A COMPARISON OF BLOOD ALCOHOL LEVELS AS DETERMINED BY BREATH AND BLOOD TESTS TAKEN IN ACTUAL FIELD OPERATIONS

Thomas J. Smith

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ABSTRACT

During its 1972 session, the General Assembly of Virginia enacted Senate Bill 104, which authorizes the breath test, as well as the blood test used previously, as a proper chemical test to determine the alcoholic content of the blood. Any person arrested in Virginia after January 1, 1973 for suspicion of driving while intoxicated may elect to have either the breath or blood sample taken, but not both.

In anticipation of the use of the breath test for determining the level of intoxication, the Highway Safety Division of Virginia decided to conduct preliminary field testing of breath-testing devices in conjunction with the Fairfax Alcohol Safety Action Project (ASAP). Increased police surveillance and enforcement against drunken drivers started in February 1972 in the ASAP area. Drunken drivers who were arrested in Fairfax routinely submitted to the blood test for blood alcohol determination, but in addition, each subject was also encouraged to take the breath test, which was not evidentiary at that time.

The results of the blood tests from both the Commonwealth's sample and the sample sent by the defendant to a private laboratory were recorded alongside the corresponding reading from the breath test. All of the breath tests were taken on an Intoximeter - Mark II, which uses gas chromatography to determine the alcohol content of the breath. The Intoximeter - Mark II was equipped with an automatic digital readout from which the results could be read one minute after the breath sample was taken. Two Intoximeters, which were mounted in a mobile van with the blood-drawing equipment, were used for the breath tests. Whenever an arrest was made, a police officer would call the mobile van operator and arrange to meet him, either at the scene of the arrest, at the office of a Justice of the Peace, or at some other prearranged site. A requirement on all the tests was that an arrested subject must wait a minimum of 15 minutes after the arrest before the breath test could be conducted.

For the purpose of this analysis, a total of 104 sets of data were used. Each set consisted of the blood alcohol readings from the breath test, the Commonwealth's blood sample, and the private laboratory sample. The results of the breath test were compared to the results from the Commonwealth's blood sample and to the private laboratory blood sample. The private laboratory sample was also compared with the Commonwealth's blood sample. From the comparisons, some conclusions were drawn and recommendations made, as will be discussed in detail in the technical report.

Summary of Findings and Conclusions

(1) The breath test results were found to be lower than those of either of the two blood tests by a statistically significant amount. The t value of 3.256 determined in the comparison of the breath test with the Commonwealth laboratory blood test indicated that the two methods were significantly different (statistically speaking) at the 1% level of significance. The t value of 2.109 for the comparison of the breath test with the private laboratory blood test indicated that the two methods were significantly different at the 5% level, but not at the 1% level. The average BAC readings for the Commonwealth laboratory, private laboratory, and breath test were 0.19913%, 0.19798%, and 0.19077%, respectively. Thus, the nature of the statistically significant differences was that the breath test consistently yielded a lower reading than the corresponding blood tests, and consequently, would generally have benefited the defendants.

(2) No significant differences were found between the Commonwealth laboratory blood test results and the private laboratory blood test results. The t value of 0.613 was not statistically significant even at the 50% level.

(3) There was a wider range of differences between the breath test results when compared to either blood test than when the two blood tests were compared to each other. This discrepancy in readings was reflected by standard deviations of 0.02615% for the breath-Commonwealth lab comparison, 0.03487% for the breath-private lab comparison, and 0.01916% for the Commonwealth lab-private lab comparison. These standard deviations represent the standard errors for the estimate of a single BAC reading when given a BAC reading from another source. The larger standard error of the estimate for the breath test comparisons to the two blood tests was largely attributable to the significantly lower BAC reading which the breath test method had yielded. However, with a standard error of approximately 0.03% for the breath test, a person having a reading of 0.20% would have about one chance in 20 of having a true BAC as low as 0.14% or as high as 0.26% (2 standard deviations for the 95% confidence interval). This large standard deviation becomes more important as the BAC readings approach the legal presumptive limits, where a subject's guilt or innocence would more likely be affected. Although the standard error of the estimate was large, it was partially compensated for by the breath test averaging approximately 0.01% lower than the blood tests.

(4) This was the first large-scale field testing of breath-testing equipment in Virginia. Consequently, some of the differences in BAC readings may have been due to the inexperience of the operators who had not taken the required state training course which will be mandatory when the breath test is legalized on January 1, 1973. Another possible source of error may have been the poor calibration of the

machines because of poor chemical standards used for calibration. Other possible sources of error could have been that the machines were too fragile to have been used in the mobile police vans or perhaps were affected by an irregular voltage flow in the mobile vans. A replication of this study will be conducted to determine if any of the differences are traceable to a single machine, if the magnitude of the differences in BAC readings for breath and blood tests goes down as the breath test operators gain experience, or if an Intoximeter yields more accurate results when used at a fixed location.

(5) Appendix A is a list of the BAC results for the 104 samples, and Figures 2, 4, and 6 are scatter diagrams for the results listed in Appendix A.

A COMPARISON OF BLOOD ALCOHOL LEVELS AS DETERMINED BY BREATH AND BLOOD TESTS TAKEN IN ACTUAL FIELD OPERATIONS

by

Thomas J. Smith
Highway Research Analyst

BACKGROUND

In 1970, motor vehicle accidents accounted for some 54,862 deaths throughout the United States.[1] The abuse of alcohol has been determined to be the leading cause of these traffic fatalities. The United States Department of Transportation has determined that alcohol is a major causative factor in about 50% of all traffic fatalities. Of "these alcohol-involved fatalities, problem drinker-drivers and problem drinker-pedestrians are responsible for about two-thirds, and young people inexperienced in combining drinking and driving and mature social drinkers, driving while impaired or intoxicated, cause about one-third."[2]

To combat the menace of the drinking driver, the Department of Transportation has appropriated funds for experimental Alcohol Safety Action Projects. These projects consist of increased police enforcement against drunken driving, new methods of screening by professional probation staff workers, new judicial procedures, educational and alcohol treatment programs, and public information campaigns. The primary goal of these Alcohol Safety Action Projects is to achieve a significant reduction in the number of deaths and the severity of personal injury and property damage accidents. Secondarily, the ASAPs seek to correlate this reduction with the goal of reduced incidences of "driving while intoxicated", or DWI.

The Alcohol Safety Action Project in Fairfax County, Virginia, afforded the Virginia Highway Research Council the opportunity to conduct tests of breath-testing devices under actual field conditions. The two breath-testing machines, which were purchased by the Alcohol Safety Action Project for use in voluntary roadside surveys and public information demonstrations, have been stationed in the two mobile vans used by the police during the arrest of drunken drivers. After an arrested subject had submitted to the blood test, he was also asked to take the breath test. During the initial stages of the ASAP, 104 samples of this nature were obtained.

