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HEALTHCARE DATA WAREHOUSING

The Architecture of Performance Measurement

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Managing Director, Health Systems Consulting

1992 2012 CHiME 20 Years Serving Healthcare CIOs

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Today's speaker

Jason Oliveira, MBA
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Jason provides Recombinant clients with business advisory services on enterprise information management and business intelligence initiatives based on more than 27 years of experience.

Jason's combination of thought leadership in the governance, definition, and stewardship of data and HIT expertise has been critical to the success of engagements with numerous clients: UNC Health System, UCSF Medical Center, UCLA Health System, Yale New Haven Health System, Texas Children's Hospital, and PeaceHealth.

- Partner, Kurt Salmon Associates, led the healthcare business intelligence business advisory practice
- Director of Decision Support Systems, Columbia-Presbyterian Medical Center
- Senior Architect, 11 hospital data warehouse and cost accounting system, NYC Health and Hospitals Corporation
- Past Chair of the HIMSS Data Mining and Data Warehousing Special Interest Group (SIG)

Recombinant's Ecosystem

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Topics

- Performance measurement drivers
- Impact on health system operations
- An architecture response

Performance measurement drivers

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- **Transparency**
  - ONC Strategic Framework
  - HealthGrades
  - CMS Hospital Compare
- **Improvement**
  - ARRA Meaningful Use
  - Disease registries
  - IHI 5 Million lives
  - AHRQ
  - Doctor's Office Quality-IT
- **Quality as Marketing**
- **Accreditation**
  - TJC ORYX (Core Measures)
  - NCQA HEDIS
- **Value-Based Purchasing**
  - MSSP / ACO
  - PQRS
  - Bridges to Excellence
  - CMS IPPS – 2005 Deficit Reduction Act

The measurement burden

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Independent of the perceived value of these performance measurement systems as drivers of desirable change, the reality is that they are here; they affect the bottom line; and they are now an operational reality, and burden, to provider organizations.

Impact on operations

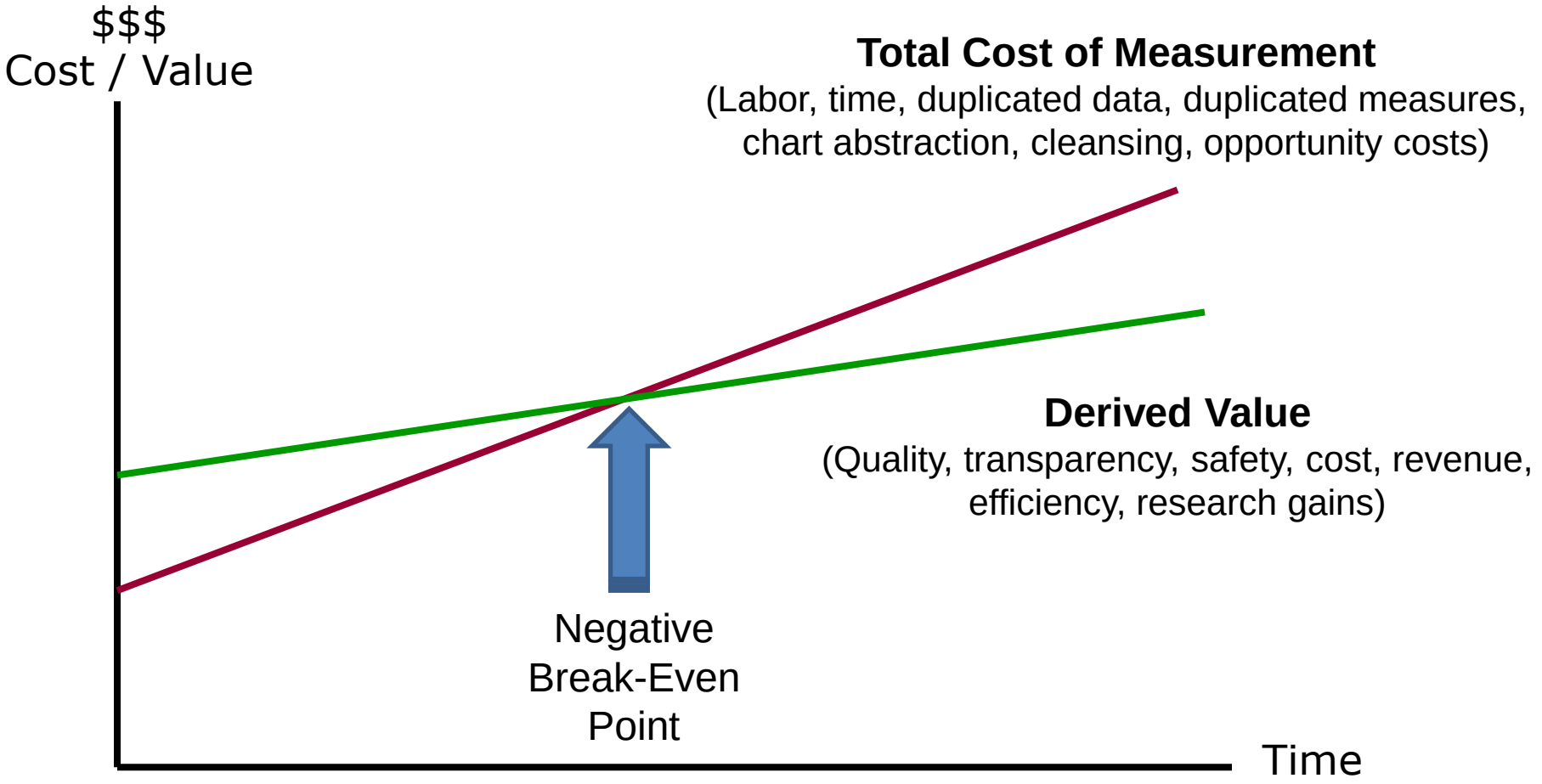
- Many, and growing, measurement programs
- Conflicting and duplicative measure sets
- Remaining inadequacy of HIT solutions to support ‘the final mile’ of data abstraction and measurement calculations
- Significant human resources devoted to measurement data capture, and growing, but remain inadequate

