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Alcohol Models

Ingested through drinks – beer, wine, mixed drinks. The alcohol in these drinks is ethanol. Why do we care?

- (1) What are the long term effects of alcohol – good and bad
- (2) links to diseases
- (3) law enforcement - DUI laws

How do we measure alcohol in the body?

BAC – Blood Alcohol Concentration, $[BAC] = \frac{g}{100mL}$. $BAC = \frac{0.08g}{100mL} = 0.08\%$, $BAC \geq 0.08\%$ is too impaired to drive in most states

0.1% is drunk (dizzy)

0.4% will most likely be a comma

At a traffic stop, a breathalyzer can indirectly approximate your alcohol concentration (BrAC) through your breath.

$$BAC = BrAC \times 2250 \pm 46 \quad (1)$$

Factors that determine BAC:

- # of drinks
- Time between drinks
- gender
- body mass
- height
- stomach contents

liver – metabolizes alcohol into acetaldehyde \rightarrow acetate

Widmark Model

$$\begin{aligned}\frac{d}{dt}\text{BAC} &= -\beta, & \text{BAC}(0) &= \frac{D}{V_d} \\ \text{BAC}(t) &= -\beta t + k \\ \text{BAC}(t) &= -\beta t + \frac{D}{V_d}\end{aligned}\tag{2}$$

$V_d = Wr$ where W is the weight of the person, r is with widmark (fudge) factor

In 2000, $r(\text{men}) = 0.31 - 0.0048W + 0.0046H$ where H is height

Flaws:

1. BAC goes < 0
2. no timing of drinks
3. only one compartment
4. liver metabolizes the ethanol

Wagner Model

$$CL = \frac{V_{max}}{K_m + \text{BAC}}$$

Pieters' Model

3 compartments, stomach, intestine, central (blood stream)