

Mapping SNOMED CT Procedure Concepts to ICD-10-PCS

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Delivering

SNOMED CT

The global
language of
healthcare

IHTSDO SNOMED CT Expo

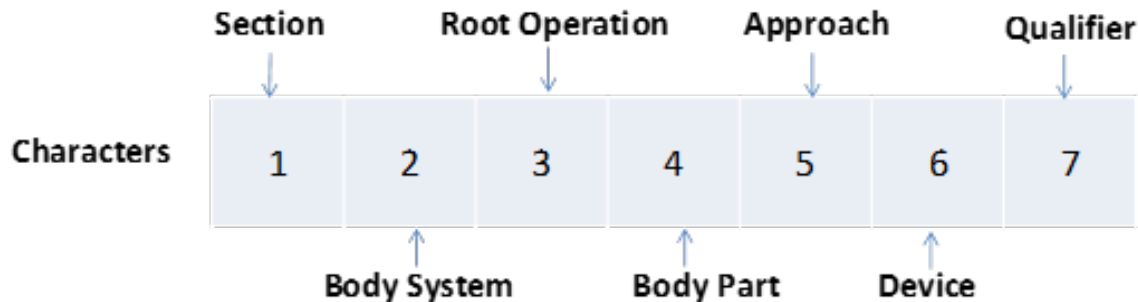
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Outline of presentation

- ICD-10-PCS map project overview
- Mapping approaches explored
 - Concept mapping – lexical mapping of indexes
 - Component mapping – mapping of the Approach axis
- Demonstration of how to use the map
 - Prototype of a real-time, interactive coding tool
- Future work

ICD-10-PCS

- Brand-new classification system created by U.S. Centers for Medicare and Medicaid Services (CMS)
- Multi-axial structure. The seven characters in the code correspond to the seven axes, each describing a particular aspect of the procedure.



ICD-10-PCS map project group

- Formed in 2015, bi-weekly conference calls
- Representatives from Belgium, Spain and U.S.
- Also contributions from Hospital Privado Universitario de Córdoba, Provincia de Córdoba, República Argentina
- To explore ways to map between SNOMED CT and ICD-10-PCS
- Expected benefits of the map:
 - Improve SNOMED CT and ICD-10-PCS coding efficiency and accuracy
 - Promote re-use of clinical data for administrative, epidemiologic and statistical purposes
 - Facilitate integration of clinical and administrative data to support data analytics

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Lexical mapping

- Direct lexical matching between ICD-10-PCS and SNOMED CT terms does not work well
 - (1) ICD-10-PCS names are composite terms created by combining the values in the various axes while SNOMED CT names are words in clinical discourse e.g.,
 - ICD-10-PCS: 0DTJ4ZZ Resection of Appendix, Percutaneous Endoscopic Approach
 - SNOMED CT: 6025007 Laparoscopic appendectomy
 - (2) Mismatch in granularity - An ICD-10-PCS code often includes information about
 - approach e.g., open approach, via natural or artificial opening
 - device e.g., synthetic substitute, metallic joint prosthesis
 - intent e.g., diagnostic
- SNOMED CT procedure concepts only occasionally include such information

The ICD-10-PCS index

- ICD-10-PCS index is more suitable for lexical matching because it contains more “clinician-friendly” terms at a more general level

Duodenectomy

see Excision, Duodenum [0DB9](#)

see Resection, Duodenum [0DT9](#)

Duodenocholedochotomy see Drainage, Gallbladder [0F94](#)

Duodenocystostomy

see Bypass, Gallbladder [0F14](#)

see Drainage, Gallbladder [0F94](#)

Duodenoenterostomy

see Bypass, Gastrointestinal System [0D1](#)

see Drainage, Gastrointestinal System [0D9](#)

Mapping of ICD-10-PCS index

- Extracted main index terms from xml index files, together with associated codes (in main and sub- entries)
- Use MetaMap (NLM's online natural language processing program) to map main index terms through the UMLS to SNOMED CT concepts
- Restrict SNOMED CT targets to descendants of 387713003 Surgical procedure