The 1972 session of the General Assembly of Virginia passed Senate Bill 104, which authorized the use of the breath test as a means of collecting chemical evidence of intoxication. Thus Virginia joined the other 49 states which had already authorized the breath test as a means of determining the blood alcohol content (BAC) of a drinking driver. The field testing of the Intoximeter - Mark II has yielded data which can be used to provide information to the members of the General Assembly who are interested in the introduction and use of the breath test in Virginia. The field testing has also enabled several lab technicians to become thoroughly familiar with one method of breath-testing and to discover the attendant problems of any new method. As a result of their experiences with breath-testing during a period when the breath test results could not be introduced as evidence, the lab technicians should be able to provide important information to the Highway Safety Division for inclusion in its comprehensive training course for the operators of breath-testing machines.

METHODOLOGY

Because of the high arrest rate for DWI after the start of ASAP operations, it was evident that a large sample could be collected in a relatively short period of time. A sample size of approximately 100 was determined to be adequate for comparing the results of the blood and breath tests. A researcher located in Fairfax collected this information and forwarded it to the primary researcher in Charlottesville. The results from the blood tests of both the private laboratory and the Commonwealth's laboratory were necessary in addition to the breath test reading. Since some of the people arrested for DWI refused the blood test, and sometimes the breath test, it was necessary to wait for more than 100 arrests to obtain 100 sets of breath and blood data. The 104 sets of data used in this report were obtained from the first 104 subjects whose BAC readings were taken with all three tests. None of the results from subjects who submitted to both the blood and breath tests were omitted, so there should be no sampling bias which could have influenced the data shown in this report.

There were three basic sources of data for the BAC readings. First there were the BAC readings obtained as a result of breath testing conducted inside the mobile police vans. All of the breath tests were conducted on breath-testing devices called the Intoximeter - Mark II, which uses gas chromatography to determine the BAC reading. The second sources of BAC readings were offices of the State Medical Examiner, whose BAC results will hereafter be referred to as those of the Commonwealth's laboratory. The third sources of BAC readings were a variety of state-approved private medical laboratories from which an arrested driver could choose to have his blood sample analyzed for determination of the BAC. These sources will be called private laboratories through the remainder of this report.

Because there were three sources of the BAC data, three basic comparisons were necessary. First, the breath test results were compared with the results from the Commonwealth's laboratory. Second, the breath test results were compared with the results from the private laboratories. Third, the BAC results from the Commonwealth's laboratory were compared with the results from the private laboratories. The basic technique for making these comparisons was taken from a pamphlet titled "Note on Comparison of Two Averages" (UVA-Q-54), which was used in a statistics course at the Graduate School of Business Administration of the University of Virginia after reproduction by permission of the author from Statistics, by R. J. Hader, North Carolina State University Press, Raleigh, N. C., 1958. The tests and formulas used in this report were reproduced from the section titled "Differences Between Two Averages — Paired Data".

The average difference, $\bar{d}$, is used to estimate the true average difference between measurements taken by two methods. The tests of significance are made by "t" tests where

$$t = \bar{d} \,/\, \left[S_d / \sqrt{p} \right] \qquad (1)$$

and where p is the number of pairs (BAC readings) and S_d is the standard deviation of the differences and determined by the formula

$$S_d = \sqrt{\left[\Sigma (d - \bar{d})^2 \right] \,/\, (p - 1)} \qquad (2)$$

where t is the t-value given for student's distribution, $\bar{d}$ is the average difference, S_d is the standard deviation of the differences, and p is the number of pairs.

Confidence limits for $\bar{d}$ are determined by the following formula.

$$C.L. = \bar{d} \pm \left[(t_{\epsilon} \cdot S_d) \,/\, \sqrt{p} \right] \qquad (3)$$

DISCUSSION OF TEST RESULTS

Appendix A lists the BAC readings for the 104 subjects used in this report. The reader should refer to this appendix if he wishes to compare all three BAC readings simultaneously for any of the 104 subjects.

Comparison of Breath Test Results With the Commonwealth's Laboratory Blood Test Results

The blood test had long been the only accepted chemical test for BAC determinations in Virginia until passage of breath test legislation during the 1972 session of the General Assembly. Therefore, it was logical to make a comparison between the breath test results and the corresponding blood test results. The first type of comparison between the two methods of determining the BAC reading was simply to compare the average difference of the pairs of readings. If it could be established that the two types of chemical tests yield exactly the same BAC results for a specific subject, then the probability that any single breath test result would be higher than the blood test result would be equal to the probability that the breath test result would be the lower. In comparisons of the 104 pairs of BAC readings, it was found that the breath test was lower in 64 cases (61.5%), the two tests were the same in 13 cases (12.5%), and the breath test was higher in 27 cases (26.0%). Thus simple observation would seem to indicate that in this instance there is not the uniform distribution expected of two procedures that supposedly give identical measurements of blood alcohol concentrations.

A summary of the differences is shown in Table 1.

TABLE 1

BREATH TEST IN RELATION TO COMMONWEALTH LABORATORY BLOOD TEST

Absolute Difference	Frequency	Absolute Difference	Frequency
-.06	1	.01	8
-.05	3	.02	6
-.04	12	.03	4
-.03	12	.04	5
-.02	20	.05	3
-.01	16	.06	0
0.00	13	.07	1

As an example, Table 1, row 1, indicates that the breath test was .06% lower than the blood test for 1 pair of data.

Figure 1 is a graphical depiction of the frequency distribution of absolute differences between the breath test and the Commonwealth's blood test. Visual examination shows that the distribution is skewed rather than being uniform, thus indicating that the breath test results tend to be lower than the blood test results.

Figure 2 is a scatter diagram showing the breath test results compared with the Commonwealth laboratory blood test results. The 45^{o} line divides the scatter diagram into two parts. The points above the 45^{o} line indicate that the blood test was higher than the corresponding breath test, whereas the points below the line indicate that the breath test was higher.

A more precise measure of the difference between the two methods of determining BAC levels is given by the "t" test for the differences between two averages for paired data. The average BAC reading for the 104 blood samples (Commonwealth laboratory) was 0.19913% compared to an average BAC reading for the breath test of 0.19077%. The t test was used to determine the level of significance of the average difference of 0.00836%. This average difference was found to be significant at the 1% level of significance.