Case in point: The 43 data points necessary for a patient with acute myocardial infarction (AMI), a very prevalent measurement set, takes 20 to 25 minutes per patient on average in one study by Premier*.

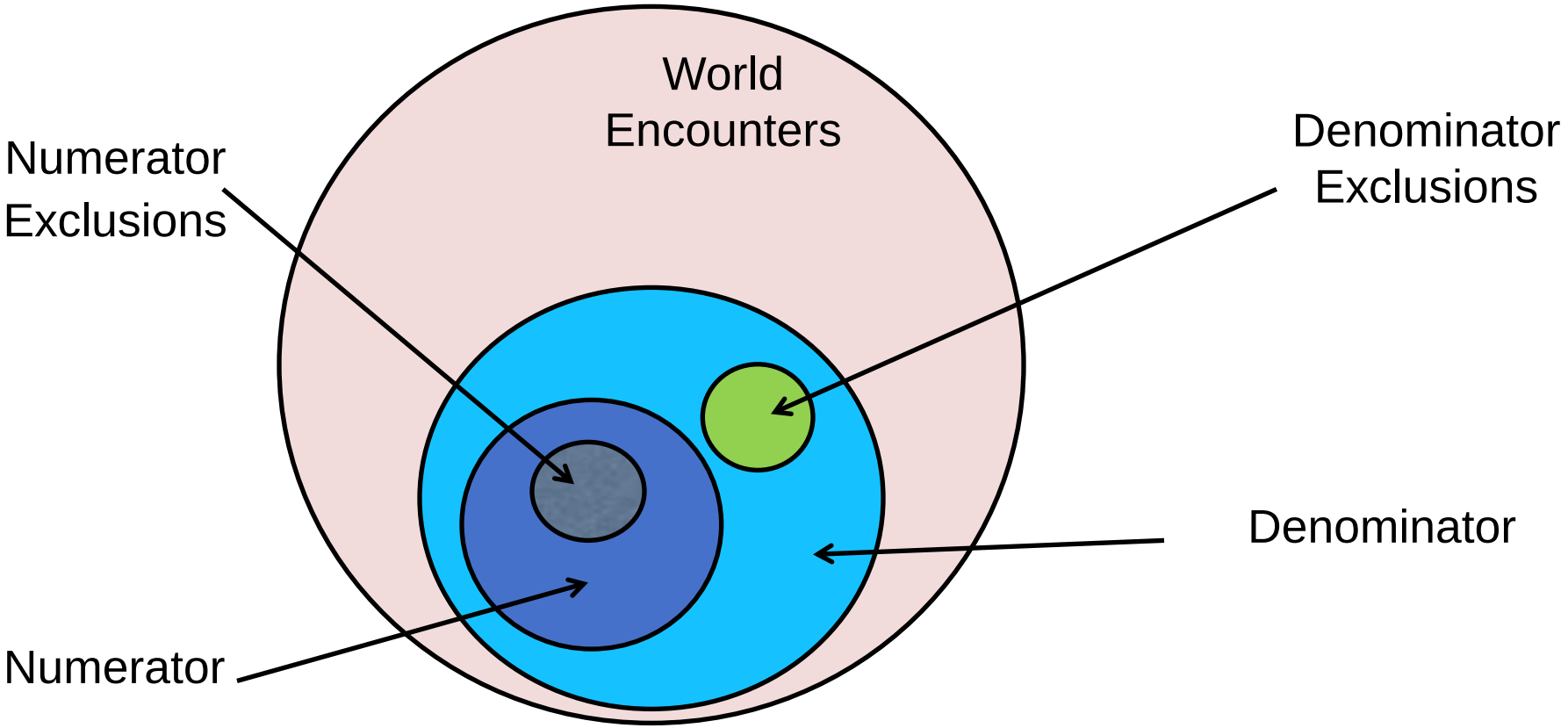
* Scalise, Dagmara, “Quality paperwork is never done”, Hospitals & Health Networks, Storyboard, 81(1):26, 2007