Results of lexical mapping of ICD-10-PCS index

- Found ICD-10-PCS map for 569 SNOMED CT surgical procedures
- ICD-10-PCS target codes mostly at 3 or 4 character level
- Mapping accuracy:
 - Correct 45%
 - Broader 44%
 - Related/unrelated 11%
- Even broader maps will be useful as they narrow down the search to the ICD-10-PCS table level

ICD-9-CM procedure codes index

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ICD-9-CM

Gastrectomy (partial) (sleeve) (subtotal) NEC 43.89
with
 anastomosis (to) NEC 43.89
 duodenum 43.6
 esophagus 43.5
 gastrogastric 43.89
 jejunum 43.7
 esophagogastrostomy 43.5
 gastroduodenostomy (bypass) 43.6
 gastroenterostomy (bypass) 43.7
 gastrogastrostomy (bypass) 43.89
 gastrojejunostomy (bypass) 43.7
 jejunal transposition 43.81
complete NEC 43.99
 with intestinal interposition 43.91
distal 43.6
Hofmeister 43.7
laparoscopic, vertical (sleeve) 43.82
Polya 43.7
proximal 43.5
radical NEC 43.99
 with intestinal interposition 43.91
sleeve
 laparoscopic 43.82
total NEC 43.99
 with intestinal interposition 43.91

ICD-10-PCS

Gastrectomy

Partial see Excision, Stomach [0DB6](#)
Total see Resection, Stomach [0DT6](#)
Vertical (sleeve) see Excision, Stomach [0DB6](#)

Compared to the ICD-10-PCS index,
ICD-9-CM index is much richer – has
more refinement options and includes
eponyms e.g. Polya gastrectomy

Parsing the ICD-9-CM index

- The original file is in .rtf file format
- Index parsed programmatically to extract main entry, indented entries, see references and codes
- Generate full name by concatenating main and indented entries

main	ind...	indent2	indent3	ICD9...	Full name
Gastrectomy (partial) (sleeve) (subtotal) NEC				43.89	Gastrectomy (partial) (sleeve) (subtotal) NEC
Gastrectomy (partial) (sleeve) (subtotal) NEC	with				Gastrectomy (partial) (sleeve) (subtotal) NEC with
Gastrectomy (partial) (sleeve) (subtotal) NEC	with	anastomosis (to) NEC		43.89	Gastrectomy (partial) (sleeve) (subtotal) NEC with anastomosis (to) NEC
Gastrectomy (partial) (sleeve) (subtotal) NEC	with	anastomosis (to) NEC	duodenum	43.6	Gastrectomy (partial) (sleeve) (subtotal) NEC with anastomosis (to) NEC duodenum
Gastrectomy (partial) (sleeve) (subtotal) NEC	with	anastomosis (to) NEC	esophagus	43.5	Gastrectomy (partial) (sleeve) (subtotal) NEC with anastomosis (to) NEC esophagus

Indirect map through the GEM

- Map ICD-9-CM index to SNOMED CT
 - Map ICD-9-CM codes to SNOMED CT through UMLS
 - Map concatenated index terms to UMLS terms after normalization
- Use the forward GEM (General Equivalence Map) to map ICD-9-CM to ICD-10-PCS



14247003 Cerebral
hemispherectomy
(procedure)

01.52 Hemispherectomy



00T70ZZ Resection of Cerebral
Hemisphere, Open Approach
00T73ZZ Resection of Cerebral
Hemisphere, Percutaneous Approach
00T74ZZ Resection of Cerebral
Hemisphere, Percutaneous Endoscopic
Approach

Mapping through ICD-9-CM index



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- ICD-9-CM index processing can find maps for 7,059 SNOMED CT concepts
- Cardinality of map
 - 549 concepts with 1-to-1 map
 - The rest: 1-to-many (up to 1,287 targets)
 - Average 25 targets
- Additional benefits: a rich collection of index terms leading to SNOMED CT and ICD-10-PCS codes

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Component mapping

SNOMED

Mapping: Laparoscopic Appendectomy

wide

SNOMED CT

Concept:

6025007
Laparoscopic appendectomy
(procedure)

1

Method:

Excision - action

2

Procedure site -
direct:

Appendix structure

3

Using access device:

Laparoscope, device

4

ICD-10-PCS

Class:

0D[TB]J4ZZ

Section:

0 Medical & Surgical

Body system:

