Leveraging SNOMED CT in Healthcare Analytics

Prashant Natarajan & Sanjoy Mondal

Oracle Health Sciences GBU

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Presentation Outline

- Introduction to Presenters

- The Different Flavors of Analytics

- The Critical Nature of Master Data in Healthcare

  – Brief overview of the types of healthcare master data

- Healthcare MDM

  – Challenges & Opportunities

  – Types of HC MDM

- Why is SNOMED-CT the most appropriate standard for clinical analytics?

- How can SNOMED-CT be leveraged in healthcare data warehousing, BI, and analytics?

- From Meaningful Ideas to Practical Benefits

  – Terminologies and MDM in Oracle Enterprise Healthcare Analytics

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Introductions

- Prashant Natarajan
  - Sr. Manager, Healthcare Product Management, Oracle HSGBU
  - Leads healthcare product management efforts at Oracle
  - Background in conceptualizing and developing EMR/EHRs, disease management, and healthcare BI solutions
  - Author, *Implementing Business Intelligence for Healthcare Organizations*, HIMSS Press (2012)

- Sanjoy Mondal
  - VP, Software Development, Oracle HSGBU
  - Leads development of Oracle's EHA, TRC, HIE, and HSN product portfolios for global health sciences customers
  - Background in data base design and development, healthcare data warehousing and BI, and interoperability, MDM, and clinical trial management solutions

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Healthcare Data Across the Enterprise

Data and Master Data in a Healthcare Organization
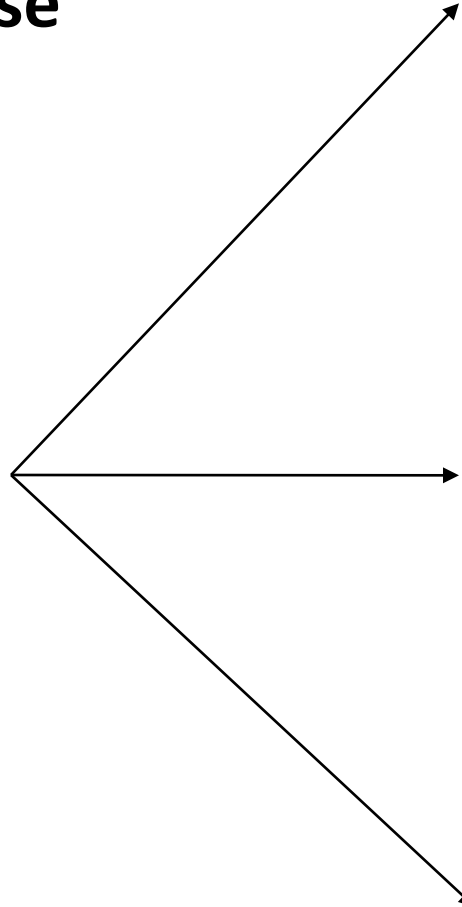
Transactional

- EMR/EHR
- ERP
- CPOE
- Lab
- Registries
- Etc.

Master

- Terminologies
- Ontologies
- Units of Measure
- Entity management
- Conformed Dimensions
- Hierarchies

Analytical

- Operational Reporting
- Retrospective BI
- Predictive BI
- Near real-time
- Discovery BI
- Data mining

The Different Flavors of Analytics - 1

- Operational Reporting – "quick and dirty" reporting out of EMR/EHR/ERP

- Retrospective BI – analyzes current, time-variant, and historical data to examine calculated/derived measures that can be "drilled-down" or filtered via the use of scorecards, interactive dashboards, and reports

- Predictive BI – applies mathematical, statistical, and associated methodologies to current and historical data to obtain insights into future states or behaviors

The Different Flavors of Analytics - 2

- Near Real-Time Analytics – analytics based on low-latency receipt of data but with rigor on standardization and data quality

- Data Mining – identifies hidden facts to develop insights into the current state (and any associated correlation & causation)

- Discovery BI – applies a search index to structured and unstructured data with the ability to map data into a data warehouse or other reporting structure

Healthcare MDM – What is it? - 1

- Master data
  - Describes a healthcare organization's business entities, clinical concepts, reference data, their relationships, and any associated hierarchies
  - Represents common definitions and use of business objects around which the transactions are performed
  - Spans concepts that are shared across more than one transactional application and/or analytical application
  - Creates a single version of the truth across the organization, context, and use – using either a centralized or a federated model
  - Serves a foundation for standardization and consistency

Healthcare MDM – What is it? - 2

- Master Data Management (MDM)
  - is a combination of data,metadata, applications and processes that collect, consolidate, clean, and augment enterprise master data, and synchronize it with
    - Transactional source systems – via "operational MDM"
    - Business processes (via business rules)
    - Data warehousing and analytical tools via "analytical MDM"

- A planned, unified, and comprehensive MDM solution across your organization results in significant improvements in data management, operational efficiency, reporting and analytics, and fact-based decision-making.

