Implications of the Major Health KOSs during the COVID-19 Pandemic

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Outline

1. Prompt actions of the major health KOSs
   a) The recent efforts to eliminate ambiguities and semantic conflicts through naming of the disease
   b) New codes and coding guidance from major standardized health KOSs
2. Usages of Health KOSs
3. Conclusion

Based on Chapter 1 & 2 of the full paper:

Zeng, M. L., Y. Hong, J. Clunis, S. He, & L.P. Coladangelo. 2020. Implications of Knowledge Organization Systems for Health Information Exchange and Communication during the COVID-19 Pandemic. *Data and Information Management*, 4(3): 148-170. Available at https://doi.org/10.2478/dim-2020-0009

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The Problem of Information Overload

"Information overload" refers to the difficulty a person can have understanding an issue and making decisions that can be caused by the presence of too much information. Toffler, 1970

Challenges during a global pandemic

- News reports are from around the world;
- Terms carry different meanings in different contexts;
- Uncertain methods or criteria for collecting data;
- Communicating across languages, regions, and cultures,
- …

Standardized health KOSs

- increasingly play a larger and more important role in healthcare information systems to facilitate data normalization,

  -- which is a fundamental requirement for any subsequent data analysis, information management, and decision-making.

The Problem of Semantic conflicts

Naming of a disease; Classifying and defining a disease.

- 2009 H1N1 Flu (Swine Flu)

  - "swine flu"
  - "pig flu"
  - "[new] Spanish flu"
  - "Mexican flu"
  - "North American influenza"
  - "Influenza A virus subtype H1N1" – Wikipedia
  - "Influenza A (H1N1)" – WHO
  - "Swine-Origin Influenza A H1N1 Virus" – CDC, (MeSH)
  - "Influenza A Virus, H1N1 Subtype" – MeSH

- Even after standardized authority control efforts, semantic conflicts can still occur through the way concepts are classified and defined.
- Incorrect diagnoses and cause of death is a well-known problem with international morbidity and mortality statistics (O'Malley et al., 2005).

LePan, Nicholas , 2020-03. “Visualizing the History of Pandemics”
https://www.visualcapitalist.com/history-of-pandemics-deadliest

Three most important names to be decided

- **the species**
- **the virus**
- **the disease**

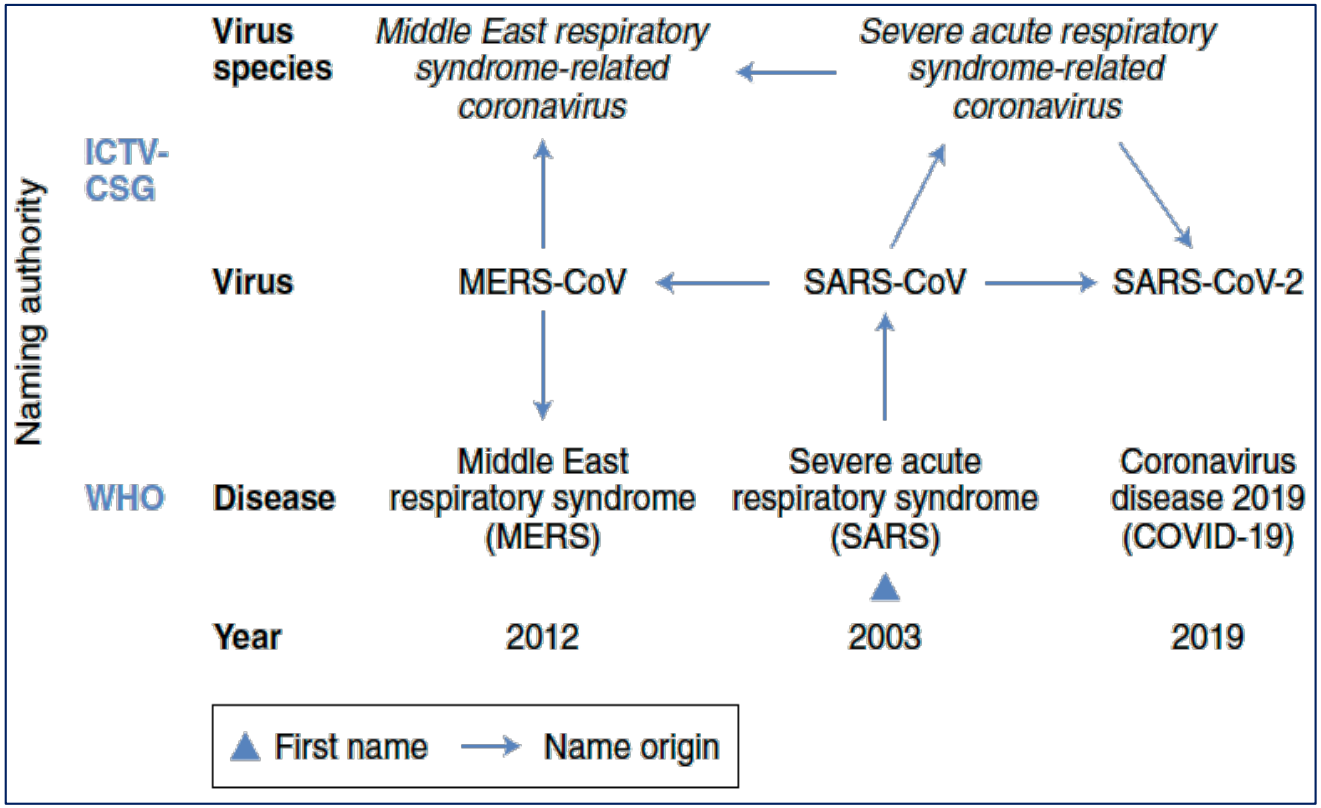


Image source: ICTV: Naming the 2019 Coronavirus. https://talk.ictvonline.org/ CC BY-SA 4.0

Gorbalenya, A.E., Baker, S.C., Baric, R.S. *et al.* The species *Severe acute respiratory syndrome-related coronavirus*: classifying 2019-nCoV and naming it SARS-CoV-2. *Nat Microbiol* **5,** 536–544 (2020). https://doi.org/10.1038/s41564-020-0695-z

ICTV = International Committee on Taxonomy of Viruses, the official body of the Virology Division of the International Union of Microbiological Societies.
ICTV-CSG = The *Coronaviridae* Study Group (CSG) of the International Committee on Taxonomy of Viruses

WHO Best Practices for Naming of New Human Infectious Diseases

https://www.who.int/topics/infectious_diseases/naming-new-diseases/en/

Ensuring that the name **does not** refer to

- a geographical location,
- an animal,
- an individual or group of people,

while still being pronounceable and related to the disease (WHO, 2015).