Status quo is not sustainable

The cost of measurement very well may exceed the derived value. This is not a sustainable model and demands a response.



Anatomy of a measure



Measure Score = $\dfrac{\text{Numerator} - \text{Numerator Exclusions}}{\text{Denominator} - \text{Denominator Exclusions}}$

An ‘e-Measure’ in action

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To illustrate an example of the current challenges of capturing and exploiting performance measurement data, consider a common performance measure: AMI.1, or aspirin on arrival for AMI patients.

DENOMINATOR: Definition of Case Selection to Which Measurement Criteria Applies

Case Selection Definition	Typical Data Collection Process
All Acute Myocardial Infarction (AMI) discharges	Case selection queries are run in the Patient Accounting system based on discharges where Principal Diagnosis Code includes an ICD-9-CM code indicating AMI (e.g., 410.00 - AMI ANTEROLATERAL, UNSPEC)

EXCLUSIONS: Cases That are Excluded From Case Selection

Case Selection Definition	Typical Data Collection Process
Comfort care only	If there is any indication that the provision of aspirin was to provide only comfort, such as for terminally ill patients, then the case is excluded. This is not readily available information without reviewing the free-form physician, nurse practitioner, or physician assistant notes as typed into the ED documentation system. If comprehensive coding is being applied to ED cases, then ICD-9-CM code V66.7– Palliative Care could be recorded in the medical records coding system.
Patients with aspirin contraindications	The presence of an adverse reaction or other allergy to aspirin excludes the case. Allergies are not readily available in an encoded manner in most hospital information systems to date. The abstractor commonly reviews physician notes for such indications or allergy lists if such are maintained by the organization in the clinical information system. ICD-9-CM does not capture this clinical observation, but SNOMED, rarely implemented as part of clinical documentation systems, does (e.g., 292044008 – ASPIRIN ADVERSE REACTION).

NUMERATOR: Examples of Measurable Best Practice Criteria

Case Selection Definition	Typical Data Collection Process
Subset of discharges with administration of a platelet aggregation inhibitor (aka aspirin)…	Information systems will have varying degrees of ability to capture that specifically a platelet aggregation inhibitor was ordered, dispensed, and actually administered to an emergent patient. Unfortunately, our example environment does not. Aspirin is a floor stock and administration is documented in the paper medical record. The potential for the future is the use of the FDA National Drug Code and accurate administration event capture (e.g., 12843010106 – Aspirin 325 mg oral tablet Bayer) through pharmacy cabinets and drug administration bar coding.
… within 24 hours before or after time of arrival	Capture of aspirin administration prior to arrival, for example, at the patient's home or in the ambulance, is in the ambulance paper report. Accurately capturing and recording the time of arrival is also a challenge and often solely recorded in the ED medical record.

