Exploristics

Exploristics provides world-class analytics and specialized software for life sciences, with specific expertise in clinical trials, biomarkers, personalized medicine research, observational studies, medical devices, diagnostics, real-world data analytics and risk stratification. We combine robust processes with scientific principles to create streamlined, flexible solutions that ensure quality while enabling new innovative approaches. The company provides comprehensive statistical support, offering researchers high quality services and software products in statistical modeling, data analysis, visualization and study design. Exploristics has just launched KERUS™, a novel *in silico* simulation platform for the prospective optimization of research studies involving complex, correlated data. This platform has a user-friendly interface, enabling researchers from a range of backgrounds to improve the efficiency of biomarker discovery and development.

Keywords: analytics • flexible • innovation • modeling • simulation • software • statistics • visualization

Profile

Founded in 2009, Exploristics is a growing SME based in Belfast and London providing world-class analytics, specialized software products and statistical services for the pharmaceutical, biotechnology and healthcare sector. The company has in-depth experience in the personalized medicine field and offers expertise more generally in supporting the design and analysis of clinical trials, pharmacogenomics, observational studies, electronic health records, medical devices, diagnostics, real-world data analytics and risk stratification. As a small company, Exploristics is able to focus on the individual needs of its customers, providing comprehensive statistical services and analytics support. With innovative in-house R&D, Exploristics is also able to devise new solutions for emerging needs in medical research and has recently developed a unique range of computer modeling software for the healthcare market. Launched in July 2015, the revolutionary KERUS™ platform is a software tool for optimizing the design

and analysis of research studies involving multiple correlated outcomes, offering the non-technical user industry-leading computer simulations capabilities in a virtual environment. This ensures that studies are suitably powered statistically to answer relevant clinical questions when real studies commence, improving their chances of success. The KERUS software has broad application in clinical research including personalized medicine research, biomarker research, diagnostics, risk/benefit, comparative effectiveness and predictive modeling.

Extracting meaningful information from the data deluge in personalized medicine

In recent years, large Pharma has encountered difficulties in translating R&D investment into marketable treatments, precipitating new approaches to drug discovery including the growing field of personalized medicine. This has involved targeting therapies to patients most likely to respond to

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treatment and has proved an attractive strategy with its promise of individualized medical therapies, offering better outcomes and safer medicines while reducing the costs and failure rates of treatments during development. However, targeting therapies effectively in this way requires the integration of numerous types of patient-level data to identify likely responders. As a result, the success of this approach is highly dependent on the collection and analysis of large volumes of data generated during the course of drug development. Moreover, given the quantity and range of data-types now collected routinely it has been difficult to extract meaningful information from these data for use in the clinic, with personalized medicine yet to yield the treatment breakthroughs it seemed to promise.

Over the last 6 years, Exploristics has been at the leading edge of trial design and analysis in personalized medicine, where the rapid growth of the field has provided both challenges and opportunities. The emergence of new data types able to be integrated into the personalized medicine approach has created a rich environment for new innovations. However, the explosion of available data within clinical studies has also highlighted the lack of statisticians and data analysts able to support these studies. Due to the wide variety of data types being generated in research studies and clinical trials today, the personalized medicine space has become multidisciplinary drawing on expertise from a range of backgrounds, such as academia, target identification, drug discovery and clinical development. In addition, there has been the convergence of different analytical skills including statistics, genetics, bioinformatics and computational biology, among others. This has created a clash of cultures and attitudes within clinical research, pitting the exploratory nature of drug discovery versus the regulation of clinical development; the innovation versus the process; the flexibility versus the rigor. Although each research discipline has brought valuable skills and experience to the field, there has been a growing need for effective integration and collaboration between them. Therefore, to accommodate the multidisciplinary nature of these studies, a flexible approach is required to fully utilize and exploit the data generated.

With our rich experience within both industry and academia at Exploristics, we understand the need for flexibility and provide an analytics service closely aligned with the requirements of both the researcher and the study. To do this, we have developed and implemented processes and standards which allow us to integrate multidisciplinary data sources while achieving the rigor of clinical statistics but with the ability to use innovative and exploratory methods when required. Moreover, at Exploristics we feel that future

success in the clinical development of new treatments will be fundamentally dependent on the application of correct study design, analysis strategy and decision criteria. With our statistical services and range of specialized software, the company is well placed to support this process, helping key decision-making and driving down the considerable costs now involved in developing new treatments. To address the multidisciplinary nature of the studies we support, employees come from a range of backgrounds within statistics, physics, engineering, molecular biology and software development with the majority holding a PhD. We have experience in handling a wide range of data types including next-generation sequencing, genotyping, protein arrays, gene-expression arrays, imaging modalities, metabolomics platforms and high-dimensional data, allowing us to implement practical solutions with novel data types.

Exploristics: offering strategic support in the design & analysis of clinical trials

Exploristics provides analytics and statistical consultancy services to a wide range of healthcare organizations, catering to the constraints encountered within drug development such as cost and time. We are able to assist researchers in a number of ways including the direct provision of analytics, training researchers to perform their own in-house analysis and the development and distribution of new software tools (Figure 1). We offer broad experience in clinical research, study design, statistical analysis and reporting, mathematical modeling and data management, with specific expertise in data mining, the development and application of new analysis methods and visualization techniques. Our range of specialized tools and purpose-built infrastructure enables us to address many of the issues encountered in running clinical trials today, allowing the company to offer key support in the design, execution and analysis of clinical trials. An example of the important contribution of our statistical expertise to biomarker identification within a clinical development program was recently published in the *Lancet Respiratory Medicine* [1].

