MarkLogic®

The Opportunity of Real World Data

WHITE PAPER

For Life Sciences companies, real world evidence initiatives present a golden opportunity to demonstrate the clinical and economic value of their drugs and medical devices—and to get those products to market faster. However, the success of real world evidence development efforts depends heavily upon your organization's capacity to generate results in a comprehensive and cost-efficient manner. The ability to extract more value from healthcare data is key to leveraging real world evidence to greater competitive advantage. Is your organization equipped for success?

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EXECUTIVE SUMMARY

Though researchers have long called for the use of patient outcomes data in medical evidence, the concept of Real World Evidence (RWE) is a more recent occurrence. According to the Network for Excellence in Health Innovation, "The premise behind generation and use of real world evidence is that richer data will yield better healthcare decisions and better care."[1]

Today, all stakeholders in the Healthcare ecosystem—including patients, providers, payers, and drug and medical device manufacturers—have an interest in the untapped potential and possibilities afforded by RWE from both a healthcare and economic standpoint. Life Sciences companies, in particular, have a vested interest in the opportunities presented by RWE and its potential value throughout product development and lifecycle.

As new drug therapies and innovative medical devices are made available to the public, payers and providers are under mounting pressure to ensure patient safety while reducing the overall cost of care. This increases the burden on Life Sciences organizations, e.g., Pharmaceutical and Medical Device Manufacturers, to not only demonstrate the effectiveness and safety of their products but to also show evidence of their product's impact on the total cost of patient care and proof of its value to patient health.

In a competitive landscape marked by uncertainty and risks from quickly changing payment models, and diminishing differentiation among drug classes and medical products—the time has come for Life Sciences companies to seize the opportunities available within their RWE initiatives by employing a strategy to extract more value from their data at less cost.

In this paper, stakeholders in the Life Sciences market will learn about critical considerations and pitfalls in real world evidence generation and the significant role data technology plays in determining the outcome of your organization's RWE efforts and ability to maximize return on investments.

REAL WORLD EVIDENCE: A CRITICAL COMPLEMENT TO RCTS

A Randomized Controlled Trial, or RCT, is a scientific (often medical) experiment that aims to reduce bias when testing a new treatment. Considered the gold standard for clinical trials, RCTs are used to test the efficacy of various types of medical intervention and may provide information about adverse effects, such as drug reactions.[2] However, to assess the cost-effectiveness of a drug in the real world and measure its impact on improving quality of care, RCTs need to be reinforced with the comparatively new standard of RWE.

In fact, the 21st Century Cures Act authorized $6.3 billion in funding, to expedite the process by which new drugs and devices reach approval. The bill incentivizes Life Sciences companies to invest in data strategies—and RWE—to further supplement RCTs or "Pragmatic Trials" and potentially support the approval of new indications for previously approved drugs.[3]

1 The Network for Health Innovation Issue Brief: Real World Evidence: A New Era for Health Care Innovation, September 2015

2 Wikipedia: Randomized Controlled Trial: https://en.wikipedia.org/wiki/Randomized_controlled_trial

3 Deloitte, 2017 RWE Benchmark Survey: Getting Real With Real-World Evidence (RWE), 2017: www.deloitte.com/us/real-world-evidence

> “A clinical trial is the best way to assess whether an intervention works, but arguably the worst way to assess who will benefit.”
>
> - Kravitz et al. Milbank Quarterly[4]

PAYERS AND PROVIDERS

Amplifying the call for evidence collected outside of RCTs is the fact that treatment decisions made by clinicians are no longer based solely on efficacy and safety as costs now play a crucial role in the selection of therapies. When it comes to managing the cost of care, demographically-homogenous RCTs are increasingly challenged by healthcare payers and providers who want deeper “real life” insights into how a new drug will perform—in terms of safety and effectiveness—once it’s approved and used by heterogeneous patient populations of the real world.

Further, while providers specifically look for data-oriented proof that the prescribed drug helps to optimize patient treatment and brings added cost-efficiency, payers (both government and private) also require both providers and manufacturers to further substantiate the value of the products and services they reimburse.