Using equations (1) and (2) the t-value was determined to be 3.256, and the standard deviation of the individual differences was 0.026185%.

$$t = 0.00836 \ / \ (0.026185 \ / \ \sqrt{104}) = 3.256$$

$$S_d = \sqrt{(706.232 \times 10^{-4})} \ / \ 103 = 2.6185 \times 10^{-2} = 0.026185\%$$

With a t-value as high as 3.256 indicating that the average difference is significant at the 1% level, or more importantly that the two methods are significantly different at the 1% level, it was important to examine the consequences for a person arrested for drunken driving. Fortunately for a defendant, on the average the breath test results were lower than the corresponding blood test by the Commonwealth's laboratory by 0.00836% (absolute BAC percentage point differences). So even though it can be stated that the breath test did not yield the same readings as the blood test, the differences in readings in the two types of tests were in favor of the defendant. The mean absolute difference of 0.00836% compares very closely with the 0.008% for a portable intoximeter found by the National Safety Council's Committee on Tests for Intoxication at Michigan State University in 1953,[3] and with the 0.012% differences for the Breathalyzer found by J. D. Chastain in his 1957 study in Austin, Texas.[4] However, the standard deviation of 0.026185% in the Fairfax tests was more than twice as large as the standard deviation of 0.012% reported in a study by Drew in 1959.[5] The large standard deviation is critical in estimating a single BAC reading taken with the Intoximeter. The 95% confidence interval, which is the one most commonly accepted for comparing blood and breath

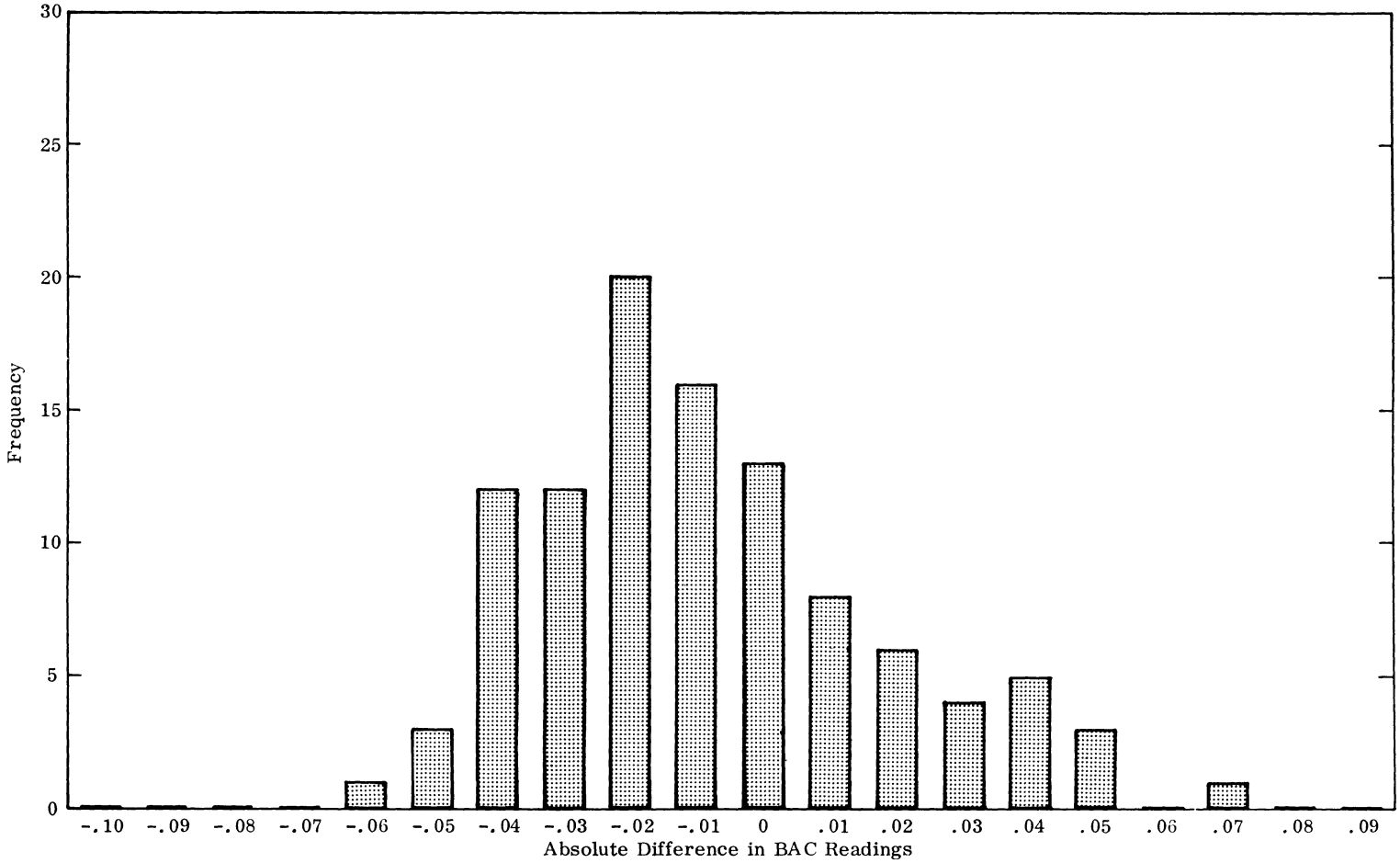

Figure 1. Breath tests in relation to Commonwealth laboratory blood tests.