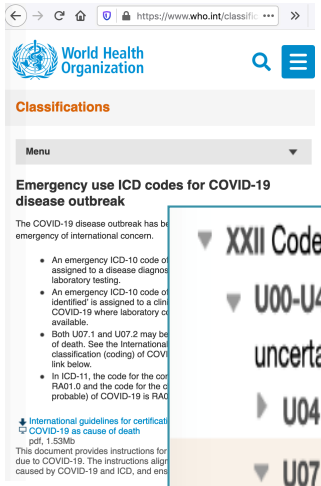
Establishing a name for a new disease provides a shared understanding for researchers and developers to discuss disease prevention, spread, transmissibility, severity, and treatment. Viruses are named based on their genetic structure to facilitate the development of diagnostic tests, vaccines, and medicines (WHO, 2020a).

Naming and Classifying by WHO and ICD-10*

- 2020-01-30.
  - WHO declared the 2019 Novel Coronavirus (**2019-nCoV**) disease outbreak a public health emergency of international concern.
- 2020-01-31.
  - WHO Family of International Classifications (WHO-FIC) network's Classification and Statistics Advisory Committee (CSAC) convened an emergency meeting to discuss the creation of a specific code for this new type of coronavirus.
  - ICD-10 established a new emergency code ("U07.1, 2019-nCoV, acute respiratory disease").
- 2020-02-11.
  - The WHO officially announced the name of the disease, **COVID-19**, an acronym for "coronavirus disease 2019."
  - A study group of the International Committee on Taxonomy of Viruses (ICTV) christened the novel virus as "severe acute respiratory syndrome coronavirus 2," or **SARS-CoV-2** (ICTV, 2020).
  - The ICD-10 was updated with two emergency codes:
    - "U07.1 COVID-19, virus identified" and
    - "U07.2 COVID-19, virus not identified"

***ICD-10 = *International Classification of Diseases* 10th**

WHO ICD-10 codes of COVID-19



- XXII Codes for special purposes
  - U00-U49 Provisional assignment of new diseases of uncertain etiology or emergency use
    - U04 Severe acute respiratory syndrome [SARS]
    - U07 Emergency use of U07
      - U07.0 Vaping-related disorder
      - U07.1 COVID-19, virus identified
      - U07.2 COVID-19, virus not identified
      - U07.3 Emergency use of U07.3
      - U07.4 Emergency use of U07.4
      - U07.5 Emergency use of U07.5
      - U07.6 Emergency use of U07.6
      - U07.7 Emergency use of U07.7
      - U07.8 Emergency use of U07.8
      - U07.9 Emergency use of U07.9
    - U08 Emergency use of U08

U07.1 COVID-19, virus identified

COVID-19 NOS

Use this code when COVID-19 has been confirmed by laboratory testing irrespective of severity of clinical signs or symptoms. Use additional code, if desired, to identify pneumonia or other manifestations.

Excl.: Coronavirus infection, unspecified site (B34.2)
Coronavirus as the cause of diseases classified to other chapters (B97.2)
Severe acute respiratory syndrome [SARS], unspecified (U04.9)

U07.2 COVID-19, virus not identified

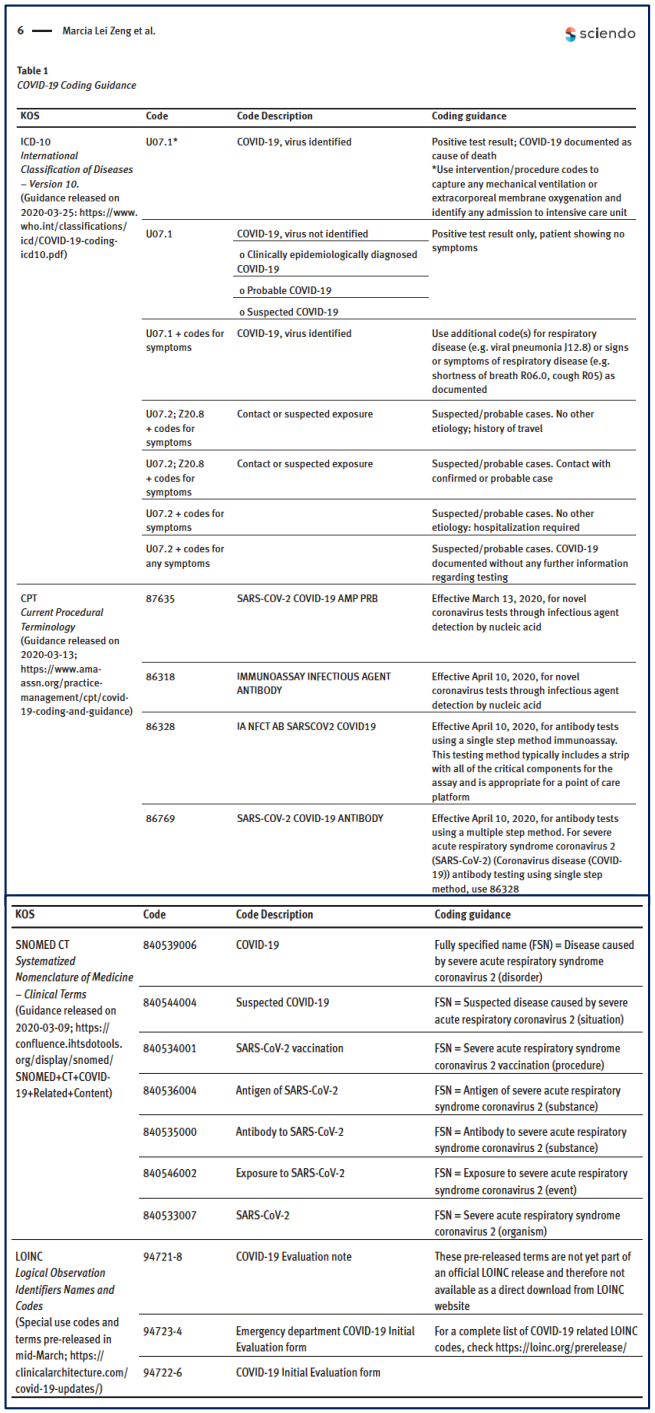
Use this code when COVID-19 is diagnosed clinically or epidemiologically but laboratory testing is inconclusive or not available. Use additional code, if desired, to identify pneumonia or other manifestations

Excl.: Coronavirus infection, unspecified site (B34.2)
COVID-19:
- confirmed by laboratory testing (U07.1)
- special screening examination (Z11.5)
- suspected but ruled out by negative laboratory results (Z03.8)

Source: https://icd.who.int/browse10/2019/en#/U07 (Image captured 2020-04-26).

