Toxicology Tutorial – Dose Response
Variation of Responses Among a Population

If we draw a graph of individual responses to a substance, we can visualize how a specific population is affected. Along the x-axis, we will have the response, on a scale from mild to severe. Along the y-axis, we will show the number of individuals with each type of response. We'll use an arbitrary scale of a few individuals, to many individuals within this particular population.

Now, if we graph the individual responses, we end up with a bell-shaped curve, also known as a standard distribution. Notice the largest number of individuals fall within the highest area of the graph, which happens to be the mean response.
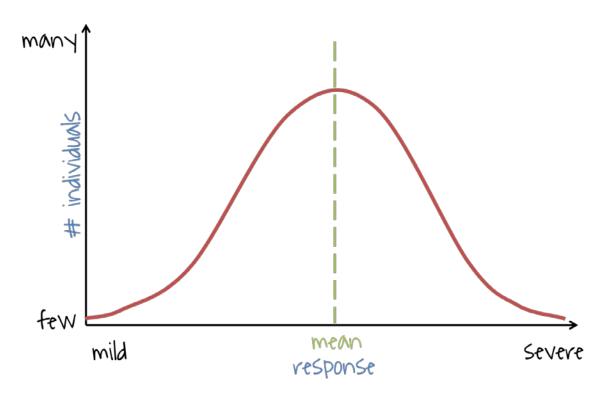

Figure 1 – Graph of individual responses to a substance, generally resulting in a bell-shaped curve, or standard distribution.

In statistics, the standard deviation, or SD, is a measure that indicates the variation or dispersion of a set of values. An SD near 0 indicates that most values fall near the mean. This is why we can say the majority of responses to a toxicant are similar within a specific population.

Dose responses are commonly presented as "mean plus or minus one standard deviation." Here on our graph we have minus one standard deviation from the mean, and in the other direction, we have plus one standard deviation from the mean.

Statistically, this range from minus one standard deviation to plus one standard deviation accounts for about 68 percent of the individuals.

If we move out one more standard deviation, that is to minus two standard deviations and plus two standard deviations, about 95% of individuals within a population will fall within this range of plus or minus two standard deviations from the mean.

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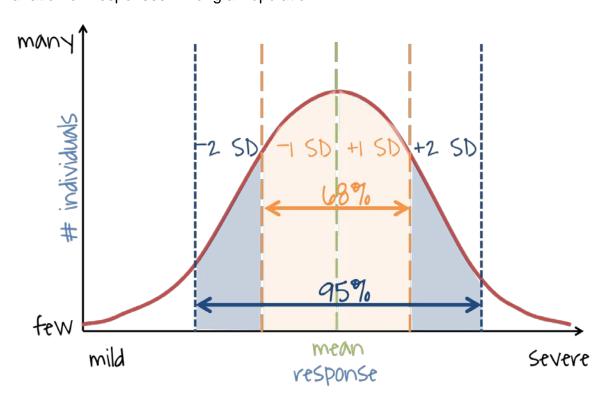Variation of Responses Among a Population

The greater the standard deviation, the greater the variability within a population.