Understanding HL7:
Messaging with SNOMED and LOINC

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Objectives

- Describe HL7 structure, v2.x and v3.0
- Describe messaging structure of HL7 using standardized terminology
Outline

- HL7 Historical Overview

- HL7 Version 2.x
  - Structure
  - Standardized Terminology (LOINC/SNOMED)

- HL7 Version 3 (Reference Information Model)
  - Structure
  - Standardized Terminology (LOINC/SNOMED)
  - Templates
Why Standards?

- Data exchange
  - Intrahospital (Lab to EHR)
  - Interhospital (Patient Records)
  - Government (Disease Reporting)
  - Across Settings (Inpatient to Home Health)

- Codes and vocabulary
Benefits of Standards

Impedance 25.43 ohms
255 lumen

a = 2.55"
b = 3.00"
c = 0.35"
d = 1.00"
e = 0.85"
33 deg
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Goal of Standards

- Information and data sharing
- Enable Evidence-Based Practice
- Increase Quality Care
  - Reduce redundant data entry
  - Reduce errors in transmission
  - Generate Alerts
- Secondary Data Use
  - Quality Measures
  - Research
Interoperability Definition

“Any meaningful exchange of utterances depends upon the prior existence of an agreed upon set of **semantic** and **syntactic** rules”.

Levels of Interoperability

- **Basic** – allows messages to be exchanged between computer systems
  - Word processing documents, spreadsheets
- **Functional** – describes the standard syntax (format) of the message
  - Document templates, forms, data structures
  - Message standards
- **Semantic** – meaning from sending and receiving application is the same.
  - Requires use of standard vocabularies within the message
Barriers to Data Quality and Interoperability

“The challenges ahead aren’t about hardware and software, but underlying integration issues such as vocabulary and clinical concepts.”

Morgan Passiment, American Medical Colleges
Historical Perspective


Mainframe

Order entry, Census and Charges Interfaces

Mini
Historical Perspective…
What does “HL7” mean?

A domain-specific, common protocol for the exchange of health care information.

ISO-OSI Communication Architecture Model

- Application
- Presentation
- Session
- Transport
- Network
- Data Link
- Physical
HL7 Background

- Started in late 1980’s to address interoperability among clinical systems

- Focus
  - Patient information (ADT) systems
  - Billing
  - Laboratory Data Systems

- Original scope was the exchange of information between healthcare systems
HL7 Background (continued)

First viable standard was Version 2

- Released early 1990’s
- Specified message syntax and structure
- (Most) content and semantics were left to the implementers
- Version 2.5, which was approved in 2003 is still in wide use today
HL7 Mission

“… to create flexible, cost effective approaches, standards, guidelines, methodologies, and related services for interoperability between healthcare information systems.”
Why HL7?

- Decrease time and cost of implementation
- Approach “plug-and-play”
- Enable data sharing
  - Mergers due to managed care
  - Regional or national clinical studies
  - Disease prevention and control
- Enable sharing of decision support modules
  - Alerts
  - Protocols
  - Clinical pathways
HL7 Standard Versions

- 2.0 (1988) Prototype
- 2.1 (1990) First standard
- 2.2 (1994) Widely Adopted
- 2.3 (1997) In operation
- 2.3.1 (1999) Current ANSI standard
- 2.7 (2007) In ballot
- 3.0 Balloting of Prototype in 2000, balloting of formal specifications in 2001
HL7 Version 2.x
Version 2 HL7 Message

MSH|^~\&|||19941122100053||ORU^M01|
Evn|M01|199411181141|
PID||661041|GARDNER^REED^M|
Pv1|I|E7^703^^LDS|
OBR|^A000520|LYTES^Serum Electrolytes|
OBX|1|NM|NAS^Serum Sodium|1|138|mmol/L|
OBX|2|NM|K^Serum Potassium|1|3.2|mmol/L|
OBX|3|NM|CL^Serum Chloride|1|114|mmol/L|
OBX|4|NM|CO2^Serum CO2|1|24|mmol/L|
HL7 Observation Message