Releases of Guidelines by KOSs in March 2020

- ICD-10
- CPT (Current Procedural Terminology)
- LOINC (Logical Observation Identifiers Names and Codes)
- SNOMED CT (Systematized Nomenclature of Medicine – Clinical Terms)



sciendo

Table 1
COVID-19 Coding Guidance

KOS	Code	Code Description	Coding guidance
ICD-10 *International Classification of Diseases – Version 10.* (Guidance released on 2020-03-25: https://www.who.int/classifications/icd/COVID-19-coding-icd10.pdf)	U07.1*	COVID-19, virus identified	Positive test result; COVID-19 documented as cause of death *Use intervention/procedure codes to capture any mechanical ventilation or extracorporeal membrane oxygenation and identify any admission to intensive care unit
	U07.1	COVID-19, virus not identified	Positive test result only, patient showing no symptoms
		o Clinically epidemiologically diagnosed COVID-19	
		o Probable COVID-19	
		o Suspected COVID-19	
	U07.1 + codes for symptoms	COVID-19, virus identified	Use additional code(s) for respiratory disease (e.g. viral pneumonia J12.8) or signs or symptoms of respiratory disease (e.g. shortness of breath R06.0, cough R05) as documented
	U07.2; Z20.8 + codes for symptoms	Contact or suspected exposure	Suspected/probable cases. No other etiology; history of travel
	U07.2; Z20.8 + codes for symptoms	Contact or suspected exposure	Suspected/probable cases. Contact with confirmed or probable case
	U07.2 + codes for symptoms		Suspected/probable cases. No other etiology: hospitalization required
	U07.2 + codes for any symptoms		Suspected/probable cases. COVID-19 documented without any further information regarding testing
CPT *Current Procedural Terminology* (Guidance released on 2020-03-13; https://www.ama-assn.org/practice-management/cpt/covid-19-coding-and-guidance)	87635	SARS-COV-2 COVID-19 AMP PRB	Effective March 13, 2020, for novel coronavirus tests through infectious agent detection by nucleic acid
	86318	IMMUNOASSAY INFECTIOUS AGENT ANTIBODY	Effective April 10, 2020, for novel coronavirus tests through infectious agent detection by nucleic acid
	86328	IA NFCT AB SARSCOV2 COVID19	Effective April 10, 2020, for antibody tests using a single step method immunoassay. This testing method typically includes a strip with all of the critical components for the assay and is appropriate for a point of care platform
	86769	SARS-COV-2 COVID-19 ANTIBODY	Effective April 10, 2020, for antibody tests using a multiple step method. For severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Coronavirus disease (COVID-19)) antibody testing using single step method, use 86328
SNOMED CT *Systematized Nomenclature of Medicine – Clinical Terms* (Guidance released on 2020-03-09; https://confluence.ihtsdotools.org/display/snomed/SNOMED+CT+COVID-19+Related+Content)	840539006	COVID-19	Fully specified name (FSN) = Disease caused by severe acute respiratory syndrome coronavirus 2 (disorder)
	840544004	Suspected COVID-19	FSN = Suspected disease caused by severe acute respiratory coronavirus 2 (situation)
	840534001	SARS-CoV-2 vaccination	FSN = Severe acute respiratory syndrome coronavirus 2 vaccination (procedure)
	840536004	Antigen of SARS-CoV-2	FSN = Antigen of severe acute respiratory syndrome coronavirus 2 (substance)
	840535000	Antibody to SARS-CoV-2	FSN = Antibody to severe acute respiratory syndrome coronavirus 2 (substance)
	840546002	Exposure to SARS-CoV-2	FSN = Exposure to severe acute respiratory syndrome coronavirus 2 (event)
	840533007	SARS-CoV-2	FSN = Severe acute respiratory syndrome coronavirus 2 (organism)
LOINC *Logical Observation Identifiers Names and Codes* (Special use codes and terms pre-released in mid-March; https://clinicalarchitecture.com/covid-19-updates/)	94721-8	COVID-19 Evaluation note	These pre-released terms are not yet part of an official LOINC release and therefore not available as a direct download from LOINC website
	94723-4	Emergency department COVID-19 Initial Evaluation form	For a complete list of COVID-19 related LOINC codes, check https://loinc.org/prerelease/
	94722-6	COVID-19 Initial Evaluation form	

Refer to our full paper's Table 1 ------→
https://doi.org/10.2478/dim-2020-0009

NLM VSAC COVID-19 SNOMED CT Codeset

NIH Value Set Authority Center
U.S. National Library of Medicine

Value Set Name	2019 Novel Coronavirus COVID 19 Codeset
Code System	SNOMEDCT
OID	2.16.840.1.113762.1.4.1114.7
Type	Extensional
Definition Version	20200324
Steward	Office of the National Coordinator for Health Information Technology
Program	null,20200324 using this value set
Expansion Version	20200324
Expanded Code List	

Code	Description
461911000124106	Swab specimen from oropharynx (specimen)
840533007	Severe acute respiratory syndrome coronavirus 2 (organism)
840534001	Severe acute respiratory syndrome coronavirus 2 vaccination (procedure)
840535000	Antibody to severe acute respiratory syndrome coronavirus 2 (substance)
840536004	Antigen of severe acute respiratory syndrome coronavirus 2 (substance)
840539006	Disease caused by severe acute respiratory syndrome coronavirus 2 (disorder)
840544004	Suspected disease caused by severe acute respiratory coronavirus 2 (situation)
840546002	Exposure to severe acute respiratory syndrome coronavirus 2 (event)

[Note: This value set contains codes from the March 2020 Interim International Edition release. New approved terms for these codes will appear in the next release in September 2020.
Source: https://confluence.ihtsdotools.org/display/snomed/SNOMED%2BCT%2BCoronavirus%2BContent]

MeSH Supplementary Concept for COVID-19

COVID-19 MeSH Supplementary Concept Data 2020

Details | Concepts

MeSH Supplementary	COVID-19
Unique ID	C000657245
RDF Unique Identifier	http://id.nlm.nih.gov/mesh/C000657245
Entry Term(s)	2019 novel coronavirus disease 2019 novel coronavirus infection 2019-nCoV disease 2019-nCoV infection COVID-19 pandemic COVID-19 virus disease COVID-19 virus infection COVID19 SARS-CoV-2 infection coronavirus disease 2019 coronavirus disease-19
Registry Number	0
Heading Mapped to	*Pneumonia, Viral *Coronavirus Infections *Pandemics
Note	A viral disorder characterized by high FEVER; COUGH; DYSPNEA; renal dysfunction and other symptoms of a VIRAL PNEUMONIA. A coronavirus SARS-CoV-2 in the genus BETACORONAVIRUS is the suspected agent.
Indexing Information	severe acute respiratory syndrome coronavirus 2
Date of Entry	2020/02/13
Revision Date	2020/04/07

Source: https://meshb.nlm.nih.gov/record/ui?ui=C000657245

Wikipedia and Wikidata entries of COVID-19

(Data collected on May 20, 2020)

Wikipedia			Wikidata			
Wikipedia entry	**# of entries (languages)**	**Matching KOS IDs**	**Wikidata English Label and ID**	**scope notes**	**# of "Also Known as" in English**	**# of mapped "Identifier"**
Coronavirus disease 2019	128	•MeSH: C000657245 • ICD-10: U07.1 •ICD-10: U07.2 •SNOMED CT: 840539006	**COVID-19 (Q84263196)**	zoonotic respiratory syndrome and infectious disease in humans, caused by SARS coronavirus 2	19	21
Coronavirus	69	•ICD-10:B97.2 •MeSH:D017934	**Coronavirus (Q89469904)**	group of related viruses that cause diseases in mammals and birds	1	6
COVID-19 pandemic	125		**COVID-19 pandemic (Q81068910)**	ongoing pandemic of COVID-19	15	23
Severe acute respiratory syndrome coronavirus 2	102	•ICD-10: U07.1 •MeSH: C000656484 •SNOMED CT: 840533007	**SARS-CoV-2 (Q82069695)**	strain of virus causing the ongoing pandemic of coronavirus disease 2019 (COVID-19)	16	14

