AMIA 2017 NLM booth presentation

SNOMED CT to ICD-10-CM map and the I-MAGIC tool

***Kin Wah Fung**, MD, MS, MA, FRCSEd*

Staff scientist
Computer Science Branch
Lister Hill National Center for Biomedical Communications
National Library of Medicine, National Institutes of Health

Motivation to map

- Before Meaningful Use, most EHRs were encoding clinical information by ICD codes
- ICD-9-CM / ICD-10-CM have been shown to be inferior to SNOMED CT to support clinical care
  - Insufficient content coverage and granularity
  - Not clinically oriented
  - Not computable – no logical definitions, no post-coordination
- A SNOMED CT to ICD-10-CM map will
  - Encourage EHRs to switch to SNOMED CT
  - Enable re-use of SNOMED CT-coded data to generate administrative codes
  - Support data analytics – allow integration of clinical and claims data

Mapping method

- **"Rule-based map"** - to accommodate one-to-many maps
- Combination of ICD-10-CM codes
  - SNOMED CT: Escherichia coli urinary tract infection
  - ICD-10-CM:
    - N39.0 Urinary tract infection, site not specified AND
    - B96.20 Unspecified Escherichia coli as the cause of diseases classified elsewhere
- More than one possible target codes
  - SNOMED CT: Sleep apnea
  - ICD-10-CM:
    - P28.3 Primary sleep apnea of newborn (*for neonates*) OR
    - G47.30 Sleep apnea, unspecified (*for adults*)

Mapping procedure

- "Dual independent mapping" – built-in quality assurance
- Each map has to be corroborated by 2 independent sources
  - For most concepts, 2 map specialists independently create maps which are compared:
    - If identical $\rightarrow$ final
    - Otherwise, map reviewed by a third specialist and difference reconciled
  - For some concepts, an existing map is available (e.g. donated content from Kaiser Permanente), map created by 1 specialist is compared to existing map:
    - If identical $\rightarrow$ final
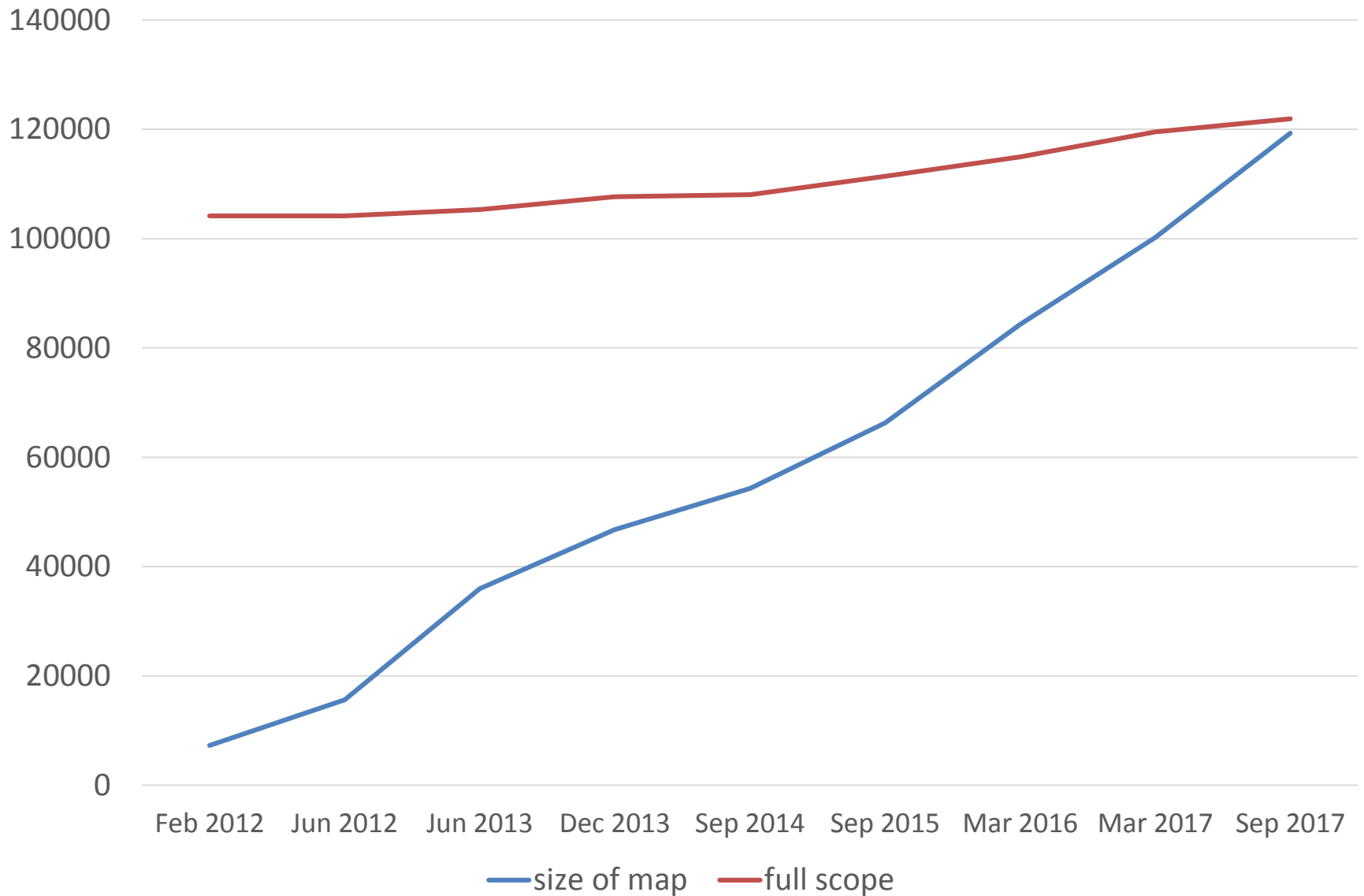   - Otherwise, disregard external map and follow workflow above