DRUG AND MEDICAL DEVICE MANUFACTURERS

When it comes to drug approvals by regulatory agencies (i.e., the FDA and the EMA), RCTs remain the ticket to play. But with increasing competition among Pharmaceutical companies, these regulatory agencies are inundated with New Drug applications and Abbreviated Drug Applications—further slowing the approval process. This issue is particularly painful for Life Sciences companies because it’s during this time in a drug or device’s lifecycle that it generates *costs*, rather than revenue, for the manufacturer. “For drugs, most of that time, in both Europe and the United States, is spent in clinical trials that can consume years and generate costs in the millions or even billions of dollars.”[5]

To accelerate the process of regulatory approval and reduce its financial burden, Life Sciences companies look to augment their RCT analyses with referential data collected from mainstream, real life use of the product. This illustrative real world data (RWD) is gathered from a number of key sources (e.g., doctor visits, labs, hospitals, and device registries), and can provide critical insights into questions around indication expansion, off-label use, brand protection, and competitor products.

Additionally, as part of the regulatory approval process, certain drugs require ongoing post-market surveillance via registries or longitudinal studies. The concern here is that though specific drugs may demonstrate beneficial effects, efficacy and safety during RCTs, they may later prove to have safety issues post-market approval as the patient population continues to grow. In these cases, RWE can advance signal detection that helps identify adverse events sooner rather than later—potentially saving the manufacturing company millions of dollars in fines from recalls and the lawsuits that result.

> “… Through 2020, patent loss will allow market entry of generic products with prices assumed to be about 70 percent lower than the price of the brand-name equivalents.”
>
> - Becker’s Hospital Review

4 Evidence-Based Medicine, Heterogeneity of Treatment Effects, and the Trouble with Averages, Kravitz et al. Milbank Quarterly. 2004; 82:661-687

5 Science Direct, Drugs and Devices: Comparison of European and US Approval Processes, Gail Van Norman MD, August 2016: http://www.sciencedirect.com/science/article/pii/S2452302X16300638#bib7

For Life Sciences companies, RWE can also present opportunities for competitive advantage that help offset the revenue decline that accompanies a brand's "patent cliff"—an unwelcome occurrence in which the company stands to lose billions of dollars in revenues from the expiration of a once patented drug that can now be manufactured and sold generically at a much lower price by a competitor.[6]

PATIENTS

But providers, payers, and Life Sciences companies aren't the only ones who stand to benefit from the advancement of RWE. The overarching objective for all stakeholder groups is to align in the generation of RWE as a means to assess and improve the clinical and economic value of healthcare products in a way that is trusted and meaningful to *all* stakeholders—foremost the patients expecting better results from their treatments.

THE CHALLENGES OF REAL WORLD DATA

Analysis of real world data is widely considered valuable to the development of research hypotheses and questions tested with RCTs, including trials for new or expanded use of existing products.[7] In this, the insight derived from the data analysis opens the door for Life Sciences companies to deliver evidence that proves the value of their products in improving quality of care and patient outcomes. But the road to opportunity is not without its ruts.

Real world data is observational data related to patient treatment and originates from a variety of sources, including registries, claims data, electronic health records, and online/social media data. Taken individually, these sources of data do not provide much context, but when these disparate data sources are collected and analyzed together, the insights generated can be used to:

- Accelerate product development
- Prove efficacy and safety
- Expedite clinical trial outcomes
- Identify unmet medical needs
- Advance value-based payments
- Defend market access over competitor products
- Demonstrate comparative effectiveness
- Maximize return on R&D investments
- Access new markets