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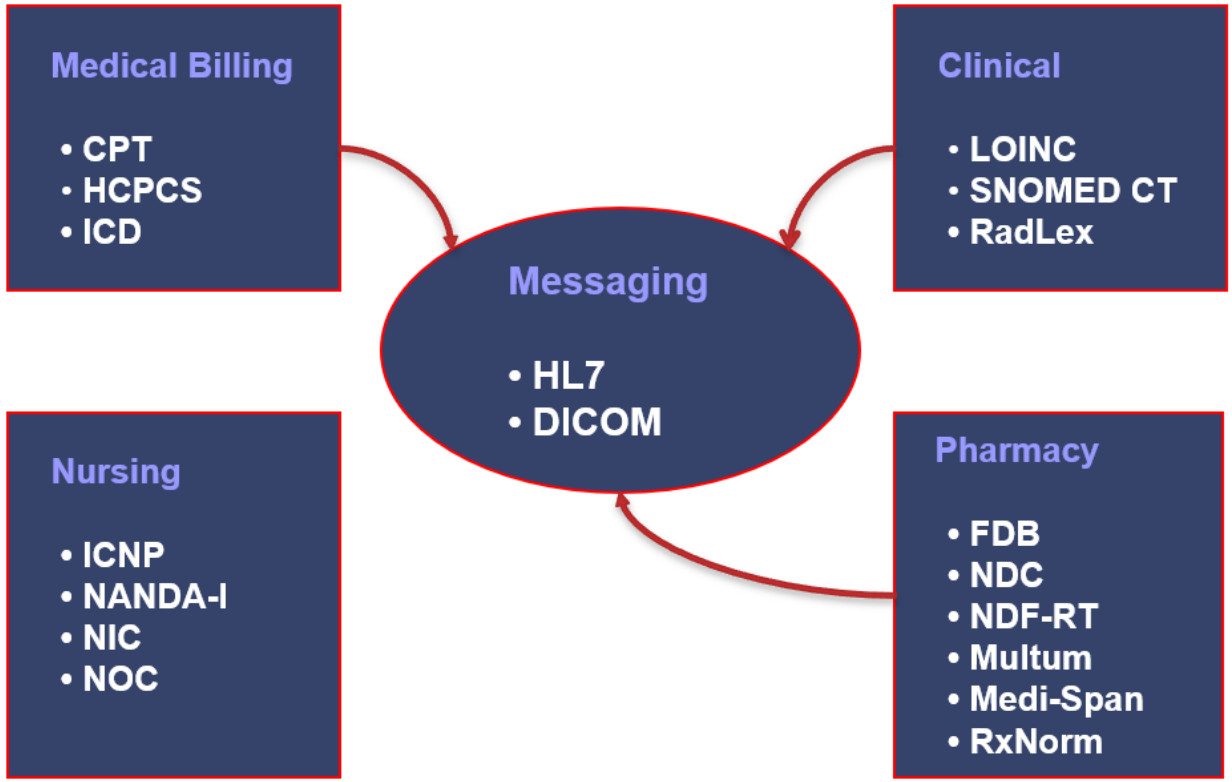
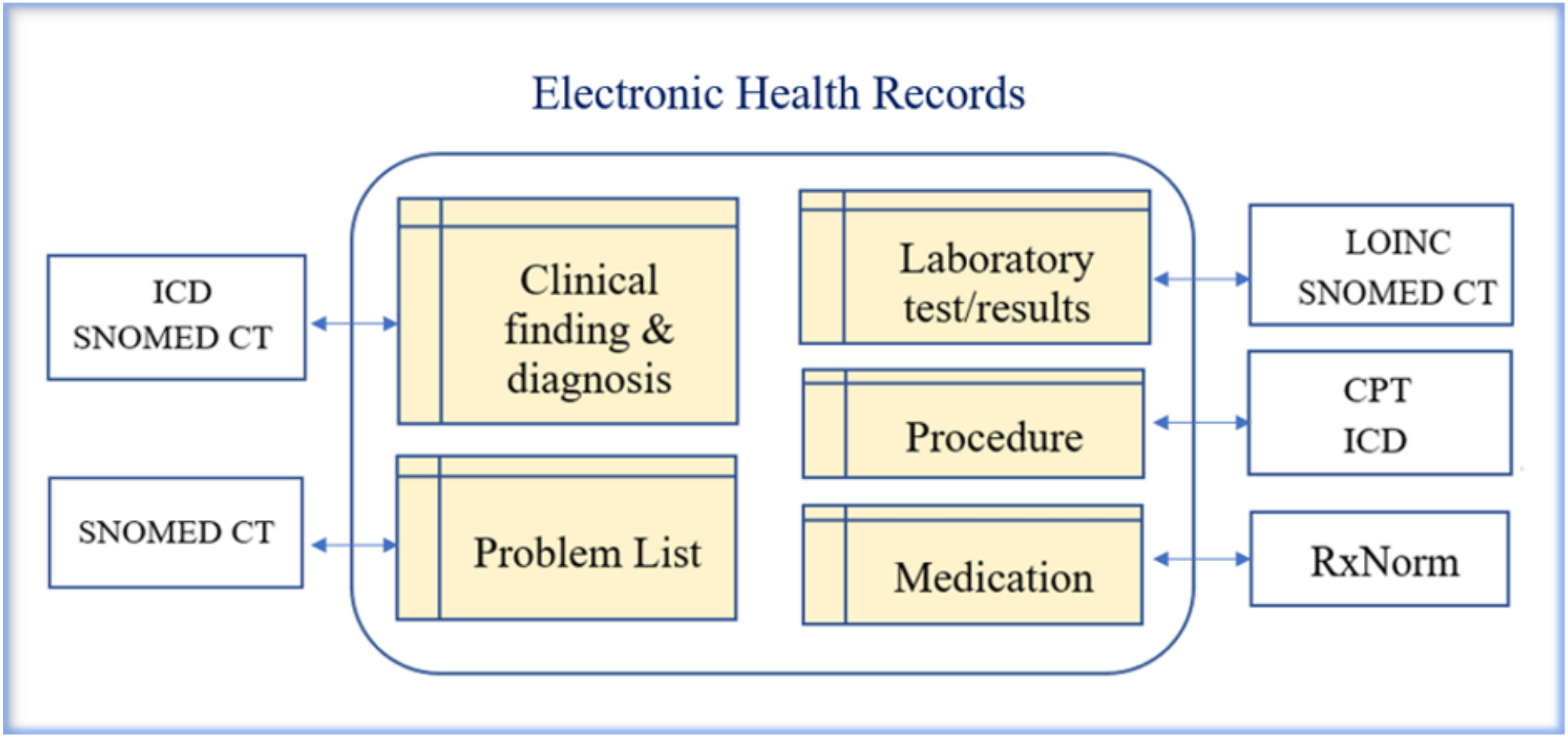
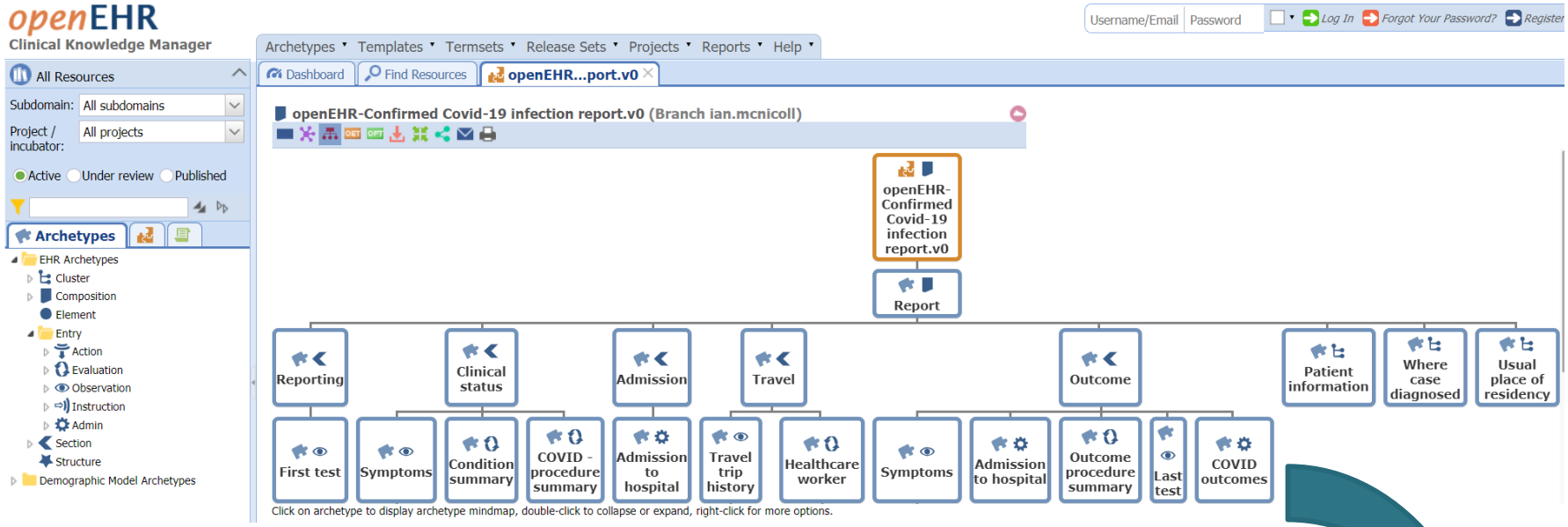
Common Health KOS Standards



