Standards Part 1

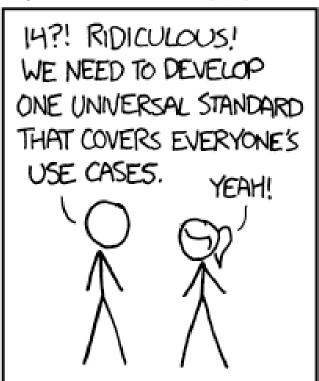
Andrew Loza, MD PhD

Housekeeping

- Assignments are due 11:59pm on Tuesday
- Remember to email your group unless you prefer to be randomly assigned

HOW STANDARDS PROLIFERATE: (SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC.)

SITUATION: THERE ARE 14 COMPETING STANDARDS.



5∞N: SITUATION: THERE ARE 15 COMPETING STANDARDS.

Standards Overview

- Today:
 - Origin of standards
 - Data standards

- Next class:
 - Classifications
 - Standards used in communication and collaborative data networks

Origins of Standards

Cubit ~3000-4000 BC



Carob bean



Bills of Mortality

- London 1500's to monitor the plague
- Considered origins of ICD-10



A generall Bill for this present year, ending the 19 of December 1665, according to the Report made to the KINGS most Excellent Majesty.



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Why have standards? Well, look what happens without them

Great Baltimore Fire of 1904

- The inferno blazed for 30 hours, destroying more than 1,500 buildings across 70 city blocks.
- Fire engines from other cities came to help, but could not. Their hose couplings (each a different size) did not fit the Baltimore fire hydrants.
- Until then, cities saw little reason to adopt a standard size coupling, and local equipment manufacturers did not want competition.



Just because a standard exists doesn't mean it's easy to use

- Javascript. What could be more standard than a computer language and "equal to"?
 - 1=='1'
 - " == 0
 - " == 'O'
 - '\t\n\' == 0
 - null == 0
 - [null] == 0
 - null == undefined
 - [null] == [undefined]
 - [undefined] == [undefined]

What standards facilitate in Clinical Informatics

- Data Aggregation
 - Data from the different sources can be combined if it uses the same format
- Data Transmission
 - Sender and receiver need to speak the same language
- Requires cooperation of many stakeholders

How are standards developed

Ad hoc:

arrangement arises naturally

• De facto:

single vendor controls large market share

Mandate:

- Required by law
- HCFA 1500

Consensus:

- representatives from multiple groups meet to decide
- DSM-V

How standards are developed: International Organization for Standardization

 Voluntary organization recognized as an authority on standards (helps solve the challenge of convincing stakeholders via

authority)

| Stage code | Stage | Associated document name | Abbreviations | Description · Notes |
|------------|-------------|---------------------------|--|---------------------|
| 00 | Preliminary | Preliminary work item | PWI | |
| 10 | Proposal | New work item proposal | NP or NWIP · NP Amd/TR/TS/IWA | |
| 20 | Preparatory | Working draft or drafts | AWI · AWI Amd/TR/TS · WD · WD Amd/TR/TS | |
| 30 | Committee | Committee draft or drafts | CD · CD Amd/Cor/TR/TS · PDAmd (PDAM) · PDTR · PDTS | |
| 40 | Enquiry | Enquiry draft | DIS · FCD · FPDAmd · DAmd (DAM) · FPDISP · DTR · DTS | (CDV in IEC) |
| 50 | Approval | Final draft | FDIS · FDAmd (FDAM) · PRF · PRF Amd/TTA/TR/TS/Suppl · FDTR | |
| 60 | Publication | International Standard | ISO · TR · TS · IWA · Amd · Cor | |
| 90 | Review | | 130 · Th · 13 · IWA · Allid · Col | |
| 95 | Withdrawal | | | |

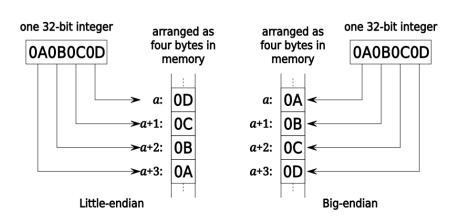
Overview of Data Standards

Data standards are the backbone of information systems

- Selected standards:
 - Data Types
 - Labs, vital signs, etc.
 - Diagnoses
 - Procedures

Primitive Data Types

- Bit: 0,1
- Byte: 8 bits
- Boolean: logical true/false (1 bit)
- Integer: signed (int8,int16,int32,...) and unsigned (uint8)
- Floating point:
 - Limited precision storage of any rational number (0.1+0.2)
 - Stores sign, exponent, mantissa: -1
- Big vs. Little Endian



Primitive Data Types Continued: Text

• Unicode:

- Standard for all text and other characters (other languages, symbols, emojis)
- Unicode Codepoint: ~150k characters and associated integer
- Encoding: (how this is represented to a computer)
 - ASCII: 128 unique characters
 - UTF-8: variable length encoding 1-4 bytes

