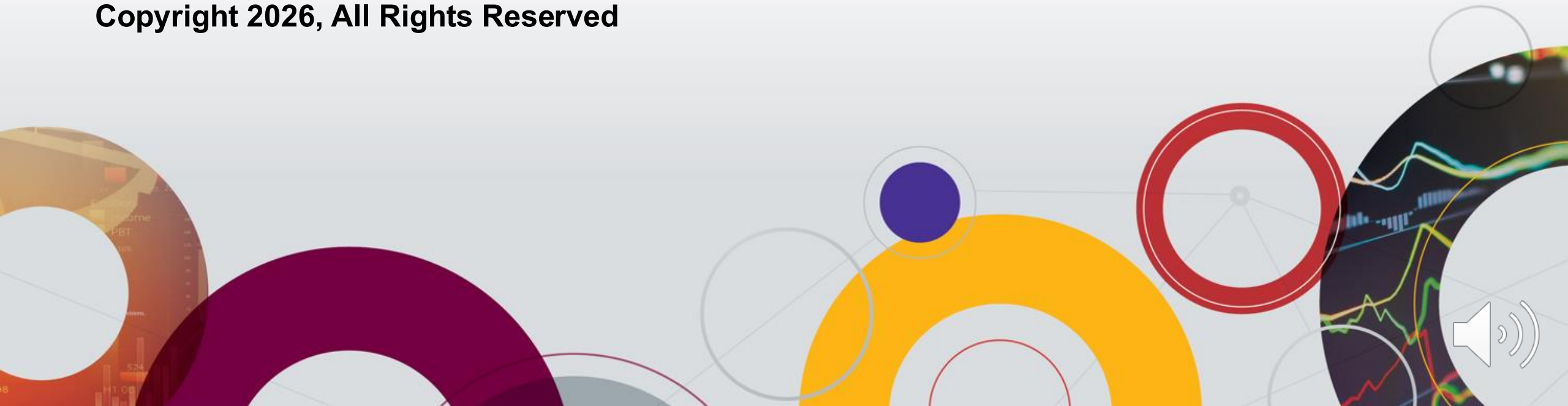


4.4b Terminology Standards

10x10 – Introduction to Biomedical Informatics & Artificial Intelligence
William Hersh, MD, FACMI, FAMIA, FIAHSI
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Drug terminology

A number of different code sets, mostly developed by US government

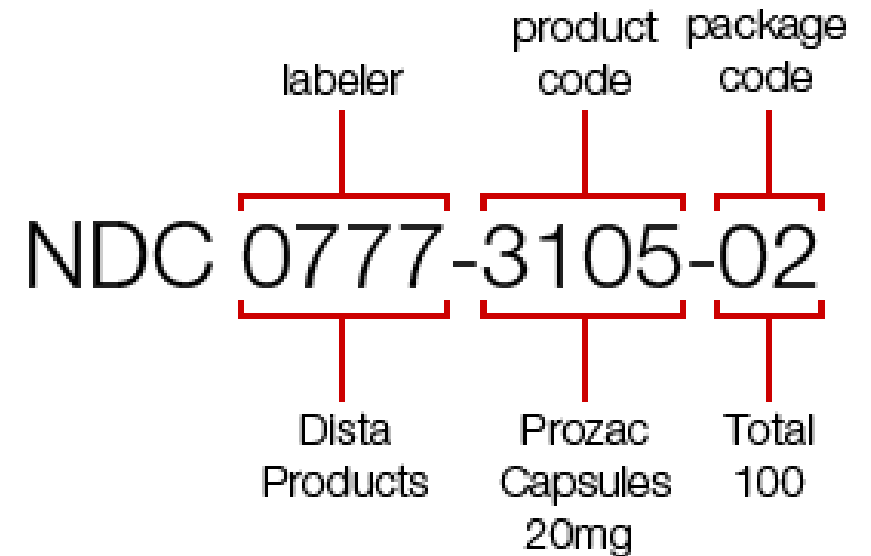
- National Drug Codes (NDC)
- Unique Ingredient Identifier (UNII)
- Medication Reference Terminology (MED-RT, formerly NDF-RT)
- NCI Thesaurus (NCIt) Structured Product Labeling (SPL)
- RxNorm, RxTerms

Including APIs to access them (Altexsoft, 2020)

National Drug Codes (NDC) (Anderson, 2020)

10 or 11-digit code for each and every pharmaceutical preparation

- First 4-5 digits for manufacturer, assigned by Food & Drug Administration (FDA), e.g., Merck, Pfizer, etc.
- Next 4 digits for product name, strength, dose form
 - One code for all variants of these
 - Problem: Not unique for same drug from different manufacturer
- Final 2 digits are code for packaging
 - e.g., number of tablets in bottle