D Gastrointestinal

Operation:

T Resection

B Excision

Body part:

J Appendix

Approach:

4 Percutaneous endoscopic

Device:

Z No device

Qualifier:


Z No qualifier

Mapping of the 'Using Access Device' attribute to the PCS Approach axis

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- 887 SNOMED CT procedure concepts
- 44 'Using Access Device' attributes

 Hysteroscopy
with resection of
intrauterine septum
(procedure)
SCTID: 54130005



Approach

0 Open

3 Percutaneous

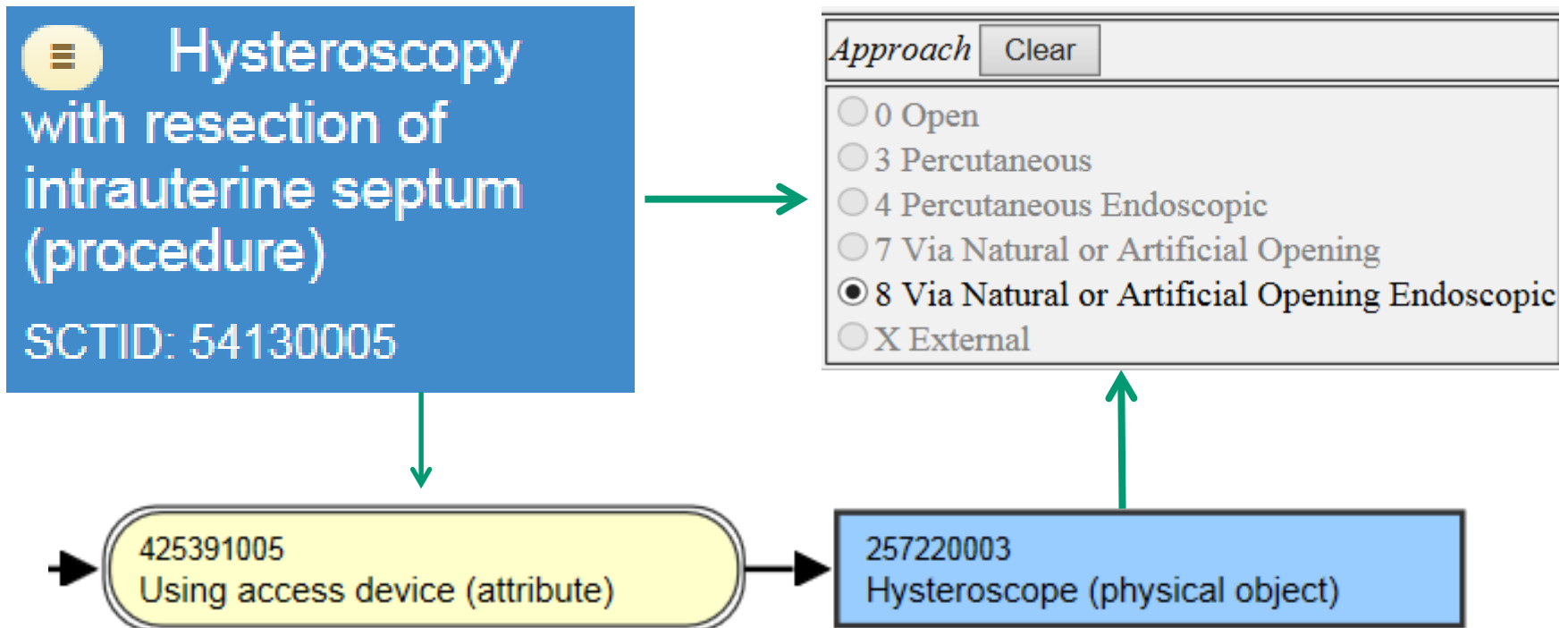
4 Percutaneous Endoscopic

7 Via Natural or Artificial Opening

8 Via Natural or Artificial Opening Endoscopic

X External

Methodology



Hysteroscope 257220003

procid	proc	device	Access_P	Y
44058009	Hysteroscopy with lysis of intrauterine adhesions (procedure)	Hysteroscope (physical object)	Endoscopic	Y
54130005	Hysteroscopy with resection of intrauterine septum (procedure)	Hysteroscope (physical object)	Endoscopic	Y
84064003	Hysteroscopy with removal of submucous leiomyomata (procedure)	Hysteroscope (physical object)	Endoscopic	Y
90742005	Hysteroscopy with endometrial ablation (procedure)	Hysteroscope (physical object)	Endoscopic	Y
176870002	Endoscopic cryotherapy to lesion of uterus (procedure)	Hysteroscope (physical object)	Endoscopic	Y
236898007	Endometrial laser ablation (procedure)	Hysteroscope (physical object)	Endoscopic	Y