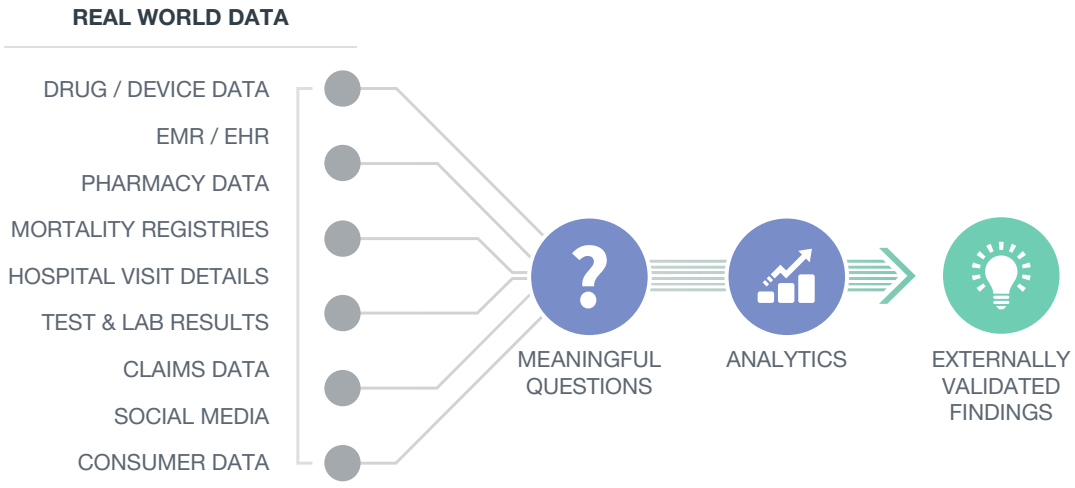

Figure 1. Disparate real world data sets must be fully integrated together to generate effective real world evidence.

6 Investopedia: Patent Cliff: http://www.investopedia.com/terms/p/patent-cliff.asp

7 The Network for Health Innovation Issue Brief: Real World Evidence: A New Era for Health Care Innovation, September 2015

To achieve these RWE goals, Life Sciences companies need to employ efficient, secure methods for collecting, connecting, and contextualizing all of this data in a manner that leads to fast, accurate and actionable insights. However, there are a number of roadblocks to the efficient development of RWE. From a data standpoint, these obstacles stem from the following:

- Disparate data silos and multi-structured content
- Data governance and security issues
- Slow search and limited results for data analysis

Let's examine all three of these challenges a bit more in depth …

DISPARATE DATA SILOS AND MULTI-STRUCTURED CONTENT

Historically, most researchers across the healthcare ecosystem conducted their work in silos for limited purpose and limited audience. So, it's not surprising that today's Life Sciences organizations tend to rely on point solutions for data management and research. With these singular, specific-use solutions, the conclusions of data scientists tend to be limited because they are burdened to first identify all available sources of data and where it's located, who has access to it, and what types of questions can be derived from it. This is problematic as real world data is stored across disparate data silos, and without a bridge between data models, finding and sharing the data is complicated and time-consuming.

DATA SILOS

Disparate data silos represent the steepest hurdle. For Life Sciences companies, it's incredibly time-consuming to fuse high volumes of real world data together because the data typically exists within disparate third-party data sets that consist of multi-structured information, segmented and siloed throughout the healthcare ecosystem as follows:

- Administrative data such as claims, reimbursement, and cost information are stored and used by financial and operational management teams. This data is used to carry out the business side of healthcare, but is not used to inform patient care or treatment protocols, and is often incomplete.

- Clinical data (e.g., patient history, vital signs, progress notes, and diagnostic test results) is stored in Electronic Health Record (EHR) systems. Clinical data is stored and accessed in different systems by research analysts, clinicians, statisticians, brand managers and other frontline clinical staff and is used to track patient care and communicate treatment plans.

- Quality and outcomes data such as hospital readmission rates, adverse reactions, complaints data, and call center data are all within the domain of quality and risk management departments.

- Vital patient-reported data, especially those reflecting quality of life issues, can often be found online and over social media channels but is often overlooked because its unstructured nature does not fit neatly into traditional data management systems.