Other drug terminology standards

[UNII](#) specifies ingredients in drugs and other compounds

[MED-RT](#) maintains mechanism of action, physiological effect, and structural class

[SPL](#) maintains pharmaceutical dosage form, route of administration, and potency

[Anatomical Therapeutic Chemical \(ATC\)](#) – usually paired with defined daily dose (DDD)

- Maintained by World Health Organization (WHO)

RxNorm and related standards and tools

[RxNorm](#) provides semantic structure for formulations and their components

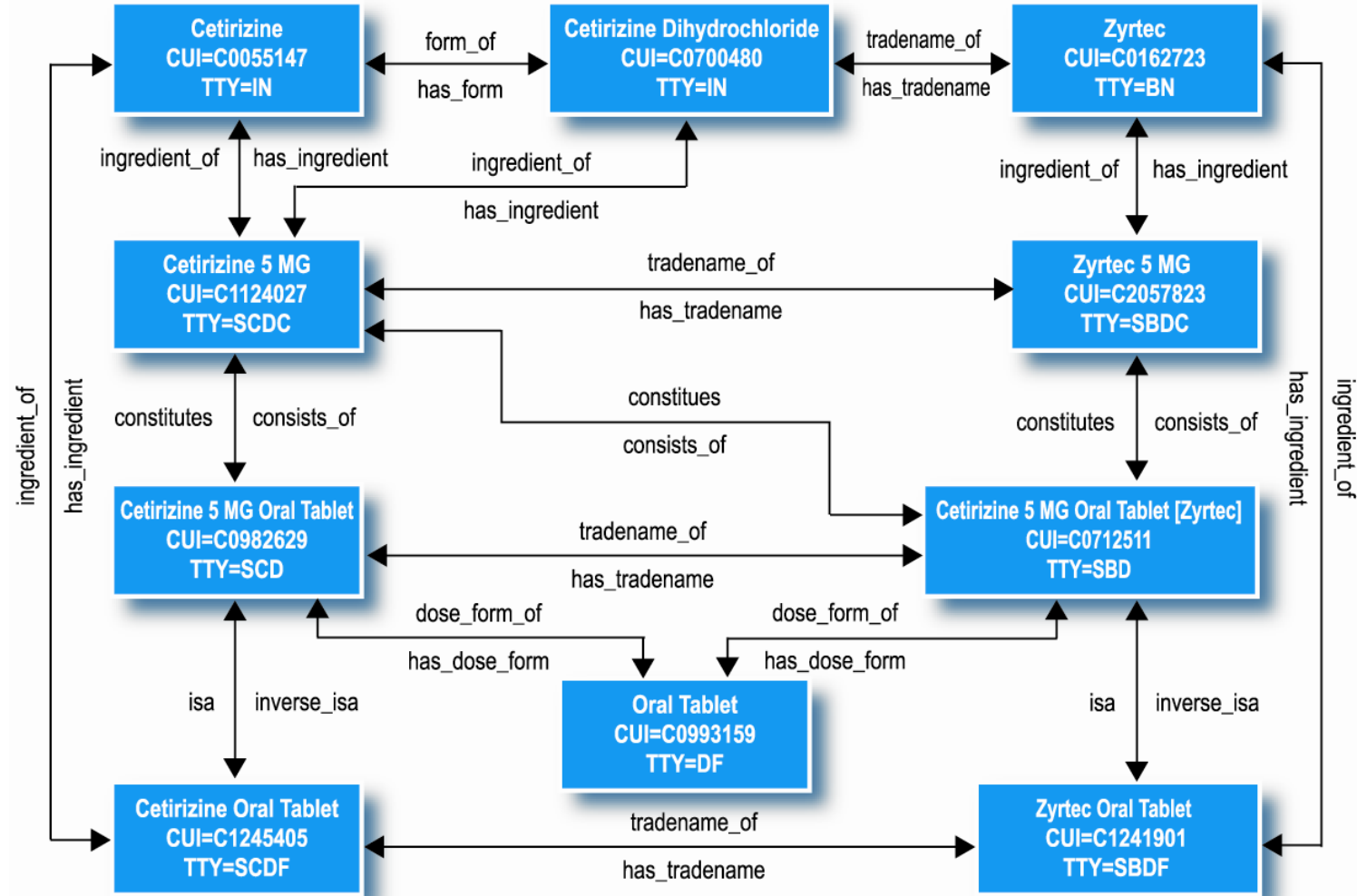
[RxTerms](#) provides interface terminology to RxNorm

