Accuracy of Portable Breath Analyzers

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Breath alcohol analyzers have been used in Poland for more than 20 years. The police are equipped with portable, hand-held devices and stationary instruments. The first are used mostly at the roadside. In many circumstances the positive result (Breath Alcohol Concentration BrAC > 0.10 mg/L) obtained by such instrument have to be confirmed using stationary breath analyzer or blood analysis. On the other hand, three of them (Alcotest 7410, AlcoSensor IV and AlcoQuant 3020) were approved by the State Central Office of Measures according to procedures patterned on OIML (International Organization of Legal Metrology) R 126 Recommendations and their metrological properties are verified every 6 months. The aim of the study was to assess the accuracy of portable analyzers on the basis of real measurements of alcohol concentration in drunken drivers.

The results of breath and blood analyses for the study were achieved by the analysis of expert opinions concerning drunk driving elaborated at the Institute of Forensic Research in 2002-2007. In 370 cases the defendant was tested by breath analyzer and the result was confirmed by the same or/and another breath analyzer or/and blood analyses. The studies were limited to two portable instruments, Alcotest 7410 (Dräger) and AlcoSensor IV (Intoximeters, Inc).

The results obtained by portable devices were compared with the readings of stationary breath analyzers (Alcomat, Siemens and Alkometr A2.0, AWAT) and blood analyses. Due to alcohol elimination process, the results of second and subsequent measurements were re-calculated using mean elimination rates. These values were estimated on the basis of differences in alcohol concentration between samples collected in time period higher than 45 minutes and amounted to 0.156 ± 0.099 g/L/h for blood (n = 206) and 0.091 ± 0.054 mg/L/h for breath (n = 149). The readings of portable instruments were in very good agreement with the results of confirmatory analyses performed by stationary devices (Alcotest 7410: r = 0.981, p < 0.001, y = 0.993 x + 0.033, n = 108; AlcoSensor IV: r = 0.973, p < 0.001, y = 0.959 x + 0.042, n = 13). The correlations were weaker when compared with the results of blood analyses (Alcotest 7410: r = 0.932, p < 0.001, y = 1.679 x + 0.258, n = 259; AlcoSensor IV: r = 0.946, p < 0.001, y = 1.764 x + 0.156, n = 59), but comparable with correlations between the readings of stationary devices and the results of blood analyses (Alkometr A2.0: r = 0.946, p < 0.001, y = 1.793 x + 0.096, n = 216; Alcomat: r = 0.945, p < 0.001, y = 1.915 x + 0.002, n = 181). The relatively high values of intercept for both portable devices could be caused by changes in blood/breath ratio of alcohol concentration with time (the portable devices are usually used first, at the roadside, when alcohol is often still absorbed into the body of the tested person). In order to compare the readings of portable and stationary breath analyzers, the Bland-Altman plots for both absolute and relative differences were also prepared. The obtained data show that the differences in results are independent of alcohol concentration both for Alcotest 7410 (absolute difference [mg/L]: r = -0.061, p > 0.1, y = -0.0119 x - 0.021; relative difference [%]: r = 0.014, p > 0.1, y = 0.58 x - 4.89) and AlcoSensor IV (r = 0.064, p > 0.1, y = 0.0150 x - 0.024; r = -0.15, p > 0.1, y = -5.35 x + 2.50 for absolute and relative difference, respectively).

The results indicate good correlation between the readings of portable breath alcohol analyzers and the results of confirmatory analyses using both stationary breath analyzers and blood analysis. It means that if a police officer follows proper procedure and the metrological properties of a breath analyzer are periodically verified, the readings of portable instruments are accurate and can be used for forensic purposes. On the other hand, the confirmatory analyses have to be performed as it is common in forensic toxicology.

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