Compounding the complexity, each of these source systems has its own vocabulary—making it difficult to make sense of the data once it's aggregated. For instance, one data set may include five patient statuses …

{Intake, Scheduled, Telemedicine-only, Discharged}

… while another might include only three:

{Scheduled, Needs_Followup, Inactive}

These statuses often overlap and prove difficult to map to one another.

MULTI-STRUCTURED CONTENT

In traditional data warehouse environments, “unstructured data” (or data that doesn’t fit readily into relational database tables) is not searchable together with structured information, making it difficult for data scientists to link and correlate information. And this isn’t an obstacle that can be easily ignored as it's currently estimated that 80% of all healthcare information may be unstructured.[8] The problem is especially pressing for Life Sciences companies striving towards RWE because many sources of critical information—including clinical test results, scanned documents, images, progress notes, patient diaries, literature reports, and annotation reports by medical reviewers—exist as unstructured data.

Data warehouses are typically of fixed design. To be used for analytical purposes in this environment, unstructured data must first be extracted from one or more source systems, transformed, and then loaded (ETL) into a central data model. These cumbersome ETL processesare time-intensive—efficient only in transforming the data scientist into a “data janitor.”

Once all of the data resides within the data warehouse, the IT department is burdened with building a search engine on top of it. Then, as new data sources are added, the brittle nature of repeated data modeling causes inevitable delays in development at the application and user interface level. In this situation, real-time data analysis is impossible as the relevance and accuracy of data is hindered by the interval of time it takes to build a unified data model.

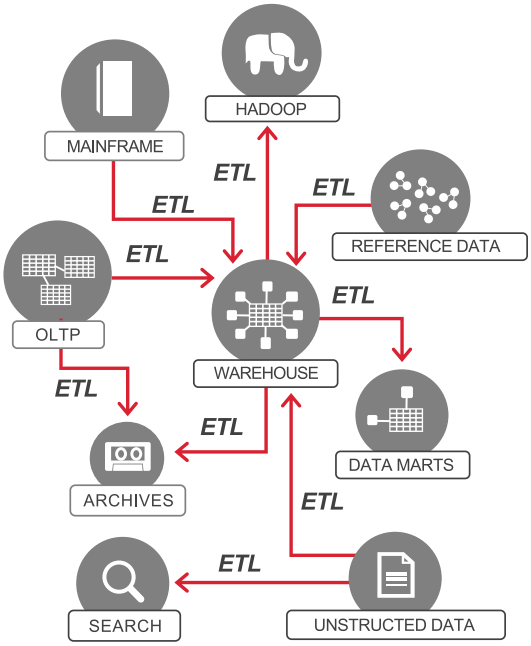

Figure 2. To make it useful for analysis, unstructured data must first be made to fit the data model via time-consuming ETL processes.

DATA GOVERNANCE AND SECURITY ISSUES

Repurposing of routine medical data for additional analyses often requires data cleaning and cross-referencing. These techniques can confirm the data’s internal consistency and identify missing values, but they cannot determine its accuracy and authenticity. How do you ensure accountability in your real world data when the data is sourced from many silos, each with its own notions of data governance? Comparing data from traditional clinical research, or Pragmatic Trials, to source documents through audits (i.e., external consistency) is an essential additional step in verifying the accuracy and completeness of the data. This type of verification is important for real world data intended for use in regulatory analyses. And speaking of regulations, another significant challenge in working with

8 Forbes: Big Data, Big Hype, CIO Network, February 2014: https://www.forbes.com/sites/ciocentral/2013/02/04/big-data-big-hype/#5467775d3666

real world data is posed by regulations regarding patient privacy and confidentiality. The Health Insurance Portability and Accountability Act (HIPAA) requires healthcare entities and their business associates to protect the privacy of patient information. The sharing of healthcare data between departments and organizations is often frustrated by the need to protect this data. To work around this, when wanting to share data, data scientists are forced to wrangle the data to meet requirements for de-identification. Attempts to "de-identify" real world data in this manner can obfuscate it to the point that it loses its value. And in certain situations, as in the case of the strict data residency and sovereignty laws of some European countries, researchers are altogether prohibited from moving or sharing any patient data.