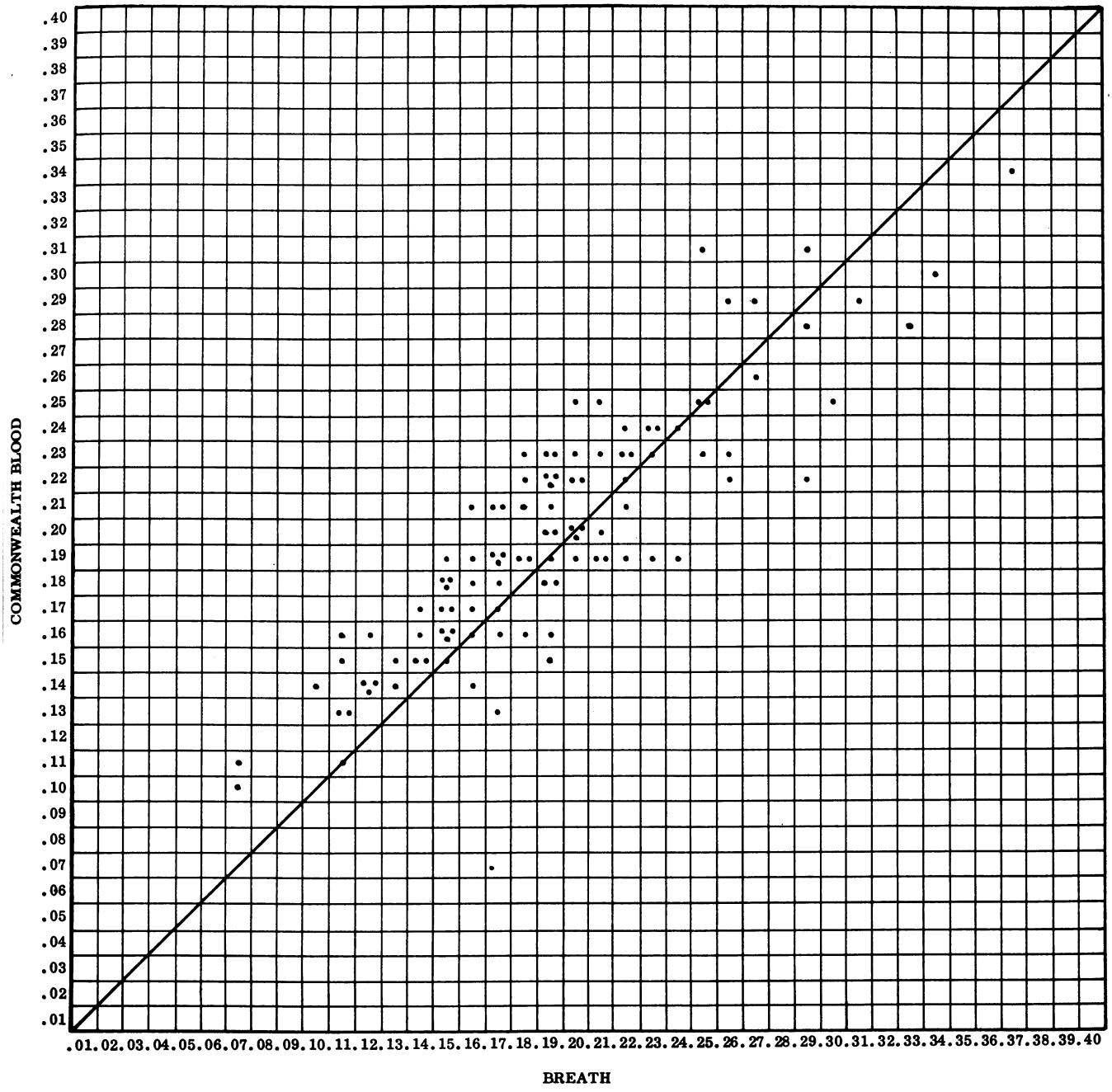

Figure 2. Correlation of Commonwealth blood with breath.

test results, is bounded by two standard deviations to each side of the estimate. For example, suppose that a subject had a blood test result of .09%. The corresponding breath test result would be estimated to be 0.08164% (.09% minus the average difference of 0.00836%). But to be confident of knowing the true range of the breath test results in 95 cases out of 100 (95% confidence level), it is necessary to add two standard deviations of 0.026185% on each side of the estmate. Thus the range of the estimate would be from 0.02927% to 0.13401% (0.08164% ± (2) (0.026185%)). As can be seen by the wide range around the estimate, the large standard deviation is critical in determining guilt or innocence at the BAC levels close to the legal presumptive limits, although not as critical at levels around .20% or higher.

An interesting finding in comparing the breath test results to the blood test results was that the substitution of the breath test for the blood test would have changed the BAC reading from the impaired driving level (.10% - .14%) to DWI (.15% and up) in only 2 cases out of 104. At the same time 8 cases out of 104 would have been reduced from DWI to impaired driving. Therefore, out of 104 actual cases only 10 people would have been affected by the substitution of the breath test for the blood test, and of those affected, only 2 (1.9% of the total) would have been adversely affected (impaired driving raised to DWI). These figures were all based on the legal BAC limits in Virginia prior to July 1, 1972. Under the limits to be in effect after July 1, 1972, when the presumptive level for DWI will be .10%, only 2 out of 104 would be affected, and they would both benefit by falling below the presumptive level on their breath test results.

Of the original sample of 104 cases, the average BAC for the Commonwealth's laboratory was 0.19913%, compared with 0.19077% for the breath test. Thus it is logical that very few of the subjects were in the low range of BACs where a large standard deviation could have adversely affected them. The problem with the large standard deviation lies in the subjects with BAC readings around .10%. These are the people most likely to be affected by the breath test results. Thus if the average BAC results get lower as more people are arrested it would be expected that more people would be affected by the large standard deviation.

Comparison of Breath Test Results With the Private Laboratory Blood Test Results

The private laboratories from which blood test results are received are a group of meidcal laboratories which have been approved by the State Medical Examiner for the analysis of blood alcohol levels. When a person is arrested for drunken driving, he is asked to give two blood samples. One of the samples goes to the Office of the State Medical Examiner, which has previously been referred to as the Commonwealth's laboratory. The second sample goes to the lab of the defendant's choice from the list of state-approved private medical laboratories.

In the comparison of the 104 pairs of BAC readings, it was found that the breath test was lower in 57 cases (54.8%), the two tests were the same in 16 cases (15.4%), and the breath test was higher than the corresponding private lab blood test in 31 cases (29.8%). Once again the number of times the breath test was higher than the blood test would have been expected to be approximately the same as the number of times it was lower, if the two methods of determining BAC levels actually yield the same results. But by observation, it appeared that the breath test yielded significantly more readings on the low side of the private laboratory blood test results.

A summary of the differences is shown in Table 2.

TABLE 2

BREATH TEST IN RELATION TO
PRIVATE LABORATORY BLOOD TEST

Absolute Difference	Frequency	Absolute Difference	Frequency
-.13	1	.01	6
-.07	1	.02	11
-.05	7	.03	2
-.04	9	.04	8
-.03	15	.05	1
-.02	7	.06	2
-.01	17	.09	1
0.0	16		

As an example, Table 2, row 1, indicates that the breath test was .13% lower than the private lab blood test for 1 pair of data.

Figure 3 is a graph of the frequency distribution of absolute differences between the breath tests and the private laboratory blood tests. The modal difference is at a difference of -.01% compared to -.02% in Figure 1. Although the data in Figure 3 seem to be more uniformly distributed than those in Figure 1, Figure 3 shows that there is a greater range in the absolute differences between the breath and private lab tests than in the absolute differences between the breath and the Commonwealth lab tests.

