

Medicolegal Alcohol Determinations — Blood- or Breath-Alcohol Concentration?

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Abstract: Measuring the concentration of alcohol in body fluids represents a large part of the workload at forensic science and toxicology laboratories. In traffic-law enforcement, breath-alcohol testing is used worldwide for roadside screening and for evidential purposes. Many jurisdictions have adopted per se laws which make it a crime to drive with a blood- or breath-alcohol concentration above a prescribed statutory limit. The choice between blood- and breath-alcohol analysis for forensic purposes depends on many factors, not least of which are political and personal interests. Breath sampling is non-invasive compared with blood sampling although breath testing is only feasible in living and cooperative subjects. The presence of narcotics or prescription drugs that might impair driving ability is easily analyzed in blood samples but not in breath samples. Re-analysis of a blood sample to confirm the result is a simple matter, whereas storage of breath specimens for confirmatory analysis is less practical. The statutory breath-alcohol concentration (BrAC) limits for driving have been derived from pre-existing blood-alcohol concentration (BAC) limits by assuming breath-to-blood conversion factors of 2000:1, 2100:1, or 2300:1 in different countries. In a large study, the mean BAC/BrAC ratio in drinking drivers was ~2400:1, which gives a generous advantage to those who provide a sample of breath when a 2100:1 ratio has been used to set the statute. The concentrations of alcohol in blood and breath are highly correlated and the fate of alcohol in the body can be monitored by analyzing a series of blood or breath samples. The results of breath-alcohol measurement are, however, more prone to physiological variations such as body and breath temperature, pulmonary function, and pattern of breathing prior to exhalation. For individuals with BAC or BrAC close to the legal limit for driving, inherent uncertainty in the analytical methods (both blood and breath) can make the difference between punishment or acquittal. This requires making a deduction from the mean of a duplicate determination of BAC or BrAC so that the value remaining is less than the true mean concentration of alcohol with a high degree of confidence (99 or 99.9%). Blood- and breath-alcohol tests are sensitive and objective ways to document over-consumption of alcohol and are more practical than recording clinical signs and symptoms of alcohol influence or performing psychomotor tests of impairment.

Key words: Alcohol, analysis, blood, breath, drunk driving, ethanol, impairment, law enforcement, pharmacokinetics, traffic safety.