Scope of mapping

- Any SNOMED CT concept which can appear in a problem list and are considered in scope for mapping
- This includes most concepts from the 3 hierarchies
  - Clinical finding
  - Event
  - Situation with explicit context
- Altogether about 120,000 concepts in scope

Coverage of the SNOMED CT to ICD-10-CM map

Legend: size of map — full scope

Usage of the map

- 2017 UMLS user report: 2,357 users are using the SNOMED CT to ICD-10-CM map
- Users include health care providers (e.g., Partners HealthCare, Indian Health Service), EHR vendors, terminology services vendors
- Some SNOMED International member countries also use the map. To expedite the creation of the map, Belgium contributed a map specialist who worked on the project for one year
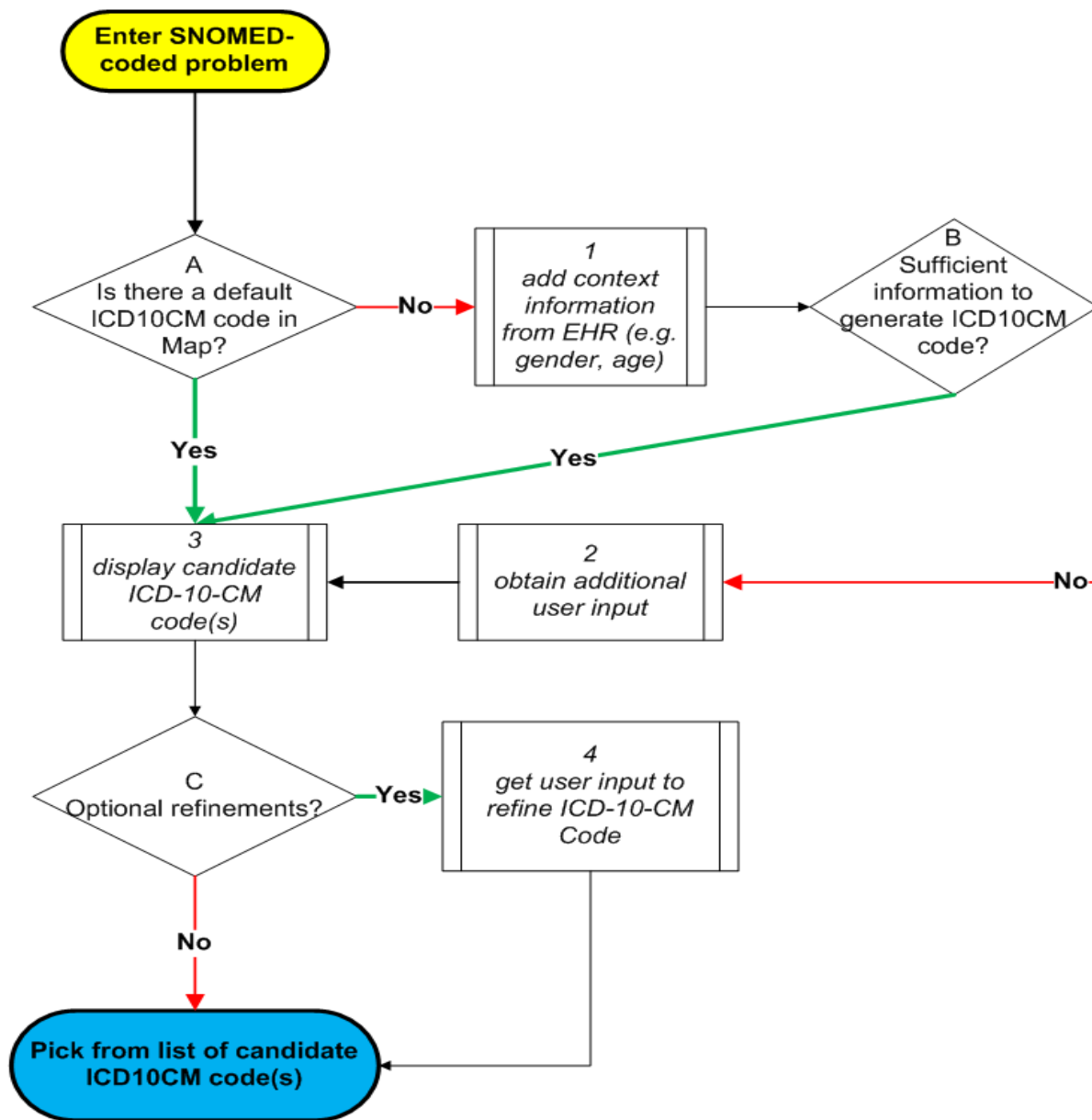
Intended uses of the map

