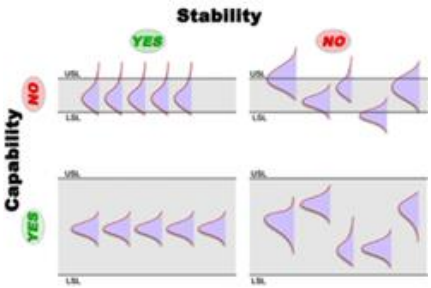
MedTech Statistics with Minitab



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Introduction

According to FDA's CFR 820.250, "*Where appropriate, each manufacturer shall establish and maintain procedures for identifying valid statistical techniques required for establishing, controlling, and verifying the acceptability of process capability and product characteristics.*"

This series of courses covers the application of statistical tools commonly used in the medical devices and pharmaceutical industries. Learn to use data analysis techniques to understand variation and defects, determine the useful life of a product, assess if a process is capable of meeting customer specifications, and monitor the stability of a validated process. Learn to use Minitab tools for validation of analytical methods, determine product stability and shelf-life, predict when your product will fail etc.

Module 1 introduces the Minitab environment and important statistical concepts, while Module 2 focuses on application of statistics as a tool for assessing process capability, measurement system capability, product stability, acceptance sampling, regression etc.

Course outline

There are two modules in this series and each module is of three days' duration. Below is a course outline for each module.

Module 1: Basic Statistics with Minitab (3 Days)

Pre-requisite: Leaving Cert Maths, Undergraduate Introductory Statistics or an interest in the subject.

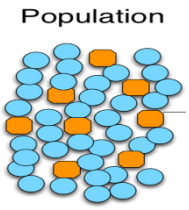
Day 1

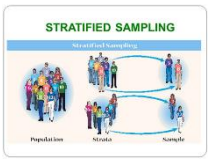
The Minitab Environment

- Get to know Minitab.

Statistical Concepts

- Understand key statistical concepts including central tendency, measures of dispersion, descriptive statistics, inferential statistics, Central Limit Theorem etc.
- Learn how to present your data numerically and graphically with Minitab - histograms, boxplots, scatterplots, Run chart, cumulative and normal probability plots.



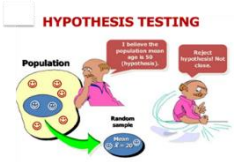


- Understand fundamentals of probability theory.
- Understand the distribution of your data
- Continuous distributions – normal, t distributions etc.
- Discrete distributions – binomial, Poisson etc.
- Use probability distributions to predict your process behaviour.

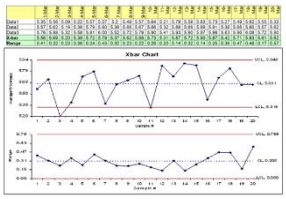
Day 2

Statistical Decision Making

- Parameter estimation – point estimate, confidences intervals, tolerance intervals for a given coverage and confidence level, k factor etc.
- Use tolerance interval to quantify the reliability of your products.
- Use tolerance interval as acceptance criteria for process validation.
- Understand how to use Minitab to make statistical decisions based on calculated risks – t-tests, F-test, Chi-sq test, Goodness-of-fit, analysis of variance (ANOVA), paired t-test, test for outliers – Grubb's test and Dixon's tests.
- Understand the relationship between p-value and test statistic, eg Anderson Darling.



- Understand the relationship between power and sample size for decision making. Use Minitab to calculate an optimum sample size for confidence interval and tolerance interval.



Day 3

Statistical Process Control

- Understand the concepts of process variation and how to monitor and control your process.
- Learn the difference between control charts for attributes and variables.
- Learn how to choose an appropriate control chart for your process.
- Learn how to use Minitab to construct and plot the various control charts – IMR, Xbar-R, Xbar-S, p, np, C and U charts.

Module 2: Statistical Application with Minitab

Pre-requisite: Module 1 or Minimum of 70% score in Basic Statistics Pre-course Test

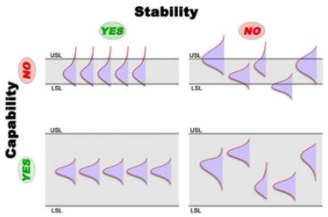
Day 1

Review of Key Statistical Tools

- Review of central tendency and dispersion – relating range to standard deviation.
- Review of standard normal distribution – use of z-value to calculate out-of-tolerance work.
- Review of control charts for variables – IMR, Xbar-R charts.