An architecture response

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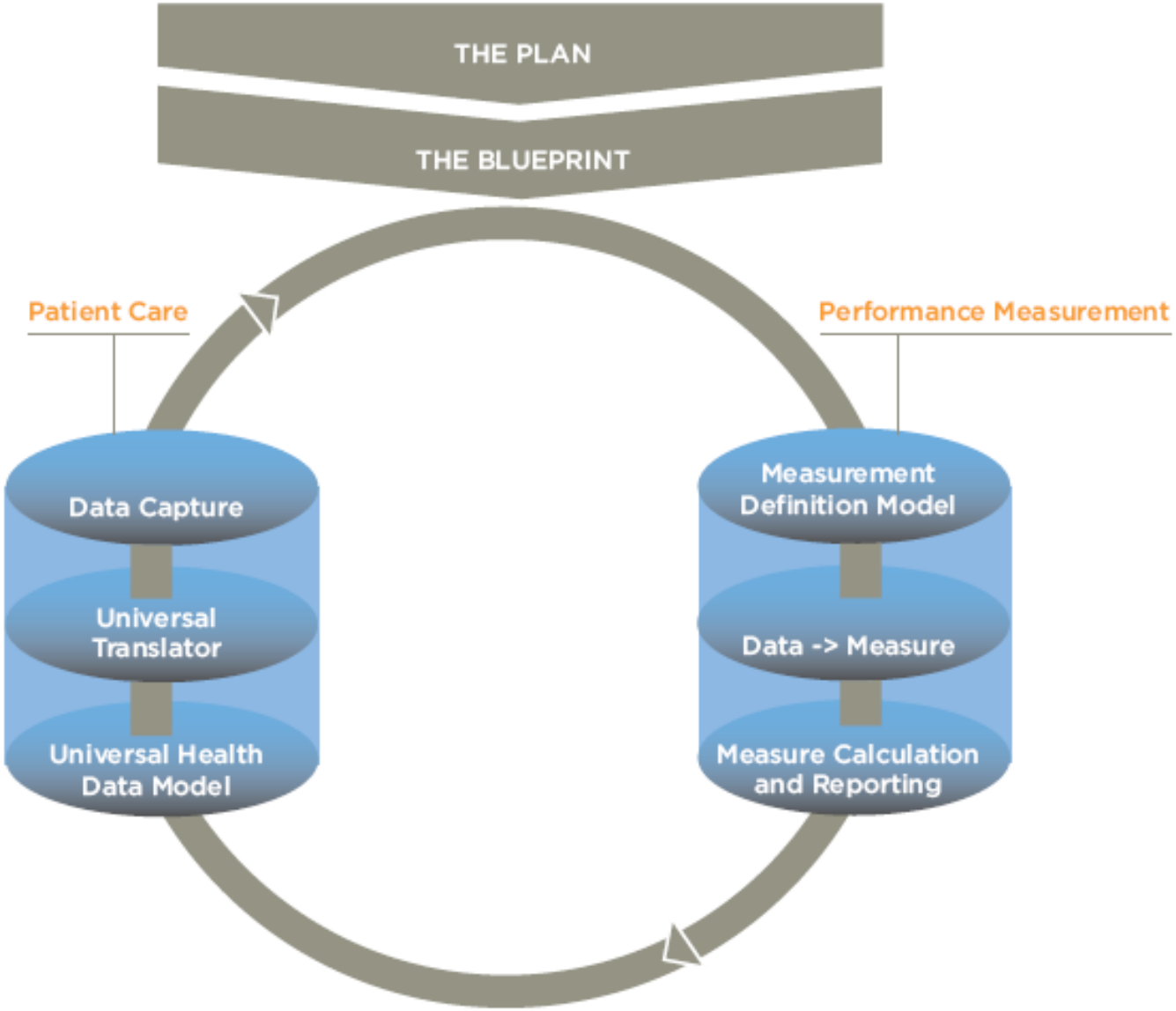