SLOW SEARCH AND LIMITED DATA ANALYSIS

As outlined above, the diverse data—structured and unstructured—needed to support Life Sciences objectives for RWE exists in disparate data sets. Searching across this unrelated data for content is inefficient with query results slow and limited by lack of "big picture" context for the data.

Further, the use of real world data for secondary and tertiary analysis presents another complexity in that healthcare analytics are often derived from the secondary use of data. For instance, whereas administrative data is collected primarily for the accounting of services rendered and payment collection, EHR data is collected to track patient progress, treatment and clinical status. When these types of specific-use data are then used to measure quality and outcomes for RWE purposes (e.g., comparative effectiveness, cost reimbursements, behavioral analyses), researchers must recognize that the original use of the data may have limited it in a way that potentially compromises the reliability and validity of any resulting conclusions.

Worse, secondary and tertiary analysis is often performed within data warehouse environments in which context is further lessened—rendering correlations suspect at best.

REAL WORLD DATA PLATFORM REQUIREMENTS

To accelerate and extract more value from their RWE efforts, drug and medical device manufacturers should address these data challenges by adopting agile technology designed to meet the unique requirements for RWE development.

> "As the demand for RWE increases, companies are turning to new technologies to compress the workflow and improve time to insight."
>
> - Deloitte RWE Benchmark Survey

The ideal technology solution would enable Life Sciences companies to accelerate the generation of RWE and ensure the quality of it. The MarkLogic® database platform supports development of RWE, providing key capabilities that enable:

- Rapid data integration and harmonization
- Data governance, privacy, and quality assurance
- Faster time to insight

RAPID DATA INTEGRATION AND HARMONIZATION

Efficient development of RWE calls for the rapid integration and harmonization of all types of real world data—structured and unstructured—from disparate and siloed sources, including claims data, patient registries, electronic health records and social media data. MarkLogic delivers these capabilities at less cost and less time.

Figure 3. MarkLogic's agile Real World Data Platform

ELIMINATE DATA SILOS

With MarkLogic, data scientists can load data of any format from any source *asis* and search the new data immediately with an integrated search engine. Documents such as PDFs will be converted to industry-standard XML for intelligent search or sharing among systems. The flexibility of storage options supports adding new metadata to the content, such as ICD or MedDRA codes, that connects the data in new ways. This ability to quickly ingest new data and create associations significantly decreases application development time—with most built within two to six months time.

MAKE BETTER USE OF ALL DATA IN LESS TIME

Multi-structured (or unstructured) data is critical to monitoring the effectiveness of medications, devices, patient outreach, and patient compliance. The challenge is first to make it available so that it can be searched, processed, and analyzed. MarkLogic is uniquely designed to support agile processes because it allows for the ingestion of *all* real world data without the need for extensive data wrangling, enriches and links this variable data, and indexes it all for full-text search, so the real work can begin faster and with less cost.

MarkLogic further supports processing and analysis of all data by separating the "noise" from the useful content when data scientists search for certain patterns or phrases, then enriches the content with the use of natural language processing tools. Once content is enriched, it provides greater value to the data scientists and more precise results in advanced analytics engines.

DATA GOVERNANCE, PRIVACY AND QUALITY ASSURANCE

Because the methods used to develop RWE are just as critical as the evidence itself, MarkLogic provides Life Sciences organizations with the means to ensure data governance and quality. Along with the ability to quickly address concerns with quality, transparency, provenance, lineage, completeness, and accuracy, MarkLogic's database platform also includes bitemporal capabilities that allow data scientists to ascertain and keep a better record of "what they knew" and "when they knew it"—further validating the integrity of the data.

