Data Analysis Solutions for the Pharmaceutical, Biotechnology, Medical Devices, Nutritionals, and Cosmetics Industries

COMPLIANCE AND VALIDATION
RESEARCH & DEVELOPMENT
QUALITY CONTROL
QUALITY BY DESIGN (QBD)
PROCESS ANALYTICAL TECHNOLOGY (PAT)
ANNUAL PRODUCT REVIEW (APR)
PERIODIC PRODUCT REVIEW (PPR)
DATA MINING IN DRUG DISCOVERY
DISSOLUTION PROFILES
STABILITY EVALUATION
HIGH-THROUGHPUT SCREENING (HTS)
REGULATORY SAFETY TESTING
PRE-CLINICAL TOXICOLOGY
CLINICAL TRIALS

StatSoft®
“We have hundreds of product formulations. It used to take us 40 hours per Annual Product Review (APR). Now, with STATISTICA Enterprise, it takes us 5 minutes per APR, and we spend more time on review and interpretation. In a nutshell, the benefits of automating periodic process reviews is standardization (all analysts develop the same APR analyses rather than each one being somewhat of a one-off with high-level procedural controls), accuracy (less opportunity for error with automated database querying, less manual analysis steps, a more streamlined workflow, and a templated report output), and time savings (more opportunity to focus on the data and the results rather than performing and re-doing manual analysis steps).”

Quality Control Manager
One of the 5 Largest Pharmaceutical Companies in the World
StatSoft, Inc. is one of the world’s largest providers of analytics software solutions for science and industry, with headquarters in Tulsa, Oklahoma USA and more than 20 offices around the world. We specialize in the design, development, and implementation of corporate analytical and data mining solutions integrated with existing data acquisition and storage systems, providing consulting expertise and training courses in statistics and data analysis applications. We also sell and support the entire STATISTICA line - our flagship line of software products ranging from off-the-shelf statistics and graphics packages to enterprise-wide and web-enabled analytical and data mining solutions.

Our software solutions comply with all relevant requirements set by the US Food and Drug Administration (FDA) and the European Agency for the Evaluation of Medicinal Products (EMEA), as well as Sarbanes-Oxley (SOX) regulations. STATISTICA offers a pre-validated core platform with fully secure user administration and configuration control, audit trails on system configuration changes, data manipulation, and analysis results, plus integrated, FDA 21 CFR Part 11 compliant document management. StatSoft is also able to offer full computer systems validation (CSV) services, including assistance with planning and executing IQ/OQ/PQ protocols.

StatSoft offers a full range of consulting services from data analysis to building customized analytical systems, integrating cutting-edge STATISTICA technology with other generic IT components. Our services include assistance with the choice of suitable statistical methods, performing analyses, and building automated data analysis and reporting systems allowing the use of analytical results throughout entire organizations. We also offer a range of specialized training in data analysis methods and applications from ‘off-the-shelf’ courses to customized courses designed to meet the specific requirements of our clients. STATISTICA software and systems are in use in many of the world’s largest and most technologically advanced pharmaceutical and medical device companies, including GlaxoSmithKline, Merck, Eli Lilly, Smith & Nephew, Vernalis, Teva, Avecia, Pfizer, AstraZeneca, Johnson & Johnson, Sanofi-Aventis, Boehringer Ingelheim, UCB, Pliva, Bioton, US Pharmacia, Servier, ICN Polfa, Lonza, Guidant and Alcon Labs.

To discuss possible software solutions to your analytic problems, contact our Pharmaceutical/Biopharmaceutical industry solutions consultants at 918-749-1119 or pharma@statsoft.com.
Many of the challenges involved in pharmaceutical manufacturing are the same as those encountered in other manufacturing operations and the need for continuous quality improvement is always present. However, the strict regulatory framework that exists in the pharmaceutical industry necessarily imposes much higher standards of control, monitoring, and documentation. This fact, along with the varied requirements of primary and secondary manufacturing sites, can mean that large organizations often end up with a diverse and expensive-to-maintain range of incompatible systems.