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Healthcare MDM – Types

- Types of Healthcare Master Data
    - Terminologies
    - Ontologies
    - Units of Measure
    - Entity management for
        - EMPI - Persons (Patient, Subject, Investigator, Service Provider, etc.)
        - Non-Persons (Product, Study, Facility/Site, Formulary, etc.)
    - Conformed Dimensions
        - Hierarchies

Healthcare MDM – Current Challenges - 1

- Given the nature of transactional source systems, data in such sources tends to exhibit 1 or more of the following characteristics:
  - Varying semantics
  - Varying structures/schema
  - Terminologies
    - Multiple coding systems
    - Non-standardized codes
    - Inconsistent application of terminology standards
    - Context-sensitive complexity
  - Questionable data (and metadata) quality
  - Lack of an integrated model that brings standardized master data and comprehensive/integrated transactional data together

Healthcare MDM – Current Challenges - 2

At this time, the realities of master data management, or rather the lack of it, are rather sobering. The challenges faced by us include:

1. Business and technical users don't have a shared understanding of master and reference terminology data across their individual silos

2. When such understanding exists, it is usually limited to individual departments or facilities and seldom includes the inventory of master data spread across diverse business processes and the organization as a whole

3. Existing master data is not identified or is managed separately and often exists within transactional records and in legacy databases, which are often poorly documented and possess minimal lineage

4. The lack of control of master data is accelerated with new regulatory requirements, transactional source system upgrades, and acquisitions

Healthcare MDM – Opportunities

- The ability to measure, compare, and predict trends reliably and accurately based on clinical, operational, and research data is a key driver of healthcare transformation and requires a reliable, comprehensive, and usable MDM foundation based on an accepted standardized clinical nomenclature/coding system.

- At the core of analytics lies the need to address and manage master data that includes codes; concepts; hierarchies; and associated metadata within structured terminologies.

- The definition, governance, implementation, and management of master data across the healthcare provider enterprise are best addressed via proactive MDM as opposed to being merely considered as a curative project for addressing data quality issues.

Healthcare MDM & Analytics

- MDM is key to analytics because
    - Analytics requires a common reference point for comparison and aggregation of data in its domain that is recorded by different individuals, systems, or institutions. In other words, analytics requires the ability to compare "apples to apples"
    - The ability to drill-up/down/across hierarchies is integral to analytics
    - Analytics that is trusted and reliable needs a foundation of correctness, consistency, and completeness that's provided by MDM
    - The need to load, store, manage, and update multiple concepts in discrete sources is reduced by using a common MDM model based on a standardized clinical ontology

SNOMED-CT in Healthcare Analytics - 1

- Definition: "SNOMED CT® is a comprehensive clinical terminology that provides clinical content and expressivity for clinical documentation and reporting. It can be used to code, retrieve, and analyze clinical data. […] The terminology is comprised of concepts, terms and relationships with the objective of precisely representing clinical information across the scope of health care" [http://www.isb.nhs.uk/]

- Use of SNOMED-CT's comprehensive coded clinical concepts in an analytics environment enables healthcare data to be shared and used in a consistent manner across people, systems, and organizations – at significantly lower costs and risks

- Applicability beyond the "Point of Care": Structured SNOMED-CT codes and associated metadata, even if NOT recorded at the point of care, can be leveraged reliably to support the multiple secondary uses of that data – be it for research, analytics, or for "actionable BI" applications

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SNOMED-CT in Healthcare Analytics - 2

- Has the required level of granularity and comprehensiveness

- Encodes meaning (semantics), relationships between concepts, and hierarchies as essential elements – and not just code-concept pairs (common in terminology systems)

- SNOMED-CT has "built-in" support for

  - Data acquisition using synonyms

  - Consistency and standardization (in the data warehouse) using Fully Specified Name (FSN)

  - Semantic flexibility at "point of use" analytical applications using both the Preferred Term (PT)