- Embedded in the EHR for real-time, interactive ICD codes generation with the I-MAGIC algorithm (Interactive Map-Assisted Generation of ICD Codes)
- To assist coding professionals by suggesting ICD codes based on SNOMED CT-encoded problem list entries
- To facilitate integration of administrative and clinical data for data analytics

Interactive Map-Assisted Generation of ICD Codes (I-MAGIC) Algorithm

I-MAGIC demo tool for the ICD-10-CM map

- http://imagic.nlm.nih.gov/imagic/code/map

I-MAGIC

The I-MAGIC (Interactive Map-Assisted Generation of ICD Codes) Algorithm utilizes the SNOMED CT to ICD-10-CM Map in a real-time, interactive manner to generate ICD-10-CM codes. This demo simulates a problem list interface in which the user enters problems with SNOMED CT terms, which are then used to derive ICD-10-CM codes using the Map.

Name: [My Patient ▾]   Gender: [▾]   Date of Birth: [_____]

Information from EHR

Problem List (SNOMED-CT terms)

What's wrong with the patient? Please add problem(s) here. (Hint: type 'dizzy')

Action	SNOMED-CT Name
Add	Problem: [_____]

(Only SNOMED CT terms included in the published SNOMED CT to ICD-10-CM Map are shown.)

Problem list entry interface

[**Update List**]   [Get ICD Codes]   Add Complex Examples: [▾]

I-MAGIC Mapper: I-MAGIC

imagic.nlm.nih.gov/imagic/code/map?v=5&js=true&pabout=&pinstructions=&init-params=&pat=My+Patient&pat.init=My+Patient&q.f=08

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I-MAGIC

About | Instructions | Demo

The I-MAGIC (Interactive Map-Assisted Generation of ICD Codes) Algorithm utilizes the SNOMED CT to ICD-10-CM Map in a real-time, interactive manner to generate ICD-10-CM codes. This demo simulates a problem list interface in which the user enters problems with SNOMED CT terms, which are then used to derive ICD-10-CM codes using the Map.

Name: My Patient (modified) ▼   Gender: Male ▼   Date of Birth: 8 Jun 1980

Problem List (SNOMED-CT terms)

What's wrong with the patient? Please add problem(s) here. (Hint: type 'dizzy')

Action	SNOMED-CT Name
Add	Problem:
	otitis

(Only SN

> SNOMED CT terms included in the published map

Labyrinthitis (23919004)
Otitis externa (3135009)
Otitis media (65363002)
Epidemic vertigo (186738001)
Acute exudative otitis media (19399000)
Chronic otitis media (21186006)
Chronic non-suppurative otitis media (232254004)
Acute otitis media (3110003)
Acute eczematoid otitis externa (54272002)
Acute suppurative otitis media with spontaneous rupture of ear drum (86279000)

Update

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Name: My Patient (modified) ▾   Gender: Male ▾   Date of Birth: 8 Jun 1980

Problem List (SNOMED-CT terms)

What's wrong with the patient? Please add or remove problem(s) here.

