

Pharmacokinetics for the Non-Specialist

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What is Pharmacokinetics?

Pharmacokinetics (PK) is the study of a drug as it is *absorbed, distributed, metabolised and excreted* (ADME) from the body – so basically it is what the body does to the drug.

- **Absorption:** Movement of a drug into the bloodstream from the site of administration. There is no absorption phase for IV drugs as they pass straight into the blood.
- **Distribution:** Transfer of a drug from the site of administration around the body. Any amount of drug that does not return to the site of measurement has been eliminated and not distributed.
- **Metabolism:** Chemical breakdown/modification (biotransformation) of the drug into metabolites – some metabolites are pharmacologically active, toxic or neither.
- **Excretion:** Physical removal of the drug and metabolites from the body, mainly through the kidneys in urine and liver in bile. Any unabsorbed drug is also eliminated through faeces.

PK is the science of measuring and interpreting the concentrations of the drug and metabolite in blood/urine after the drug has been dosed.

In contrast, **Pharmacodynamics (PD)** is the study of the *biochemical and physiological drug effects on the body* – so basically it is what the drug does to the body.

Figure 1 shows the concentration of the drug after the drug has been administered to a single individual.

IMPORTANT FEATURES OF A PK GRAPH

C_{max} – Peak concentration occurring

T_{max} – Time at which maximum concentration (C_{max}) occurs

t_{1/2} (Elimination half-life) – Time taken for concentration levels to reduce by 50% of the original value

AUC (Area Under the Curve) – Total area under the plasma concentration-time curve representing total exposure of concentration

As Figure 1 shows, before the C_{max} is reached, the absorption rate is greater than the elimination rate. At the point of C_{max}, these two rates are equal and after this the elimination rate is greater than the absorption rate. Eventually the concentration of the drug decreases and the effect diminishes.

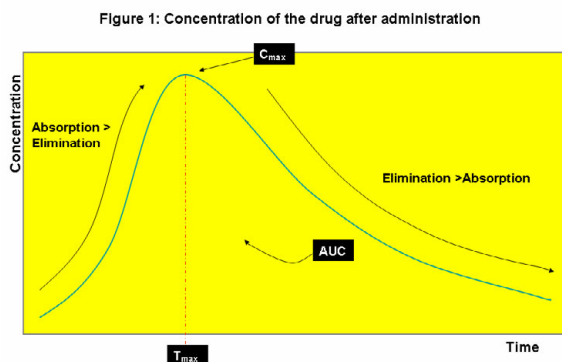
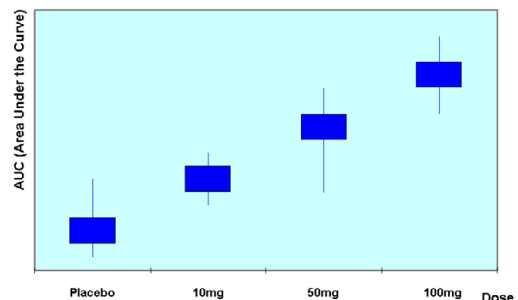


Figure 2: Mean AUC of the drug over dose

Figure 2 shows the mean AUC over dosage. It is clear that there is *linear distribution* between AUC and dose – AUC is increasing with each dose therefore resulting in *greater exposure* with each higher dosage. Some drugs have *non-linear* PK therefore increasing doses result in exponential increases of exposure; this can lead to a more complex interpretation of the drug effects.



There are many more PK parameters that could be analysed however they are beyond the scope of this introduction to PK.