Improving the success rate of clinical trials with good planning & design

At Exploristics, we have an active R&D program to develop software tools that help researchers increase the success rate of their clinical trials and research studies, maximizing the information they can derive from their data. A common difficulty encountered in many trials is that they contain multiple objectives but have been designed only to meet a primary objective based on a single outcome measure from the entire study popula-

tion (typically, a single measure of efficacy). This can be problematic when trying to identify effects for other outcome measures as there is usually substantial variability in measurements with some groups deriving benefit while others do not. Therefore it is important to measure multiple varied outcomes during a single study so that the therapeutic effect on the population, or a subset of it, can be more fully understood. However, it is not always clear prior to the onset of a study how it should be optimized. Often, inappropriate study design results in the need to extend the size and therefore cost of a trial in an effort to obtain statistically significant data, with many such trials producing contradictory and confounding outcomes.

Good planning and design of multiobjective studies is therefore fundamental to the success of any research study and yet this process is often neglected, particularly in personalized medicine. Exploristics has both the experience and track record in providing innovative technologies to facilitate this process, improving the prospective design and analysis of research programs and thereby the probability of their success. To do this, the company has developed computer simulation capabilities that enable evaluation of realistic study scenarios comprising complex data. Use of such simulation in a real study with 500 patients has shown its potential benefits, with good study design increasing the probability of identifying a genetically defined subgroup of patients by 40% without needing to increase either the size or cost of the study [2]. The same simulation technology has also been used successfully to optimize a development program for diagnostic tests as well as quantifying the impact of factors that improve or hinder study success [3]. Refinement of these simulation capabilities alongside a user-friendly interface has led to the development of KERUS, an intuitive software

Figure 1. Key areas of support offered by Exploristics.

platform providing complex simulation capabilities for the nontechnical user.

KERUS: optimizing trial design *in silico*

The new KERUS platform (Figure 2) [4] developed by Exploristics fills a gap in the market for a software package capable of generating and evaluating virtual research studies, without the need for a technical knowledge of mathematical modeling. KERUS has a simple interface with an easy to use point and click facility for inputting data which allows non-technical users to generate realistic simulations using both real and user-defined data. The platform comprises all of the tools required for running and analyzing virtual studies allowing users to examine multiple correlated end points to explore the impact of a wide range of criteria on the study outcome. This gives researchers the opportunity to refine the design of their study and data

Sample size	500	94.33%	100.00%	96.25%	89.33%	96.25%	96.25%
	400	89.67%	98.75%	94.50%	82.67%	93.25%	93.75%
	300	81.33%	97.75%	89.25%	69.67%	87.00%	88.00%
	200	57.67%	88.75%	84.75%	45.67%	75.50%	76.00%
	150	48.00%	84.25%	83.00%	35.33%	67.75%	68.50%
	100	33.67%	69.50%	80.25%	22.67%	52.50%	54.75%
	50	19.00%	40.50%	71.00%	10.00%	27.00%	28.75%
		1	2	3	4	5	6
		Analysis scenarios					

Figure 2. The KERUS™ simulation platform is designed specifically to give study simulations involving multiple correlated outcomes, a highly innovative feature.

analysis strategy *in silico* before embarking on costly clinical trials or research programs.

KERUS has a modular format and provides a core platform onto which further specialist software modules and services can be added. It has undergone intensive user testing at beta version stage by representatives from over 50 companies within the healthcare sector. KERUS is a leading-edge technology and has received positive feedback from organizations including large pharma, contract research organisations and academia. In July 2015, a locally installable version of KERUS was launched and a further enterprise version with software as a service complete with data repositories will be available in 2016. New modules for diagnostics, personalized medicine and benefit/risk studies are also currently under development and will address an emergent need for specialized support in these areas. Competitively priced, KERUS is accessible to a wide range of potential users throughout healthcare including drug developers, data providers, diagnostics companies, academia as well as regulatory authorities.

Future perspective

Increasing the success rate of exploratory research studies could transform the output of personalized medicine strategies. However, this will require a coordinated, multidisciplinary approach whereby analytic experts collaborate effectively to maximize the information derived from complex data. To improve the quality of the data generated, better prospective planning and design of studies is also needed to ensure trials are suitably powered so that they can answer relevant clinical questions and identify and develop new biomarkers.

Increasing the chances of success of studies through optimization *in silico* could therefore provide a real game changer in translating the large volumes of data now generated into meaningful information that can be used in the development of new treatments. Access to complex simulation techniques via user-friendly software such as KERUS can enable researchers to optimize study design and analysis methods in a low-cost virtual environment without the need for a technical knowledge of computer modeling. Indeed, increasing the success rate and cost efficiency of research programs and clinical trials could have a significant economic impact on medical research more generally, with the cost of clinical trials escalating in recent years. Our research has shown that optimization of study design through virtual simulation is able to deliver large cost savings as well as increasing the likelihood of success for individual studies and development programs [2,3]. With the provision of complex simulation *in silico* through our KERUS platform combined with the bespoke statistical services we offer, Exploristics is uniquely positioned to be a leading analytics partner for personalized medicine research going forward.

Financial & competing interests disclosure

The author has no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

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Executive summary

- Robust, growing company with expanding client list and history of repeat business.
- Provider of analytics services and products to life sciences.
- Services include data management, statistics, modeling, visualization and software development.
- Specialists in biomarkers, personalized medicine research, clinical trials and electronic health records.
- Focus on flexible, pragmatic and cost-effective solutions.
- Active R&D program to develop software products that maximize the information derived from complex data.
- First software product, KERUS™, launched in July 2015.
- KERUS enables the prospective optimization of design and analysis of research studies involving complex data.
- KERUS platform can be applied to a wide range of optimization problems in clinical research.
- Exploristics is the ideal analytics partner for personalized medicine research.

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