Action	SNOMED-CT Name
☐ Remove	Otitis media
☐ Remove	Failure to gain weight
☐ Remove	Herniated urinary bladder
Add	Problem:

Click here to see ICD-10-CM codes

(Only SNOMED CT terms included in the published SNOMED CT to ICD-10-CM Map are shown.)

Update List   **Get ICD Codes**   Add Complex Examples:

I-MAGIC

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Name: My Patient (modified) ▾   Gender: Male ▾   Date of Birth: 8 Jun 1980

Mapping Problems to ICD-10-CM

SNOMED-CT	ICD-10-CM Code	ICD-10-CM Name	Optional refinement
Otitis media (65363002)			
	H66.90	Otitis media, unspecified, unspecified ear	Laterality / ICD notes
Failure to gain weight (36440009)			
	R62.7	Adult failure to thrive	
Herniated urinary bladder (410070006)			
	N32.89	Other specified disorders of bladder	

Submit Refinement   **Back to Problem List**

ICD-10-CM codes

Options to refine ICD-10-CM codes

I-MAGIC

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Name: [My Patient (modified) ▼]   Gender: [Male ▼]   Date of Birth: [8 Jun 1980]

Mapping Problems to ICD-10-CM

SNOMED-CT	ICD-10-CM Code	ICD-10-CM Name		Optional refinement
Otitis media (65363002)				
	H66.90	Otitis media, unspecified, unspecified ear		Laterality / ICD notes

Laterality refinement

Refine "Otitis media, unspecified":
- ○ Otitis media, unspecified, **unspecified ear**
- ○ Otitis media, unspecified. **right** ear
- ○ Otitis media, unspecified, **left** ear
- ○ Otitis media, unspecified, **bilateral**

Laterality refinement choices

Failure to gain weight (36440009)			
	R62.7	Adult failure to thrive	
Herniated urinary bladder (410070006)			
	N32.89	Other specified disorders of bladder	

[Submit Refinement]   [Back to Problem List]

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Name: [My Patient (modified) ▼]   Gender: [Male ▼]   Date of Birth: [8 Jun 1980]

Mapping Problems to ICD-10-CM

SNOMED-CT	ICD-10-CM Code	ICD-10-CM Name		Optional refinement
Otitis media (65363002)				
	H66.90	Otitis media, unspecified, unspecified ear		[Laterality] [ICD notes]

ICD coding notes

ICD notes for "Suppurative and unspecified otitis media"

Use additional code for any associated perforated tympanic membrane (H72.-)

Use additional code to identify:
exposure to environmental tobacco smoke (Z77.22)
exposure to tobacco smoke in the perinatal period (P96.81)
history of tobacco use (Z87.891)
occupational exposure to environmental tobacco smoke (Z57.31)
tobacco dependence (F17.-)
tobacco use (Z72.0)

Failure to gain weight (36440009)			
	R62.7	Adult failure to thrive	
Herniated urinary bladder (410070006)			
	N32.89	Other specified disorders of bladder	

Submit Refinement   **Back to Problem List**

The I-MAGIC (Interactive Map-Assisted Generation of ICD Codes) Algorithm utilizes the SNOMED CT to ICD-10-CM Map in a real-time, interactive manner to generate ICD-10-CM codes. This demo simulates a problem list interface in which the user enters problems with SNOMED CT terms, which are then used to derive ICD-10-CM codes using the Map.

Name: My Patient (modified)   Gender: Male   Date of Birth: 8 Jun 1980

Mapping Problems to ICD-10-CM

SNOMED-CT	ICD-10-CM Code	ICD-10-CM Name		Optional refinement
Otitis media (65363002)				
	H66.90	Otitis media, unspecified, unspecified ear		Laterality / ICD notes
Failure to gain weight (36440009)				
	R62.7	Adult failure to thrive		
Herniated urinary bladder (410070006)				
	N32.89	Other specified disorders of bladder		

ICD-10-CM code for adult

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Name: My Patient (modified)   Gender: Male   Date of Birth: 8 Jun 2006

