

Standards Part 1

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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.)



Standards Overview

- Today:
 - Origin of standards
 - Data standards
- Next class:
 - Classifications
 - Standards used in communication and collaborative data networks

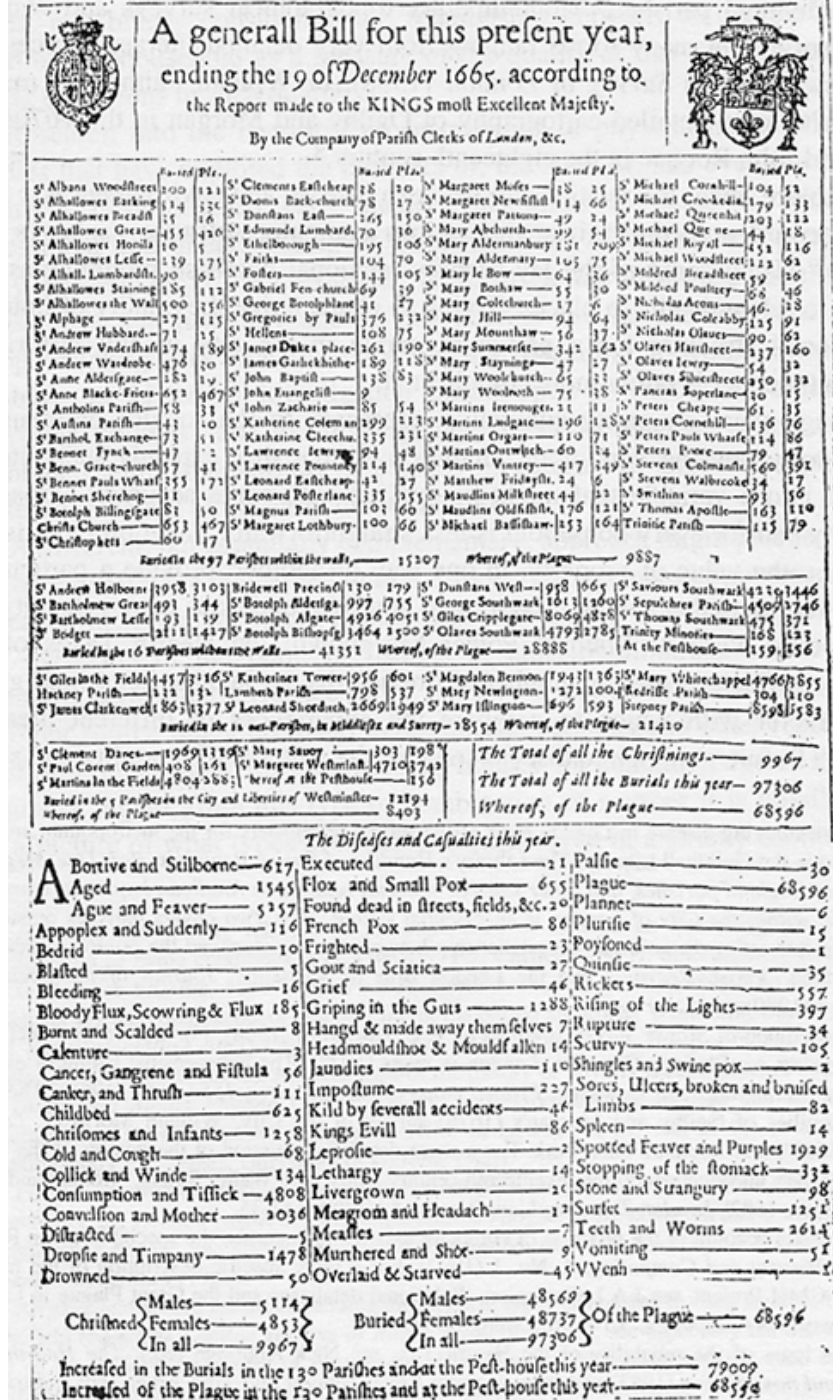
Cubit ~3000-4000 BC



Carob bean



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



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`
 - `"" == '0'`
 - `'\t\n\' == 0`
 - `null == 0`
 - `[null] == 0`
 - `null == undefined`
 - `[null] == [undefined]`
 - `[undefined] == [undefined]`

