Therapeutic index:-

The concept of therapeutic index refers to the relationship between toxic and therapeutic dose. This pharmacodynamic parameter is relevant to clinical practice because it determines how safe (or toxic) a drug is.

Article outline:

Therapeutic index equation

The therapeutic index of a drug is the ratio of the dose that produces toxicity to the dose that produces a clinically desired or effective response in a population of individuals.

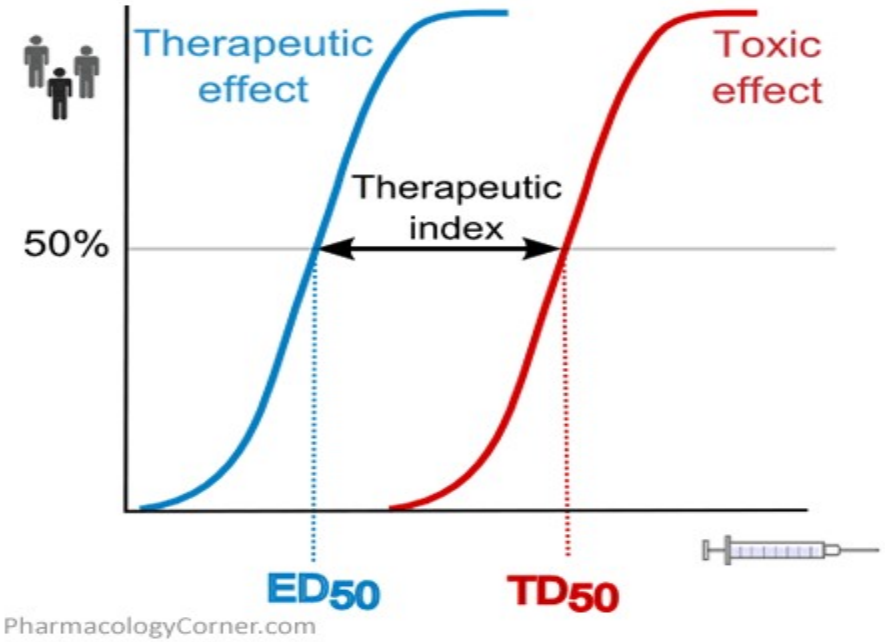
$$\text{Therapeutic index} = \frac{TD_{50}}{ED_{50}}$$

Where: TD50 is the dose of drug that causes a toxic response in 50% of the population and ED50 is the dose of drug that is therapeutically effective in 50% of the population.

How therapeutic index is determined

Therapeutic index and quantal dose response curves

Both ED50 and TD50 are calculated from **quantal dose response curves**, which represent the frequency with which each dose of drug elicits the desired response or toxic effect in the population.

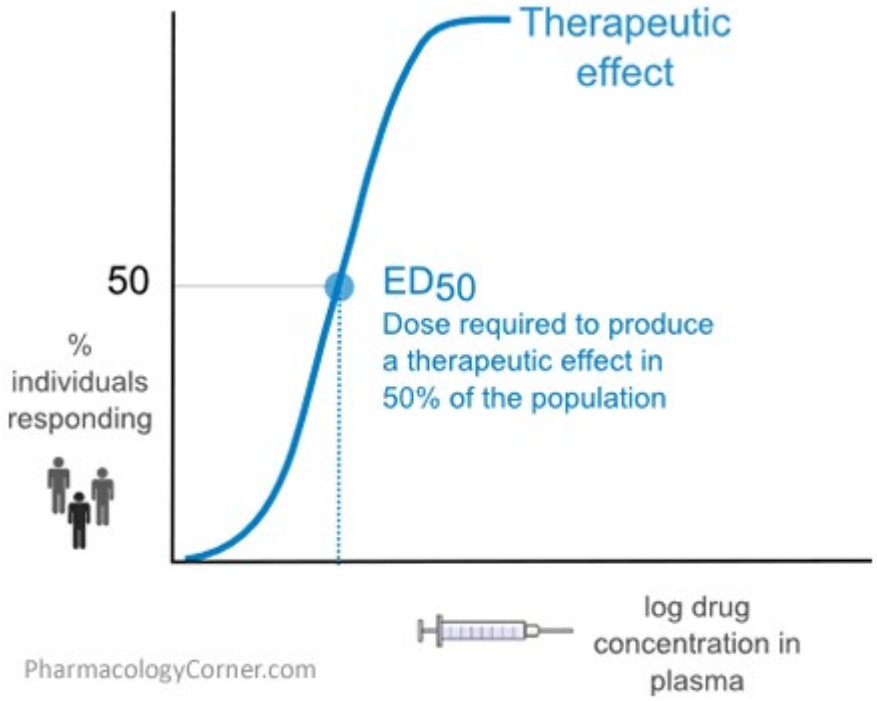


There are some important characteristics of quantal dose-response curves (see image above) that are worth noting:

- Dose of drug in plasma is plotted in the horizontal axis while the percentage of individuals (animals or humans) that responds or shows a toxic effect is represented in the vertical axis.
- These curves measure all or none (positive or negative) responses. Some examples of positive responses include: relief of headache for an antimigraine drug, increase in heart rate of at least 20 bpm for a cardiac stimulant, or 10 mmHg fall in diastolic blood pressure for an antihypertensive.
- Data is obtained from a population.

