Modern Healthcare Business Intelligence
Santa Clara Valley Health & Hospital System: A Case Study

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About
Santa Clara Valley Health and Hospital System (SCVHHS) provides healthcare services to community members who reside within Santa Clara County, California. The system through its six agencies provides high quality inpatient, ambulatory, behavioral health, custody health, public health and emergency medical services.

314e is a healthcare IT services company, based in Fremont, CA. Since 2004, 314e has assisted over 100 provider organizations with implementation and support of EHR and other systems. In addition, 314e has a large analytics practice.

Problem
SCVHHS has felt an increasing pressure to keep up with the growing demands for reporting and analytics. The user community is interested in making data driven decisions for operational improvements and to validate organizational strategies. The shift from volume to value-based care creates a need for data in an actionable form, readily available to support decision-making. Typical to organizations with similar profiles, clinical and financial data at SCVHHS spans many systems which are maintained by different departments, creating information silos. Analysis of this data will provide insight into the state of community members’ health, as well as a financial and clinical operational overview, allowing SCVHHS to manage its health services effectively.

At an operational level, SCVHHS faced challenges including:
- Demand for scarce and expensive programmer-level resources
- Lack of standards in report development
- Turnaround time from request to delivery of reports is 6 plus months
- Business Intelligence (BI) tools overload – parsing through vendor claims of “silver bullet” solutions

These challenges resulted in the initiation of SCVHHS’s BI program. SCVHHS, after an extensive search, selected 314e to assist with its BI program’s strategy definition, tools selection and detailed implementation.

314e, in an advisory capacity, assisted SCVHHS with determining a path through its operational and analytical reporting obstacles. 314e engaged and collaborated with SCVHHS’s business executives, managers, and operational staff to establish a robust plan to achieve self-sufficient reporting capabilities.

BI issues not only involved changes to tools and technology, but also soft problems including educating key SCVHHS staff with cross-functional domain expertise through a resilient educational program and formalized data governance. To establish a successful self-service reporting program, it became apparent that a BI tool infrastructure that is modern and reduces the proportion of resources was crucial.
**Strategy**

SCVHHS, with 314e’s assistance, established vital BI strategy components including:

**Pilot Charter:**
- Provides an analysis of high utilizers for the care coordination transitions program
- Empowers key business analysts across different departments through the availability of self-service tools
- Develops quick turnaround assistance to departments aiding business development and compliance functions.

**Data Governance Framework:** 314e worked with SCVHHS stakeholders to establish the need for a robust data governance program. 314e continues to provide assistance in creating a functional data governance framework that spans SCVHHS’s various systems. While the creation of a full-fledged framework and its adoption across the enterprise is critical and a top priority, BI strategy and implementation were run in parallel because its establishment during the same period was crucial. For immediate governance needs and issues that centered around one data source and limited users, a small executive group was assembled for quick decision-making. Alongside, the effort for a robust data governance program across departments was led to coincide with downstream phases of enterprise data warehouse (EDW) efforts. These decisions, facilitated by 314e, kept the organization’s strategic goals and best practices in mind.

**Self-Service Enablement:** The BI self-service program mandated the reduction of dependency on programmers and the reporting team, allowing users to create report content independently. This mandate came from clinical and financial executives spanning different departments as senior analysts felt handicapped by the dependency of traditional reporting and wait times. To enable true self-service, it was evident in the early stages that there is value provided by utilizing Epic SAP Universes for Cogito EDW, and SSAS Cubes for Resolute Hospital Billing and Professional Billing. These data models allowed power users to interact directly with the system to generate reports and BI content without relying solely on programming staff. This ensured that departments had the ability to work independently for generation of certain reports. This would not have been possible without SAP Universes and SSAS Cubes.

**Staff Capability Development:** A core full-time team was trained and engaged in all aspects of the project from planning to financial and clinical domain based discussions. These core members shadowed 314e’s consultant team in order to promote adoption. Training programs aligned a core group of business and technical users with the latest trends in healthcare, technology, and business operations. It emphasized the development of cross-functional skills by encouraging people to work across groups and reduced issues of information silos.
Tools and Technology

314e assisted with evaluation of SCVHHS’s current BI software tools. Though SCVHHS was already leaning towards using Epic’s Cogito EDW, 314e through a quick analysis helped validate and make sense of this decision.

The three alternative approaches considered in this process:

- **Legacy Approach**: The legacy path of Clarity reports was not cost effective due to the mandated skillset, formalized inter-departmental processes of report requests, and report development and release, which had an average wait time of 6 months.

- **Third Party Vendor Solutions**: Some vendors proposed solutions that included extracting data from SCVHHS systems, transforming, and normalizing the data to produce the exact content to suit SCVHHS needs. This option was risky because:
  - The data extraction process is from all of SCVHHS’s systems to the vendor software
  - These vendors depend on SCVHHS resources
  - The black box nature of the vendor’s middleware and the lack of SCVHHS’s control over it, especially if any issue arises with this middleware
  - The inflexibility to modify content produced and developed

- **Direct Access of BI tools**: The team considered using BI tools like QlikView and Tableau directly against the Clarity relational schema. However, it was not feasible, as it does not allow end users to navigate data models thus taking away the self-service benefit.