A measures management architecture

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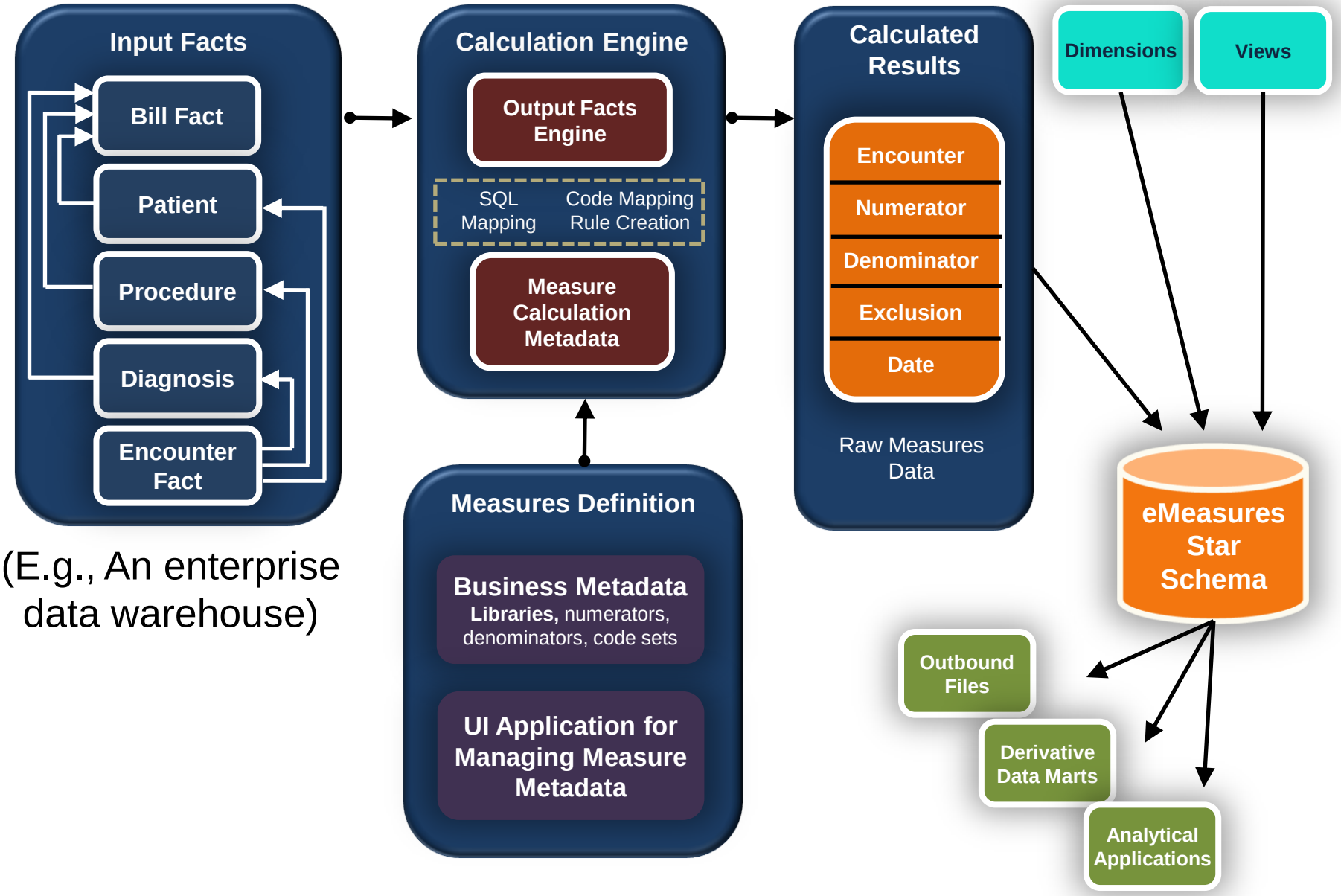
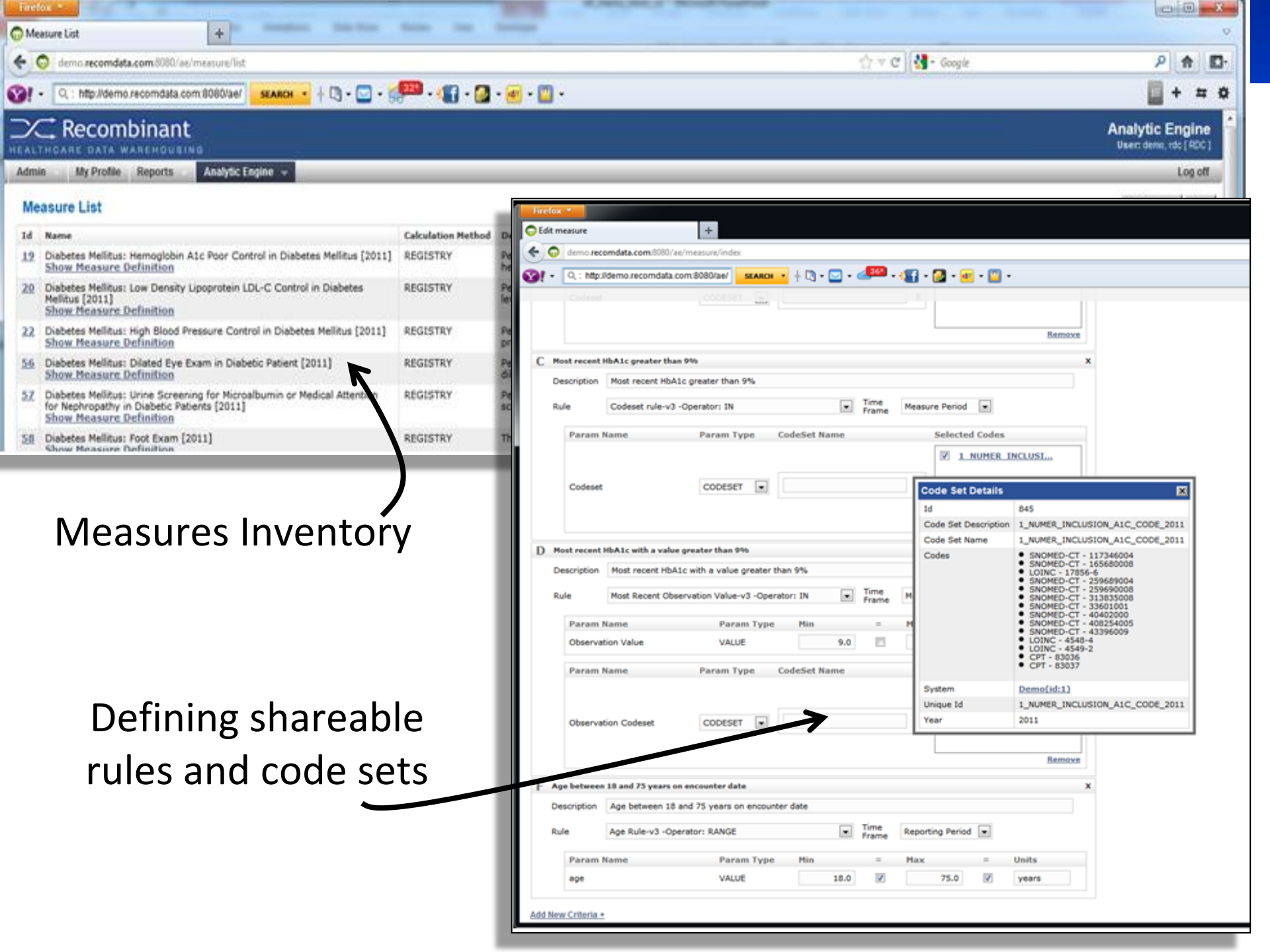


