Molecular Health

Transforming Cancer Treatment to Improve Patient Lives

Using Powerful Big Data Technology and Analytics in the Battle Against Cancer
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Executive Summary

Each cancer diagnosis is unique, so individualized treatment is critical. With its Molecular Health Guide® (MH Guide) powered by SAP HANA®, Molecular Health is transforming cancer treatment. The solution mines and analyzes a wealth of data on each patient, their cancer, and relevant medical data to help oncologists quickly identify the most promising therapies. By advancing personalized, evidence-based medicine, Molecular Health is transforming cancer treatment to help improve patient lives and outcomes.
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Digital innovations
Big Data, analytics, and data curation and integration

Why SAP
Ability of the SAP HANA business data platform to process complex workloads in order to identify effective cancer treatments in a fraction of the time needed using traditional methods

Products and services
Molecular Health Guide® (MH Guide) powered by SAP HANA® – a solution to analyze the molecular and clinical data of individual patients against the world’s medical, biological, and pharmacological knowledge in order to drive more-precise diagnostic, therapeutic, and drug safety decisions

Market trends
Greater availability of DNA and genome data as well as Big Data tools, creating the opportunity to improve cancer care

Business goal
Creation of a data-driven approach to treatment decision support and help oncologists and patients in the battle against cancer

Outcome
Faster, better therapy planning for customers, including physicians, labs, and hospitals – leading to more-effective, safer, and more-timely cancer treatment

SAP® Solutions
SAP HANA
The best approach to treating cancer varies from individual to individual, depending on the person and their specific type of cancer. To identify the right treatment for a given patient, physicians traditionally have had to manually “match up” each case with the appropriate medicines using printed reports about lab samples, medical research, and pharmaceuticals. What’s more, because medicine, research, and cancer therapies are constantly evolving, those printed guidelines have the potential to be out of date.

Hospitals and labs have developed some solutions to help improve this process. But these have primarily been stand-alone, homegrown applications used for research systems that are not designed for use by oncologists treating cancer patients in a clinical setting.

Overall, the wealth of data needed to identify the right targeted cancer treatments has been siloed and not especially easy to access or turn into actionable insights. As a result, experienced oncologists trying to match patients and treatments often spend hours reading, researching, and talking to colleagues in order to pull together the information they need.

Molecular Health, a computational biomedicine company, decided to address this problem with an innovative software solution that draws on analytics and Big Data to reshape the entire process. Harnessing the power of the SAP HANA® business data platform, the company is using digital technology to arm oncologists with a practical, effective tool that brings data-driven decision-making to the front lines of cancer care.

I am driven by the difference we can make – and are making – for cancer patients, for caregivers, and for innovators pushing the boundaries of what is possible in medicine.

Dr. Friedrich von Bohlen, CEO, Molecular Health
Cancer Treatment Focused on the Individual

Molecular Health selected SAP HANA to create Molecular Health Guide® (MH Guide), a solution that accelerates the process of identifying effective, targeted treatments for cancer patients.

MH Guide analyzes genetic data about individual types of sample tissue from each patient. This data is used to create a variant calling file (VCF) or an XML file, which typically includes about 10,000 lines of information for one patient. The SAP HANA database, which is hosted in a private cloud, then runs these VCFs against data sets drawn from a massive, proprietary data set repository called Dataome®.

Built over the course of 15 years by Molecular Health, Dataome houses 10 terabytes of integrated current, comprehensive, and cleaned data about treatments, preclinical data and clinical trials, biomarkers, a host of other factors, and the interrelationships of them all. By quickly analyzing the individual patient’s VCF and the immense amount of Dataome data made available in MH Guide, SAP HANA helps to determine which treatments are most appropriate and which are likely to be ineffective – or worse, cause harm to that specific patient.

Using MH Guide, oncologists, labs, and hospitals can interact directly with the SAP HANA database to access the information for the analyses they have ordered. When a physician clicks on a tab to display effective treatments, for example, SAP HANA will run an analysis in real time to show a list of the most appropriate medications and flag those that are most likely to be ineffective or create unwanted side effects, given the patient and their disease. With the solution, a process that used to take half a day is done in seconds. The physician can quickly use MH Guide’s insights to make a decision about the most effective treatment for a patient using up-to-date information. Altogether, the speed with which physicians can access this accurate data helps them improve the care they give each individual patient.

MH Guide®, the only in-vitro diagnostic device of its kind in Europe and powered by SAP HANA, brings together 10 terabytes of molecular and clinical data, including data on:

- **56,000** Drugs
- **679,000** Drug interactions
- **7,350** Biomarkers
- **273,000** Protein interactions
- **126,000** Clinical trials
- **26 million** Publications

Oncologists can use the solution to get access to data for treatment outcomes for large volumes of patients.
Molecular Health worked with SAP to take advantage of the power of SAP® technology. The SAP HANA database provides the high levels of performance needed to quickly analyze billions of relevant data points to produce insights into treatment options. MH Guide uses the combined transactional data processing and analytical data processing capabilities of SAP HANA to quickly categorize and analyze patient data and the biomedical knowledge derived from Dataome. At the same time, its in-memory processing accelerates data processing and enables real-time analytics and will in the future also support the integration of machine learning algorithms.

With its high levels of performance, SAP HANA makes it possible for oncologists to interact with the data in real time. “The database has to run very fast, because this is a multi-user, concurrent application combining both OLTP and OLAP functionality,” explains Dr. Rudolf Caspary, CIO of Molecular Health. “When users click the tabs on their screen, the solution is automatically performing a lot of heavy load analytics for each tab.”