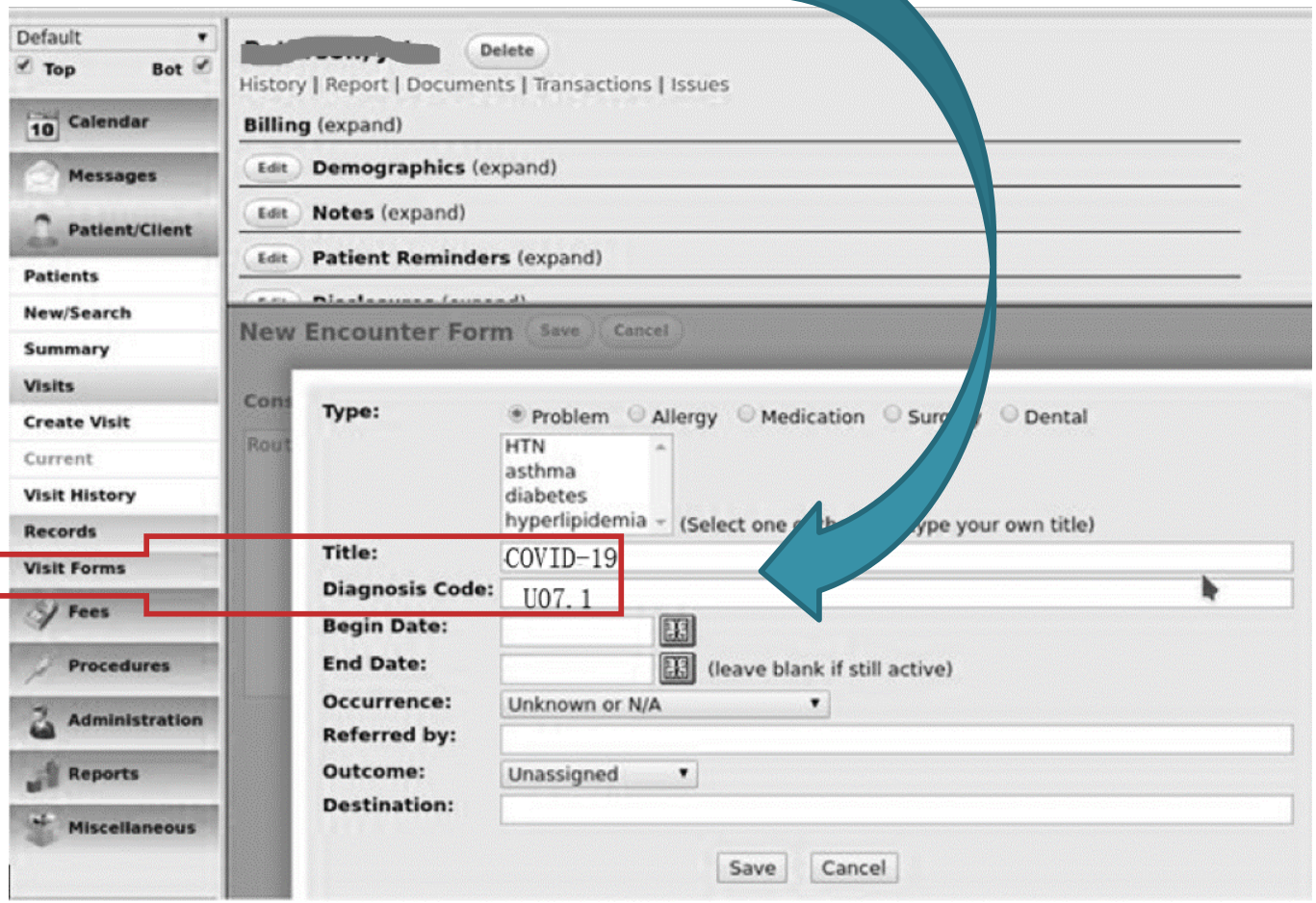
- Most popular KOS standards in EHR and HIE:
  - International Classification of Diseases (ICD)
  - Current Procedural Terminology (CPT)
  - Systematized Nomenclature of Medicine--Clinical Terms (SNOMED-CT)
  - Logical Observation Identifiers Names and Codes (LOINC)
  - RxNorm
  - Health Level Seven (HL7) messages