RxNorm/RxTerms is standard into which other drug terminologies must map

[RxMix](#) allows applications from RxNorm, RxTerms, and others

[RxNav](#) provides browser for exploration

Relationships in RxNorm – overview



Vaccines Administered (CVX)

Maintained by HL7, mainly used with Version 2.5.1

Contains short description, full vaccine name, and status

- Active – currently available administrable vaccine
- Inactive – administrable vaccine formulation no longer available for patient administration
- Pending – vaccine expected to become active in future
- Non-US – vaccine available outside US only
- Never Active – vaccine that was never available and not in pipeline of new vaccines

Which COVID-19 vaccine did you get initially? Me: 208

- COVID-19, mRNA, LNP-S, PF, 30 mcg/0.3 mL dose
- SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, preservative free, 30 mcg/0.3mL dose

Laboratory test terminology

Unlike drug terminology, one leading terminology but still challenges for interoperability (American Association for Clinical Chemistry, 2023)

[Logical Observation Identifiers Names and Codes \(LOINC\)](#) is leading lab terminology system (Vreeman, 2017; Stram, 2020)

Started as standard for laboratory tests and names but extended into other types of measures (e.g., radiology – Vreeman, 2018) and languages beyond English (Vreeman, 2012)

LOINC observations

Component (analyte) – substance or entity measured or observed

Property – e.g., mass concentration, numeric fraction

Time – point in time

Specimen (system) – e.g., blood, cerebrospinal fluid

Scale – e.g., qualitative, quantitative, ordinal, nominal

Method – optional, procedure used to make observation

LOINC examples

Blood glucose - GLUCOSE:MCNC:PT:BLD:QN:

Serum glucose - GLUCOSE:MCNC:PT:SER:QN:

Urine glucose concentration - GLUCOSE:MCNC:PT:UR:QN:

Urine glucose by dip stick - GLUCOSE:MCNC:PT:UR:SQ:TEST STRIP

Ionized whole blood calcium - CALCIUM.FREE:SCNC:PT:BLD:QN:

24 hour calcium excretion - CALCIUM.TOTAL:MRAT:24H:UR:QN:

Automated hematocrit - HEMATOCRIT:NFR:PT:BLD:QN:AUTOMATED COUNT

Manual spun hematocrit - HEMATOCRIT:NFR:PT:BLD:QN:SPUN

Erythrocyte MCV - ERYTHROCYTE MEAN CORPUSCULAR
VOLUME:ENTVOL:PT:RBC:QN:AUTOMATED COUNT

ESR by Westergren method - ERYTHROCYTE SEDIMENTATION
RATE:VEL:PT:BLD:QN:WESTERGREN

LOINC code naming

Fully-Specified Name (FSN) – mapping

Long Common Name (LCN) – primary display name

Short Name – column header, old-school systems with character limits

Display Name – provider-friendly display name

Consumer Name – consumer-friendly display name

LOINC codes do not contain

- Reason for test
- Details about specimen or testing machine
- Test interpretation
- Who/where test performed
- Anything not part of naming the test

LOINC has codes for individual observations and collections

Individual observations

- 6690-2 Leukocytes [# /volume] in Blood by Automated
- 2339-0 Glucose [Mass/volume] in Blood
- 29463-7 Body weight
- 55423-8 Number of steps in unspecified time Pedometer
- 57021-8 CBC W Auto Differential panel – Blood

