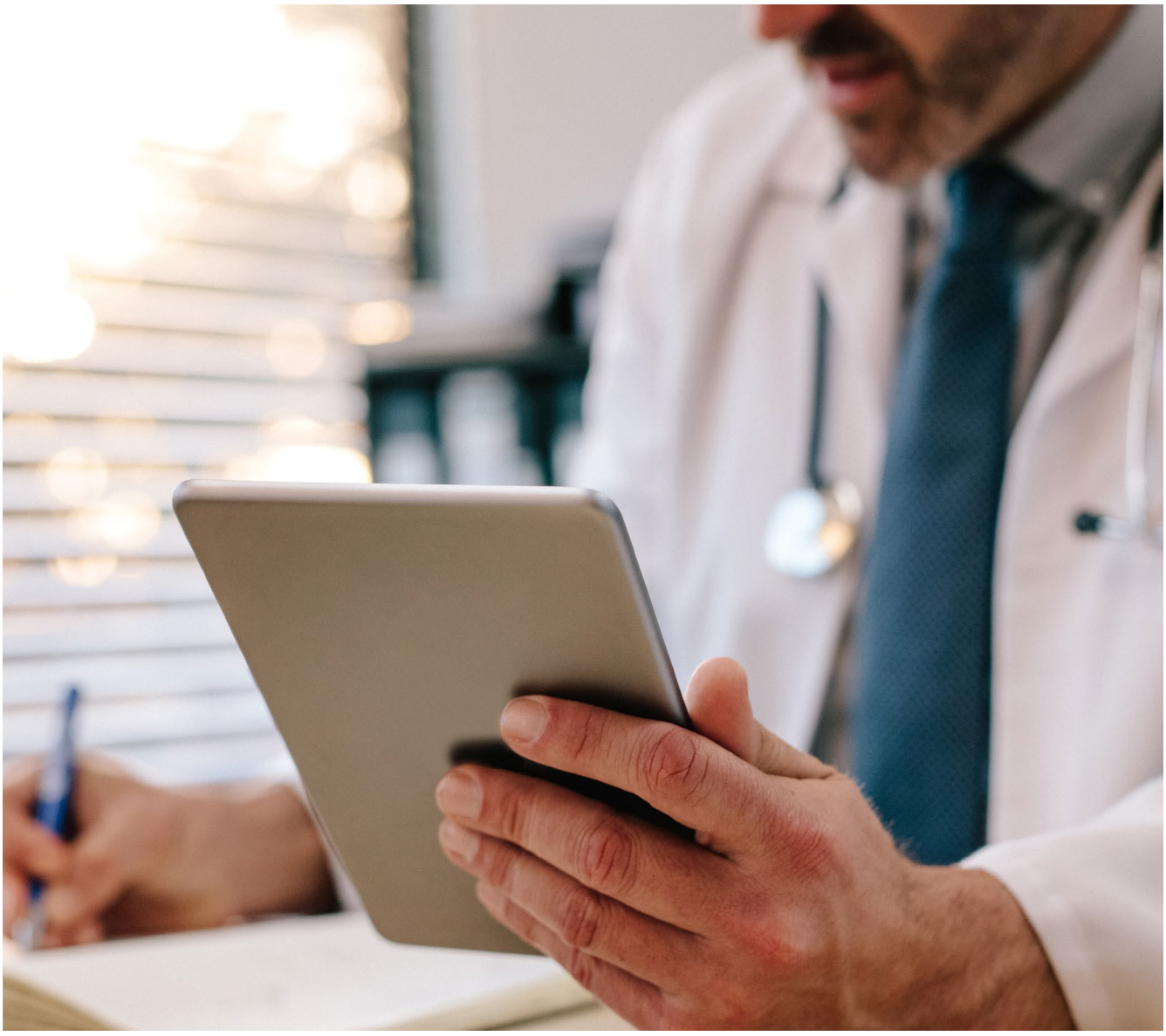
Why Healthcare Needs a New Breed of Analytics



Orion Health White Paper
Jerry Hart
Product Director
072016

ORION HEALTH

Overview

Around the world, healthcare is coming under increasing pressure as expectations on health systems continue to rise and the cost of care continues to approach unsustainable levels. In the US, there are mounting efforts to move from the traditional fee-for-service model to value-based reimbursement, where providers assume risk for the overall cost of care. Globally, health systems are striving to improve the delivery of care but are inevitably hamstrung by their inability to measure and track outcomes, ever-changing quality measures, and the processes they're responsible for. At the heart of these issues and initiatives is the inability for healthcare organizations to effectively enable system-wide quality improvements and cost-reduction efforts.