Standard health KOSs in electronic health records (EHR)





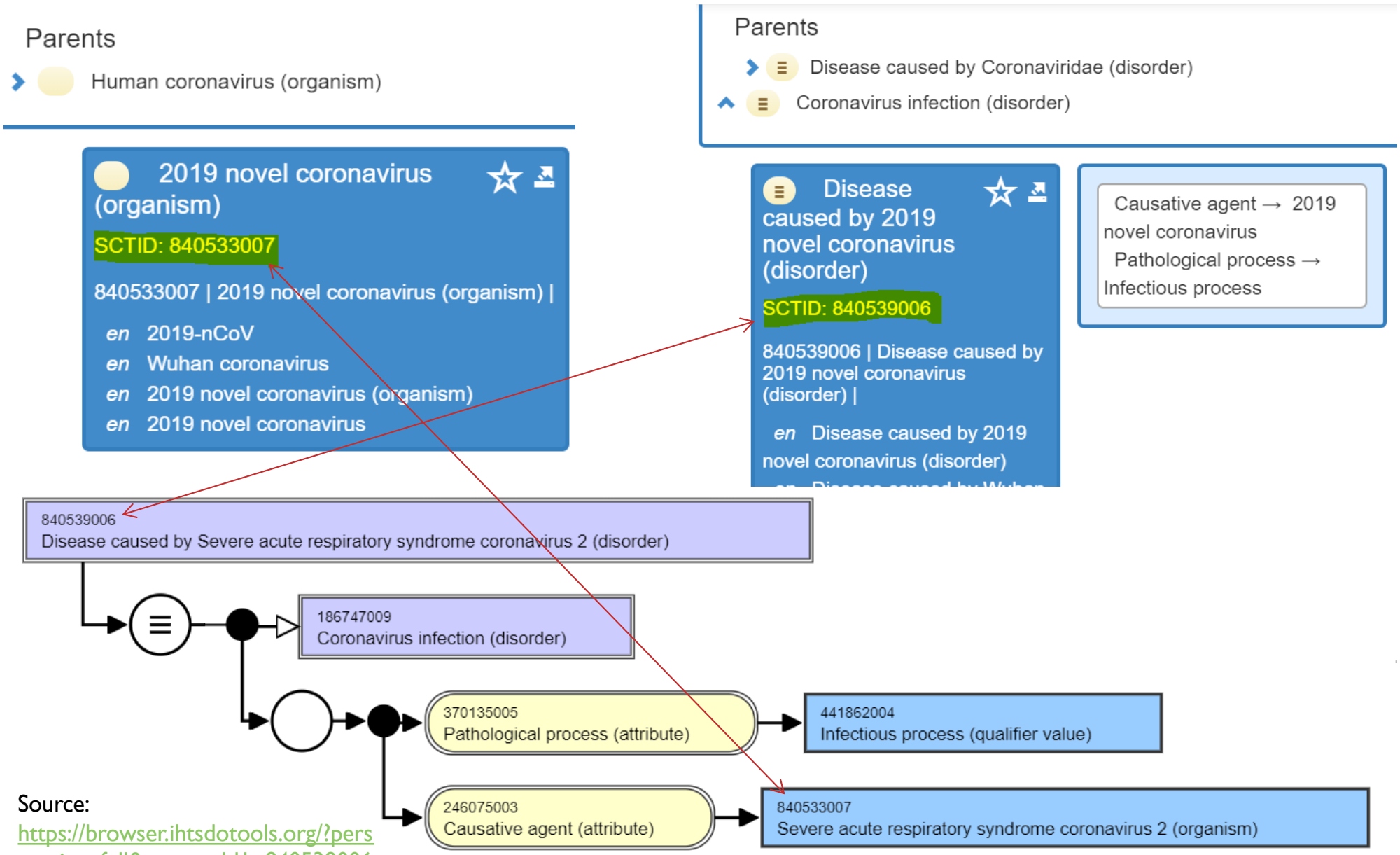
Source: https://openehr.org/ckm/templates/1013.26.272/orgchart



COVID-19 encounter diagnosis in OpenEMR's Problem List

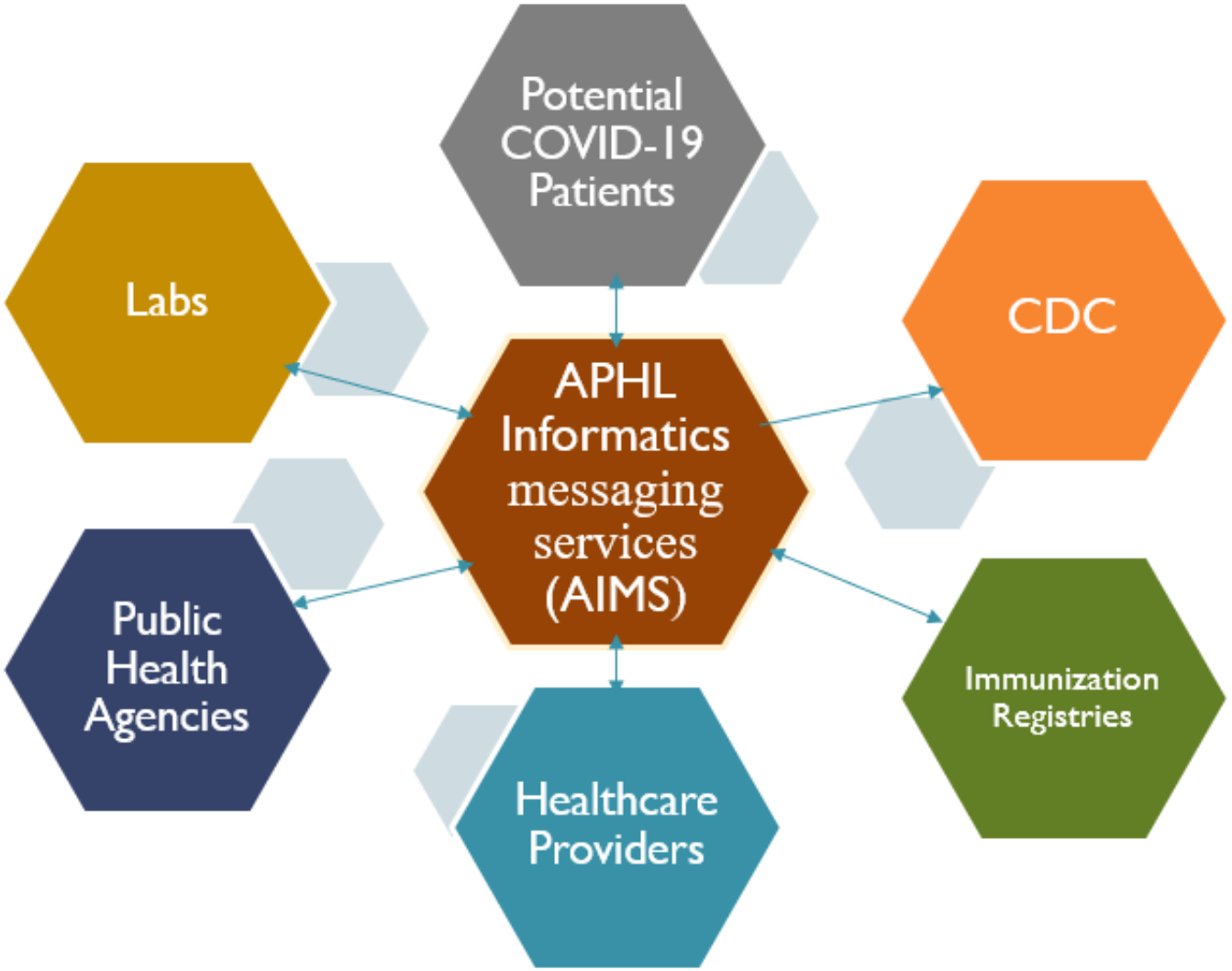
Source: https://www.open-emr.org/wiki/index.php/OpenEMR_Features

