Application for 2013 University of California Larry L. Sautter Award for Innovation in Information Technology

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Project Title: Tethered Meta Registry
University of California Davis Health System

Project Leadership:
- Michael Hogarth, M.D., Professor, School of Medicine; Medical Director, Clinical Registries
- Michael Minear, Chief Information Officer
- Kent Anderson, M.S., Research Technology Manager; Associate Director, CTSC Biomedical Informatics
- Sharon L. Myers, Ph.D., Clinical Registries Supervisor

Information Technology
- Albert “Bill” Riedl, M.S., Clinical Registries Technical Lead
- Larry Errecart, Analyst
- Colleen Gordon, M.S., Analyst

Project Team:
The team works directly with various stakeholder groups to implement clinical registries. These stakeholders include physicians and nurse managers, hospital administrators, quality and process improvement experts, and faculty from the Schools of Medicine and Nursing. In addition, the team collaborates with other Health and Research IT groups to triage client requests and meet the specific project objectives.

Summary:
The UC Davis Health System created a Tethered Meta Registry (TMR) that integrates data from multiple information sources and provides the ability to query and analyze data across multiple patient populations.

The Tethered Meta Registry is the first registry of this magnitude. The TMR consolidates more than 2.1 million patient records and provides a centralized source of highly diversified population data for research and clinical quality improvement purposes. This registry eliminates the need for uniquely managed spreadsheets and databases maintained by students, faculty, clinicians, researchers, administrators, and health system staff.
**Project Description**

In October 2011, a clinical registry team was created to support registries for UC Davis Health System quality improvement projects, federal and state incentive programs, and health science research. The TMR brings together various silos of clinical content, such as data in the electronic health record, administrative/billing data, imaging data, laboratory information systems, biorepository systems, and niche clinical applications.

The Tethered Meta Registry (hereafter referred to as TMR) accomplishes the following goals:

- Establish a single, unified, curated patient data set that forms a common core dataset for all clinical registries;
- Integrate content across the various information sources;
- “Tether” to clinical and other information sources to provide real-time, actionable data;
- Curating and validating disparate data sources to derive high quality data;
- Providing a single interoperable “meta-registry” containing sets of patients that are flagged with cohort-identification algorithms, and the ability to query across multiple registries.

The unique and distinguishing characteristic of the TMR is the ability to summarize, analyze, and visualize a patient population. Population health analytics are the first step in the derivation of hypotheses, interventions, and quality improvement projects targeted at improving individual patient and community health and measuring the changes resulting from UCDHS initiatives.

Prior to the TMR, legacy registry data sets were managed within non-secure software applications such as Microsoft Excel, Filemaker Pro, and Microsoft Access. Often, these isolated applications were a security risk, and the data derived from these systems is often incompatible across other systems due to conflicting cohort definitions (varying interpretations of how patient populations should be defined) and poor data quality.

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**Figure 1 - The Tethered Meta Registry (TMR) Concept.** The TMR harnesses 2.1 electronic health records from one of the most diversified metropolitan areas in America into cohesively and highly curated data sets that can be cross-queried with advanced algorithms for providing unique value in patient populations.
Benefits of the TMR – The Sepsis Example
The Sepsis Registry serves as a data collection and integration platform designed to support quality of care initiatives, reporting, and research. This registry uses a structured definition of sepsis to provide a clear view on sepsis management with metrics and visualizations that can be shared across multiple stakeholder groups and departments. The Sepsis Registry supports the following stakeholders:

- Sepsis Improvement Collaborative (SIC) – Lean Six Sigma
- Delivery System Reform Incentive Payment (DSRIP) – Sepsis Measures
- Betty Irene Moore Foundation – Sepsis Measures

Through a marriage of clinical guidance and technical expertise, procedural and outcomes data are collected for these patients and organized in a way that simplifies and shortens the data analysis process, rendering actionable information to improve sepsis management across the institution and directly impact patients’ lives:

- 25% reduction in sepsis mortality; 53 lives saved
- Reporting and benchmarking data tied to setting performance goals and capturing incentive payments for the Medi-Cal DSRIP program. DSRIP is part of California’s five-year, $10 billion ”Bridge to Reform” Medicaid Section 1115 waiver, which aims to strengthen the Medi-Cal program and prepare safety net providers for nearly one million newly eligible Medi-Cal beneficiaries in 2014.
- Source data for cohort identification and research projects by student and faculty through collaboration with the CTSC.
**Figure 3 – Sepsis Registry Dashboard.** The dashboard provides near real-time reporting of sepsis cases, mortality, and bundle compliance measures.

**Relevant URLs**

Access to the TMR is granted through an oversight committee, and may not be available to the reviewers.


