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# Comparative Analysis of ICD-10-CM with ICD-11 for Morbidity Coding

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## Background

- ICD-11 adopted by the World Health Organization (WHO) in May 2019, will be implemented from January 2022
- In the US, we have been creating our own extension called Clinical Modification (ICD-9-CM, ICD-10-CM) for morbidity coding, because the international core is not precise enough to describe the clinical details
- What's new in ICD-11
  - 40% bigger than ICD-10 (4,000 more codes)
  - Supports postcoordination (over 14,500 extension codes)
- Is a Clinical Modification still necessary?



#### NCVHS National Committee on Vital and Health Statistics

November 25, 2019

The Honorable Alex Azar II Secretary Department of Health and Human Services 200 Independence Avenue, S.W. Washington, D.C. 20201

#### Re: Preparing for Adoption of ICD-11 as a Mandated U.S. Health Data Standard

Dear Secretary Azar:

As stipulated by the Health Insurance Portability and Accour National Committee on Vital and Health Statistics (NCVHS) n effectiveness of adopted health data standards pursuant to administrative simplification provisions. This includes making adoption of the International Classification of Diseases, versi

The ICD is a classification system developed by the World He as the foundation for identifying health trends and statistics standard for reporting diseases and health conditions. WHO 2018 and the World Health Assembly formally adopted this effective beginning January 1, 2022. <u>Adoption of ICD-11 by t</u> <u>dimensions</u>:

- First, adoption for mortality, i.e., cause of demembership in the World Health Organization surveillance. It is led by the National Cerwith state vital registration and statistical surveillance.
- Second, adoption for morbidity, i disord conditions, however, requires H and since income code set. Its use for morbidity atory for hospitus, payment, health care provider and state ettings. Uses include monitoring the incidence and prevalence of diseases, a orting claims for reimbursement, tracking of safety and quality guidelines, payment, ation health monitoring, research as well as state health data reporting.

The U.S. implemented ICD-10 for mortality reporting in 1999. It implemented it for morbidity in 2015, 25 years after it was endorsed by the WHO, and after a protracted regulatory process. As

Research topics the Committee recommends include:

Whether ICD-11 can fully support morbidity classification in the U.S. without development of a U.S. clinical modification (CM) and if not, are there areas to be targeted in a CM version. Development of a U.S. clinical modification for morbidity extends the implementation timetable and requires additional ongoing processes for curation of the classification.

#### Research method

- Identify the most commonly used ICD-10-CM codes
- Recode the ICD-10-CM codes in ICD-11 to assess coverage and level of equivalence
- Review coding guidance to look for subtle differences in the meaning of codes



#### Most commonly used ICD-10-CM codes

- Medicare claims are one of the biggest collections of ICD-10-CM codes in use
- Medicare claims data have been made available to researchers through the CMS Virtual Research Data Center
- However, Medicare patients are mostly > 65 and so missing codes from 3 chapters
  - Chapter 15 Pregnancy, childbirth and the puerperium
  - Chapter 16 Certain conditions originating in the perinatal period
  - Chapter 17 Congenital malformations, deformations and chromosomal abnormalities
- Alternative source of ICD-10-CM codes for these 3 chapters: University of Nebraska Medical Center (thanks to James Campbell and Ellen Kerns)
- All data are aggregate data and deidentified



Medicare claims:

- Jan Dec 2017
- 61 million unique Medicare patients; 28,981 unique ICD-10-CM codes
- ICD-10-CM codes as principal or secondary diagnosis (except chapters 15,16 & 17)

Nebraska University Medical Center

- Oct 2015 Mar 2020
- 778,000 unique patients, 23,832 unique ICD-10-CM codes
- ICD-10-CM codes as principal or secondary diagnosis from chapters 15,16 & 17

Most frequently used codes in each chapter covering 60% of unique patients: 962 ICD-10-CM codes