If you do not know your standards, you will break things

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)

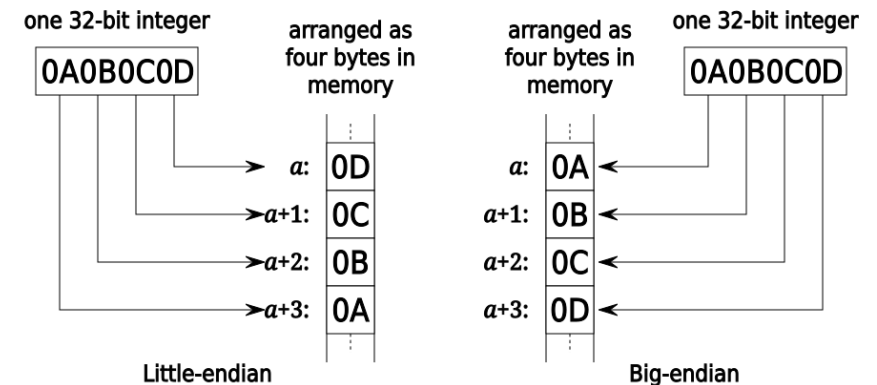
Stage code	Stage	Associated document name	Abbreviations	Description · Notes
00	Preliminary	Preliminary work item	PWI	
10	Proposal	New work item proposal	NP or NWIP · NP Amd/TR/TS/IWA	
20	Preparatory	Working draft or drafts	AWI · AWI Amd/TR/TS · WD · WD Amd/TR/TS	
30	Committee	Committee draft or drafts	CD · CD Amd/Cor/TR/TS · PD Amd (PDAM) · PDTR · PDTS	
40	Enquiry	Enquiry draft	DIS · FCD · FPD Amd · 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			
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

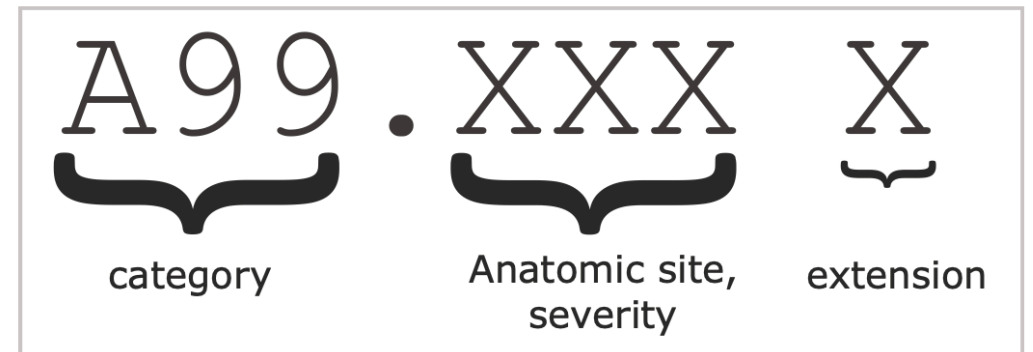
- Diagnoses
- Medications
- Observations (Labs, vitals, etc)
- Procedures
- Images

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
Number of codes	13,000	68,000
Length of code (chars)	3–5	5–7
Specificity	Somewhat detailed	Very detailed
Laterality (i.e. right or left)	Not specified	Specified
Visit type (i.e. initial, repeat)	Not specified	Specified
Max codes reported	4	12

