

Radiology Decision Support

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Impression Section Findings			
Positive		Negative	
Quoted	Coded	Quoted	Coded
<p>"Involucional changes", "microvascular white matter changes"</p>	<p>"Involucional changes" 442301001 Finding of change compared to previous radiologic examination (finding) : 363698007 Finding site (attribute) = 12738006 Brain structure (body structure) , 116676008 Associated morphology (attribute) = 85616004 Involution (morphologic abnormality) </p> <p>"microvascular white matter changes" 442301001 Finding of change compared to previous radiologic examination (finding) : 363698007 Finding site (attribute) = 68523003 Cerebral white matter structure (body structure) </p>	<p>"intracranial hemorrhage", "mass lesion", "acute territorial infarct"</p>	<p>"intracranial hemorrhage" 118247008 Radiologic finding (finding) + 1386000 Intracranial hemorrhage (disorder) </p> <p>"mass lesion" 118247008 Radiologic finding (finding) + 422840005 Mass lesion of brain (finding) </p> <p>"acute territorial infarct" 118247008 Radiologic finding (finding) + 95460007 Cerebellar infarction (disorder) : 363698007 Finding site (attribute) = 244212001 Entire posterior inferior cerebellar artery (body structure) , 116676008 Associated morphology (attribute) = 55470003 Acute infarct (morphologic abnormality) </p>
<p>"age appropriate atrophy", "No intracranial hemorrhage"</p>	<p>"age appropriate atrophy" 13331008 Atrophy (morphologic abnormality) </p> <p>"No intracranial hemorrhage" 1386000 Intracranial hemorrhage (disorder) </p>	<p>"intra-or extra-axial fluid", "intracranial hemorrhage", "midline shift", "mass effect"</p>	<p>"intra or extra axial fluid" 407670004 Computed tomography of brain abnormal (finding) + 1386000 Intracranial hemorrhage (disorder) +299728009 Midline shift of brain (finding)</p>
<p>"no interval changes", " No intracranial"</p>	<p>407670004 Computed tomography scan normal (finding) </p>	<p>"interval changes", "intracranial bleeding", "mass",</p>	<p>"intracranial bleeding" 1386000 Intracranial hemorrhage (disorder) </p>

<p>bleeding, mass, or mass effect" "No evidence of acute infarction"</p>	<p>233832000 Acute non-Q wave infarction - inferolateral (disorder) </p>	<p>"mass effect", "acute infarction"</p>	<p>"mass" mass lesion" 118247008 Radiologic finding (finding) + 422840005 Mass lesion of brain (finding) </p> <p>"mass effect" 422840005 Mass lesion of brain (finding) + Finding site (attribute) =28294002 Structure of central sulcus (body structure) </p> <p>"acute infarction" 118247008 Radiologic finding (finding) + 57054005 Acute myocardial infarction (disorder) </p> <p>"intracranial bleeding" 1386000 Intracranial hemorrhage (disorder) </p> <p>"mass" mass lesion" 118247008 Radiologic finding (finding) + 422840005 Mass lesion of brain (finding) </p> <p>"mass effect" 422840005 Mass lesion of brain (finding) + Finding site (attribute) =28294002 Structure of central sulcus (body structure) </p> <p>"acute infarction" 118247008 Radiologic finding (finding) + 57054005 Acute myocardial infarction (disorder) </p>
<p>"Arachnoid cyst in the posterior fossa", "mild mass effect"</p>	<p>367643001 Cyst (morphologic abnormality) 33595009 Arachnoid cyst (disorder) 422840005 Mass lesion of brain (finding) </p>	<p>"hemorrhage", "extra axial fluid collection"</p>	<p>"Hemorrhage" 29567006 Magnetic resonance imaging of brain and brain stem (procedure) + 50960005 Hemorrhage (morphologic abnormality) + 235958003 Acute</p>