SNOMED CT code of COVID-19



Source:
https://browser.ihtsdotools.org/?perspective=full&conceptId1=840539006&edition=MAIN/2020-07-31&release=&languages=en

COVID-19 Data Exchange on the AIMS Platform



Source: https://www.aphl.org/aboutAPHL/publications/Documents/INFO-2020-AIMS-COVID-19-Data-Flow-Infographic.pdf

COVID-19 HL7 data messaging - Sample HL7 messages for lab data exchange

```
MSH|^~\&|STARLIMS.AR.STAG^2.16.840.1.114222.4.3.3.2.5.2^ISO|AR.LittleRock.SPHL^2.16.840.1.114222.4.1.20
083^ISO|US WHO Collab LabSys^2.16.840.1.114222.4.3.3.7^ISO|CDC-EPI Surv
Branch^2.16.840.1.114222.4.1.10416^ISO|20191203100718-
0600||ORU^R01^ORU_R01|170703|T|2.3.1|||||||PHLIP_ORU_v1.0.2^PHIN_Profile_ID^2.16.840.1.114222.4.10.3^ISO
PID|1||PID13295037^^^STARLIMS.AR.STAG&2.16.840.1.114222.4.3.3.2.5.2&ISO^PI||~^^^^^^S||20000101|F|||^^^A
R^72016^USA
ORC|RE|1905700000256-12^PHLIP-Test-EHR^2.16.840.1.113883.3.72.5.24^ISO|1905700000256-
176^STARLIMS.AR.STAG^2.16.840.1.114222.4.3.3.2.5.2^ISO||CM|||||||||||||Little Rock General Hospital Lab|2217
Trancas^^Little Rock^AR^72205
OBR|1|1905700000256-12^PHLIP-Test-EHR^2.16.840.1.113883.3.72.5.24^ISO|1905700000256-
176^STARLIMS.AR.STAG^2.16.840.1.114222.4.3.3.2.5.2^ISO|68991-9^Epidemiologically important info
pnl^LN|||20191125201900-
0600|||||||20191126|ORH&Other&HL70070|1412941681^Smith^John^C^^DR^^^NPI&2.16.840.1.113883.4.6&ISO^L|^
^PH^^^952^4863332|||||||F
OBX|1|CX|LAB202^Unique Specimen
ID^PHINQUESTION||1905700000256^^^STARLIMS.AR.STAG&2.16.840.1.114222.4.3.3.2.5.2&ISO|||||F|||20191203
100718-0600
ORC|RE|1905700000256-13^PHLIP-Test-EHR^2.16.840.1.113883.3.72.5.24^ISO|1905700000256-
177^STARLIMS.AR.STAG^2.16.840.1.114222.4.3.3.2.5.2^ISO||CM|||||||||||||Little Rock General Hospital Lab|2217
Trancas^^Little Rock^AR^72205
OBR|2|1905700000256-13^PHLIP-Test-EHR^2.16.840.1.113883.3.72.5.24^ISO|1905700000256-
177^STARLIMS.AR.STAG^2.16.840.1.114222.4.3.3.2.5.2^ISO|94306-8^SARS-CoV-2 RNA Pnl XXX
NAA+probe^LN|||20191125201900-
0600|||||||20191126|ORH&Other&HL70070&&Nasopharyngeal|1412941681^Smith^John^C^^DR^^^NPI&2.16.840.1.1
13883.4.6&ISO^L|^^PH^^^952^4863332|||||20191203081920-0600|||F
OBX|1|CE|94307-6^SARS-CoV-2 N gene XXX Ql NAA N1^LN||260373001^Detected^SCT|||||F|||20191203081920-
0600
OBX|2|CE|94308-4^SARS-CoV-2 N gene XXX Ql NAA N2^LN||260373001^Detected^SCT|||||F|||20191203081920-
0600
OBX|3|CE|68993-5^Human RNase P RNA XXX Ql
NAA+probe^LN||260373001^Detected^SCT|||||F|||20191203081920-0600
```

LOINC code and name

SNOMED CT code and name

LOINC code and name

Source: https://www.aphl.org/programs/preparedness/Crisis-Management/Documents/2019nCoV_PHLIPsample_2.3.1_Detected_UPDATED3.3.20.pdf

Sample HL7 Message with "Not Detected" Test Results

sort	vsID	vsName	rowStatus	Code	ConceptName
10037	av-319	Conclusion PCR result	A	260373001	Detected
10039	av-319	Conclusion PCR result	A	419984006	inconclusive
10041	av-319	Conclusion PCR result	A	260415000	Not Detected
10045	av-319	Conclusion PCR result	A	125154007	Specimen unsatisfactory for evaluation
10970	av-318	Target PCR result	A	260373001	Detected
10973	av-318	Target PCR result	A	260415000	Not Detected

MSH|^~\&|STA
083^ISO|US W
Branch^2.16.84
0600||ORU^R0
PID|1||PID132
R^72016^USA
ORC|RE|19057
176^STARLIM
Trancas^^Little Rock^AR^72205
OBR|1|1905700000276-12^PHLIP-Test-EHR^2.16.840.1.113883.3.72.5.24^ISO|1905700000276-176^STARLIMS.AR.STAG^2.16.840.1.114222.4.3.3.2.5.2^ISO|68991-9^Epidemiologically important info pnl^LN|||20191125201900-0600|||||20191126|ORH&Other&HL70070|1412941681^Smith^John^C^^DR^^^NPI&2.16.840.1.113883.4.6&ISO^L|^^PH^^^952^4863332|||||||F
OBX|1|CX|LAB202^Unique Specimen ID^PHINQUESTION||1905700000276^^^STARLIMS.AR.STAG&2.16.840.1.114222.4.3.3.2.5.2&ISO||||||F|||20191203100718-0600
ORC|RE|1905700000276-13^PHLIP-Test-EHR^2.16.840.1.113883.3.72.5.24^ISO|1905700000276-177^STARLIMS.AR.STAG^2.16.840.1.114222.4.3.3.2.5.2^ISO||CM|||||||||||||Little Rock General Hospital Lab|2217 Trancas^^Little Rock^AR^72205
OBR|2|1905700000276-13^PHLIP-Test-EHR^2.16.840.1.113883.3.72.5.24^ISO|1905700000276-177^STARLIMS.AR.STAG^2.16.840.1.114222.4.3.3.2.5.2^ISO|94306-8^SARS-CoV-2 RNA Pnl XXX NAA+probe^LN|||20191125201900-0600|||||20191126|ORH&Other&HL70070&&Nasopharyngeal|1412941681^Smith^John^C^^DR^^^NPI&2.16.840.1.113883.4.6&ISO^L|^^PH^^^952^4863332|||||20191203081920-0600|||F
OBX|1|CE|94307-6^SARS-CoV-2 N gene XXX Ql NAA N1^LN||2260415000^Not detected^SCT||||||F|||20191203081920-0600