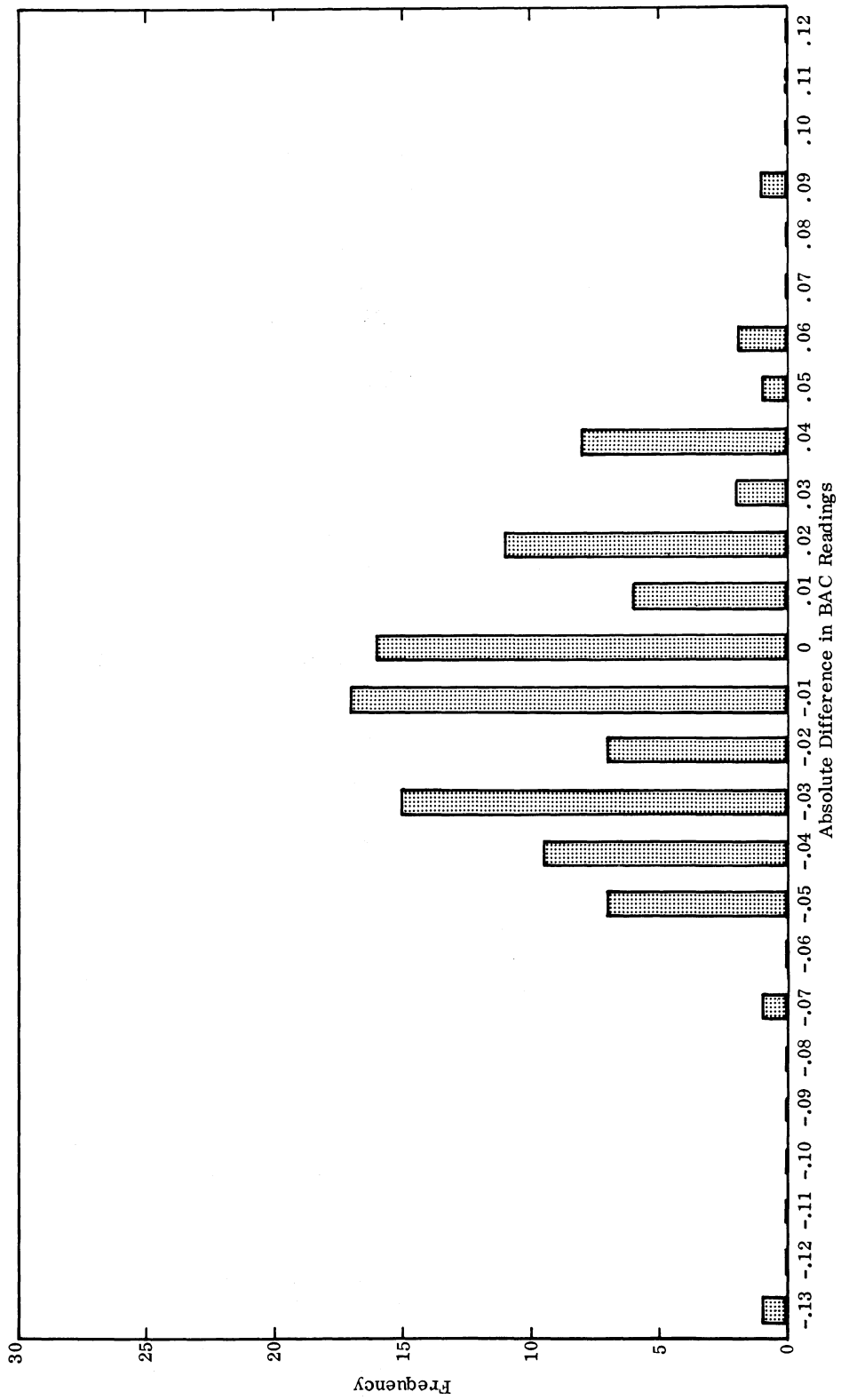

Figure 3. Breath tests in relation to private laboratory blood tests.

Figure 4 is a scatter diagram showing the breath test results in relation to the private laboratory blood test results. As in Figure 2, all the points above the 45^{o} line indicate that the blood test was higher than the corresponding breath test, and all points below the 45^{o} line indicate that the breath test was higher.

The average BAC reading for the 104 blood samples (private laboratory) was 0.19798% compared to an average BAC of 0.19077% for the breath test. The t test was used to find that the average difference of 0.0071% was significant at the 5% level but not at the 1% level. The standard deviation and the t value, calculated by the same methods as in the earlier comparison of the breath test with the Commonwealth laboratory blood test, yielded 2.109 for the t-value and 0.03487% for the standard deviation.

$$t = 0.00721 \;/\; (0.03487 \;/\; \sqrt{104}) = 2.109$$

$$S_d = \sqrt{(1,252.930 \times 10^{-4}) \;/\; 103} = 3.487 \times 10^{-2} = 0.03487\%$$

The t value of 2.109 indicated that the two methods of determining the BAC level are significantly different at the 5% level of confidence. As was the case when compared to the Commonwealth laboratory blood test results, the breath test was usually lower than the corresponding blood test. Again the differences in the readings in the two types of tests were in favor of the defendant using the breath test since the breath test averaged 0.00721% lower than the corresponding blood test. However, the standard deviation of 0.03487% is 2.9 times as large as the standard deviation found in the Chastain study mentioned previously. This large standard deviation makes the private laboratory blood test a worse predictor of the breath test results than is the Commonwealth laboratory blood test.

If the breath test results had been substituted for the private laboratory blood test results, five persons would have moved from the impaired driving level (.10% - .14%) to the DWI level (.15% and up). On the other hand, six persons would have moved down from the DWI level to the impaired driving level. Under the limits to be in effect after July 1, 1972, when the presumptive level for DWI will be .10%, only 1 subject out of 104 would be affected, and he would benefit by falling below the presumptive level on the breath test results. However, if the average BAC results are lower as more people are arrested, it would be expected that more subjects would be affected by the large standard deviation around the estimates.