> “Regardless of the original purpose for the collection of RWD, requirements for data collection and quality assurance should be put into place during the data source design and development stages to optimize the reliability, quality and usefulness of the data.”
>
> - FDA[9]

ENSURE DATA SECURITY

Much of real world data is under strict privacy and security regulations in both the U.S. and abroad. MarkLogic is one of only six database vendors – and the only NoSQL database – with NIAP Common Criteria certification. And with its advanced encryption and element-level security, MarkLogic ensures granular data security and supports users with assigned roles and privileges, meaning a user’s rights are always checked before enabling access to any data. Further, RWD can be grouped into "collections" that provide additional ways to manage role-based permissions.

STAY ALERT TO CHANGES

Real world data from disparate sources may arrive at different times and needs to be processed and integrated into the composite record. By notifying researchers when new data is ingested that matches a predefined query, MarkLogic alerts provide real-time notifications on newly ingested data that a researcher may be interested in (e.g., adverse events, signal detection). And, while similar in some ways to the triggers found in relational databases, MarkLogic is different in that it can handle hundreds of thousands of saved queries for alerting, and can send hundreds of millions of alerts per day—with minimal effect on system performance.

To ensure data quality, alerts can be created to capture and resolve known issues. For example, if a required field is missing, an alert code may entail periodically connecting to a reference data site to look up the necessary information until it is available. Using MarkLogic alerts to correct data quality issues can considerably reduce the time and effort needed to generate RWE.

FASTER TIME TO INSIGHT

Healthcare datasets should include accurate metadata that describes when, how, and by whom the data was created. Metadata helps ensure that analysts understand each other, their analytics are repeatable, and that future data scientists can query the data and find what they seek.[10]

DISCOVER NEW RELATIONSHIPS

Life Sciences companies benefit from enhanced discovery with advanced semantics capabilities that allow data scientists to harmonize and query across all data—and its critical metadata—to find deeper context and hidden connections within it. For example, a search for “cardiac catheter” can be expanded to include anything related to “implantable devices” by using a semantic ontology. MarkLogic’s "ask anything" platform indexes data as soon as it's loaded, enabling researchers to immediately ask questions of it and receive lightning fast, sub-second results.

9 US Food and Drug Administration, Use of Real-World Evidence to Support Regulatory Decision-Making for Medical Devices: Draft Guidance for Industry and Food and Drug Administration Staff, September 2016: http://www.fda.gov/downloads/medicaldevices/deviceregulationandguidance/guidancedocuments/ucm513027.pdf

10 QUALITY & GOVERNANCE NEWS, Understanding the Many V’s of Healthcare Big Data Analytics, June 05, 2017: https://healthitanalytics.com/news/understanding-the-many-vs-of-healthcare-big-data-analytics