Process Capability Analysis

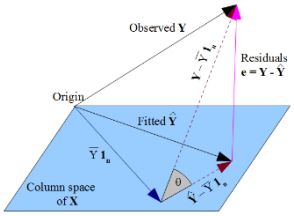
- Understand the assumptions of process capability.
- Understand capability metrics – Cp, Cpk, Pp, Ppk and Cpm, Z-Bench, etc.
- Use of capability as acceptance criteria for process validation.
- Learn how to use Minitab's Capability Sixpack to assess assumption of normality.



- Learn how to use Minitab's Individual Distribution Identification tool to find a distribution which best describes your data.
- Learn how to analyse the capability of a stable process.
- Learn how to analyse capability of a non-normal process.

Correlation and Regression Analysis

- Understand the difference between regression and correlation.

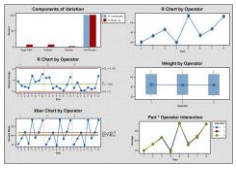


- Appreciate data considerations for regression analysis.
- Learn when and how to use Minitab's "Fitted Line Plot", "Fit Regression Model" and "Nonlinear Regression" tools.
- Analyse regression output from Minitab – coefficients, R-squared, residuals, ANOVA summary of regression statistics etc
- Understand how Minitab calculates correlation coefficient, R-squared etc
- Learn how to use the regression model to make predictions – understand importance of residuals etc.
- Learn how to use regression as a method validation tool
  - Learn how to relate slope and intercept to limit of detection (LOD) and limit of quantification (LOQ) when conducting method validation.

Day 2

Test Method Validation (Medical Devices)

- Regulatory requirements – FDA 21CFR820
- Test Method Validation (TMV) data type – variable vs attribute
- TMV terminology - accuracy, precision, stability, linearity, repeatability, reproducibility.
- TMV process – prerequisite, test specifics and protocols
- TMV Acceptability criteria – Measurement Systems Analysis (MSA)
- MSA metrics – Precision-to-Total ratio, Precision-to-Tolerance ratio etc
- Measurement Systems Analysis concepts.
  - Type 1 Gage study,
  - Gage Linearity study and
  - Gage R & R (Crossed).
- Attribute Agreement Analysis – Kappa and Kendall indices



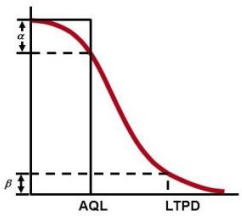
Validation of Analytical Procedures (Pharmaceuticals)

- Regulatory requirements – ICH Q2(R1)
- Parameters to be checked for method validation – specificity, accuracy, precision, stability, range, linearity, LOD, LOQ, RSD, repeatability, reproducibility.
- Understand how to calculate these parameters.

Day 3

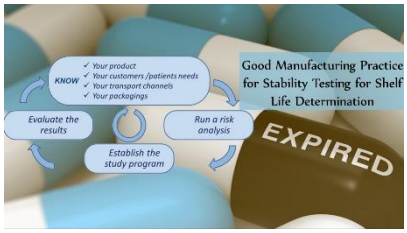
Acceptance Sampling

- Regulatory reminder for medical devices - 21CFR 820.250
- Review of sampling methods.
- Overview of binomial and hypergeometric distributions and their relevance to acceptance sampling.
- Acceptance Sampling concepts - single, multiple, sequential etc.
- Consideration of Risk/harm to user – critical, major, minor etc.
- Acceptance sampling indices - AQL, RQL, LTPD/RQL, AOQL.
- Learn how to use Minitab to define a 'Zero Failure" sampling plan.
- Learn how to use Minitab to derive an attribute sampling plan.



Stability and Shelf Life Analysis

- Regulatory requirements – ICH, FDA etc.



- Understand the difference between real-time and accelerated stability testing – Q-Rule, Arrhenius, power models etc.
- Understand the use of life-time distributions in shelf-life determination – Weibull, lognormal, exponential etc.
- Learn how to use Minitab's 'Stability Study' to estimate shelf-life based on real-time test data.
- Learn how to use Minitab's 'Reliability/Survival' tool to estimate shelf-life based on accelerated testing data.

Who should attend?

Quality engineers, test engineers, validation personnel, process engineers, supplier quality personnel, lab technicians, research and development personnel, data analysts, manufacturing engineers, metrologists and calibration technicians will benefit from any or all of the modules.