> 19 obsolete ICD-10-CM codes excluded from study

943 ICD-10-CM codes



Chapter	Code range	Total no. of codes in	Top codes (60%	Top codes as % of
		chapter	usage)	chapter
1	A00-B99 Certain infectious and parasitic diseases	1058	19	1.8%
2	C00-D49 Neoplasms	1661	66	4.0%
3	D50-D89 Diseases of the blood and blood-forming organs and	251	5	2.0%
	certain disorders involving the immune mechanism			
4	E00-E89 Endocrine, nutritional and metabolic diseases	908	10	1.1%
5	F01-F99 Mental, Behavioral and Neurodevelopmental disorders	747	10	1.3%
6	G00-G99 Diseases of the nervous system	622	13	2.1%
7	H00-H59 Diseases of the eye and adnexa	2606	51	2.0%
8	H60-H95 Diseases of the ear and mastoid process	653	18	2.8%
9	I00-I99 Diseases of the circulatory system	1378	14	1.0%
10	J00-J99 Diseases of the respiratory system	341	12	3.5%
11	K00-K95 Diseases of the digestive system	799	25	3.1%
12	L00-L99 Diseases of the skin and subcutaneous tissue	871	61	7.0%
13	M00-M99 Diseases of the musculoskeletal system and connective tissue	6487	43	0.7%
14	N00-N99 Diseases of the genitourinary system	672	10	1.5%
15	O00-O9A Pregnancy, childbirth and the puerperium	2267	45	2.0%
16	P00-P96 Certain conditions originating in the perinatal period	443	12	2.7%
17	Q00-Q99 Congenital malformations, deformations and chromosomal abnormalities	838	53	6.3%
18	R00-R99 Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	722	56	7.8%
19	S00-T88 Injury, poisoning and certain other consequences of external causes	40654	363	0.9%
20	V00-Y99 External causes of morbidity	6940	20	0.3%
21	Z00-Z99 Factors influencing health status and contact with health services	1266	37	2.9%
Total		72184	943	1.3%



## Recoding in ICD-11

- Each ICD-10-CM code was recoded in ICD-11 by 2 terminologists (Julia – NLM, Shannon – NCHS) independently, results compared and discussed until consensus is reached.
- Coding guidelines
  - Use online WHO ICD-11 browser
  - Follow ICD-11 coding reference guide for morbidity
  - Ignore parts of the names that convey absence of information e.g., gout unspecified, Zoster without complications
  - Use ICD-11 codes that are equivalent to or broader than ICD-10-CM code
  - If no equivalent code is found, try postcoordination as directed by ICD-11 browser



#### Postcoordination in ICD-11

- New feature
- Allows combination of codes ("code clustering") to represent new meaning
- ICD-11 allows two kinds of post-coordination:
  - Two or more main ("stem") codes (connected by "/") Urinary tract infection due to Extended spectrum beta-lactamase producing Escherichia coli = GC08.0 / MG50.27
    - GC08.0 Urinary tract infection, site not specified, due to Escherichia coli
    - MG50.27 Extended-spectrum beta-lactamase producing Escherichia coli
  - Main ("stem") codes with one or more extension codes (connected by "&") *Tuberculosis of prostate* = 1B12.5 & XA63E5
    - 1B12.5 Tuberculosis of the genitourinary system
    - XA63E5 Prostate gland



