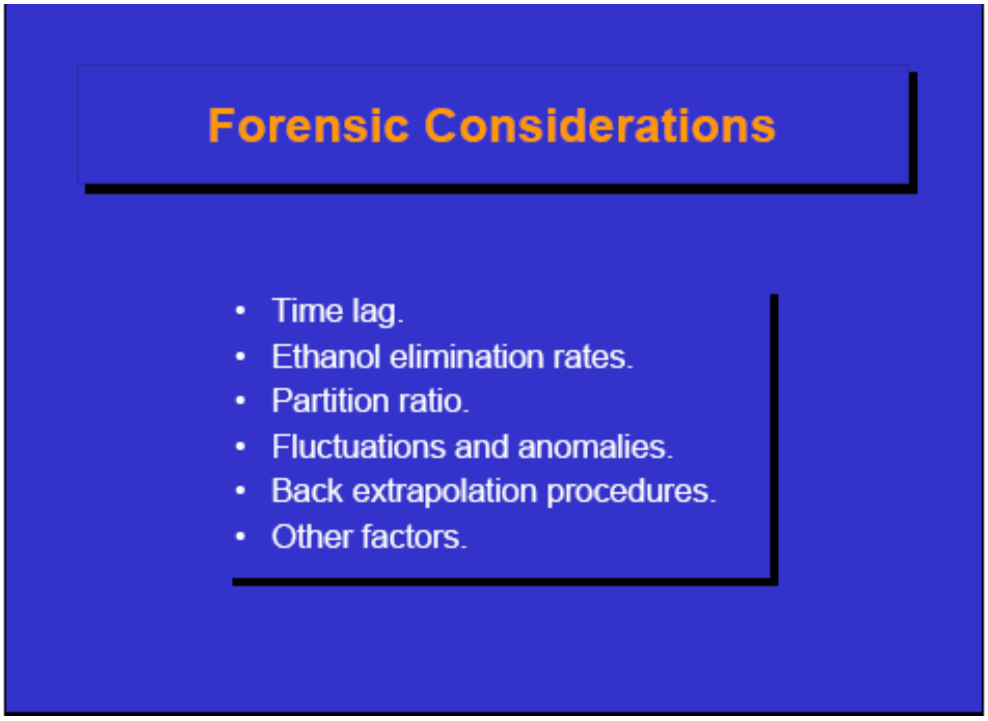

Forensic Considerations

a) Time lag.
b) Ethanol elimination rates.
c) Partition ratio.
d) Fluctuations and anomalies.
e) Back extrapolation procedures.
f) Other factors.

The concentration of alcohol in blood (or breath) may be important for evaluating the degree of acute alcohol-induced impairment of driving ability or other actions. It may also be necessary to calculate the blood alcohol concentration at the relevant time e.g. an accident occurring 2 hours previously, not the present time.

There is a time lag from the period of intake of alcohol until the peak blood alcohol concentration is reached. This is regulated by the rate of alcohol absorption after oral intake. Alcohol absorption is regulated by numerous factors (absorption slide). Because of these factors, the time to reach peak blood alcohol concentrations varies greatly e.g. 14 min to 130 min found in a controlled study (mean time = 57 min for men, 42 min for women). Hence, if alcohol absorption is not complete, peak alcohol levels will not yet be reached.

There is a 3-4 fold variation in ethanol elimination rates because of genetic and environment influences. In one controlled study assaying the rate of decrease of breath alcohol concentration in 134 men, rates varied from 5.9 to 27.9 mg per 230 liters air per hour. The absence or presence of food is very important as a regulatory factor as is sex, age, body weight, and even the time of day can influence the rate of ethanol metabolism.
Breath alcohol is usually determined to reflect blood alcohol. The typical value assumed to reflect the mean partition factor between blood alcohol and breath alcohol in the post absorptive state is 2300 : 1. In a controlled study of 393 men, this value ranged from 1706 : 1 to 3063 : 1. Blood : urine partition ratio shows an even greater variability (0.21 : 1 to 2.66 : 1).
Not all blood or breath alcohol curves follow the idealized Widmark pattern shown in panel A. Alcohol absorption is not always complete at 60 to 90 min (panel D), peak alcohol concentrations cannot always be predicted (panel C), ethanol elimination is not always linear as there are fluctuations in the decay curves (panel E, F).
To back extrapolate from a blood alcohol concentration taken at one time to a value at an earlier time, one needs to know an accurate value for the ethanol elimination rate, which as discussed in B, is not likely in view of the large inter-individual variability in ethanol elimination kinetics. Also, to back extrapolate, one uses linear kinetics, which may not be correct, especially for the concentration range under consideration. The variability in individual rates of ethanol elimination, the difficulty in knowing exactly when absorption of ethanol was completed, and the newer model showing that rates of ethanol elimination can change at different blood ethanol concentrations casts doubt on the validity of such retrograde calculations to an earlier blood ethanol concentration.
Alcohol Policy

Breath Alcohol Levels