	<p>310786005 Bone structure of posterior cranial fossa (body structure) </p>		<p>pancreatic fluid collection (disorder) </p>
<p>"Sagittal and coronal reconstructions", "intervertebral disc spaces are maintained", "prevertebral soft tissues are unremarkable"</p>	<p>118950002 Procedure on head AND/OR neck (procedure) 81420000 Structure of intervertebral disc space of thoracic vertebra (body structure) 158064003 Entire soft tissues of head and neck (body structure) </p>	<p>"fractures or dislocations of the cervical spine", "vertebral bodies and posterior elements ."</p>	<p>"Fractures/dislocation of the cervical spine", 263069008 Fracture dislocation of cervical spine (disorder), 655142016 "Vertebral bodies/posterior elements aligned" 244514004 Entire joint between cervical vertebral bodies (body structure) 280721008 Posterior vertebral element (body structure)</p>
<p>"No abnormal enhancement of the walls of the bowel", "No lymphadenopathy", "No Fluid Collections".</p>	<p>"Abnormal enhancement of the walls of the bowel" 67015007 Abnormal large bowel motility (finding) </p> <p>"No lymphadenopathy" 274621000 Lymphadenopathy absent (situation) </p>	<p>"Mild separation of the loops of distalileum in the right pelvis may be secondary to peristalsis or Crohn's disease."</p>	<p>"Mild separation of the loops of distalileum in the right pelvis" 263585009 Site of distal bowel involved (attribute) + 163208006 On examination - visible abdominal peristalsis (finding) + 34000006 Crohn's disease (disorder) </p>
<p>"No evidence of hydronephrosis", "liver, spleen, pancreas and adrenal glands are unremarkable", "inferior vena cava is unremarkable", "aorta is normal caliber".</p>	<p>"No evidence of hydronephrosis" 43064006 Hydronephrosis (disorder) </p> <p>"liver and adrenal glands" 110807007 Liver and adrenal gland (combined site) (body structure) </p> <p>"spleen and pancreas" 277603008 Entire lymphatic vessel of spleen and pancreas (body structure) </p> <p>"inferior vena cava" 64131007 Inferior vena cava structure (body structure) </p>	<p>" lung bases reveals mild emphysematous changes", "small hiatal hernia", "ureteral calculus", "Colonic diverticulosis"</p>	<p>"mild emphysematous changes" 263747008 Emphysematous (qualifier value) + 57686001 Emphysematous bleb of lung (disorder) </p> <p>"small hatial hernia" 84089009 Hiatal hernia (disorder) </p> <p>"ureteral calculus" 31054009 Ureteric stone (disorder) </p> <p>"Colonic diverticulosis" 398050005 Diverticular disease of colon (disorder) </p>

	"aorta is normal caliber". 302287000 Aortic diameter (observable entity)		
"Normal Contrast Brain CT"	396207002 Computerized axial tomography of brain with radiopaque contrast (procedure)	"The imaged sinuses and mastoid air cells are clear"	241609005 Magnetic resonance imaging of paranasal sinuses (procedure) 264093007 Entire mastoid cell (body structure)
"No acute cervical spine abnormality"	164562003 On examination - cervical spine abnormal (finding)	"Trauma/injuryneck pain"	81680005 Neck pain (finding)
" No acute fracture or dislocation is seen in the cervical spine"	426792009 Cervical spine normal (finding)	"Multi-level degenerative disease and multilevel degenerative joint disease changes are present throughout the cervical spine"	202761002 Degenerative cervical spinal stenosis (disorder) 239863005 Osteoarthritis of spinal facet joint (disorder)
"Negative for acute intracranial process." "There is no underlying skull fracture."	236624004 Acute cystitis - culture-negative (disorder) 168555002 Plain X-ray skull normal (finding)	"Soft tissue swelling/hematoma of the right posterior scalp"	425002002 Structure of right half of scalp (body structure) 385494008 Hematoma (disorder) 298349001 Soft tissue swelling (finding)
"Negative trauma CT" "No evidence of vascular, solid organ, or visceral injury"	408568004 Computed tomography scan brain - normal (finding) 303906007 Vascular structure of organs (body structure) 241999000 Visceral decompression injury (disorder)	"Solitary gallstone." "CT images were acquired with intravenous contrast"	168036006 Gallbladder calculus (disorder) 113090004 Computerized tomography with intravenous contrast (procedure)
"There does not appear to be focal fluid collection or definite lymphadenopathy ."	33463005 Liquid substance (substance) 30746006	"small rounded hypodense structure in the superior aspect right hepatic lobe which may be hemangioma."	400210000 Hemangioma (disorder) 369501008 Malignant tumor involving uterine cervix