  - Multi-directional relationships between concepts

- Information Retrieval: SNOMED CT is recommended for use an application-agnostic, clinical dictionary of standard terms to support information organization and retrieval across formerly-silo'ed data and users
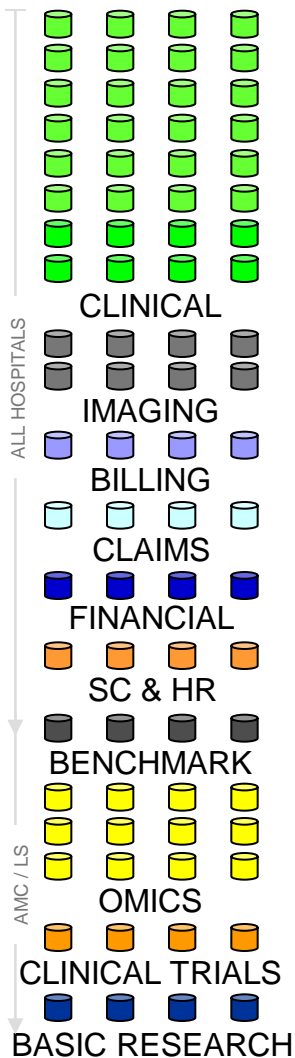
SNOMED-CT in Healthcare Analytics - 3

- Multi-lingual PTs

- Open global standard

- Versioned thereby minimizing the need for costly maintenance and updates

- SNOMED-CT provides a "machine-readable, coded, common clinical language" that can be processed systematically, in conjunction with data quality and other MDM rules, across multiple phases of the BI life cycle – be it during data acquisition, integration, warehousing, measure creation, or even "at the glass" presentation

Oracle Enterprise Healthcare Analytics

From Data Silos to Transformational Insights & Action

ALL HOSPITALS

CLINICAL

IMAGING

BILLING

CLAIMS

FINANCIAL

SC & HR

BENCHMARK

AMC / LS

OMICS

CLINICAL TRIALS

BASIC RESEARCH

HC Provider Source Systems

Highly complex provider source system
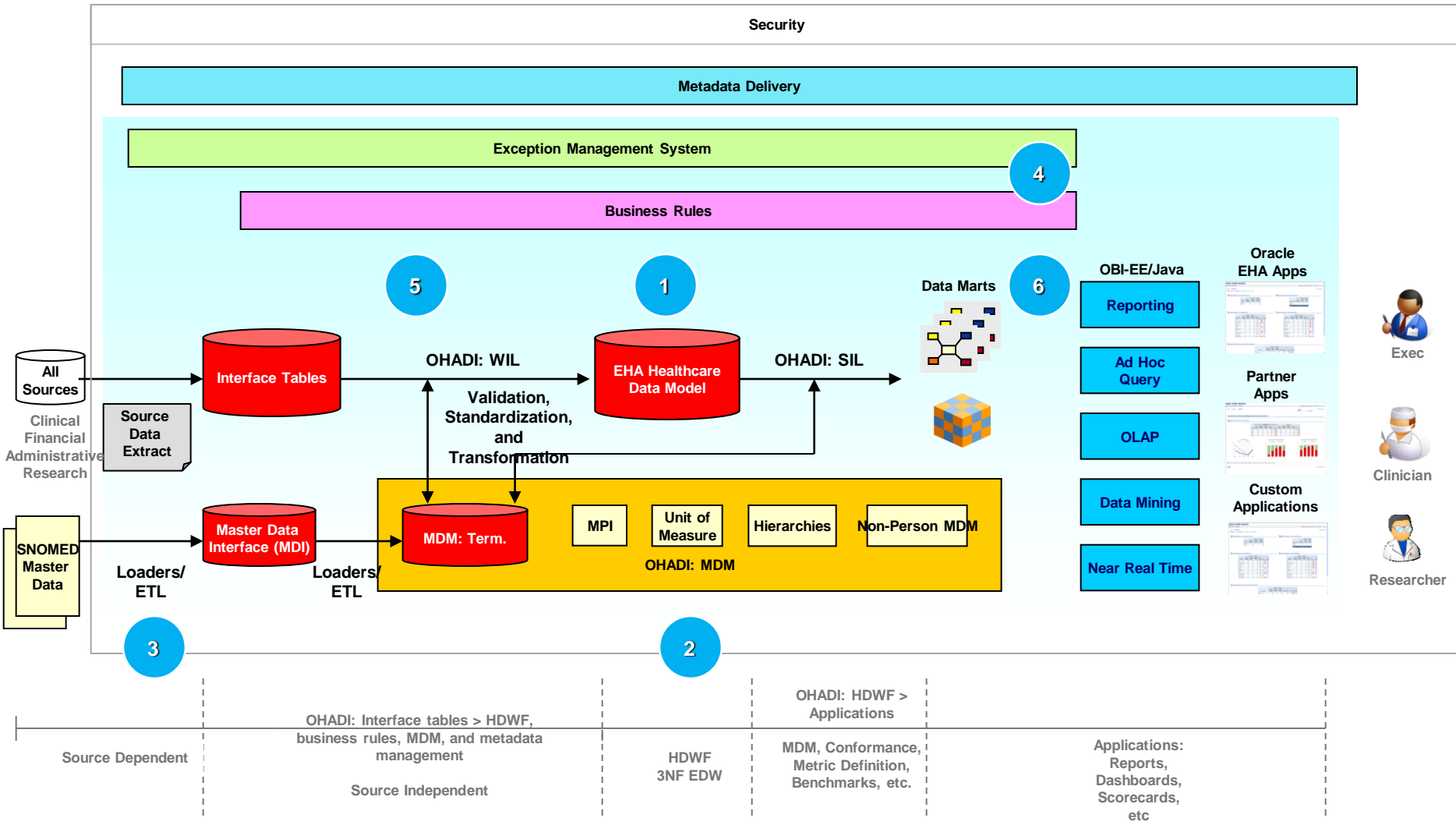data are of uneven quality and un-integrated.