**STATISTICA** can provide a single, standardized quality control and improvement solution that can be easily validated for use for GxP applications, and that covers the whole range of manufacturing statistics, including simple descriptive statistics and graphics, QC charting, capability analyses for normal and non-normal distributions, design and analysis of experiments (DOE) and much more. **STATISTICA** integrates well with existing systems and practices, including Six Sigma, TQM, and Lean, and the ability to directly link to a wide range of data collection and storage systems provides the optimal solution for on-line (real-time) process monitoring and early detection of process shifts.

Regular, formal review of key process parameters is a basic FDA requirement to ensure that products stay within acceptable limits. This imposes a significant burden on pharmaceutical manufacturers and can become a major resource drain for companies with many well-established products and processes.

Typically, most of the analyst’s time is spent in obtaining and validating the data, performing repetitive analyses and generating standard reports, rather than on interpreting and understanding results. Due to their repetitive nature, annual/periodic process reviews lend themselves very well to automated report generation. Where data are stored in LIMS or other data warehousing systems, complete end-to-end analysis and reporting systems can be built rapidly using **STATISTICA Enterprise** technology, saving thousands of hours of analyst time every year.

Standardization and automation can revolutionize the review and reporting process, allowing analysts to spend their time examining and acting upon analytical results, rather than performing routine data collection and analysis steps manually. In addition to saving time, this approach minimizes the probability of errors and allows routine reviews to be completed by personnel with a lower level of expertise.
Recent guidance from the FDA regarding Process Analytical Technology (PAT) emphasizes the need for real-time monitoring of in-process parameters, rather than relying exclusively on finished product quality metrics. Typically, the relationships between manufacturing process variables and the resulting finished product parameters are complex, but new techniques and technologies now allow for greater insights into these relationships.

The STATISTICA software platform provides the optimal solution for process monitoring applications. It provides a wealth of techniques packaged within a single software environment, including Multivariate Statistical Process Control using PCA/PLS (NIPALS), on-line monitoring of batch processes, general linear and nonlinear predictive modeling, recursive partitioning algorithms (tree-based models), feature extraction and data reduction techniques, clustering algorithms, and machine learning approaches (e.g., neural networks, support vector machines). STATISTICA also integrates directly with your process information repositories, LIMS databases, and MRP systems.

In contrast with many other ‘niche’ applications that offer a limited range of analytical options, STATISTICA provides a comprehensive solution that is ultimately much better equipped to meet the diverse challenges of modern pharmaceutical manufacturing.

Compliance and Validation

- Validated Software
- Analysis Audit Trails
- 21 CFR Part 11 Compliance
- Computer Systems Validation

STATISTICA offers a pre-validated core platform with fully secure user administration and configuration control, audit trails on system configuration changes, data manipulation, and analysis results, plus integrated, FDA 21 CFR Part 11 compliant document management (which also meets all SOX legislation requirements). Together, these features can radically change the way your organization works and remove the need for extensive manual documentation of analytical processes.

StatSoft is also able to offer a full computer systems validation (CSV) service, including assistance with computer systems validation (IQ/OQ/PQ) procedures.
Drug absorption from a solid oral dose depends in large part on the dissolution characteristics of the product. In-vitro studies designed to observe and model the dissolution profile are an essential part of the drug development process, and there are many model-dependent and model-independent methods for doing this. In particular, researchers are often interested in performing comparative studies to establish bioequivalence of alternative formulations and to ensure continued, lot-to-lot stability (and therefore quality) of a manufactured product.

*STATISTICA* provides an ideal platform for both linear and nonlinear model-based comparisons, as well as the calculation of simple f1 difference and f2 similarity indices. The fully integrated and highly customizable graphics enable decisions to be supported by direct visual comparison of response profiles.

Both pharmaceutical and consumer healthcare products require estimates of shelf-life that are used to assess product stability in storage under varying temperature and humidity conditions, as well as exposure to light. This information is commonly obtained from stability studies conducted according to internationally agreed guidelines.