445766004	Hysteroscopic excision of polyp of uterus (procedure)	Hysteroscope (physical object)	Endoscopic	Y
446804002	Hysteroscopic excision of leiomyoma of uterus (procedure)	Hysteroscope (physical object)	Endoscopic	Y
447215009	Hysteroscopic destruction of uterus and supporting structures (procedure)	Hysteroscope (physical object)	Endoscopic	Y
447237002	Hysteroscopic excision of uterus and supporting structures (procedure)	Hysteroscope (physical object)	Endoscopic	Y
713172009	Hysteroscopy with division of intrauterine septum (procedure)	Hysteroscope (physical object)	Endoscopic	Y
				11

Flexible cystoscope 257218001

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International

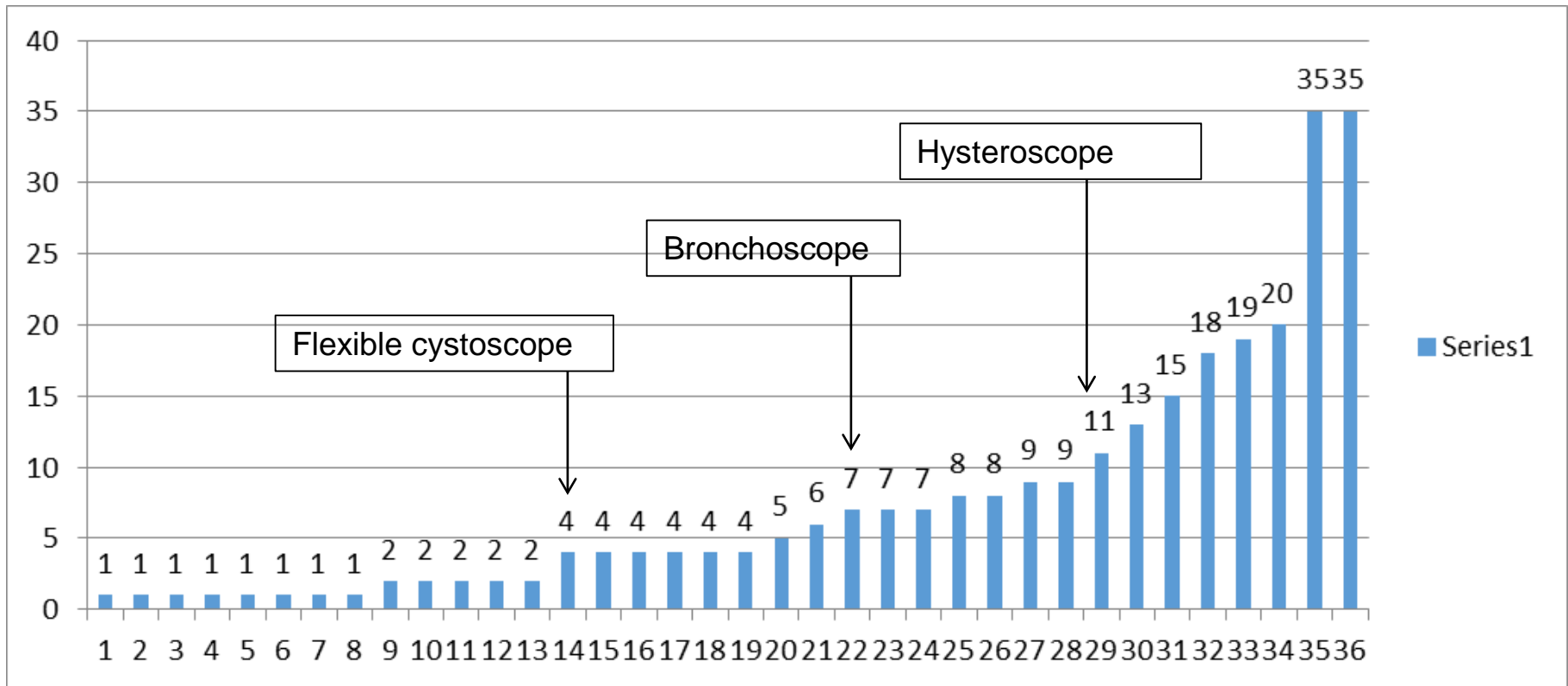
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procid	proc	device	Access_PCS	Y/N/C/W
300963001	Flexible cystoscopy and laser destruction of bladder lesion (procedure)	Flexible cystoscope (physical object)	Endoscopic	Y
236234003	Flexible check cystoscopy and cauterization of bladder lesion (procedure)	Flexible cystoscope (physical object)	Endoscopic	Y
236231006	Flexible cystoscopy and cauterization of bladder lesion (procedure)	Flexible cystoscope (physical object)	Endoscopic	Y
176158003	Flexible cystoscopic excision of bladder lesion (procedure)	Flexible cystoscope (physical object)	Endoscopic	Y
				4