	Lymphadenopathy (disorder)]	"There appears to be fullness of the cervix, uterus and ovaries."	by separate metastasis from ovary (disorder)
"Abdominal pain"	"Abdominal Pain" 139313005	urinary tract stones	urinary tract stones 74512330
No thoracic aortic aneurysm or dissection	51185008 Thoracic structure (body structure)]	masses or lymphadenopathyVascular structures,	"Lymphadenopathy"
No infiltrates, masses, or pleural effusionsMediastinum and hila	Lung function testing normal142191000	Negative for pulmonary embolism	Plumonary embolism 194882001
Degenerative changes of the spine	Brachyrachia 254087001	No evidence of an acute intrathoracic abnormality	Intrathoracic abnormality 158608004
Free flow of fluid	"Body Fluid" 32457005	No intra-abdominal lymphadenopathy	Lymphadenopathy16187800
"No thoracic aortic aneurysm or dissection"	51185008 Thoracic structure (body structure)] 85659009 aneurysm] 67362008 Aortic aneurysm (disorder)]	"No pulmonary embolism identified" "No pleural effusion or pneumothorax"	59282003 Pulmonary embolism (disorder)] 60046008 Pleural effusion (disorder)] 36118008 Pneumothorax (disorder)]
"Cellulitis"	"Cellulitis"128045006	Fracture of bone	"Fracture of bone"125605004
"Normal Structure of Lung"	"Normal Structure of Lung" 76271006	Infectious disease of abdomen, Pelvis tilted	Infectious disease of abdomen128070006 Pelvis tilted 249732004
"Normal Kidney structure"	"normal Kidney structure"64033007	"Pneumoperitoneum" , "Acute Pain"	"Pneumoperitoneum" 17204006 "Acute Pain" 274663001
"Liver Normal", Spleen Normal"	"Liver Normal"300337001 "Spleen Normal" 78961009 "Hemorrhagic cyst of ovary"707529015	"Diverticulitis", "Appendicitis"	"Diverticulitis"155779000 "Appendicitis" 155729003
Space of ventricular system of brain,	Space of ventricular system of brain 67256014	Acute sinusitis, Mastoiditis, Intracranial injury	Acute sinusitis (disorder)808089011 Mastoiditis (disorder)790410013, Intracranial injury282604004
"Liver Normal", "Spleen Normal", "Hemorrhagic cyst of ovary"	"Liver Normal"300337001 "Spleen Normal" 78961009	"adenopathy" "solid visceral mass"	"adenopathy" 141342003 "solid visceral mass"28428009

	"Hemorrhagic cyst of ovary"707529015		
"Bone Structure of Cervical Column"	"Bone Structure of Cervical Column"506165011	Lymphadenopathy, spondylosis	Lymphadenopathy161878009, spondylosis 8847002
" Lacunar infarction", "Chronic Sinus"	" Lacunar infarction" 345651012 "Chronic Sinus"2573414016	"intracranial injury"	"intracranial injury" 282604004
There may be small retention cysts or polyps are maxillary sinuses	Polyp of maxillary sinus (disorder)29074008	No definite acute facial bone/orbital fracture by CT	"Fracture of bone"125605004
right MCA distribution clots with developing early nonhemorrhagic infarct, versus vascular malformation	Congenital vascular malformation (disorder)400159008	No acute intracranial hemorrhage	intracranial hemorrhage1386000
"Hematoma of scalp"	"Hematoma of scalp"2795181017	"Intracranial Pressure"	"Intracranial Pressure" 641286016
"No obstruction of airway", "Translucency of maxillary sinus", "Maxillary Sinusitis", "Mastoiditis"	"No obstruction of airway" 820765015 Translucency of maxillary sinus (finding) Acute maxillary sinusitis (disorder)808089011 Mastoiditis (disorder)790410013	"edema of pharynx"	"edema of pharynx" C0236024
Mild diffuse osteopenia	Osteopenia (disorder) 203889002	"acute fracture"	C2062254 x-ray of cervical spine: acute fracture
Spine intact with preservation sagittal alignment on MPR workstation reformations.	Normal vertebral column 44300000	The appendix is well seen and normal	Appendicitis 155729003
There is no evidence of acute fracture of the cervical vertebrae	Normal Cervical column361684008	"disc space narrowing", "acute fracture"	Narrowing of intervertebral disc space (disorder) 645691018 C2062254 x-ray of cervical spine: acute fracture

As part of your response, please explain in 500 words or less why you chose certain Terminologies and what type of concept coverage they provide. You should reference at least 6 of Cimino's Desiderata (from the paper posted under "Terminology Desiderata").