Measurement is the first step that leads to control and eventually to improvement. If you can't measure something, you can't understand it. If you can't understand it, you can't control it. If you can't control it, you can't improve it.[1]

Measuring care processes and outcomes across a health network is complicated by the fact that patients, especially those with significant health challenges, receive care from a variety of services within, or outside of, that network. Meaningful analytics is therefore impossible unless information from those various care settings can be aggregated into a single repository in which the analysis and measurement can be performed. While the digitization of health information is progressing at an impressive rate due to the increased adoption of EMR systems and the growing prevalence of devices that capture and measure health information, healthcare systems have failed to truly harness the value of that data, as it continues to exist in silos, which makes sharing difficult. And even when it is shared, it's not usually accompanied by any other meaningful information except that which must be supplied in order to comply with existing regulations and avoid financial penalties.

As a result, the majority of measurement done within healthcare systems today tends to be focused solely on problems that can be adequately analyzed from data from either a single or small number of source systems, and even those quality measures are flawed due to a lack of near-real-time clinical data. This typically restricts analysis to either:

a. activity that occurs within a single care setting or
b. areas that can be adequately measured through the use of claims data.

Despite providing limited insight into the nature of the care delivered, claims data does provide a single source of information that covers a broad range of healthcare activity across a population. As healthcare organizations are well aware, this current approach leaves significant gaps in the insights they have available about their populations—care gap identification is plagued by false positives and lateness, predictive models fail to reach the levels of accuracy required to implement meaningful response programs, and siloed analysis fails to adequately identify the true causes of inefficiency in an overall health system.

These challenges are not insurmountable, and immense benefits will be realized once the challenges have been addressed, but will require a new breed of technology to resolve them effectively. Specifically, tomorrow's healthcare analytics platforms will need to:

[1] H James Harrington, CIO, September 1999, p19

- Address the evolving integration challenges presented by the healthcare environment
- Scale to effectively handle the increasing volumes of data being collected about a patient's healthcare and status
- Be flexible enough to keep pace with the evolving quality-measurement needs of health systems
- Integrate directly into care delivery processes and workflows
- Leverage advanced analytics and machine-learning techniques to more accurately understand and predict outcomes

Orion Health made it a priority to approach each of these challenges in the design and build of Amadeus, its next-generation population health management platform.

Tackling the Integration Challenge

The foundation of any meaningful healthcare analytics implementation is a repository of high-quality data. Despite significant efforts from standards organizations like HL7®, initiatives like FHIR®, and regulatory incentives for vendors and healthcare organizations to improve system interoperability and data sharing, inconsistencies and quality issues plague the information exchange interfaces of healthcare systems. As a result of these challenges, a majority of analytics initiatives fail to move past the task of implementing and populating the underlying data repository.

Due to the large number of source systems that must typically be integrated to adequately profile and report on outcomes within a population, analytics platforms must be extremely cost effective at building high-quality integrations. This requires tools that:

- Natively understand the interoperability message formats of source systems
- Support real-time message feeds and the specific challenges that event-based integration presents
- Analyze message feeds to identify variants from message standards and other data quality issues
- Provide tools to support efficient iterations of message loading and output analysis, along with robust monitoring and error-handling infrastructure

Amadeus combines the depth of integration experience built into the Rhapsody integration engine for over 15 years and couples this with its next generation data engine. The raw data store component provides a highly functional implementation of the data lake enterprise integration pattern to store data of all shapes and sizes in a single repository. The data processing pipeline allows acquired data to be processed and mapped to evolving data models over time, avoiding costly re-acquisition efforts as usage requirements evolve. To effectively handle real-time data streams, it provides a sophisticated event-sourcing infrastructure that handles the common issue of message re-ordering and variable data update modes that message feeds inevitably present.

From a data modelling perspective, analytics platforms need a rich set of prebuilt, standards-based models that cover the core clinical-, claims-, and device-data domains. The HL7 FHIR resource set has rapidly evolved to provide a well-considered data model set to support the needs of healthcare integration, and it's the obvious model for healthcare analytics platforms to adhere to.

However, the future requires these platforms to provide the flexibility to extend core models, create entirely new models to support evolving data acquisition needs, and—as social, behavioral, environmental, and genomic information becomes increasingly important in the effort to analyze and predict health outcomes—support the collection and utilization of a much broader range of data points.