Bronchoscope 257226009

procid	proc	device	Access_PCS	Y/N/C/W
448753000	Endoscopic destruction of lesion of trachea using rigid bronchoscope (procedure)	Rigid bronchoscope (physical object)	Endoscopic	Y
271409006	Therapeutic endoscopic operations on trachea using rigid bronchoscope (procedure)	Rigid bronchoscope (physical object)	Endoscopic	Y
173117002	Endoscopic snare resection of lesion below trachea using rigid bronchoscope (procedure)	Rigid bronchoscope (physical object)	Endoscopic	Y
173116006	Therapeutic endoscopic operation on lung using rigid bronchoscope (procedure)	Rigid bronchoscope (physical object)	Endoscopic	Y
173111001	Endoscopic laser destruction of lesion below trachea using rigid bronchoscope (procedure)	Rigid bronchoscope (physical object)	Endoscopic	Y
173084001	Endoscopic laser destruction of lesion of trachea using rigid bronchoscope (procedure)	Rigid bronchoscope (physical object)	Endoscopic	Y
173083007	Endoscopic snare resection of lesion of trachea using rigid bronchoscope (procedure)	Rigid bronchoscope (physical object)	Endoscopic	Y
				7

Results: 36 one-to-one maps (274 procedure concepts)



Results: 4 one-to-many maps (591 procedure concepts)

- Endoscope (214)
 - By default: GI - **Endoscopic** (70,09%)
 - But:
 - abdomen (7,01%), joint (4,67%), chest (2,80%) → PC Endo
 - ENT (3,74%) → Endoscopic
- Laparoscope (260)
 - By default: **Percutaneous Endoscopic** (92,69%)
 - But: *'Laparoscopic assisted'* procedure → Open
- Thoracoscope (19)
 - By default: **Percutaneous Endoscopic** (84,21%)
 - But: *'Video Assisted Thoracoscopic Surgery'* → Open
- Arthroscope (98)
 - By default: **Percutaneous Endoscopic** (93,88%)
 - But: *'Arthroscopic aided'* procedure → Open