The solution also uses XS JavaScript (XSJS) in SAP HANA to deliver treatment options to physicians via the Web in a concise, user-friendly manner. This allows physicians to quickly find the information they need, while SAP HANA capabilities allow them to access various views and dimensions of the data with a few clicks. “The physician is in control of what he or she would like to see,” underlines Caspary. “That’s important because the machine provides all relevant evidence for a treatment decision, but the physician is responsible for the final decision.”

Physicians needed a better way to analyze patients’ genetic information and identify the right treatment. It is not an isolated research task, but it requires a big platform that serves many parties so physicians can quickly access all the data they need.

Dr. Friedrich von Bohlen, CEO, Molecular Health
Faster Flow of Medical Data

As demonstrated in the figure, the MH Guide process begins when a lab, acting on a doctor’s order, analyzes an individual’s tissue sample, looking at DNA and related proteins from both healthy and cancerous cells to create a large 20 to 50 gigabyte file for that patient. This is then sent to an MH Guide variant detection pipeline – a compute cluster that sorts through the file and finds relevant data to create a reduced file with about 10,000 lines of information in a structured format – the VCF.

SAP HANA then analyzes the VCF – which is essentially genetic information about a specific patient – against data from the Dataome database incorporated in MH Guide. Within minutes, it produces a set of prioritized treatment options for that patient. Accessing the solution via the Web, physicians can work interactively with SAP HANA to explore those treatment options. In addition, a clinical order portal (Molecular Health order portal) lets physicians initiate the entire process by placing orders through MH Guide analyses online. “When introducing a new software application for physicians, it is very important that it fits easily into the clinical workflow and works fast and efficiently,” says Caspary. “Physicians are chronically pressed for time, so both database performance and ease of use are paramount.”

As illustrated in the figure, with the MH Guide architecture, the process of matching patients and treatments is simplified, integrated, and accelerated. “SAP HANA in the cloud lets us connect quickly to many stakeholders, such as labs, physicians, and hospitals, to create a streamlined, user-friendly workflow,” emphasizes Caspary. “The beauty of the solution is that it lets users work with a wealth of data in a very cost- and time-efficient way.”

Figure: Molecular Health Guide (MH Guide) Solution Architecture – Overview
Physician Empowerment in the Battle Against Cancer

With MH Guide, physicians have a comprehensive tool that taps into the power of data to transform and accelerate the planning of cancer treatments.

The solution gives physicians the ability to quickly access up-to-date data and sophisticated analytics. At Charité – Universitätsmedizin Berlin, where the solution is being used for pediatric cancer patients, doctors have reported that MH Guide analyses were easily integrated into their clinical routines. They also say the solution helps with the daunting task of keeping pace with the latest discoveries in pharmacology and genomics.

The solution can be used by any organization that wants to use data to understand and improve the treatment of cancer.

At the same time, MH Guide provides oncologists and human geneticists with comprehensive explanations on the rationale behind its treatment options in the form of reports that cite relevant studies and publications and explain why a certain drug would work in that specific situation. These reports enable oncologists to communicate and collaborate with other physicians or their teams as well as with the hospital tumor boards that approve cancer treatments.

The ability to develop individualized recommendations in real time saves physicians hours of effort, which means they can get effective, targeted treatments to patients more quickly. That in turn helps drive better outcomes for those patients in terms of comfort, quality of life, and, potentially, a longer lifespan.

The solution can also have a bottom-line impact. For example, German health insurance fund Techniker Krankenkasse began using the solution because it saw potential savings from the reduced use of ineffective or harmful medications. In practice, the savings are expected to be so significant that tumor analysis with MH Guide will hopefully become part of the standard reimbursement package of insurers to certain types of cancer patients.

In addition to oncologists who are working with patients, the solution can be used by a range of parties, from labs to medical researchers – any organization that wants to use data to understand and improve the treatment of cancer.

MH Guide enables me to make decisions in under five minutes. I can easily review older reports, manage report versions, and even work with other tumor board physicians on the same patient case.”

Matthias Löhr, MD, PhD, Oncology, Karolinska Institute
Today, a growing number of organizations are using the MH Guide solution, including hospitals, laboratories, and universities around the world.

With the solution, Molecular Health is providing these customers with a powerful tool for improving healthcare and making cancer treatment more effective. Indeed, in Europe, MH Guide is now registered as an in vitro diagnostics medical device – providing confidence in high-quality data capturing and curation and its value and importance in clinical decision-making and data-driven, evidence-based medicine.

Looking ahead, Molecular Health plans to continue to evolve the MH Guide solution – for example, by extending it to provide insights specifically for molecular biologists as well as clinical oncologists and human geneticists. And as data and knowledge about cancer and treatments continue to grow, the Dataome database will grow as well. That may prompt the use of more artificial intelligence and machine learning capabilities in SAP HANA to handle those growing volumes.

Overall, with MH Guide powered by SAP HANA, Molecular Health has not only created a revenue-generating business opportunity. It has also positioned itself as a leader in healthcare innovation – one that is bringing data, analytics, and physicians together to move cancer treatment forward on the path to personalized medicine. In doing so, Molecular Health is working to fulfill the company’s motto – Better Data, Better Insights, Better Outcomes – and staying on the leading edge of a paradigm shift that promises to dramatically improve the treatment of cancer to benefit society – and each individual patient.

"Molecular Health sees great opportunity in combining the world’s wealth of molecular, clinical, and drug data with Big Data analytics to keep improving diagnoses, therapies, and outcomes – and make patients’ lives better."

Dr. Friedrich von Bohlen, CEO, Molecular Health