More Complex Data Types

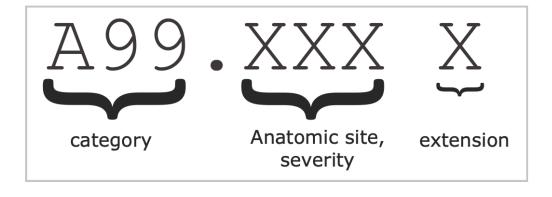
- Diagnoses
- Medications
- Observations (Labs, vitals, etc)
- Procedures
- Images

ICD-9 and ICD-10

- ICD-10 = International Classification of Disease, 10th Revision
- Hierarchical, by organ system and etiology
- Specificity used for billing
- Example: W61.62XD

| ICD-9 | ICD-10 |
|-------------------|--|
| 13,000 | 68,000 |
| 3–5 | 5-7 |
| Somewhat detailed | Very detailed |
| Not specified | Specified |
| Not specified | Specified |
| 4 | 12 |
| | 13,000 3–5 Somewhat detailed Not specified Not specified |

| CODE | EXPLANATION |
|---------|--|
| H66 | Suppurative and unspecified otitis media |
| H66.0 | Acute suppurative otitis media |
| H66.00 | Acute suppurative otitis media without spontaneous rupture of eardrum |
| H66.001 | Acute suppurative otitis media without spontaneous rupture of eardrum, right ear |
| | |



Learning about Naming Standards from ICD

- Vocabulary: set of symbols/codes
- Terminology: limited vocabulary to express ALL concepts in a domain
- Nomenclature: system of composition for unlimited expression
- Ontology: concepts + relationships

Diagnosis Related Group

- Developed here at Yale in the 1970's!
- 745 principle diagnoses for encounters
- Used by CMS for reimbursements for hospitalizations
- Grouped by 25 body sites

Severity specified by Major Comorbid Conditions (MCC), CC, without CC

| MS-DRG | MDC | TYPE | TITLE | WEIGHT | GMLOS | AMLOS |
|--------|-----|------|--|--------|-------|-------|
| 280 | 05 | MED | Acute myocardial infarction, discharged alive w/MCC | 1.7289 | 4.7 | 6.0 |
| 281 | 05 | MED | Acute myocardial infarction, discharged alive w/CC | 1.0247 | 3.0 | 3.7 |
| 282 | 05 | MED | Acute myocardial infarction, discharged alive w/o CC/MCC | 0.7562 | 2.0 | 2.4 |

Abbreviations: MDC Major Diagnostic Category, GMLOS Geometric Mean Length Of Stay, AMLOS Arithmetic Mean Length Of Stay, MCC Major Comorbid Condition, CC Comorbid condition. Major Diagnostic Category 05 refers to diseases of the circulatory system

Current Procedural Technology®

- Copywritten set of codes maintained by AMA for describing procedures
- Used by most insurers and CMS
 - Must pay yearly licensing fee
- Each code is associated with an RVU (relative value unit)

| SERVICE | CPT CODE | RVU |
|--|----------|------|
| EKG rhythm interpretation | 93042 | 0.22 |
| Application of finger splint | 29130 | 0.83 |
| Single laceration up to 2.5 cm (scalp, neck, axillae, external genitalia, trunk-including hands and feet) | 12001 | 1.27 |
| Level III ED exam | 99283 | 1.75 |
| Single laceration repair 2.6–7.5 cm (scalp, neck, axillae, external genitalia, trunk-including hands and feet) | 12002 | 2.08 |
| Endotracheal intubation | 31500 | 3.24 |
| Critical care (30–74 min) | 99291 | 6.31 |
| Treatment of shoulder dislocation | 23650 | 8.18 |

Health Care Financing Administration Common Procedure Coding System (HCPCS)