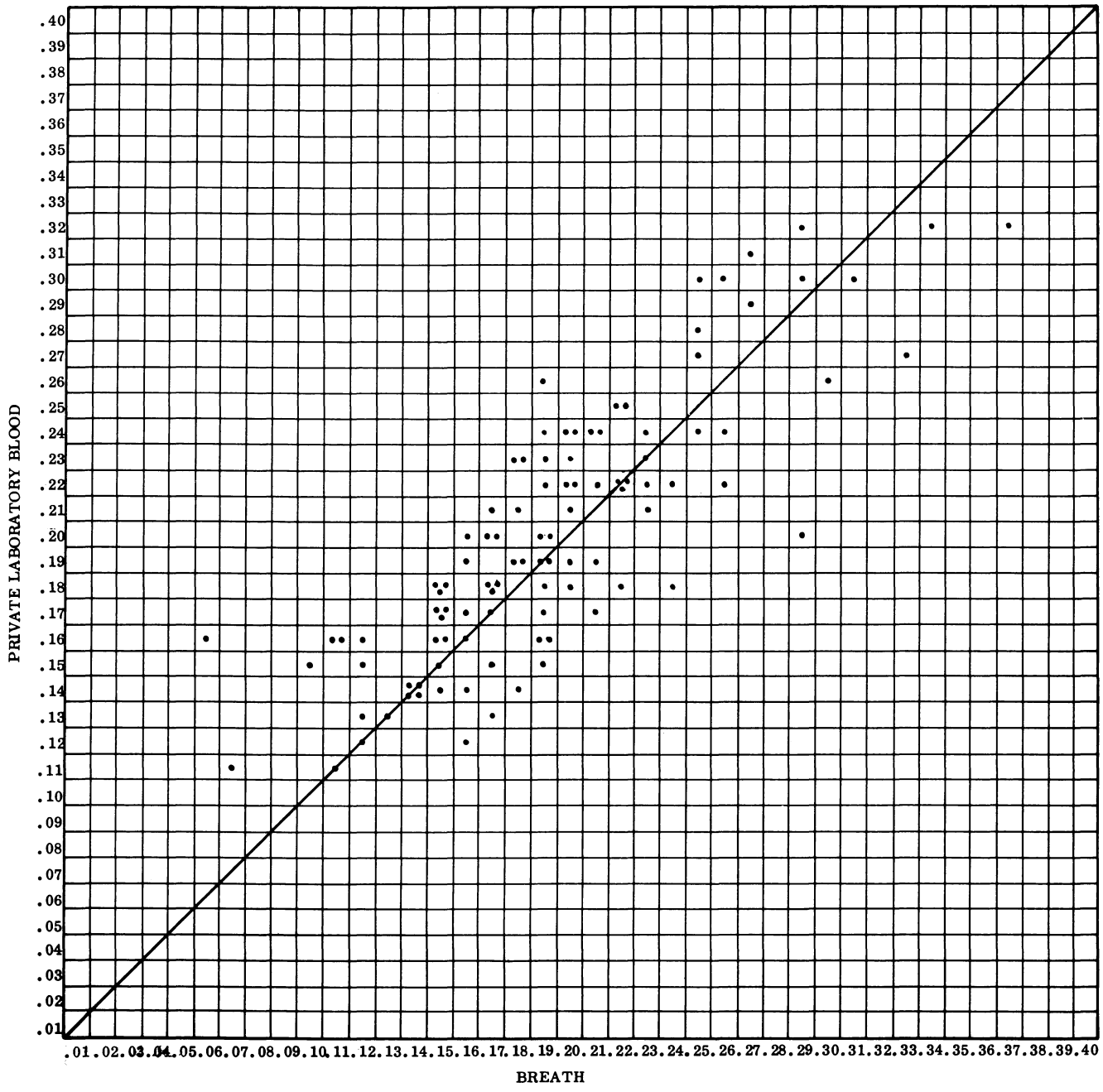

Figure 4. Correlation of private laboratory blood with breath.

Comparison of the Private Laboratory Blood Test Results with the Commonwealth's Laboratory Blood Test Results

The third comparison between pairs of BAC readings was the comparison of the two types of blood tests. The average BAC reading for the Commonwealth laboratory blood tests was 0.19913% compared with 0.19798% for the average BAC reading from the private laboratories. It was found that the Commonwealth laboratory reading was higher than that of the private laboratory in 42 cases (40.4%), the two tests were the same in 26 cases (25.0%), and the Commonwealth laboratory reading was lower in 36 cases (34.6%). The relatively small average difference of 0.0115% ($\bar{d}$) and the comparison of highs and lows made it appear that the two types of blood tests were more uniformly distributed around the same true mean value than when the breath test was compared to the blood tests.

A summary of the differences is shown in Table 3.

TABLE 3

COMMONWEALTH LABORATORY BLOOD TEST IN RELATION TO PRIVATE LABORATORY BLOOD TEST

Absolute Difference	Frequency	Absolute Difference	Frequency
-.11	1	.01	23
-.03	3	.02	14
-.02	9	.03	1
-.01	23	.04	3
0.0	26	.06	1

As an example, Table 3, row 1, indicates that the Commonwealth laboratory blood test was .11% lower than the private laboratory blood test for 1 pair of data.

Figure 5 is a graph of the frequency distribution of absolute differences between the blood tests analyzed by the Commonwealth laboratory and those analyzed by private laboratories. The distribution appears to be centered around zero with the graph being much more symmetric than the previous graphs. The range of differences between corresponding tests is smaller for the comparison of the two blood tests than it was for either of the comparisons of the breath test with a blood test.