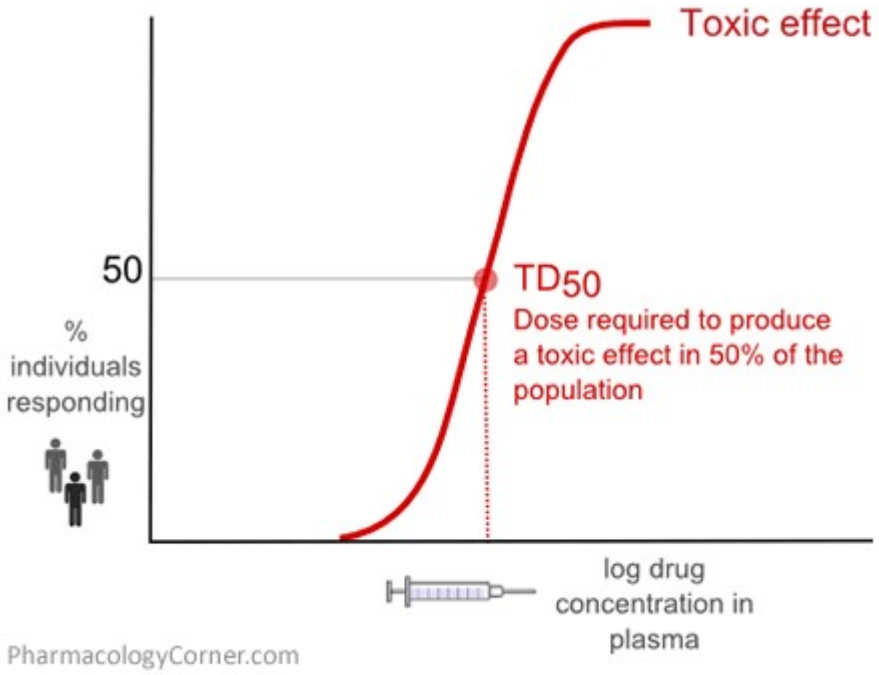
Unlike graded dose-response graphs, data for quantal dose-response curves is obtained from many individuals

ED50



The dose required to cause a therapeutic effect (positive response) in 50% of a population is the ED50.

TD50

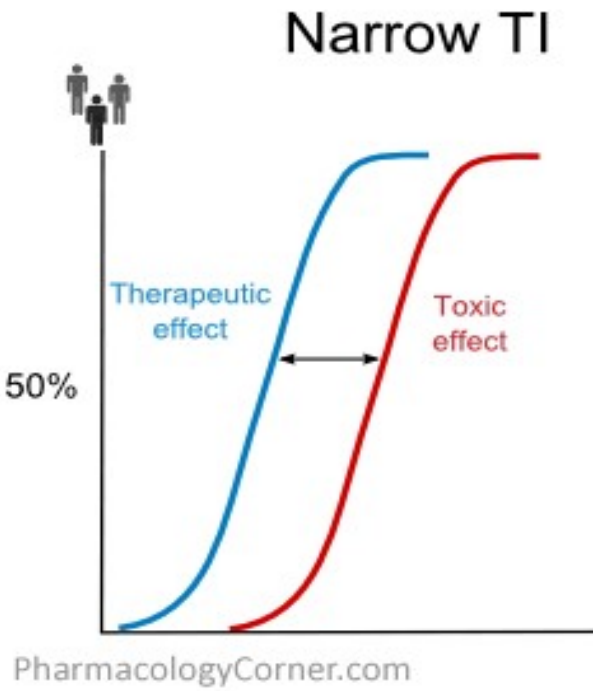


The dose required to produce a toxic effect in 50% of the studied population is the TD50. For animal studies, LD50 is the dose that results in death of 50% of the population.

Narrow therapeutic index drugs

The list below mentions some examples of narrow therapeutic index drugs:

- Warfarin
- Lithium
- Digoxin
- Phenytoin
- Gentamycin
- Amphotericin B
- 5-fluorouracil
- AZT (zidovudine)


Narrow TI
Therapeutic effect
Toxic effect
50%
PharmacologyCorner.com