Collections – panels and documents

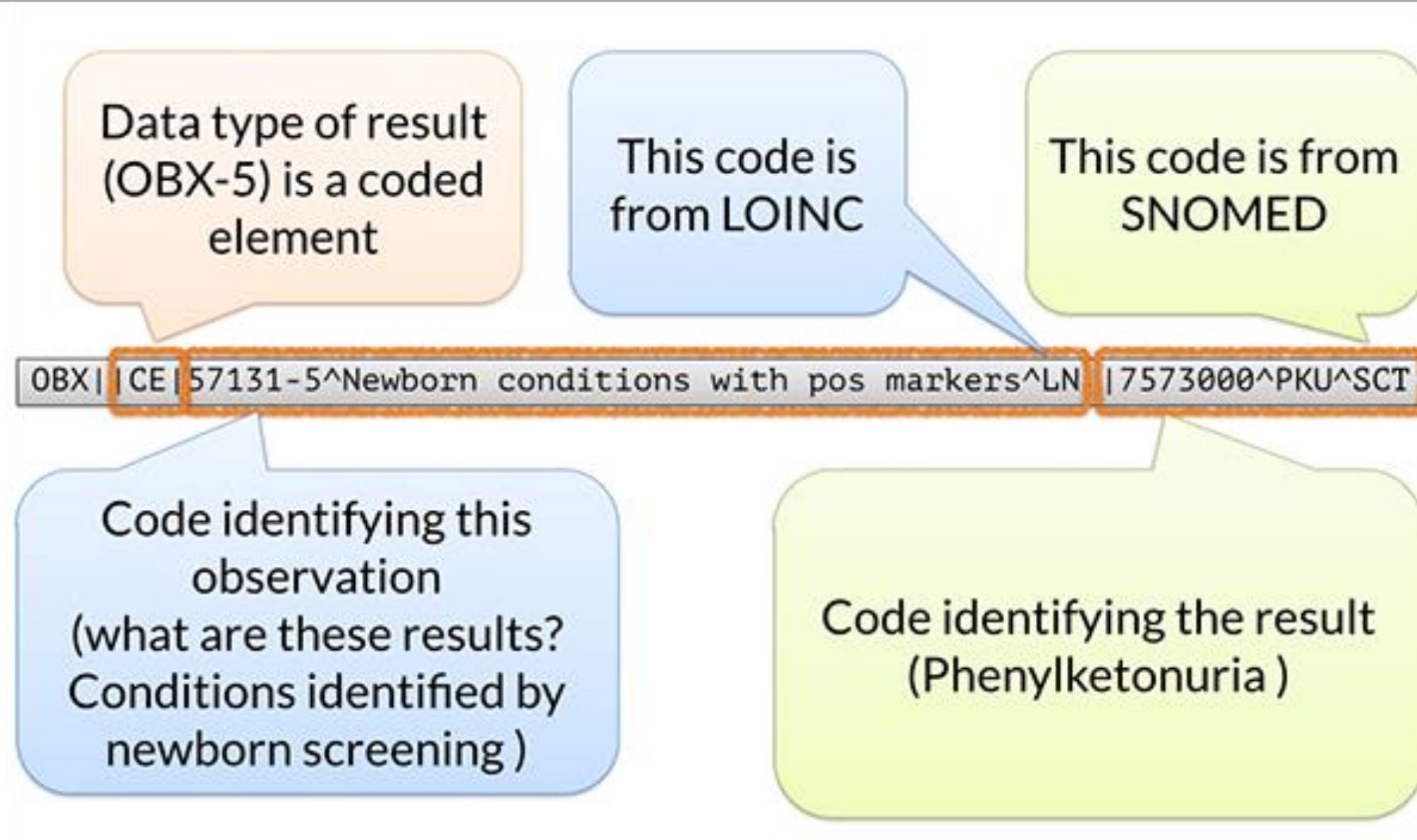
- 34565-2 Vital signs, weight and height panel
- 44249-1 PHQ-9 quick depression assessment panel
- 36813-4 CT Abdomen and Pelvis W contrast IV
- 18842-5 Discharge summary

LOINC document ontology (Li, 2011; Wang, 2014; Xuo, 2020)

Each document has five attributes (example of progress note in primary care underlined)

- Type of Service – healthcare services provided
 - e.g., Consultation, Evaluation and Management, Progress
- Kind of Document – type of clinical document on basis of structure
 - e.g., Note, Report, Checklist
- Setting – location or channel where clinical care provided
 - e.g., Ambulance, Birthing Center, Intensive Care Unit, Office
- Role – people and their occupations involved in service or authors who created note
 - e.g., Physician, Nurse, Pharmacist
- Subject Matter Domain – clinical specialty relevant to document or main purpose of creating document
 - e.g., Anesthesiology, Urology, Cardiovascular Disease, Primary Care

Compatible with other standards



Concerns for LOINC

Clinicians not always able to understand lab test names and functions (Carter, 2024)

Lab tests often have context and aggregation; not always captured by discrete LOINC terms (Drenkhahn, 2020)

LOINC names sometimes ambiguous (Stram, 2020)

Leading to safety issues (Carter, 2020)

Sometimes challenges in mapping to other terms in systems; can be reduced by automated methods (McDonald, 2023)

Current Procedural Terminology (CPT-4)

Classification of procedures performed by physicians

Usually required for reimbursement by government and private insurance companies in U.S.

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Evaluation/management (E/M) portion documents clinical encounters

- Levels of coding require more documentation and contribute to “note bloat” (Berenson, 2011)
- Modified in 2021 to define levels based on time spent and complexity of medical decision-making (AMA, 2020)

Some challenges

- Physicians do not always use comprehensively, especially in provision of preventive and coordinated services (Agarawal, 2022)
- Currently does not account for machines that might carry out services in future (Frank, 2022)



HCFA Common Procedure Coding System (HCPCS)

HCPCS Level One is CPT-4

HCPCS Level Two adds items and supplies and non-physician services

HCPCS Level Three added local codes

- Abolished in 2003 under HIPAA rules