Mapping Problems to ICD-10-CM

SNOMED-CT	ICD-10-CM Code	ICD-10-CM Name		Optional refinement
Otitis media (65363002)				
	H66.90	Otitis media, unspecified, unspecified ear		Laterality / ICD notes
Failure to gain weight (36440009)				
	R62.51	Failure to thrive (child)		
Herniated urinary bladder (410070006)				
	N32.89	Other specified disorders of bladde		

ICD-10-CM code for child

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Name: My Patient (modified) ▾   Gender: Male ▾   Date of Birth: 13 Nov 2013

Mapping Problems to ICD-10-CM

SNOMED-CT	ICD-10-CM Code	ICD-10-CM Name		Optional refinement
Otitis media (65363002)				
	H66.90	Otitis media, unspecified, unspecified ear		Laterality / ICD notes
Failure to gain weight (36440009)				
	P92.6	Failure to thrive in newborn		
Herniated urinary bladder (410070006)				
	N32.89	Other specified disorders of bladder		

ICD-10-CM code for newborn

Submit Refinement   Back to Problem List

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Name: `My Patient (modified)`   Gender: `Male`   Date of Birth: `8 Jun 1980`

Mapping Problems to ICD-10-CM

SNOMED-CT	ICD-10-CM Code	ICD-10-CM Name		Optional refinement
Otitis media (65363002)				
	H66.90	Otitis media, unspecified, unspecified ear		Laterality / ICD notes
Failure to gain weight (36440009)				
	R62.7	Adult failure to thrive		
Herniated urinary bladder (410070006)				
	N32.89	Other specified disorders of bladder		

Submit Refinement   **Back to Problem List**

> ICD-10-CM code for male

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Name: My Patient (modified)   Gender: Female   Date of Birth: 8 Jun 1980

Mapping Problems to ICD-10-CM

SNOMED-CT	ICD-10-CM Code	ICD-10-CM Name		Optional refinement
Otitis media (65363002)				
	H66.90	Otitis media, unspecified, unspecified ear		Laterality / ICD notes
Failure to gain weight (36440009)				
	R62.7	Adult failure to thrive		
Herniated urinary bladder (410070006)				
	N81.10	Cystocele, unspecified		

ICD-10-CM code for female

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Name: Mother 1 (modified) ▾   Gender: Female ▾   Date of Birth: 20 Jun 1990

Mapping Problems to ICD-10-CM

SNOMED-CT	ICD-10-CM Code	ICD-10-CM Name	Optional refinement
Chorioamnionitis (11612004)			
	O41.1290	Chorioamnionitis, unspecified trimester (not applicable or unspecified)	Trimester / Multiple fetuses

Trimester refinement   Trimester specification

Refine Trimester:
○ **unspecified** trimester
○ **first** trimester
○ **second** trimester
○ **third** trimester

Multiple fetuses refinement   Fetus specification

○ **not applicable or unspecified**
○ **fetus 1**
○ fetus **2**
○ fetus **3**
○ fetus **4**
○ fetus **5**
○ **other fetus**

Submit Refinement   **Back to Problem List**

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Name: Male adult 1 (modified) ▼   Gender: Male ▼   Date of Birth: 1 Dec 1965

Mapping Problems to ICD-10-CM

SNOMED-CT	ICD-10-CM Code	ICD-10-CM Name		Optional refinement
Simple goiter (267369002)				Refine problem

Problem refinement

Would one of the following diagnoses apply? Choose the most specific one:

- ○ Non-toxic multinodular goiter
- ○ Non-toxic uninodular goiter
- ○ Non-toxic nodular goiter
- ○ *The above choices are* **not applicable**

☐ Replace the original problem with the more specific diagnosis

	E04.0	Nontoxic diffuse goiter

Different ICD-10-CM codes if these more specific conditions apply

Submit Refinement   **Back to Problem List**

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Name: Trauma 1 (modified)   Gender: Male   Date of Birth: 25 Sep 1989

Mapping Problems to ICD-10-CM

SNOMED-CT	ICD-10-CM Code	ICD-10-CM Name	Optional refinement
Fracture of thoracic spine (125607007)			
	S22.009-	Unspecified fracture of unspecified thoracic vertebra	ICD notes

Required Episode refinement

- ○ initial encounter for **closed** fracture
- ○ initial encounter for **open** fracture
- ○ **subsequent** encounter for fracture **with routine healing**
- ○ subsequent encounter for fracture with **delayed** healing
- ○ subsequent encounter for fracture with **nonunion**
- ○ **sequela**

No valid default ICD-10-CM code

Mandatory refinement choices

Submit Refinement   **Back to Problem List**