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

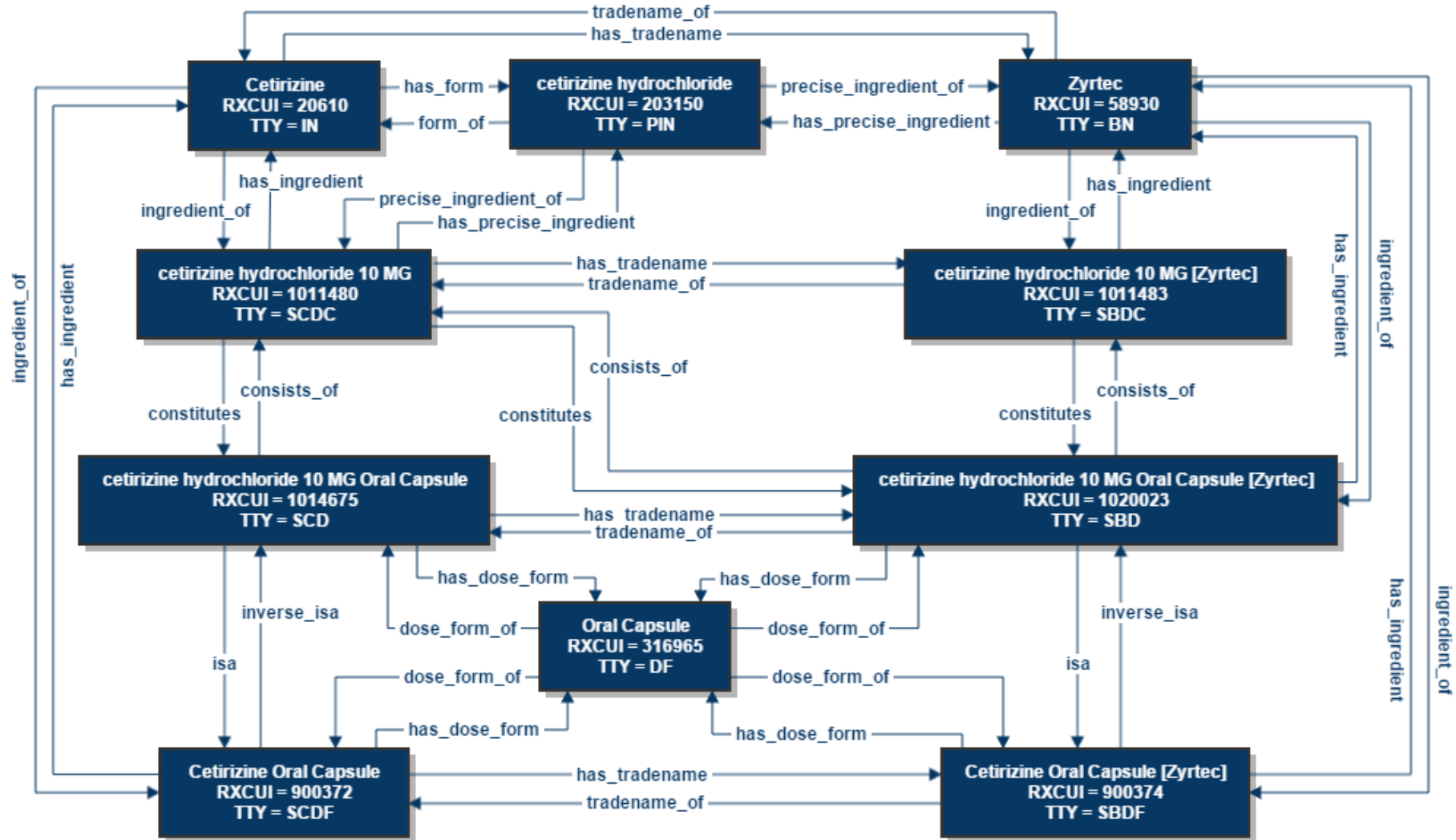
Medications

- 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	CHEM
00718-7	Hemoglobin [mass/volume] in blood	Hem/BC
02823-3	Potassium [moles/volume] in serum or plasma	CHEM
02345-7	Glucose [mass/volume] in serum or plasma	CHEM
02951-2	Sodium [moles/volume] in serum or plasma	CHEM
03094-0	Urea nitrogen [mass/volume] in serum or plasma	CHEM
02028-9	Carbon dioxide, total [moles/volume] in serum or plasma	CHEM
02075-0	Chloride [moles/volume] in serum or plasma	CHEM
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/>