MSH|^~\&|OADD||DADD||19941122100053||ORU^M01|
Evn|M01|199411181141|
PID|||661041||TEST^PHARM FIVE^|
Pv1|||PSYE^3313^PCM|
ORC|RE|
OBR||^A000520|LYTES^Serum Electrolytes|
OBX|1|NM|NAS^Serum Sodium|1|138|mmol/L|
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OBX: name-value pair approach

Other data fields include: date of observation, identity of provider giving observation, normal ranges, abnormal flags

A code that identifies the *datatype* of OBX-5

A code that identifies the units of numerical data in OBX-5 (Temp Reading)

OBX-5: Data

Status

A code that identifies the data in OBX-5

11289-6^^LN | 38 | C^^ISO+ | F
OBX: with a coded value

A code that identifies the *datatype as a coded element*

The code is from LOINC

The code is from SNOMED

OBX||CE|883-9^Blood Group^LN||58460004^Group O^SMI|

A code that identifies the data in OBX-5 (ABO Blood Group)

OBX-5: Data
A code for Group O
All are using HL7; what is the problem?

- **Site 1:**
  \[OBX|1|CE|ABO^{ABO GROUP}||O^{Type O}\]

- **Site 2:**
  \[OBX|1|CE|BLDTYP^{ABO GROUP}||TYPEO^{Type O}\]

- **Site 3:**
  \[OBX|1|CE|ABOTYPE^{ABO GROUP}||OPOS^{Type O}\]

You and I may know that these are similar results, but our computers will not.
Goal

Site 1:

OBX|1|CE|883-9^ABO Type^LN||58460004^Group O^SMI|

Site 2:

OBX|1|CE|883-9^ABO Group^LN||58460004^Group O^SMI|

Site 3:

OBX|1|CE|883-9^Blood Type^LN||58460004^Group O^SMI|

Agree on a universal coding system for clinical observations.
Version 2.x Problems

- HL7 specifies message structure

- Everyone uses different terms and codes
  - No formal bindings to standard vocabularies

- Time consuming mapping

- Existing coding systems incomplete
HL7 Version 3
Version 3 Goals

- Provide a common model for healthcare.
- Improve clarity and precision of specification
- Improve adaptability of standards to change
- Begin to approach “plug and play”
HL7 V3 RIM - Backbone

- **Entity**
  - People, Places, Physical Things

- **Associations**
  - Roles & Relationships

- **Act**
  - Collections of Events

- Schadow / Russler, 2003
Backbone of the RIM

- Schadow / Russler, 2003
HL7 V3 RIM – Backbone Example

- **Entity** = Person

- **Associations**
  - Role = Patient

- **Act** = Observation

- Schadow / Russler, 2003
HL7 Act Examples

- Observation
- Substance Administration
- Patient Encounter
- Working List
- Procedure

- Schadow / Russler, 2003
HL7 RIM Act Hierarchy

- Schadow / Russler, 2003
HL7 RIM Observation Hierarchy

- Russler, 2004
Procedure Act = Appendectomy

PROC
E VN
387713003 surgical procedure
25876001 emergency
181255000 entire appendix
65801008 excision
129238008 endoscopic approach
Vocabulary Role in Version 3

- Each coded attribute should be constrained to a specific vocabulary domain
- Codes can be from HL7 or standard external sources
- The coding scheme should be comprehensive for the domain of intended use
- Coding schemes external to HL7 must be registered with HL7
Examples

marital_status_cd : CV <MaritalStatus>
   e.g., married, separated, divorced, widowed, common-law marriage.

procedure_cd : CV <Procedure>
   e.g., Cholecystectomy, Abdominal Hysterectomy, IV Insertion
Implications for Nursing and You

- HL7 Attendance
  - Many Working Groups (Patient Care, Public Health, Structured Documents, etc.)
  - www.HL7.org

- Nursing Terminology Development

- Model and Terminology Use
  - Template Development starting
  - Applications
Conclusion

- Value of terminology standards
- HL7 Version 2.x
  - Most widely used today
- HL7 Version 3 (Reference Information Model)
- Standardized Terminology can be used in both
Thank You!

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