ICD-11 for Mortality and Morbidity	Statistics (Version : 0	9/2020)						∰ EN
Search GC08.0	[ Advanced Search ]	Browse	Coding Tool	Special Views	Info			
<ul> <li>16 Diseases of the genitourinary system</li> <li>Diseases of the female genital system</li> <li>Diseases of the male genital system</li> <li>Disorders of breast</li> </ul>	Foundation URI : http://id. GC08.0 Urinary	who.int/icd/ei	ntity/905570639	not specified	d, due to Escheri	chia coli		^
<ul> <li>Diseases of the urinary system</li> <li>Glomerular diseases</li> <li>Renal tubulo-interstitial diseases</li> <li>Kidney failure</li> <li>Urolithiasis</li> </ul>	Parent GC08 Urinary	tract infectic	on, site not speci	fied			Show all ancestors 😒	)
<ul> <li>Cystic or dysplastic kidney disease</li> </ul>	Postcoordination	0						
<ul> <li>GB90 Certain specified disorders of kidney or ureter</li> <li>Certain specified diseases of urinary system</li> </ul>	GC08.0 Urinary tract i	nfection, sit	te not specified, MG50.27 Exten	due to Escherich ded spectrum be	nia coli eta-lactamase producii	ng Escherichia coli 🛛 😣	Code: GC08.0/MG50.2	27
<ul> <li>GC00 Cystitis</li> <li>GC01 Other disorders of bladder</li> <li>GC02 Urethritis and urethral syndrome</li> <li>GC03 Urethral stricture</li> <li>GC04 Fistula of the genitourinary tract</li> <li>GC05 Prolapsed urethral mucosa</li> <li>GC06 Urethral diverticulum</li> <li>GC07 Urethral caruncle</li> <li>GC08 Urinary tract infection, site not specified</li> </ul>	Add detail to <b>Urinar</b> Has manifestation (u 1G40 1G41 JB40.0 KA60 Associated with (use	y tract infe se additional Sepsis witi Sepsis witi Puerperal Sepsis of f additional c	ction, site not s al code, if desired hout septic shock h septic shock sepsis fetus or newborn code, if desired .)	<b>pecified, due to</b> (.) :k 1	Escherichia coli			
GC08.0 Urinary tract infection, site not	MG50.20	Sulfona	mide or trimeth	oprim resistant E	scherichia coli			
specified, due to Escherichia coli GC08.1 Urinary tract infection, site not specified, due to Klebsiella pneumoniae GC08.2 Urinary tract infection, site not specified, due to Proteus JB40.3 Urinary tract infection following delivery	MG50.21 MG50.22 MG50.23 MG50.24 MG50.25 MG50.26	Fluoroq Third ga Fourth- Carbapa Polymy Penicilli Extenda	uinolone resista eneration cepha generation ceph enem resistant E xin resistant Esch n resistant Esch ed spectrum bet	nt Escherichia co losporin resistant nalosporins resista scherichia coli nerichia coli erichia coli a-lactamase prod	li Escherichia coli ant Escherichia coli lucing Escherichia coli	I		~
	₩IG50.27	Extende	ea spectrum bet	a-lactamase prod	lucing Escherichia coli		(alle) (alle) (alle) (alle)	~



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## Three levels of representation

	Example	Number of ICD-10- CM codes (%)
Full representation without postcoordination	Q02 Microcephaly → LA05.0 Microcephaly	222 (23.5%)
Full representation with postcoordination	H52.13 Myopia, bilateral → 9D00.0 Myopia <mark>&amp;</mark> XK9J Bilateral	81 (8.6%)
Partial representation	S80.211A Abrasion, right knee, initial encounter → NC90.0 Abrasion of knee & XK9K Right	640 (67.9%)
Total		943 (100%)



Chapter	Full representation without		Full representation with		Partial representation	
	postcoordination		postcoordination			
	% of codes	% of usage	% of codes	% of usage	% of codes	% of usage
1	52.6%	70.1%	21.1%	14.3%	26.3%	15.6%
2	37.9%	46.8%	36.4%	28.9%	25.8%	24.2%
3	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
4	80.0%	86.6%	10.0%	4.7%	10.0%	8.7%
5	60.0%	54.5%	0.0%	0.0%	40.0%	45.5%
6	61.5%	55.8%	0.0%	0.0%	38.5%	44.2%
7	17.6%	29.6%	13.7%	11.2%	68.6%	59.2%
8	16.7%	30.0%	44.4%	37.4%	38.9%	32.6%
9	64.3%	87.6%	7.1%	3.4%	28.6%	9.0%
10	83.3%	92.8%	0.0%	0.0%	16.7%	7.2%
11	64.0%	81.2%	8.0%	3.1%	28.0%	15.8%
12	16.4%	21.6%	14.8%	11.2%	68.9%	67.2%
13	20.9%	33.1%	34.9%	32.4%	44.2%	34.4%
14	70.0%	72.6%	10.0%	5.4%	20.0%	22.0%
15	26.7%	34.2%	0.0%	0.0%	73.3%	65.8%
16	91.7%	96.7%	0.0%	0.0%	8.3%	3.3%
17	45.3%	44.1%	5.7%	2.9%	49.1%	53.0%
18	53.6%	56.3%	0.0%	0.0%	46.4%	43.7%
19	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
20	0.0%	0.0%	5.0%	3.1%	95.0%	96.9%
21	27.0%	21.5%	13.5%	16.5%	59.5%	62.0%
Chapter	47.1%	53.1%	10.7%	8.3%	42.2%	38.6%
average						



#### Inter-rater agreement in ICD-11 coding





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## Failure analysis

- Reviewed all codes that were partially represented
- Reasons for not achieving full representation:
  - 1. Missing information in postcoordination
    - Postcoordination not allowed e.g.,