Amadeus data spaces couple a rich library of HL7 FHIR-based data models that cover core clinical-, claims- and device-data domains with the ability to design and deploy custom data spaces through an intuitive user interface. This ensures that healthcare organizations can ingest and model all of the data required to advance their analytics requirements.

Scale

As organizations look beyond core clinical and claims data integration to data sourced from devices, large genome data sets, and information from supporting systems that provide insights into behavioral, social, and environmental factors, healthcare analytics platforms will be presented with ever-increasing scalability challenges.

Other industries have already been forced to tackle these challenges, and technologies frequently referred to as "distributed databases" and "computing engines" have emerged to meet the demand. Databases built for speed such as Cassandra and Elastic Search, and computing engines such as Apache Spark, allow storage capacity and processing power to be spread across multiple servers, providing the ability to incrementally increase capacity by augmenting the size of the server clusters that support the deployment. There are numerous examples of these technologies being deployed across thousands of clusters, storing petabytes of data, and processing millions of transactions per second. But equally, deployments can begin on small, commodity hardware clusters, which eliminates the need to anticipate future processing needs and make a large, up-front hardware investment.

Complementing these technologies are Infrastructure as a Service (IaaS) providers such as Amazon Web Services (AWS), who simplify the process of provisioning and deploying new hardware, literally to the point of the click of a button.

For software vendors, leveraging these technologies requires a significant R&D investment and specialized engineering teams for integration and deployment. Waiting until existing technology choices reach a breaking point will leave many without sufficient time to make the transition. Recognizing this, Orion Health has been investing in developing its next generation platform for the past two years. It has large-scale installations of its data engine, streaming & computation engine and patient registries (backed by Cassandra, Elastic Search, and Apache Spark, respectively) in production today in large payer and provider organizations. We are using AWS to simplify our ability to deploy and scale our customer solutions on demand.

Flexible and Extensible

As healthcare organizations continue to broaden the data available for measuring processes and quality—and predicting outcomes across populations—the possibilities for refining existing reports and algorithms and creating entirely new ones are significant. To respond effectively to these rapidly evolving demands, healthcare analytics platforms will need to be much more flexible and extensible than ever before.

To help provide this flexibility, Orion Health has chosen Elastic Search as the database to support its patient registries. Its high-performance, full-text indexing capability provides the ability for general-purpose registry designs to effectively support a much broader range of analysis without needing to design and deploy use-case-specific registries.

Furthermore, its schema-less design allows solutions to evolve without costly schema updates and migration efforts. Coupling the inherent flexibility of these technologies with intuitive query builders and dashboard designers—without requiring ongoing software enhancements to support evolving use cases and new regulations—will empower our customers to extend and evolve their solution.

In addition to flexible data modelling, query building, and report design, we have recognized the need to integrate third-party algorithms and groupers, as well as enable more advanced healthcare organizations to create, deploy, and evolve their own. Our streaming & computation engine is built on top of the highly extensible Apache Spark, which supports a wide range of application integration approaches, comes bundled with a machine learning library, and supports plugins written in Java, Python, and R—tools commonly leveraged by data scientists to deploy advanced analytics and machine-learning algorithms.

Care Delivery Integration

Another key challenge that hinders the effectiveness of today's healthcare analytics solutions is the limited ability to use the insights generated by these platforms in the delivery of care. Identifying high-risk patients and patients with significant care gaps is meaningless unless physicians and care coordinators are informed and empowered to help those patients. Printed lists and spreadsheets are all too common in today's healthcare environment and result in highly inefficient processes that hinder rather than help.

Amadeus integrates effortlessly with Coordinate, Orion Health's care-coordination solution. Patient cohorts defined through Amadeus' analytics application, Population Health Explorer, can be pushed to the provider's workflow through shared worklists, triggering of tasks, and enrollment in care pathways, from which proactive care management interventions can occur.

For customers using third-party care-coordination platforms, Amadeus not only provides the traditional file-based export mechanisms, but a series of REST APIs that allow third-party applications to integrate programmatically with defined cohorts in real time.

Conclusion

While the increasing digitization of health data offers unprecedented opportunities to measure and improve the delivery of healthcare, the technology challenges that must be overcome to realize those opportunities are daunting. They require a new breed of platform and cutting-edge applications, combined with a depth of understanding about healthcare data and its unique integration challenges. It necessitates modern technology frameworks that provide the scalability, flexibility, and extensibility to grow and evolve with the ever-changing demands of the healthcare industry.