The ICH Q1E guidance for statistical analysis of stability data describes a number of approaches that can easily be performed with *STATISTICA*. Studies may involve simple comparisons to choose between separate batch, parallel slopes or pooled analyses, while also accommodating complex ‘bracketing’ or ‘matrixing’ designs. The eventual choice of model will depend on significance tests to compare the alternative analysis pathways, as well as the linearity of chosen transformations.
Pharmaceutical research and development is a complex, time-consuming, and expensive process requiring the expertise of a wide range of scientific disciplines. The range of experimental methods that may be employed requires an equally wide variety of statistical methods, while the sheer quantity of data generated means that it is not practical (or desirable) to rely on a small number of statistical specialists within an organization to perform the analyses. In this environment, while high quality statistical data analysis is crucial to success, it is virtually impossible to define a discrete subset of appropriate statistical methods to meet the needs of such a diverse research organization. As a result, pharmaceutical companies need to make available a comprehensive and easy-to-use statistical toolset that does not impose unnecessary restrictions on researchers. Deploying a single corporate analysis platform makes best use of IT and training resources and enables researchers to collaborate efficiently on multi-disciplinary projects. Increasingly, the world’s leading pharmaceutical companies are discovering that STATISTICA is the only package that has the capacity to meet all of these needs.

Even small improvements in research and development processes directly affect an organization’s bottom line, and many pharmaceutical research organizations have experienced the positive impact of deploying STATISTICA. Offering a choice of desktop (stand-alone), networked, and server-based analytics platforms, STATISTICA provides scientists with analytical tools that are easy to use, relevant, and integrated with their data sources, and results in hard and soft return on investment by:

- empowering scientists with the analytic and exploratory tools they need to make more sound decisions and gain greater insights from the precious data that they collect,
- saving the scientists’ time by integrating analytics into their core processes,
- saving the statisticians’ time to focus on the specification, delivery, and packaging of effective analytic tools within the STATISTICA framework,
- saving IT and training resources through standardization on a single analysis platform,
- increasing the level of collaboration across the R&D organization by sharing study results, findings, and reports.
Regulatory Safety Testing/Pre-clinical Toxicology

- Comprehensive Set of Statistical Tools for Researchers and Statisticians
- Power and Sample Size Calculation
- Predictive Data Mining Methods
- Automated Analysis and Report Generation
- Fully FDA Compliant

The requirements of pre-clinical toxicology and safety testing are distinct from those of other areas of drug development in a number of ways. In animal studies, two of the three Rs (reduction and refinement) require that the most powerful experimental and statistical methods be used in order to minimize the number of animals involved and to extract the maximum amount of information from study data. Although the majority of studies are performed according to standard designs based on regulatory guidelines, there is still scope for the use of newer, more powerful statistical methods. Increasingly, data mining and artificial intelligence methods are finding a place in predicting safety outcomes in advance of in-vitro and in-vivo testing.

From simple bioassay and dose-response experiments to long-term survival and carcinogenicity studies, STATISTICA has the tools to handle your data. Where standard study designs are used, STATISTICA Enterprise provides the most efficient mechanism for automating and validating routine analysis and report generation (with full, secure audit trails), cutting submission delays and reducing time-to-market.

Clinical Trials

- Directly Read SAS Data Files and All Standard Database Formats
- Power and Sample Size Calculation for Parallel and Crossover Trials
- Generalized Linear and Nonlinear Models (Types I to VI Sums of Squares)
- Variance Components Estimation for Mixed Models (ANOVA, REML)
- Integrated 21 CFR Part 11 Capability and FDA Compliance

In the final stages of bringing a product to market, GCP demands that the most rigorous statistical methods are employed by researchers and the importance of validated software systems cannot be overstated. Ethical considerations and (at least in phase I and II studies) small sample sizes make it imperative that the most powerful statistical methods be used in order to establish efficacy and detect side effects. STATISTICA is unique in providing a fully integrated 21 CFR part 11 compliant document management system along with a complete analytical toolkit. With the ability to directly query standard database platforms and to import a wide range of data file formats (including SAS files), plus the most comprehensive array of general and specialized statistical and graphical methods, STATISTICA can provide a single, validated platform for all your clinical data analysis needs.
With the advent of new technologies that allow very large amounts of data to be captured and stored automatically, many new challenges are presented. In the application of classical statistical methods, many were developed specifically to extract the maximum amount of information from minimal data sets. New disciplines such as bioinformatics and chemoinformatics have appeared, drawing on both traditional statistical methods and the newer data mining technologies, and found immediate, valuable applications in drug discovery.