H93.13 Tinnitus, bilateral → MC41Tinnitus (does not allow postcoordination)

Addition of existing extension code not allowed e.g.,

-M25.552 Pain in left hip → ME82 Pain in joint & XA4XS4 Hip joint (further addition of extension code XK8G Left is not allowed)

#### Missing extension code e.g.,

-S00.31XA Abrasion of nose, initial encounter

- -O16.3 Unspecified maternal hypertension, third trimester
- -T45.515A Adverse effect of anticoagulants, initial encounter

»ICD-10-CM distinguishes between adverse effect (drug properly administered), poisoning (improper use) and underdosing (taking less than required)



#### Reasons for not achieving full representation (cont'd):

- 2. Residual categories
  - Both ICD-10-CM and ICD-11 have "catch-all" residual categories (e.g., R18.8 Other ascites, R26.2 Difficulty in walking, not elsewhere classified) to ensure coding of every possible case
  - The meaning of these categories depends on the neighboring codes (mainly the siblings)
  - Even apparently equivalent codes can have different meanings e.g. H26.8 Other specified cataract ≠ 9B10.2Y Other specified cataracts

H26: Other cataract

- I H26.0: Infantile and juvenile cataract
- H26.1: Traumatic cataract
- H26.2: Complicated cataract
- 1 H26.3: Drug-induced cataract
- H26.4: Secondary cataract
- Discrete Strain Strain
- Dispecified cataract 🕄 🖉

9B10.2 Certain specified cataracts
 9B10.20 Traumatic cataract
 9B10.21 Diabetic cataract
 9B10.22 After-cataract
 9B10.23 Subcapsular glaucomatous flecks
 9B10.2Y Other specified cataracts



#### Reasons for not achieving full representation (cont'd):

- 3. ICD-11 more specific than ICD-10-CM
  - Usually we choose an ICD-11 code that is equivalent or broader than the ICD-10-CM code
  - In some cases, ICD-11 coding guidance points to a specific code e.g.
    - ICD-10-CM code M62.82 Rhabdomyolysis
    - ICD-11 index term "rhabdomyolysis" points to FB32.20 Idiopathic rhabdomyolysis, which is more specific than rhabdomyolysis
  - Postcoordination is not applicable in these cases because it can only refine a code and make it more specific, but not more general



Reason for failure	ICD-10-CM codes (%)	
1. Missing information in	Episode of care	375 (39.8%)
postcoordination	Laterality	53 (5.6%)
	Mode of exposure	35 (3.7%)
	Trimester of pregnancy	16 (1.7%)
	Other missing information	
	- anatomy	45 (4.8%)
	- devices	25 (2.7%)
	- injury dimension	25 (2.7%)
	- etiology	16 (1.7%)
	- substances	11 (1.2%)
	- severity	10 (1.1%)
	- temporality	5 (0.5%)
	- external cause	4 (0.4%)
	- histopathology	3 (0.3%)
	- capacity context	1 (0.1%)
	- Others	100 (10.6%)
	Total	245 (26.0%)
2. Residual categories		131 (13.9%)
3. ICD-11 more specific		13 (1.4%)



#### **ICD-11** enhancements

- Some minor changes in ICD-11 can make a big difference
  - Add 9 extension codes (3 episode of care, 3 trimester of pregnancy, 3 mode of drug exposure)
  - Allow adding laterality modifier to anatomic entities

	Number of ICD-10-CM codes (%)		
	Existing ICD-11	Enhanced ICD-11	
Full representation without postcoordination	222 (23.5%)	222 (23.5%)	
Full representation with postcoordination	81 (8.6%)	332 (35.2%)	
Partial representation	640 (67.9%)	389 (41.3%)	
Total	943 (100%)	943 (100%)	



#### Coding guidance review

- ICD-10-CM and ICD-11 have inclusions, exclusions and an index that provide guidance to coders and delineate the boundaries of a code
- ICD-11 has a description (definition) for most codes
- The coding guidance is important in understanding the full meaning of a code and what it encompasses.
   Apparently equivalent codes can have different meanings due to differences in the coding guidance
- We reviewed the coding guidance of the ICD-10-CM code and its corresponding ICD-11 target for conflict



### Definitions

- The definition of each ICD-11 code was reviewed with the inclusions and exclusions of the ICD-10-CM code and its ancestors
- No conflict detected



