhaps to narcotics in some jurisdictions in the United States where there may tend to be repeat patterns of use. The importance of the severity of sanctions appears clear to me from the study.

LAMBERT I was just curious about your summary where you look at 'uncontrolled' and you give a figure of twelve to twenty per cent. I think England would be slightly doubtful about calling it 'uncontrolled' because what you're really looking at with the twelve per cent in their case is one drug for which they had just developed a method of analysis. I mean if there was no dope testing in England, I presume it would be up in the twenty per cent. You had three figures. The third one seemed to be totally irrelevant: Whether they were testing or not, there was no change. But the English one I would find hard to include in that summary because it was really just one drug.

TOBIN I was trying to get some grip on what the rate of drug use would be in an uncontrolled situation. And the figures that came out—and they came from Michael's work—all suggested twelve to twenty per cent as a minimum, and I should perhaps have emphasized that this would be a minimum level of illegal use of these medications.

MOSS I think I ought to qualify those results on the anabolic steroids because, it isn't generally known, but when we first launched that test I remember that Ed, who was involved in developing the method, told me that he didn't think that the mass spectrometer that we had at that time would really be sensitive enough to pick up positive results. And we in fact picked up, I think, seven in the first fifty. So I think this was a tip of quite a large iceberg, and we reckoned that the true figure was considerably higher than that.

TOBIN Would you care to make an estimate? A ballpark figure: that's all we can do.

MOSS We were certainly aware that the equipment (MS20) that we were using at the time didn't appear to be sensitive enough to pick up the recommended therapeutic dose. So we suspect there were a lot of undetected anabolic steroids at the time. I guess that figure—you said twelve per cent, twenty per cent, whatever it was—

TOBIN It appears to run between twelve and twenty from the figures.

MOSS Yes, but I think it was considerably higher than that. The other point I'd like to make, if I may, on your phenylbutazone figures regarding comparison between the positives reported in the 'nonpermitted' jurisdictions, as you call them, and the 'permitted': They do certainly

produce the same kind of return on proportion of positives but again I wonder if this is necessarily the right interpretation to put upon those figures. Because if we make the assumption that, in fact, the phenylbutazone is masking, it would be equally tenable, I would submit, to postulate there was a higher rate of positives. I think one can't automatically assume, just because the figures come out the same, that the phenylbutazone is having no effect.

TOBIN I again concede that there was no unequivocal evidence from this study to suggest a masking effect was not occurring. However, I would like to point out that my conclusion was independently supported by the results of TLC studies, which showed no effect of phenylbutazone on the detection of narcotic drugs or other basic or hard drugs by our HPTLC screens.

IRVINE I'd like to add a comment on the incidence of drug administration without any control by any analytical programme. In New Zealand when the New Zealand Racing and Trotting Conference were agonizing about whether or not they would introduce drug testing in about 1960, I think it was (I'm not sure of the date), they asked me to gather some data on the extent to which horses were doped. And I was able to do this with my very close contacts with a number of horse trainers. And the conclusions I reached were that about seventy or seventy-five per cent of horses were given drugs of some sort, mostly narcotics. In fact, one of the leading trainers made the observation that if the horse wasn't doped, the trainer should be disqualified because he obviously didn't want to win. And that is a true statement of the situation before drug control was introduced in New Zealand.

MARTIN A 'positive', by definition, varies from jurisdiction to jurisdiction and in Canada our positive is defined as requiring three individual and different tests. Just having a mass-spec analysis, although we're pretty sure what we have, wouldn't be good enough to call a positive. So our rules are a little different—we think they're good rules. But rules vary from jurisdiction to jurisdiction, so it's dangerous sometimes to look at pure numbers and make decisions from them.

TOBIN A positive to me is not a scientific event; it's an administrative event. And I defined it as such when writing the paper.

KAMERLING Can you comment on the most frequently abused hard drug that you came across, and was there any regional distribution in its occurrence?

TOBIN I'm afraid I can't pull that out of my memory, Steve. My apologies. However, if I had to guess, I would suggest procaine as an inadvertent positive.

KAMERLING Okay.