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**Figure 1: Alternative approaches considered for BI**

- **Legacy Approach**
  1. Time consuming
  2. Cannot meet changing BI demands
  3. Complex data model for reporting
  4. Increased wait times for reports
  5. Complex resources & processes
  6. Cannot run self-service needs

- **Third Party Vendor Solutions**
  1. Necessary to export all data to vendor
  2. Substandard processes to import & manage data
  3. Vendor resources tap into your team to understand data
  4. No flexibility to customize reporting

- **BI Tools Direct Access**
  1. Complex data models
  2. Lack of semantic layer limits the value of BI tool
  3. Decreased performance optimization
  4. Cannot support self-service without semantic layer
To get the full benefit of a self-service BI, it was necessary to add Epic's reporting middleware of pre-built Universes, Cubes and the simplified Cogito EDW data model. The Cogito EDW model was evaluated, from a schema perspective, to ensure it could support SCVHHS's cross-functional data needs.

Epic’s Cogito EDW, SAP Universes, and SSAS Cubes provided the necessary benefits of reducing the resource burden and aligning reporting resources with departmental reporting needs. The dimensional approach simplified the data model for the on-staff programmers. Epic’s Universes and Cubes provided true self-service layers that allow direct access to users without the need for additional programmers, which aligned with SCVHHS’s goal to retool reporting and BI infrastructure.

Cogito EDW runs on Microsoft’s SQL Server, with SSIS and SSAS to facilitate ETL and Cubes. It supports a dimensional model with both fact and dimension schemas including clinical and financial data. The schema allows for importing of data from non-Epic systems. Epic provides prebuilt SSIS packages including MSSP Shared Savings format (CCLF file) and Press Ganey (Patient Satisfaction Data). For the BI platform, SAP’s products as well as Tableau were used.

**Figure 2: SCVHHS BI Solution**

Better Alignment of Reporting Resources with Departments
The key advantages presented by Cogito EDW are:

**Simplification of the Core Data Model:** Cogito EDW has a simplified dimensional model that results in fewer tables to access clinical and financial data. The schema, though not as comprehensive as Clarity, uses a smaller number of tables to cover the same functional areas, which simplifies reporting analysis. The model reduces the entry threshold of complex reports by organizing it into 16 fact and dimension schemas, leading to fewer relationships to navigate. This in turn eliminates superfluous data elements that prevent quick analysis. The model’s documentation and ability to navigate through the ETL processes, which populates parts of the model, proved to be key to its adoption.

**Deployment of a Semantic Layer to Support Self-Service Reporting:** To help drive self-service reporting, a simplified model was essential so users could grasp concepts and elements that are organized similar to their business world. The deployment of SAP and the Cogito EDW Universes was determined to be key in order to support self-service.

**Deployment of BI Tools:** In addition to the rollout of a core data model and the semantic layer, Tableau, WebI, and PowerPivot were deployed to various users based on skill level and expertise. These front-end tools are a necessary component to facilitate easy interaction with the simplified data models and allow easy data organization. They significantly helped with data visualization in accordance with business concepts and flows.

This resulted in value addition to the following stakeholders:

**Physicians:** Utilization of Epic’s Physician Analytics tool – Slicer / Dicer – allowed the team to support physicians with their patient population analytics needs.

**Finance:** Financial and business utilization of Resolute HB and PB Cubes allowed the use of pre-existing licensed tools like Excel and PowerPivot. Financial users required minimal training since they are familiar with these tools.
Implementation

314e assisted SCCVHS with all aspects of the Cogito EDW implementation including planning, project management, infrastructure design, installation and configuration of software components, and authoring ETL.

- **Implementation of the Cogito EDW infrastructure**: Key implementations comprised of the data warehouse, SSIS jobs from Clarity, and Analysis Services Cubes for HB and PB
- **Implementation of the SAP Business Objects Infrastructure**: for WebI and Universes
- **Staff Training**:
  - Software development
  - Healthcare analytics
  - Data governance
  - Health information exchange
  - Databases & SQL
  - Tableau
  - SAP WebI
  - SAP Universes
  - Excel – Microsoft PowerPivot
  - Epic HB & PB Cubes
- **Content Development**: Charts and dashboard content was developed for:
  - SCVHHS high utilizers used by the CCTP program
  - Compliance department
  - Business development group

Cogito EDW

1. Simpler data model
2. Dimensional Data model with fact & dimension tables
3. Ease of understanding model by report writers
4. Universes allows self-service reporting
5. HB & PB Cubes allow for easy self-service reporting

314e

1. Advisory services to help roadmap your custom BI path
2. Cross functional domain experts to train your team
3. Augment your team as and when needed
314e PROVIDED US WITH SERVICES TO FULLY IMPLEMENT OUR EPIC DATA WAREHOUSE, ADVANCE OUR ANALYTICS INFRASTRUCTURE AND DEVELOP SOPHISTICATED BUSINESS INTELLIGENCE CONTENT TO MAKE US MORE COMPETITIVE IN THE MARKETPLACE.

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Success Metrics

Deployed the Cogito EDW infrastructure within a three-month period

Successful rollout of BI dashboard for high utilizers

Comprehensively trained analysts in Tableau, WebI, and SAP Universes

Full utilization of self-service analytics by two business groups
Top 3 Lessons Learned
- Account for the huge increased demand for self-service and simplified analytics after the initial go-live to effectively support business groups
- Unite our IT and business staff as a single team to drive the overall group’s progress
- Provide domain training to internal resources to effectively participate in analytics discussions with various business groups

What Would We Do Differently?
- Integrate IT and business staff earlier in the project
- Provide training sooner
- Initiate the data governance effort prior to the data warehouse effort

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