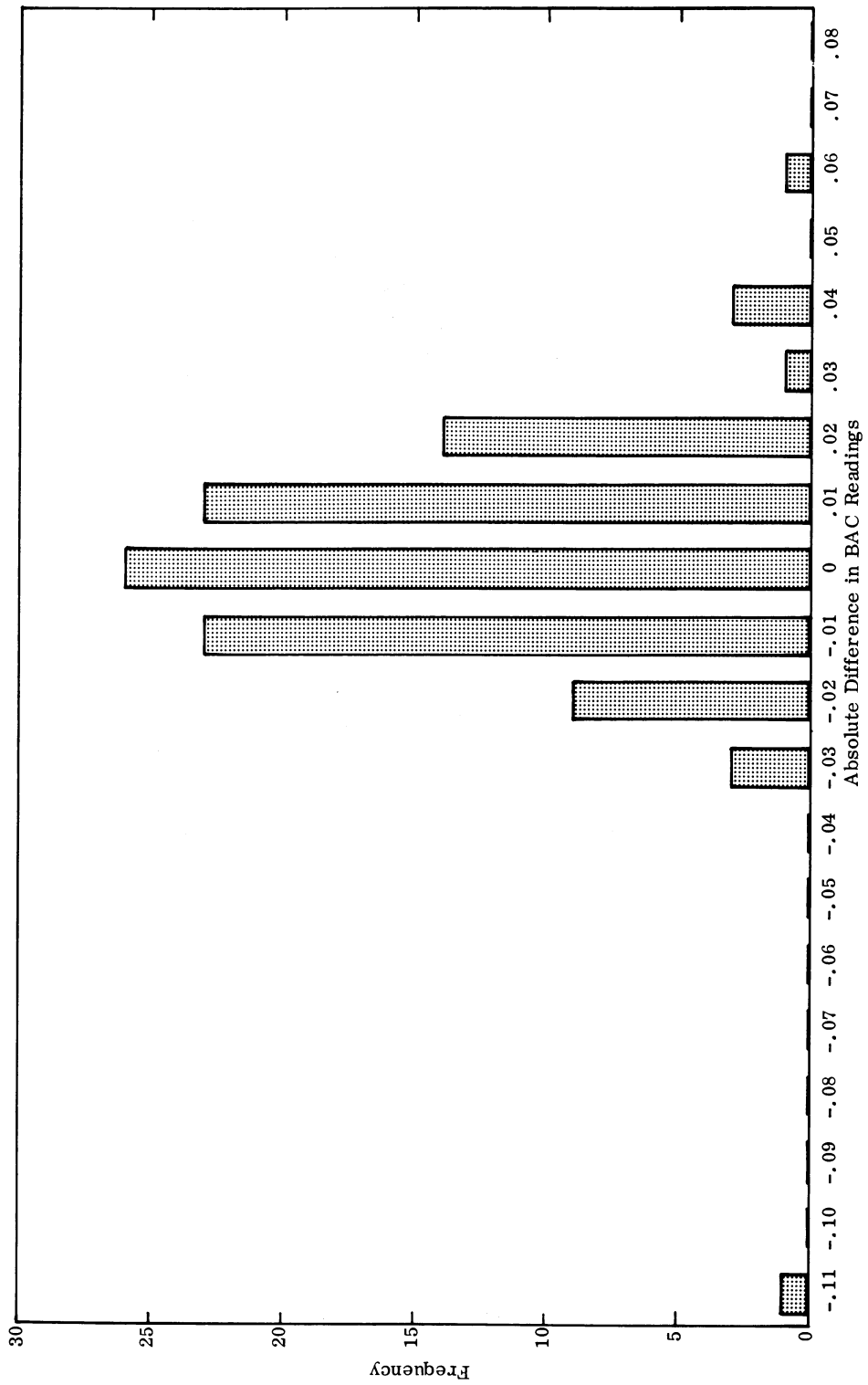

Figure 5. Commonwealth laboratory blood tests in relation to private blood tests.

Figure 6 is a scatter diagram showing the Commonwealth blood test results in relation to the private laboratory blood test results. In comparing Figure 6 with Figures 2 and 4, the reader should notice the much narrower range of points about the line for Figure 6.

The average difference between BAC readings of the two blood tests was 0.00115%, which was not significant at the 5% confidence level. The t value was 0.613 and the standard deviation was 0.01915%. Thus it can be concluded that there was little difference in the BAC readings determined by the two methods. It should be kept in mind, however, that the mathematically significant differences found in the two previous breath test comparisons were attributable primarily to the fact that the breath test yielded lower readings than either of the blood tests.

$$t = 0.00115 \ / \ (0.01915 \ / \ \sqrt{104}) = 0.613$$

$$S_d = \sqrt{(377.882 \times 10^{-4}) \ / \ 103} = 1.915 \times 10^{-2} = 0.01915\%$$

If only one test had been used as the sole basis for convicting a defendant, a total of nine persons would have been affected. Seven of the nine would have been above the presumptive limit of .15% on the basis of the Commonwealth laboratory blood test results, but not on the basis of private laboratory test results. On the other hand, two of the nine would have been above the .15% level on the private laboratory results, but not on the Commonwealth laboratory results. If the post July 1, 1972, level of presumption for DWI had been used, 3 out of 104 would have been affected by the choice of blood samples. All three would have been above the presumptive level on the Commonwealth laboratory test, but under that level on the basis of the private laboratory test.

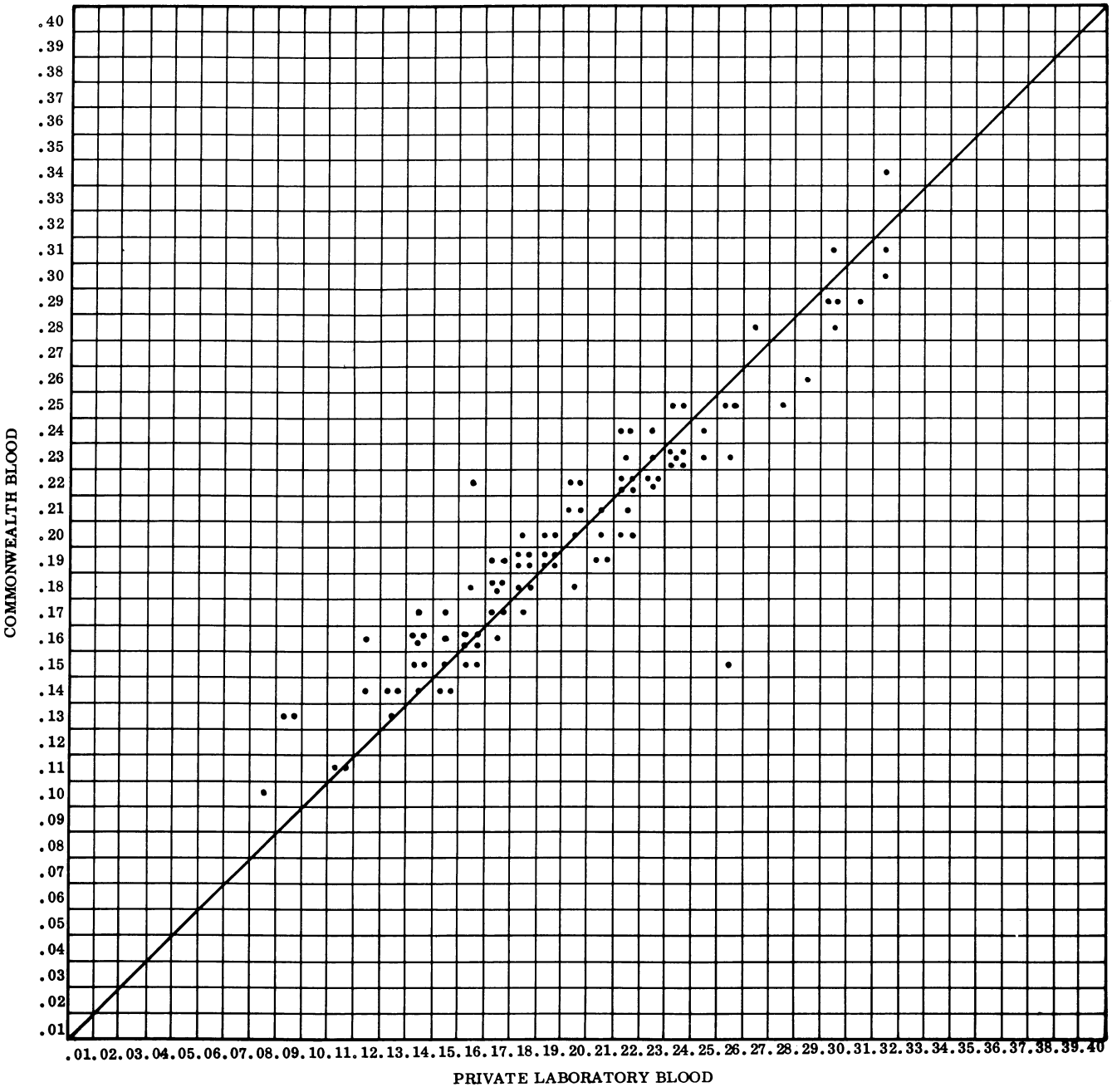

Figure 6. Correlation fo Commonwealth blood with private laboratory blood.