How ?

Transformational Analytic Applications

The analytic applications that will
help transform Healthcare
require reliable, high quality, and
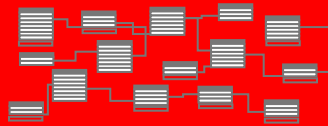integrated data and master data.

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AMC / LS – Academic Medical Center / Life Science Company.
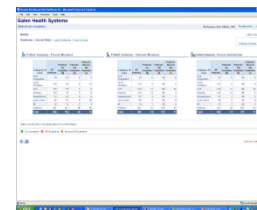
Oracle Enterprise Healthcare Analytics (EHA)

Healthcare Data Warehouse Foundation: By the Numbers

1

HA Healthcare Data Warehouse Foundation

• Integrated View of Clinical,
Financial, Supply Chain & Research Data

• Atomic data structured for data warehousing (core HDWF model) and data acquisition (interface tables)

• Has attributes at the most granular level as represented by source systems – and as required by the customer

• Easily extensible

• Includes conformed dimensions as an accelerator for downstream analytics/conformance/aggregation needs

- Engineered specifically for healthcare providers to lower DW/Analytics development cost, time & risk

- Atomic 3 NF Logical & Physical Models
  - Logical Data Model has 1100+ entities and 15000+ functional attributes
  - Physical Data Model has 700+ tables and 28000+ columns (including system columns)
  - Pattern-driven model: makes it easy to use, maintain, and extend
  - Customer is "upgrade protected"
    - Designed "out of the box" for backward and forward compatibility
    - Data model is mature and updates are additive
- Built upon an integrated foundation that manages atomic transactional and master data to create analytics

EHA HDWF: Integrated Healthcare DW

Integrated and pattern-based representation of atomic clinical, financial, administrative & research data elements

HDWF
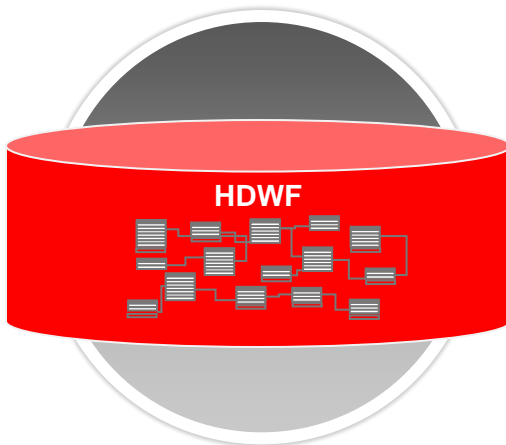
1

Foundational
- Party – Individual and Organization
- Facility
- Encounter
- Master Catalogs
- Charge Master
- Consent & Advance Directive
- Code Repository