According to the FDA’s ‘Critical Path Initiative,’ the use of data mining technology and methodology is central to the improvement discovery, pre-clinical and clinical research and can help to predict safety outcomes and provide better trial designs. QSAR (Quantitative Structure-Activity Relationship) methodology also makes extensive use of these methods to predict potential biological activity of molecules. A powerful, broad-spectrum toolkit such as STATISTICA Data Miner provides an ideal platform to meet these challenges.

High-throughput screening methods have now become a key element of the drug discovery process, allowing pharmaceutical companies to capitalize on the large libraries of novel compounds they have amassed over many years. Highly automated systems, making use of automated ('robotized') plate-based assay techniques and microarray technology, are able to screen very large numbers of compounds, producing vast quantities of data.

Another vital aspect of screening systems is that of quality assurance. In addition to the experimental compounds, reference samples are used to monitor the quality of the assay throughout a campaign. An automated, on-line quality control system can ensure that any problems that arise are immediately recognized and dealt with.

STATISTICA’s unique combination of technologies designed for data mining in large databases, real-time analysis, and automated reporting provide the ideal platform for a complete high-throughput analytical solution.
“STATISTICA has revolutionized the way in which our scientists analyze their data. [It] ... allows them to create an analysis without any need to learn a statistical language, and this analysis forms both an audit trail and a template for future work.”

Senior Statistician, Research & Development
Global Pharmaceutical Company

“STATISTICA’s Report generation has automated our process for generating Annual Product Review reports for GMP compliance, saving us hundreds of hours per year. Just considering the report generation alone, the ROI for the software will be achieved in one year of use.”

Quality Control Manager
Global Pharmaceutical Company

“By integrating WebSTATISTICA [...] we now are positioned to not only deliver a full palette of statistical analyses and visualizations of biological study data without leaving the security of the product, but we also have the ability to respond to specific needs for custom analyses”.

Vice President
Solutions Provider for Managing Development and Pre-clinical Life Science Studies

“With STATISTICA Enterprise we deployed a web-enabled data analysis system that connects independent data sources into one system. Process data, quality management tools, LIMS, and historical plant information are all accessible through one gateway. Raw data is summarized into useful information via pre-defined graphical methods and statistical analyses. More importantly, the system can be accessed remotely by internal personnel as well as external customers over the Internet”.

Statistician, Manufacturing Technical Services
Global Biotechnology Company
Key Features of the STATISTICA Family of Software

- A complete set of statistical, graphical, and data mining tools available in a consistent, easy-to-use and customizable working environment. Desktop software and enterprise solutions, including Web-based options.

- Sensible default analysis settings combined with the widest range of options to meet your own unique requirements.

- High quality, automatically-updated charts with virtually unlimited possibilities for customization and easy export to other applications. Unbeatable graphical data visualization.

- Convenient output management, including a graphical report editor and a wide range of export formats (PDF, HTML, etc.).

- Direct integration with databases.

- Real-time process monitoring with automated alarm functions and options to add cause, action, and comment text to both charts and underlying databases.

- A single solution for large organizations enabling hundreds of employees with a wide range of qualifications and responsibilities to work simultaneously on many different tasks.

- Easy automation of routine tasks (analysis, report generation, etc.).

- Built-in STATISTICA Visual Basic programming language.

- Option of integration with dedicated data entry environments.

- Open architecture conforming to universal standards enables integration with existing IT systems.

- Central configuration options to store measurement data, chart specifications, analysis scripts, and report templates in a central database.

- Option to allow access to all components via a Web browser or Terminal Services (e.g., Citrix™).

- Full compatibility with Six Sigma methods including Six Sigma Calculator and Six Sigma Shortcuts.


- Computer Systems Validation options.

- Conforms to ISO, FDA, GxP, PAT, and Sarbanes-Oxley requirements.

- Direct access to expert technical support, consulting services, and training courses. English, German, French, Spanish, Italian, Japanese, Polish, Czech, Russian, Chinese, and soon other language versions. Full technical support provided by more than 20 StatSoft offices worldwide.

For more information, contact our Pharmaceutical/Biopharmaceutical industry solutions consultants at 918-749-1119 or pharma@statsoft.com.