(E.g., An enterprise data warehouse)



Measures Inventory

Defining shareable rules and code sets

Define measures once and share

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Id	Measure Name	Calculation Method	Description
4	Preventive Care and Screening: Colorectal Cancer Screening	REGISTRY	Percentage of patients aged 50 through 75 years who received the appropriate colorectal cancer screening
19	Diabetes Mellitus: Hemoglobin A1c Poor Control in Diabetes Mellitus	REGISTRY	Percentage of patients aged 18 through 75 years with diabetes mellitus who had most recent hemoglobin A1c greater than 9.0%
20	Diabetes Mellitus: Low Density Lipoprotein LDL-C Control in Diabetes Mellitus	REGISTRY	Percentage of patients aged 18 through 75 years with diabetes mellitus who had most recent LDL-C level in control-less than 100 mg/dL
22	Diabetes Mellitus: High Blood Pressure Control in Diabetes Mellitus	REGISTRY	Percentage of patients aged 18 through 75 years with diabetes mellitus who had most recent blood pressure in control (less than 140/90 mmHg)
24	Preventive Care and Screening: Tobacco Use: Screening and Cessation Intervention	REGISTRY	Percentage of patients aged 18 years and older who were screened for tobacco use one or more times within 24 months AND who received cessation counseling intervention if identified as a tobacco user

A good measures catalog will include both standard industry measures (e.g., MU, Core Measures, PQRS) and the facility to define internal measures

Define rules once and share

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Id	Rule Name	Description	Rule Operator
1	Age Rule-v2	Patient Age at encounter	RANGE
3	CPTII proc code rule	CPTII codes	IN
4	System Rule - Update Pass Value In Score Table	System Rule - Update Pass Value In Score Table	EQUALS
5	System Rule - Pass Encounters to Result Table	System Rule - Pass Encounters to Result Table	EQUALS
20	P_Sex_Rule	P_Sex_Rule	EQUALS
21	P_Age_Rule	P_Age_Rule	RANGE
22	P_Codeset_Problems	P_Codeset_Problems	IN
27	P_Codeset_Vitals	Vitals Codeset	IN
30	P_Codeset_Labs	P_Codeset_Labs	IN
31	P_Codeset_Medication	P_Codeset_Medication	IN

A small number of rules can enable numerous measures when well designed.