Source: https://www.aphl.org/programs/preparedness/Crisis-Management/Documents/2019nCoV_PHLIPsample_2.5.1_NotDetected_UPDATED3.3.2020.pdf

Sample HL7 Message with "Inconclusive" Test Results

5/23/2020 2019-nCoV_Encoding Guidelines_FINAL_r1.xlsx

sort	vsID	vsName	rowStatus	Code	ConceptName
10037	av-319	Conclusion PCR result	A	260373001	Detected
10039	av-319	Conclusion PCR result	A	419984006	inconclusive
10041	av-319	Conclusion PCR result	A	260415000	Not Detected
10045	av-319	Conclusion PCR result	A	125154007	Specimen unsatisfactory for evaluation

ORC|RE|1905700000266-13^PHLIP-Test-EHR^2.16.840.1.113883.3.72.5.24^ISO|1905700000266-177^STARLIMS.AR.STAG^2.16.840.1.114222.4.3.3.2.5.2^ISO|||||||1412941681^Smith^John^C^^DR^^^NPI&2.16.840.1.113883.4.6&ISO^L^^^NPI^^^^^^^^MD||^WPN^PH^^1^707^2643378||||||Little Rock General Hospital Lab^D^^^^NPI&2.16.840.1.113883.4.6&ISO^NPI^^^1255402921|2217 Trancas^Suite 22^Little Rock^AR^72205^USA^M|^WPN^PH^^1^707^5549876
OBR|2|1905700000266-13^PHLIP-Test-EHR^2.16.840.1.113883.3.72.5.24^ISO|1905700000266-177^STARLIMS.AR.STAG^2.16.840.1.114222.4.3.3.2.5.2^ISO|94309-2^2019-nCoV RNA XXX NAA+probe-Imp^LN|||201902281257-0500|||||||1412941681^Smith^John^C^^DR^^^NPI&2.16.840.1.113883.4.6&ISO^L^^^NPI^^^^^^^^MD|^WPN^PH^^1^707^2643378||||20190402082143-0500|||F
OBX|1|CWE|94309-2^2019-nCoV RNA XXX NAA+probe-Imp^LN||419984006^Inconclusive^SCT|||||F|||201902281257-0500|||||201904020721-0500||||Public Health Laboratory^D^^^^CLIA&2.16.840.1.113883.19.4.6&ISO^XX^^^05D0897628|3434 Industrial Loop^^Little Rock^AR^72205^USA^B
NTE|1|L|94309-2 is a report code. It should be conditional in the panel = either this OR all the target codes MUST be used; both may be used also.
SPM|1|^1905700000266-12&STARLIMS.AR.STAG&2.16.840.1.114222.4.3.3.2.5.2&ISO||258500001^Nasopharyngeal swab (specimen)^SCT||||||||||201902281257-0500|201903011118-0500

Source: https://www.aphl.org/programs/preparedness/Crisis-Management/Documents/2019nCoV_PHLIPsample_2.5.1_Inconclusive_UPDATED3.3.2020.pdf

Conclusion

Health KOSs have become even more critical to aid the frontline endeavors to overcome the obstacles of information overload and semantic conflicts that can occur during special historic and worldwide events like the COVID-19 pandemic.

They have played important roles in:

- supporting health data exchange and information management,
- ensuring consistency and interoperability of data collection and reuse among various providers and healthcare settings
- facilitate data normalization, which is a fundamental requirement for any subsequent data analysis and information management

Implications of the Major Health KOSs during the COVID-19 Pandemic

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References

- CDC. (2020, March 18). *New ICD-10-CM code for the 2019 novel coronavirus (COVID-19).* https://www.cdc.gov/nchs/data/icd/Announcement-New-ICD-code-for-coronavirus-3-18-2020.pdf
- Gorbalenya, A.E., Baker, S.C., Baric, R.S. et al. (2020). The species Severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nat Microbiol* 5, 536–544. https://doi.org/10.1038/s41564-020-0695-z
- International Committee on Taxonomy of Viruses. (2020). *Naming the 2019 Coronavirus*. https://talk.ictvonline.org/
- LePan, Nicholas (2020) Visualizing the History of Pandemics. [Blog March 14, 2020] https://www.visualcapitalist.com/history-of-pandemics-deadliest
- O'Malley, K. J., Cook, K. F., Price, M. D., Wildes, K. R., Hurdle, J. F., & Ashton, C. M. (2005). Measuring diagnoses: ICD code accuracy. *Health Services research*, 40(5 Pt 2), 1620–1639. https://doi.org/10.1111/j.1475-6773.2005.00444.x
- Toffler, A. (1970). *Future shock*. New York, NY: Bantam Books.
- WHO. (2015). *WHO best practices for naming of new human infectious diseases*. https://www.who.int/topics/infectious_diseases/naming-new-diseases/en/
- WHO. (2020a). *Naming the coronavirus disease (COVID-19) and the virus that causes it*. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it
- WHO. (2020b). *Coronavirus disease (COVID-19) Pandemic*. https://www.who.int/emergencies/diseases/novel-coronavirus-2019
- WHO. (2020c). *Global COVID-19: Clinical platform: Novel coronavirus (COVID-19): Rapid version*. https://www.who.int/publications-detail/global-covid-19-clinical-platform-novel-coronavius-(-covid-19)-rapid-version
- Zeng, M. L., Hong, Y., Clunis, J., He, S., & Coladangelo, L. P. (2020). Implications of Knowledge Organization Systems for Health Information Exchange and Communication during the COVID-19 Pandemic. *Data and Information Management*, 4(3): 148-170. https://doi.org/10.2478/dim-2020-0009
- Whittenburg, L. (2019). *Standardized Terminologies for Data Interoperability in Health Information Exchange*. J P Systems, Inc. https://www.interoperabilityshowcase.org/sites/interoperabilityshowcase/files/jpsystems_-_standard_terminologies_for_interoperability.pdf
- Syzdykova, A., Malta, A., Zolfo, M., Diro, E., & Oliveira, J. L. (2017). Open-source electronic health record systems for low-resource settings: systematic review. *JMIR medical informatics*, 5(4), e44. DOI: 10.2196/medinform.8131