Codes for procedures not covered in CPT

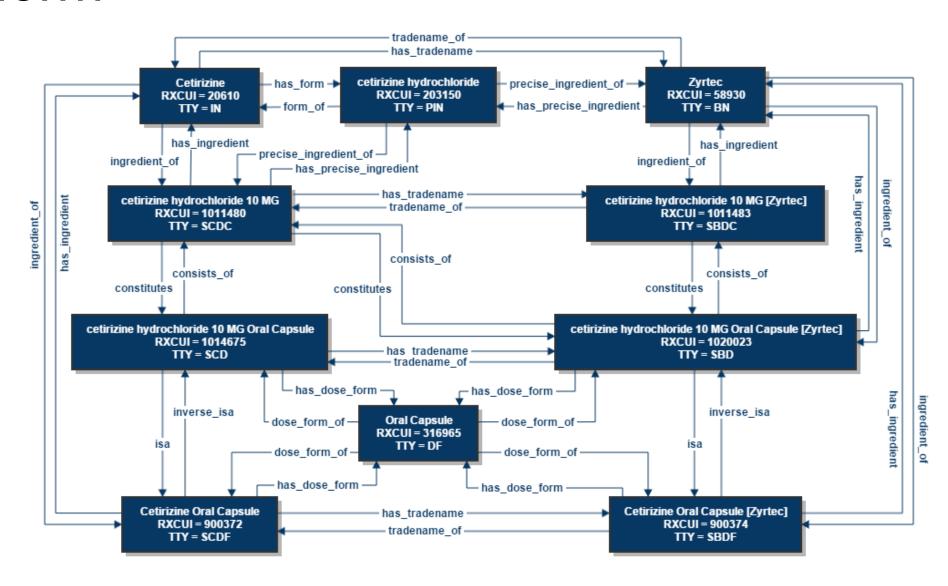
Medications

- NDC: National Drug Code, unique identifier for FDA approved medications
 - 10 digits that specify manufacturer, compound, unit size
- RxNorm
 - Formal concept-based representation of prescription medications

Rx Norm

| TTY | NAME | DESCRIPTION | EXAMPLE |
|------|----------------------------------|---|--|
| IN | Ingredient | A compound or moiety that gives the drug its distinctive clinical properties. Ingredients generally use the United States Adopted Name (USAN) | Fluoxetine |
| PIN | Precise ingredient | A specified form of the ingredient that may or may not be clinically active. Most precise ingredients are salt or isomer forms | Fluoxetine hydrochloride |
| DF | Dose form | How the drug is used | Oral solution |
| SCDC | Semantic clinical drug component | Ingredient + strength | Fluoxetine 4 MG/ML |
| SCDF | Semantic clinical drug form | Ingredient + dose form | Fluoxetine oral solution |
| SCD | Semantic clinical drug | Ingredient + strength + dose form | Fluoxetine 4 MG/ML oral solution |
| BN | Brand name | A proprietary name for a family of products containing a specific active ingredient | Prozac |
| SBDC | Semantic branded drug component | Ingredient + strength + brand name | Fluoxetine 4 MG/ML [Prozac] |
| SBDF | Semantic branded drug form | Ingredient + dose form + brand name | Fluoxetine oral solution [Prozac] |
| SBD | Semantic branded drug | Ingredient + strength + dose form + brand name | Fluoxetine 4 MG/ML oral solution [Prozac |

Rx Norm



Logical Observation Identifiers, Names, and Codes (LOINC)

- All clinical and laboratory observations
- 6 digits with hyphen between 5 and 6

| ID | NAME | CLASS |
|---------|--|--------|
| 02160-0 | Creatinine [mass/volume] in serum or plasma | СНЕМ |
| 00718-7 | Hemoglobin [mass/volume] in blood | Hem/BC |
| 02823-3 | Potassium [moles/volume] in serum or plasma | СНЕМ |
| 02345-7 | Glucose [mass/volume] in serum or plasma | СНЕМ |
| 02951-2 | Sodium [moles/volume] in serum or plasma | СНЕМ |
| 03094-0 | Urea nitrogen [mass/volume] in serum or plasma | СНЕМ |
| 02028-9 | Carbon dioxide, total [moles/volume] in serum or plasma | СНЕМ |
| 02075-0 | Chloride [moles/volume] in serum or plasma | СНЕМ |
| 00789-8 | Erythrocytes [#/volume] in blood by automated count | HEM/BC |
| 00786-4 | Erythrocyte mean corpuscular hemoglobin concentration [mass/volume] by automated count | HEM/BC |
| | | |

Digital Imaging and Communications in Medicine (DICOM)

- Set of standards for medical image storage, transmission, etc.
- Stream of elements
 - Element Tag: 4 byte number for what is stored
 - Value Representation: how it is stored
 - Value Length: how long the value is
 - Value: the actual data

Classifications, Taxonomies, and Ontologies

- Classification
 - Convention for naming a grouping
- Taxonomy
 - Specific type of classification with a single hierarchy (parent, child)
- Ontology
 - Generalized system where relationships can go in more than one directions

Things to consider in a classification

- Concept orientation: all codes have relationships to other codes
- Concept permanence: codes are never deleted or reused
- Non-ambiguity: coded concepts have only one meaning.
- Explicit versioning: each version of the dictionary is given a version number
- Semantic vs. nonsemantic: whether codes are related to the hierarchy or relationship among concepts.
- Multihierarchy: concepts can have multiple relationships
- Multiple granularities: concepts have varying degrees of specificity for different users.

Systematized Nomenclature of Medicine-Clinical Terms (SNOMED-CT)

- Extensive set of concepts and relationships between concepts
- Mix of pre-coordinated and post-coordinated terms
 - Pre-coordinated: term exists as an entity in a code book (pneumonia)
 - Post-coordinated: concept is expressed by assembling (lung+infection)

https://ontoserver.csiro.au/shrimp/