**Technology Utilized**

The TMR is comprised of many technologies, each chosen to fit a specific need and categorized as a front end or backend technology. The backend supports data movement, storage, data derivations, and analytics. The front end supports user access to and education surrounding the output.

From the back moving forward the registries team employs an Oracle database optimized for data warehousing activities.

- Data are either physically moved into the Oracle instance via Talend, a powerful ETL tool, or logically integrated via database links, when supported.
- Data intake occurs at various paces, from quarterly to real time dependent upon the data source.
- The result is a Logical Data Environment, LDE, which acts a basis for additional layers as data move through the stack.
Once integrated, the Oracle job scheduler is used to kick off algorithms which run daily, weekly, monthly, or quarterly to clean the data and derive clinically validated new values.

Analytics engines sit on top of the algorithm output. Currently, Corda CenterView is utilized for web-based dashboards and the team is rapidly tooling for Business Objects (web intelligence and xcelsius), which was chosen for its integration with the UCDHS’ electronic medical record (EMR).

- Both of these solutions offer web based analytics with user controlled parameters.
- Business objects offer additional enhanced metadata management for improved user understanding; this is a feature the registry team intends to fully leverage.
- In front of the analytics layer is Liferay, a full featured web portal offering content management, social networking, and collaboration tools. Liferay acts as compass to help users navigate TMR and funnel them to the correct subprojects, collaborate with others of similar interests and engage with the TMR design team.

### Timeframe of implementation

<table>
<thead>
<tr>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2011</td>
<td>Tethered Meta Registry scope defined</td>
</tr>
<tr>
<td>October 2011</td>
<td>Team members hired, Cancer Registry development commences</td>
</tr>
<tr>
<td>April 2012</td>
<td>Burn registry version 1 complete</td>
</tr>
<tr>
<td>June 2012</td>
<td>Sepsis registry version 1 complete</td>
</tr>
<tr>
<td>December 2012</td>
<td>Diabetes registry version 1 complete</td>
</tr>
<tr>
<td>March 2013</td>
<td>Patient Centered Medical Home registry complete</td>
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</tbody>
</table>

### Current state

There are currently 52 active registry account users and 9 live registries within the TMR. Additionally, broad access to the Sepsis Improvement Collaborative interactive dashboard on severe sepsis and septic shock is available to approximately 3,000 clinical department staff and some UC residents and students.

### Completed Registries

<table>
<thead>
<tr>
<th>Completed Registries</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer Registry</td>
<td>Built to the current UC Davis cNeXT model as first step in integrating data from 4 partner sites</td>
</tr>
<tr>
<td>CT Radiation Dose Registry</td>
<td>Radiation dosage information by anatomic site</td>
</tr>
<tr>
<td>Burn Registry</td>
<td>Tether the data from Clarity and from National Tracs (NTRACS) data software system.</td>
</tr>
<tr>
<td>Sepsis Clinical Cohort Registry</td>
<td>Supports the Sepsis Improvement Collaborative and Moore Foundation grant</td>
</tr>
<tr>
<td>Diabetes Population Registry</td>
<td>UCDHS diabetes population and control measures</td>
</tr>
<tr>
<td>Patient Centered Medical Home Registry</td>
<td>Hypertension &amp; diabetes control, flu vaccine coverage, mammography</td>
</tr>
</tbody>
</table>

### Objective Customer Satisfaction

“The registry team provided excellent expertise in converting our existing database into a registry. They helped us further refine data points we were pulling from our EHR. They converted a largely labor intensive, time consuming, manual process of data transformation into an automated process. They provided a platform for dashboard review of information down to an actionable level of detail.”

-- Dr. Hien Nguyen, Medical Director, Acute Infections Management Service

“Thank you to your terrific team also - the Registry does look terrific - even with all the discussion! Light years ahead of what we had now that your team is on it!”

-- Angela Gandolfo, Performance Improvement Advisor, Clinical Operations
Appendix

Definitions

_Tethered_ – Registry interfaced and linked to a modern EHR

_Meta Registry_ - one Registry data model supporting multiple cohort or registry definitions where patients/subjects are ‘tagged’ with cohort identifying algorithms. Patients can be tagged and belong to multiple ‘registries’

_Modern Registry design_ - supports complex data models, many different sources, clinical images, basic genetic data, and patient/subject portals

![Diagram of Logical Data Environment, LDE](image_url)

**Figure 4 – TMR Technology Overview**

![Image of Tethered Meta Registry Cohort Linking Capability](image_url)

**Figure 5 Example of the Tethered Meta Registry Cohort Linking Capability (PCMH and Diabetes)**