Utilizing key words to extract useful information from a medical database is a key critical task to being able to make decisions that are consistent with evidence based medicine and research. Physicians, nurses, radiologists, and other healthcare professionals rely on these knowledge systems as a supporting framework to Clinical Decision Support Systems in order to accurately determine and prepare a diagnosis as well as review specific data that can improve a final outcome. For example, reviewing specific data has the potential to predict probable events such as drug interactions or disease symptoms. Therefore, useful data is only as valuable as the knowledge base it is derived from, along with its ability to produce accurate and precise results. Given these facts, the approach we took in selecting certain terminology extends a logic technique that targets forward chaining. For example, the term blood clot (morphologic abnormality—code 75753009) could create a reason for a Cardiac CT (Computed tomography of heart (procedure), code 241547009) resulting in the diagnosis of the term acute myocardial infarction (disorder, code 57054005), which in turn has a "causative agent" relationship to the concept myocardial infarction. This could further be broken down to a finding site relationship (i.e.: entire myocardium of right ventricle (body structure), with a SNOMED code of 362020004). This method allowed us to strategically target words that are multipurpose. This is beneficial to natural language processing (i.e.: a heart attack is synonymous to a myocardial infarction), encapsulating clinical findings (i.e.: abnormal breathing), and being able to apply certain terms to medical knowledge (i.e.: clinical researchers utilize medical terms in patient studies that correspond with specific conditions, such as hypothermia). Consequently, much consideration was given to James J. Camino's article on Desiderata. One focal point was '*concept orientation*'. It is imperative in medicine to relate words to their most precise meaning so that any misinterpretation can be avoided. Camino states that a "distinction must be made between ambiguity of the meaning of a concept and ambiguity of its usage." Being mindful of this, we methodically looked for words that were applicable to this concept orientation: In row five of the Excel spreadsheet, for example, the word *hemorrhage* is ambiguous in its usage to refer to bleeding, but when used with a descriptive (medical) adjective, such as "*intracranial*" it becomes unequivocally understood in its contextual meaning, and it identifies a finding site (i.e.: bleeding inside the skull). Next, effort was placed on terms that convey '*formal definitions*' that can be hierarchically linked to other concepts through relationships. For example, *Subdural hematoma* (i.e.: Excel sheet, row six) can be delineated with the "is a" link relative to the concept 'type of *intracranial mass lesion*.' Therefore the intracranial mass lesion inherits a 'site' relationship with the concept 'cranium' since this is subdural hematoma's finding site relationship. Moving forward, we address Camino's '*multiple granularities*.' It is obvious that with the abundance of varying levels of ailments or chronic illnesses present in modern society that there needs to be some degree of granularity that will convey the appropriate concept. For example, in row seven of the Excel spreadsheet, the term 'cyst' (code: 367643001 morphologic abnormality) conveys a more controlled concept in medical knowledge that an abnormal growth is present, whereas the term Arachnoid cyst is more granular in its precision of the medical knowledge, making healthcare professionals aware that this cyst is one that is most common in the brain. Identifying more granular terms was a component of our strategic term search. Camino also points out that there is a need supply '*multiple consistent views*' for terms that serve multiple functions or warrant various levels of granularity. In keeping with this concept, we singled out terms in the excel sheet that reflected the potential of belonging to a more 'course-grained' concept based on their preciseness of nature. For example, the

precision of the term '*aortic aneurysm*' in row twenty-two of the Excel spreadsheet reflects specificity (i.e.: "fine-grained", according to Camino) therefore giving the indication that this term could belong to a parent group, such as 'aneurysm' allowing it to be collapsed into a more "course-grained" concept and act as a synonym. This is also true of the term '*pulmonary embolism*' (Excel sheet, line 22, negative coded column) which can also be collapsed into the parent group 'embolism.' This would allow it to serve as a multipurpose term. In conclusion, discussion regarding Camino's points of reference to '**concept permanence**' and the '**non-semantic concept identifier**' invoked the realization of certain limitations in being able to utilize strategic techniques to expedite searches based on possible naming or numeric strategies. For example, in trying to quickly input some of the data into the Excel spreadsheet, there is no way that you can just apply one word to a condition and expect the corresponding concept to be perceived accordingly. This became evident when entering the word 'emphysematous' in row ten of the Excel spreadsheet (negative coded) into SNOMED trying to quickly extract its code. Since emphysematous serves as a 'qualifier' value of multiple concepts it is necessary to specify its site relationship (i.e.: bleb of lung). Though this is not quite synonymous to 'concept permanence' the idea behind the rationale of concept permanence (i.e.: the meaning of a concept must stay the same even if its name evolves) was beneficial in ensuring that full terms were used to extract appropriate contextual meanings. A true example of 'concept permanence' would be using the updated term '*spontaneous pneumothorax*' instead of '*pneumothorax*' to define collapsed lung. Regarding the aforementioned 'non-semantic concept identifier' topic, it became immediately apparent that there is no possible way to retrieve concept descriptions that may be related based on a numeric hierarchical code using the concept id. For example, the concept id 95570007 is an identifier for *kidney stone*. It is not possible to input the prefix of this concept id (i.e.: 955) or any other part of its numeric representation into the SNOMED browser to bring up a list of related terms, such as *kidney inflammation*. Camino suggest that such a coding system could be problematic "if a concept belonged to more than one location in the hierarchy." In conclusion, the ultimate lesson to be learned here is that knowledge management must be based on a strong foundation inclusive of both conceptual modeling and logical design. This would ensure that users are able to access the information they need seamlessly while performing the least amount of tasks in doing so.