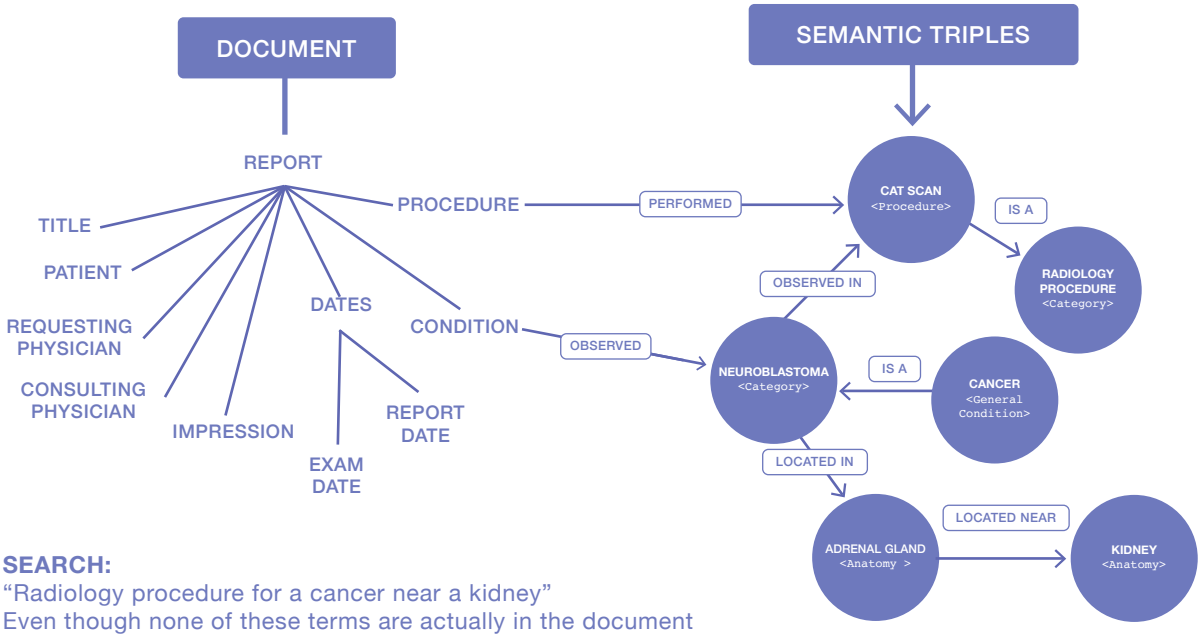

Figure 4. Advanced semantics capabilities enable rapid discovery of hidden connections and relationships

By integrating disparate data silos onto a real world data platform, data scientists can take advantage of semantic technologies to harmonize and link this unified data using shared vocabularies and publicly available medical taxonomies. This single view helps scientists to "connect the dots" for greater insights and more informed decision-making, e.g., "Go or No" decisions on clinical trials, patient selection, on-boarding, competitive intelligence, and global regulatory compliance initiatives.

ENHANCE ANALYSIS AND INSIGHT

Analysis of real world data sources is widely considered valuable to the development of research hypotheses and questions that can be tested in RCTs of drugs, devices, and procedures—including trials for new or expanded uses of existing products.[11]

Analytical limitations reduce the power of the healthcare data being produced every day. To improve RWE decision-making, Life Sciences companies must first achieve a complete 360 view of their data. Defined as gathering, analyzing, and leveraging all of the data an organization has on its competitors, products, and customers—MarkLogic enables a 360 view of data by combining operational data sources with big data sources to create an on-demand analytical view that provides enhanced discovery of untapped yet critical information and faster time to insight.

When disparate data sets are integrated together into a single platform, the unified view can illustrate relationships and patterns that allow co-occurrence analysis that may show "heat density" or "popping" activity. In these cases, the data itself tells data scientists *what they know* and *what they don't know*—and therefore what questions to ask—potentially revealing dramatic new information.

11 The Network for Health Innovation Issue Brief: Real World Evidence: A New Era for Health Care Innovation, September 2015

IMPROVE FORMULARY POSITIONING

Used effectively, a 360 view of data can reveal unknown correlations and hidden patterns in medical research. The insights and intelligence derived from these revelations can improve patient outcomes, inspire the development of new products, guide formulary positioning in the market—and create competitive advantages for the company.

MARKLOGIC'S DATABASE PLATFORM ADVANCES RWE

The ability to access, analyze, and manage vast volumes of multi-structured real world data is critical for process improvement, clinical insights, brand protection, and competitive intelligence. MarkLogic eliminates many of the challenges Life Sciences companies encounter when integrating data from a variety of sources and formats.

> "For any given drug, payments will be increasingly based on evidence of the real world impact of the medication."
>
> - The Value of Real World Evidence[12]

An Enterprise NOSQL database provides the features and functions required for an RWE platform (including JSON, XML, Semantics/RDF, Search, etc.) and simplifies the polyglot persistence challenges of other architectures. And, because all of these capabilities are integrated together, MarkLogic provides unrivaled capabilities in data ingestion, search, data linking, and application development time.

CUSTOMER USE CASE

A METADATA CATALOG FOR A FORTUNE 50 COMPANY

Our customer, a Fortune 50 company, built its RWE application, a metadata catalog, on the MarkLogic database platform. The company chose MarkLogic because of its ability to ingest and store data from a variety of formats, harmonize it, and find relationships among the data. The flexible capabilities of the platform, its powerful semantic search and ability to include Java and REST APIs, enabled the company to experience the many advantages of an agile, scalable, secure database platform—over traditional, limited, off-the-shelf tools.