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APPENDIX A

BLOOD ALCOHOL CONTENT (BAC) READINGS

Sample Number	Commonwealth Blood (CB)	Private Lab Blood (PLB)	Breath (B)	Differences		
				CB-B	PLB-B	CB-PLB
1	.20	.18	.19	.01	-.01	.02
2	.20	.22	.21	-.01	.01	-.02
3	.22	.20	.29	-.07	-.09	.02
4	.13	.13	.17	-.04	-.04	.00
5	.16	.16	.19	-.03	-.03	.00
6	.19	.18	.22	-.03	-.04	.01
7	.24	.22	.23	.01	-.01	.02
8	.14	.12	.12	.02	.00	.02
9	.19	.18	.24	-.05	-.06	.01
10	.22	.23	.20	.02	.03	-.01
11	.19	.17	.21	-.02	-.04	.02
12	.13	.09	.11	.02	-.02	.04
13	.14	.13	.12	.02	.01	.01
14	.18	.16	.16	.02	.00	.02
15	.23	.24	.21	.02	.03	-.01
16	.22	.22	.22	.00	.00	.00
17	.23	.24	.25	-.02	-.01	-.01
18	.23	.25	.22	.01	.03	.01
19	.20	.20	.16	.04	.04	.00
20	.25	.24	.20	.05	.04	.01
21	.21	.22	.22	-.01	.00	-.01
22	.15	.14	.14	.01	.00	.01
23	.23	.23	.18	.05	.05	.00
24	.21	.20	.17	.04	.03	.01
25	.23	.24	.20	.03	.04	-.01
26	.28	.27	.33	-.05	-.06	.01
27	.23	.22	.22	.01	.00	.01
28	.31	.32	.29	.02	.03	-.01
29	.21	.20	.19	.02	.01	.01
30	.24	.22	.24	.00	-.02	.02
31	.19	.18	.17	.02	.01	.01
32	.21	.20	.17	.04	.03	.01
33	.29	.30	.31	-.02	-.01	-.01
34	.19	.19	.21	-.02	-.02	.00
35	.14	.14	.16	-.02	-.02	.00

APPENDIX (continued)

Sample Number	Commonwealth Blood (CB)	Private Lab Blood (PLB)	Breath (B)	Differences		
				CB-B	PLB-B	CB-PLB
36	.11	.11	.00	.00	.00	.00
37	.22	.16	.19	.03	-.03	.06
38	.23	.24	.19	.04	.05	-.01
39	.19	.18	.20	-.01	-.02	.01
40	.14	.15	.10	.04	.05	-.01
41	.16	.16	.15	.01	.01	.00
42	.19	.19	.18	.01	.01	.00
43	.18	.18	.15	.03	.03	.00
44	.22	.22	.19	.03	.03	.00
45	.23	.24	.26	-.03	-.02	-.01
46	.29	.30	.26	.03	.04	-.01
47	.20	.22	.20	.00	.02	-.02
48	.18	.17	.17	.01	.00	.01
49	.25	.24	.21	.04	.03	.01
50	.20	.19	.19	.01	.00	.01
51	.17	.14	.14	.03	.00	.03
52	.31	.30	.25	.06	.05	.01
53	.25	.26	.25	.00	.01	-.01
54	.15	.16	.11	.04	.05	-.01
55	.16	.16	.11	.05	.05	.00
56	.17	.15	.15	.02	.00	.02
57	.24	.25	.22	.02	.03	-.01
58	.16	.16	.12	.04	.04	.00
59	.16	.15	.17	-.01	-.02	.01
60	.19	.21	.17	.02	.04	-.02
61	.23	.24	.23	.00	.01	-.01
62	.15	.15	.19	-.04	-.04	.00
63	.34	.32	.37	-.03	-.05	.02
64	.19	.21	.23	-.04	-.02	-.02
65	.29	.31	.27	.02	.04	-.02
66	.15	.16	.15	.00	.01	-.01
67	.16	.14	.15	.01	-.01	.02
68	.19	.17	.15	.04	.02	.02
69	.22	.22	.26	-.04	-.04	.00
70	.16	.14	.18	-.02	-.04	.02
71	.28	.30	.29	-.01	.01	-.02
72	.11	.11	.07	.04	.04	.00

APPENDIX (continued)

Sample Number	Commonwealth Blood (CB)	Private Lab Blood (PLB)	Breath (B)	Differences		
				CB-B	PLB-B	CB-PLB
73	.19	.19	.19	.00	.00	.00
74	.22	.23	.19	.03	.04	-.01
75	.15	.14	.14	.01	.00	.01
76	.23	.26	.19	.04	.07	-.03
77	.25	.26	.30	-.05	-.04	-.01
78	.21	.21	.18	.03	.03	.00
79	.19	.18	.17	.02	.01	.01
80	.18	.20	.19	-.01	.01	-.02
81	.16	.12	.16	.00	-.04	.04
82	.13	.09	.11	.02	-.02	.04
83	.24	.23	.23	.01	.00	.01
84	.10	.08	.07	.03	.01	.02
85	.20	.21	.20	.00	.01	-.01
86	.18	.17	.19	-.01	-.02	.01
87	.14	.15	.12	.02	.03	-.01
88	.17	.17	.16	.01	.01	.00
89	.25	.28	.25	.00	.03	-.03
90	.14	.13	.13	.01	.00	.01
91	.16	.14	.14	.02	.00	.02
92	.19	.19	.18	.01	.01	.00
93	.18	.18	.15	.03	.03	.00
94	.19	.19	.16	.03	.03	.00
95	.26	.29	.27	-.01	.02	-.03
96	.22	.23	.18	.04	.05	-.01
97	.22	.22	.20	.02	.02	.00
98	.15	.26	.13	.02	.13	-.11
99	.16	.17	.15	.01	.02	-.01
100	.30	.32	.34	-.04	-.02	-.02
101	.18	.17	.15	.03	.02	.01
102	.17	.18	.17	.00	.01	-.01
103	.17	.17	.15	.02	.02	.00
104	.20	.19	.20	.00	-.01	.01