Instantiate the definitions with data

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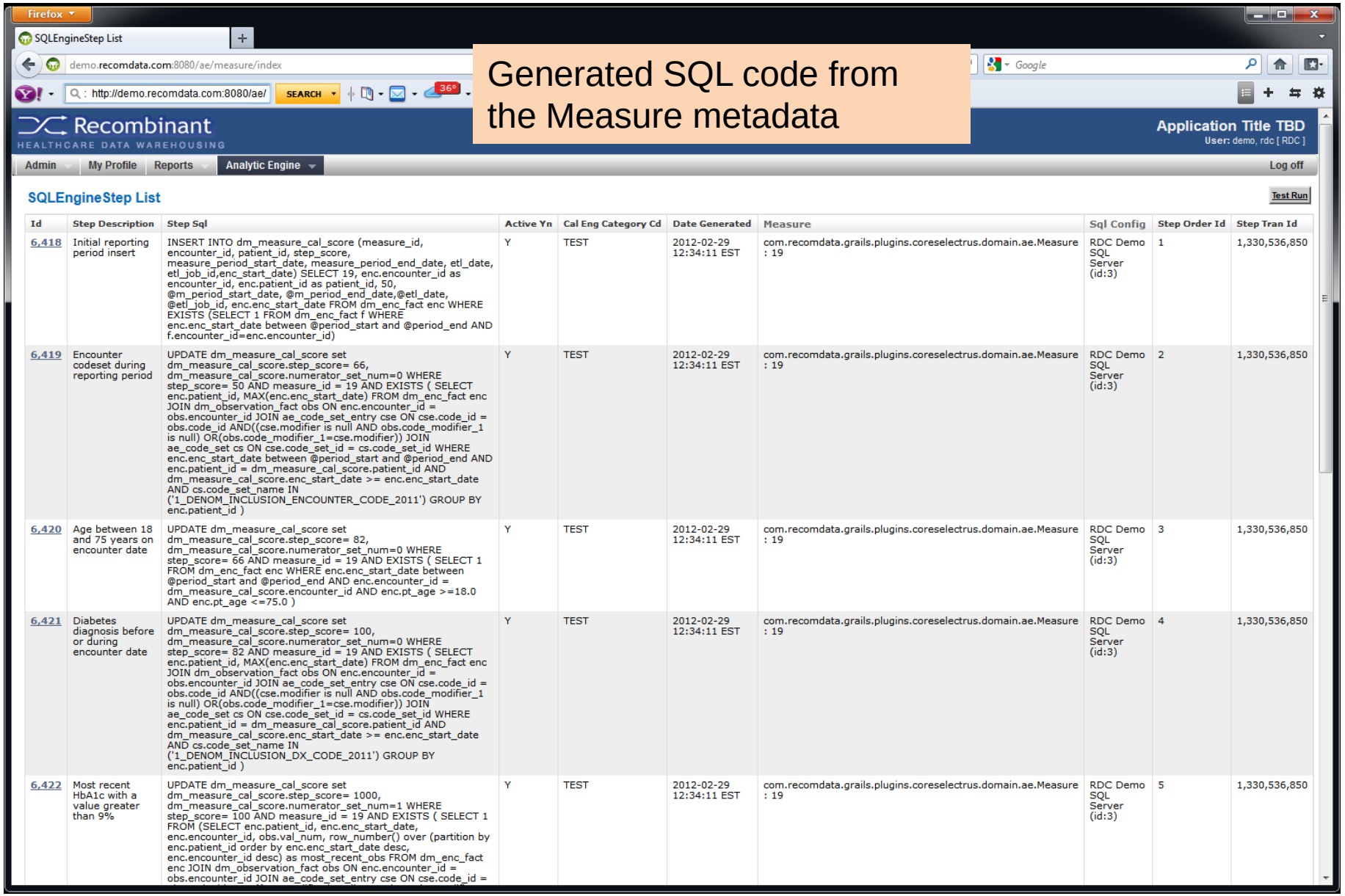
Generated SQL code from the Measure metadata