Clinical
- Patient
- Service Provider
- Case
- Diagnosis, Problem, Chief Complaint, etc (Concern)
- History
- Incident
- Procedure, Med Admin, and Patient Education (Intervention)
- Clinical Finding, Assessment, Vital Signs, Results, signs/symptoms, etc. (Observation)

- Order
- Specimen
- Substance
- Clinical Study (Trial)

Financial & Administrative
- Billing
- Cost Allocation
- Charge Capture
- Insurer
- Claims & Reimbursements
- AP & AR
- Inventory
- Purchasing
- Scheduling
- HR and Payroll
- Survey
- Patient Accounting
- Financial Reporting
- Pharmacy & Formulary

EHA DI: MDM, Business Rules, and Analytics Agents

EHA DI MDM

(2)

- Provides a robust and stable MDM product for varied Healthcare and Life Sciences customers/users
- Centralized repository for all ontologies, terminologies, and associated meta data, classifications, and hierarchies
- Enables and manages MDM at all points of the BI life cycle, including
  - Transactional data acquisition from source systems
  - Data warehousing in HDWF
  - Provides support for receipt of original codes, coding systems, and associated metadata
  - Provides intra- and inter-version cross maps and metadata structures for codes and coding systems

(3)

  - Validates standard codes & code related rules
  - Supports validation, standardization, & transformation of original source system codes to BOTH warehouse-standard and application-standard terminologies – either/both can be based on SNOMED-CT
  - Supports SNOMED loaders using 3rd-party terminology vendors
- EHA DI MDM supported by interface tables for transaction data, ETL business rules, and in-built exception framework

EHA Data Integration: MDM, Business Rules, and Analytics Agents

EHA Data Integration

(4) Ready-to-use, configurable Rules Framework

- Data Quality Validation & Transformation
- Late-arriving data & Versioning

Data Management Rules for Master Data

- Integrated with EMPI via OHMPI
- Validation of completeness and consistency of both original codes & master data
- Standardization & Transformation
- **(5)** Seeded master data for 550 coded attributes

Automated Exception Management

- Exceptions related to rules, Exception messages
- Logging, tracking, and resolution of exceptions

(6) Analytical Analytics that leverages MDM completely

- Supports original, warehouse-standard, and application-specific ontologies even if absent in Point of Care source systems
- Measure authoring to support SNOMED-CT
- Multiple equivalences that leverage SNOMED-CT Preferred Terms

Analytics Accelerators

- Advanced hierarchy management & presentation
- SNOMED-CT based conformed dimensions

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SNOMED-CT & Oracle EHA

From Meaningful Ideas to Practical Benefits

Benefits to Healthcare Providers

1. The completeness of SNOMED-CT makes it easier to code & manage standardized clinical concepts at the most granular level of detail

2. Elimination of multiple and redundant code-concept pairs and terminology systems via a SNOMED-CT standard is definitely achievable

3. Traversal of hierarchies in multiple directions (up/down/sideways) is enabled by SNOMED-CT

4. SNOMED-CT provides clinically expressive, comprehensive, and standardized master data

1. Oracle EHA is a product suite that acquires, manages, and integrates transactional data and MDM data at both atomic and aggregate granularities for analytics

2. Oracle EHA integrates source data, analytical data, metadata, and master data silos to ensure improved data quality while quantifiably enhancing rapid deployment of analytics

3. Oracle EHA provides end-to-end and comprehensive hierarchy management & presentation features

4. Quality of care and cost management are measured and managed in an integrated way with ready-to-use EHA analytical applications

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SNOMED-CT & Oracle EHA

From Meaningful Ideas to Practical Benefits

Benefits to Patients

1. Standardization of master data and its application at multi-contextual points is possible with SNOMED-CT

2. The use of transformational analytics based on a SNOMED-CT driven MDM improves the quality of care and increased patient safety

3. Missing data and metadata are minimized with the use of a comprehensive ontology like SNOMED-CT

1. EHA products that acquire, integrate, warehouse, aggregate, and present dashboards, scorecards, and near real time BI enable better and earlier identification of patients at risk

2. EHA provides clinicians, patients, and other healthcare participants with access to relevant and timely analytics that drive the generation of new insights and action with direct benefits to patients

3. EHA provides ready-to-deploy/use analytics & data integration products that enable better and more complete insights into a patient's health or quality of life