#### Inclusions and exclusions

 Inclusions of the ICD-10-CM code and its ancestors were reviewed for conflicts with exclusions of the ICD-11 code and its ancestors



Inclusions and exclusions (cont'd)

 Exclusions of the ICD-10-CM code and its ancestors were reviewed for conflicts with inclusions of the ICD-11 code and its ancestors





#### Indexes

- An index conflict
  - In the ICD-10-CM index, an index term points to the ICD-10-CM code
  - The same index term occurs in the ICD-11 index, but points to an ICD-11 code other than the chosen target code
- Because of the large number of index terms, we were not able to do a comprehensive review
- Focused review
  - Index terms were normalized by the UMLS lexical tool (luinorm) to remove differences due to punctuation, capitalization, inflexion, word order etc.
  - Same index entries in ICD-10-CM and ICD-11 were found by matching the normalized index terms
  - Cases in which an index term in ICD-11 pointed to a code different from the chosen target code were reviewed



### Index conflict



LA8B.Y Other specified congenital anomaly of great arteries including arterial duct



#### Coding guidance conflicts - actual

Actual conflicts – need to change target ICD-11 code





Coding guidance conflicts - potential

- Target ICD-11 code is correct in general, but incorrect in specific cases. Three types:
  - 1. Partial overlap a specific case points to a broad code



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#### Coding guidance conflicts - potential

2. Granularity difference – a specific case points to a specific code





## Coding guidance conflicts - potential

3. Different default assumption





#### Coding guidance conflicts results

	Inclusions	and exclusions	Index		
	No. of conflicts	ICD-10-CM codes	No. of conflicts	ICD-10-CM codes	
Actual conflict	1	1	8	3	
Potential conflict					
partial overlap	6	6	109	41	
granularity difference	2	2	119	54	
different default assumption	1	1	20	12	
Total	10	10	266	93	



## Summary of findings

- Based on 943 frequently used ICD-10-CM codes, representing 60% of usage from each chapter, ICD-11 can achieve
  - 23.5% full representation without postcoordination
  - 8.6% full representation with postcoordination (can be increased to 35.2% with minor enhancements)
  - 67.9% partial representation
- Review of inclusions, exclusions and indexes revealed conflicts in about 10%, mostly potential conflicts that do not require change of target ICD-11 codes



#### Can ICD-11 replace ICD-10-CM?

- Based on the General Equivalence Maps (published by CMS), only 24.3% of ICD-9-CM codes have exact matches in ICD-10-CM
- Transition from ICD-10-CM to ICD-11 may not be more disruptive than transition from ICD-9-CM to ICD-10-CM
- The disruption can be even less with postcoordination
- Caveats:
  - Postcoordination has never been used in ICD coding
  - Impact on tooling and coder education
  - May increase coding variability in our study, coder variability in postcoordination is about the same as for the main codes



## Advantages of using ICD-11 for morbidity

- Avoid the cost of creating and maintaining ICD-11-CM
- Earlier use of an up-to-date, international medical classification
- Avoid divergence of the US Clinical Modification from the international core
  - Theoretically, ICD-10-CM should be totally compatible with ICD-10
  - However, significant differences can be observed e.g.
    - E14 Unspecified diabetes mellitus is not found in ICD-10-CM (diabetes unspecified is coded as type 2)
    - K68 Disorders of retroperitoneum is not found in ICD-10
    - Other differences are likely to exist due to differences in inclusions, exclusions and indexing as shown in our study
- ICD-11 Foundation Component (logical underpinning)
  - Alignment with other terminologies e.g. SNOMED CT
  - Automated coding



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#### New options for CM?

- Even if ICD-11 cannot totally replace ICD-10-CM, some alternatives to a full-fledged ICD-11-CM may be worth considering
  - "ICD-11-CM lite" adopt some chapters of ICD-11 as-is, only modify chapters that have more differences from ICD-10-CM
  - "Extension of extension" US will maintain its own additional set of ICD-11 extension codes to provide the necessary postcoordination
  - "ICD-11-CM as a linearization"
    - The various ICD-11 code sets for different use cases can be derived from the Foundation Component as linearizations
    - If ICD-11-CM can use the same logical underpinning and be generated as another linearization, it will be guaranteed to be tightly aligned with ICD-11



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