Id	Step Description	Step Sql	Active Yn	Cal Eng Category Cd	Date Generated	Measure	Sql Config	Step Order Id	Step Tran Id
6,418	Initial reporting period insert	INSERT INTO dm_measure_cal_score (measure_id, encounter_id, patient_id, step_score, measure_period_start_date, measure_period_end_date, etl_date, etl_job_id,enc_start_date) SELECT 19, enc.encounter_id as encounter_id, enc.patient_id as patient_id, 50, @m_period_start_date, @m_period_end_date,@etl_date, @etl_job_id, enc.enc_start_date FROM dm_enc_fact enc WHERE EXISTS (SELECT 1 FROM dm_enc_fact f WHERE enc.enc_start_date between @period_start and @period_end AND f.encounter_id=enc.encounter_id)	Y	TEST	2012-02-29 12:34:11 EST	com.recomdata.grails.plugins.coreselectrus.domain.ae.Measure : 19	RDC Demo SQL Server (id:3)	1	1,330,536,850
6,419	Encounter codeset during reporting period	UPDATE dm_measure_cal_score set dm_measure_cal_score.step_score= 66, dm_measure_cal_score.numerator_set_num=0 WHERE step_score= 50 AND measure_id = 19 AND EXISTS (SELECT enc.patient_id, MAX(enc.enc_start_date) FROM dm_enc_fact enc JOIN dm_observation_fact obs ON enc.encounter_id = obs.encounter_id JOIN ae_code_set_entry cse ON cse.code_id = obs.code_id AND((cse.modifier is null AND obs.code_modifier_1 is null) OR(obs.code_modifier_1=cse.modifier)) JOIN ae_code_set cs ON cse.code_set_id = cs.code_set_id WHERE enc.enc_start_date between @period_start and @period_end AND enc.patient_id = dm_measure_cal_score.patient_id AND dm_measure_cal_score.enc_start_date >= enc.enc_start_date AND cs.code_set_name IN ('1_DENOM_INCLUSION_ENCOUNTER_CODE_2011') GROUP BY enc.patient_id)	Y	TEST	2012-02-29 12:34:11 EST	com.recomdata.grails.plugins.coreselectrus.domain.ae.Measure : 19	RDC Demo SQL Server (id:3)	2	1,330,536,850
6,420	Age between 18 and 75 years on encounter date	UPDATE dm_measure_cal_score set dm_measure_cal_score.step_score= 82, dm_measure_cal_score.numerator_set_num=0 WHERE step_score= 66 AND measure_id = 19 AND EXISTS (SELECT 1 FROM dm_enc_fact enc WHERE enc.enc_start_date between @period_start and @period_end AND enc.encounter_id = dm_measure_cal_score.encounter_id AND enc.pt_age >=18.0 AND enc.pt_age <=75.0)	Y	TEST	2012-02-29 12:34:11 EST	com.recomdata.grails.plugins.coreselectrus.domain.ae.Measure : 19	RDC Demo SQL Server (id:3)	3	1,330,536,850
6,421	Diabetes diagnosis before or during encounter date	UPDATE dm_measure_cal_score set dm_measure_cal_score.step_score= 100, dm_measure_cal_score.numerator_set_num=0 WHERE step_score= 82 AND measure_id = 19 AND EXISTS (SELECT enc.patient_id, MAX(enc.enc_start_date) FROM dm_enc_fact enc JOIN dm_observation_fact obs ON enc.encounter_id = obs.encounter_id JOIN ae_code_set_entry cse ON cse.code_id = obs.code_id AND((cse.modifier is null AND obs.code_modifier_1 is null) OR(obs.code_modifier_1=cse.modifier)) JOIN ae_code_set cs ON cse.code_set_id = cs.code_set_id WHERE enc.patient_id = dm_measure_cal_score.patient_id AND dm_measure_cal_score.enc_start_date >= enc.enc_start_date AND cs.code_set_name IN ('1_DENOM_INCLUSION_DX_CODE_2011') GROUP BY enc.patient_id)	Y	TEST	2012-02-29 12:34:11 EST	com.recomdata.grails.plugins.coreselectrus.domain.ae.Measure : 19	RDC Demo SQL Server (id:3)	4	1,330,536,850
6,422	Most recent HbA1c with a value greater than 9%	UPDATE dm_measure_cal_score set dm_measure_cal_score.step_score= 1000, dm_measure_cal_score.numerator_set_num=1 WHERE step_score= 100 AND measure_id = 19 AND EXISTS (SELECT 1 FROM (SELECT enc.patient_id, enc.enc_start_date, enc.encounter_id, obs.val_num, row_number() over (partition by enc.patient_id order by enc.enc_start_date desc, enc.encounter_id desc) as most_recent_obs FROM dm_enc_fact enc JOIN dm_observation_fact obs ON enc.encounter_id = obs.encounter_id JOIN ae_code_set_entry cse ON cse.code_id =	Y	TEST	2012-02-29 12:34:11 EST	com.recomdata.grails.plugins.coreselectrus.domain.ae.Measure : 19	RDC Demo SQL Server (id:3)	5	1,330,536,850

Measures delivery

Support multiple delivery channels: outbound files, internal dashboards, analytical applications, direct queries, etc.

Creating the roadmap

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- Where do we need to be?
- Where are we now?
- How do we get there?

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HEALTHCARE DATA WAREHOUSING

Questions?

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