The company has achieved a number of time and cost benefits by using a technology platform that empowers its data scientists to:

- Ingest and integrate all types of disparate data—structured and unstructured—and harmonize it with a common language.
- Ensure data governance, including quality and transparency by addressing concerns with provenance, traceability, timeliness, completeness and accuracy.
- Query across data and metadata with semantic search that enables discovery of hidden relationships and connectedness among the information.
- Rapidly build and search on specific data views. Users can filter and analyze data using a variety of questions to find precise information. For example, if researchers need a view of patients over the age of 35 with diabetes, COPD and a thrombosis—MarkLogic can deliver up that information within seconds.

12 Strategy and PwC, Analyst Report: Revitalizing pharmaceutical R&D: The Value of Real World Evidence, 2015: https://www.strategyand.pwc.com/media/file/Revitalizing-pharmaceutical-RD.pdf

Today, the MarkLogic-based metadata catalog allows researchers to more quickly derive critical insights to accelerate product development across both Healthcare and Life Sciences markets—giving the multinational Pharmaceuticals company a competitive advantage.

CONCLUSION

According to the Network in Health Innovation, "... Robust RWE will not only tap increasing volumes of data but weave together different sources of data, such as clinical, genomic and socioeconomic, to yield a better picture of individual patient characteristics and improve medicine's ability to treat individual patient needs."[13]

For Life Sciences companies, the ability to efficiently develop and deliver RWE enables them to demonstrate the clinical and economic value of their products. And as they gain a better understanding of the underlying causes of disease, drug and medical manufacturers will leverage RWE to more rapidly provide the public with new drugs and devices that result in higher quality of care and improved patient outcomes. The degree of success of RWE development, however, depends heavily on selecting a platform that can support the integration and harmonization of multi-structured data.

MarkLogic is the only Enterprise NoSQL database platform able to integrate vast and disparate data sets together and harmonize it all for actionable analyses and secure operational functionality. With advanced semantics capabilities, data scientists can securely search this unified data for greater insights, and then receive real-time alerts when new data becomes available. Whether it's adverse event reporting, data discovery or competitive intelligence, MarkLogic advances enterprise objectives around RWE—improving time to market for new products and reducing the overall cost of IT infrastructure.

ABOUT MARKLOGIC

As the world's best database for integrating data from silos, MarkLogic's database platform empowers our customers to be more agile and cost efficient, advancing development and delivery of RWE to expedite pre- and post-regulatory approval processes. Life Sciences organizations trust MarkLogic to help accelerate the development and availability of new drug therapies and medical devices.

MORE INFORMATION

Point solutions and relational databases were not built to overcome the challenges associated with the integration of massive volumes of disparate and multi-structured data. Learn how MarkLogic's database platform enables Life Sciences companies to leverage all of their data to accelerate development of RWE:

- **The Importance of Metadata to Life Sciences**
  What if you could run complex queries across all of your data and metadata—no need to shred it first—with lightning fast results? Learn how MarkLogic features powerful search and semantics capabilities that enable you to extract more value from your metadata. Read the blog post.

- **Semantics for Dummies**
  Semantics is a data model that focuses on relationships, which adds contextual meaning around the data so it can be better understood, searched, and shared. Learn how leading organizations are more efficiently integrating disparate, multi-structured data and building smarter applications with rich analytics capabilities. Read the eBook.

13 The Network for Health Innovation Issue Brief: Real World Evidence: A New Era for Health Care Innovation, September 2015

- **NoSQL Advances Analytics in Life Sciences**
  Adverse event data is often buried in mounds of information; requiring extensive filtering that can take hours just to find it. Learn how MarkLogic enables data scientists to quickly narrow down datasets to just the “features of interest,” reducing the time it takes to get data to the machine learning aspects of signal detection. Read the blog post.

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