Results: ambiguous or wrong maps

887 SNOMED CT procedure concepts with
44 'Using Access Device' attributes

15 SNOMED CT ambiguous

237490000 Mediastinoscopic thymectomy (procedure);

309830003 Mediastinoscope → Thoracoscope

7 SNOMED CT concepts with wrong 'Using
Access Attribute'

405593001 Angioplasty of external iliac artery with
prosthesis → Open Access

310362005 Angioplasty catheter (physical object)
→ Percutaneous Access

865 SNOMED CT concepts with 40 'Using Access
Device' attributes

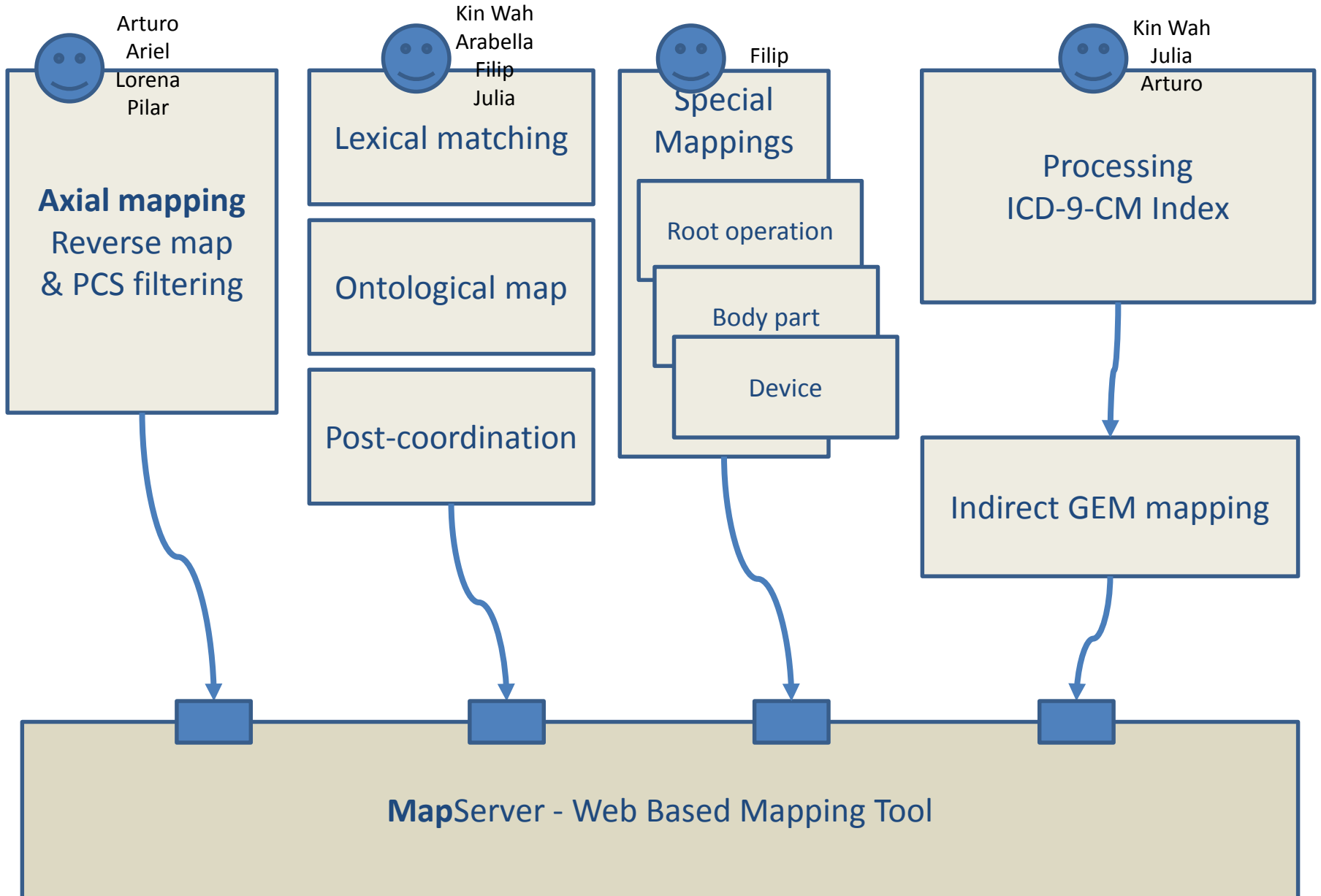
Conclusion

- 36 one-to-one Devices to Approach maps in 274 SNOMED CT concepts
- 4 one-to-many Devices to Approach maps in 591 SNOMED CT concepts for
 - Refinement
 - Manual review
- 22 SNOMED CT concepts with concept modelling difficulties

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Different approaches – one endpoint



Ongoing and future work

- Review and refine component maps
 - On-going work on body parts and root operations
 - Explore mapping of device and qualifier axes
- Enhance prototype map-assisted coding tool
 - Move from javascript to a database backend
 - Make tool available on the Internet
 - To evaluate performance of the tool in generating SNOMED CT and ICD-10-PCS codes

- Questions?
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