
Ambiguity in the UMLS Metathesaurus

2001 Edition

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1. Introduction

The UMLS[®] Metathesaurus[®] denotes explicit ambiguity by appending an ambiguity designator, a number in angle brackets, to the end of an ambiguous string. Because strings with ambiguity designators require significant special processing, the original string (with possible case changes) is always included as another string for the concept involved.¹ Thus each concept with a string ‘aaa <n>’ also has string ‘aaa’ (ignoring case differences). But now any application which gains access to the Metathesaurus textually, cannot tell the difference among the concepts of an ambiguous cluster ‘aaa <n>’ each of which is represented by ‘aaa’. The purpose of this report is to examine ambiguity in the 2001 release of the Metathesaurus in the context of its effect on natural language processing (NLP) applications.

The number of explicitly ambiguous Metathesaurus terms in the 2001 edition has grown significantly over the 2000 edition. Table 1 shows several counts that indicate that growth in broad

	1999	2000	2001
Strings with an ambiguity designator	7,912	9,416 (+19%)	12,840 (+36%)
Concepts with one or more ambiguity	6,565	7,409 (+13%)	9,637 (+30%)
Cases of ambiguity	3,669	4,361 (+19%)	5,571 (+28%)

Table 1. **Measures of ambiguity in the UMLS Metathesaurus**

terms. Some examples will clarify the meaning of the counts. There are 55 Metathesaurus strings ‘Other <n>’ for n ranging from 1 to 55; these strings occur in 55 distinct concepts but represent a single case of ambiguity. Some concepts contain more than one ambiguous string, i.e. they are ambiguous in more than one way. In fact, the concept ‘Optic Nerve Glioma, Childhood’ has 37 ambiguous strings. A more manageable example of a concept with multiple ambiguities is ‘Arthrogyriposis’ which has the following six ambiguous strings:

1. This year there are some exceptions to this rule: the strings ‘**Antitussive <2>**’, ‘**Antigonadotrophins, antiestrogens, antiandrogens, not elsewhere classified <1>**’ and ‘**Other psychotropic drugs, not elsewhere classified <1>**’ have no corresponding string without the ambiguity designator.

Amyoplasia congenita <1>
 Congenital Arthromyodysplasia <1>
 Congenital multiple arthrogyrosis <1>
 myodystrophia fetalis deformans <2>
 myodystrophia foetalis deformans <2>
 pterygium universale <2>

All but the last string are ambiguous with the concept ‘Amyoplasia congenita disruptive sequence’. The concept containing ‘pterygium universale <1>’, however, is ‘Multiple pterygium syndrome’.

The information in Table 1 shows that the amount of ambiguity in the Metathesaurus increased by about 30% from 2000 to 2001. Examining the cases of ambiguity more closely, consider the *degree* of ambiguity, i.e., the number of ways a string is ambiguous, or the number of concepts in which it occurs. ‘Other <n>’, for example, has degree 55. Table 2 contains the distribution of

Degree of ambiguity	1999 cases	2000 cases	2001 cases
55	0	0 (-)	1 (-)
54	1	1 (0%)	0 (-100%)
23	1	1 (0%)	1 (0%)
18	1	1 (0%)	1 (0%)
17	0	0 (-)	60 (-)
16	2	2 (0%)	1 (-50%)
8	3	3 (0%)	3 (0%)
7	2	2 (0%)	2 (0%)
6	1	2 (+100%)	4 (+100%)
5	9	9 (0%)	22 (+144%)
4	52	71 (+37%)	68 (-4%)
3	321	403 (+26%)	479 (+19%)
2	3,249	3,835 (+18%)	4,898 (+28%)
1	27	31 (+15%)	31 (0%)
Total	3,669	4,361 (+19%)	5,571 (+28%)

Table 2. Metathesaurus ambiguity distribution by degree

ambiguities in the Metathesaurus according to degree. Note that an ambiguity of degree one is not actually an ambiguity. ‘Abbreviations <1>’, for example, is not ambiguous since there are no other ‘Abbreviations <n>’ strings in the Metathesaurus. The most important thing to note about the table is that, with the exception of degree 17 cases, changes in ambiguity are focused on ambiguities of degree six or less and mainly of degree two. The sixty new cases of ambiguity of degree 17 would be problematic except for the fact that most of them are suppressible synonyms. So for 2001 there is effectively no proliferation of the problematic ambiguity of high degree. Table 3 shows the ambiguity distribution after excluding suppressible synonyms. Note that there is only

Degree of ambiguity	1999 cases	2000 cases	2001 cases
55	0	0 (-)	0 (-)
54	1	0 (-100%)	0 (-)
23	1	1 (0%)	1 (0%)
18	1	1 (0%)	1 (0%)
17	0	0 (-)	1 (-)
16	1	1 (0%)	0 (-100%)
8	3	3 (0%)	3 (0%)
7	2	2 (0%)	2 (0%)
6	0	1 (-)	2 (+100%)
5	6	6 (0%)	7 (+17%)
4	24	34 (+42%)	37 (+9%)
3	223	303 (+36%)	385 (+27%)
2	2,849	3,435 (+21%)	4,511 (+31%)
1	338	352 (+4%)	361 (+3%)
Total	3,449	4,139 (+20%)	5,311 (+28%)

Table 3. **Metathesaurus ambiguity distribution after removing suppressibles**

one case of degree 17 and that there are many more cases of degree 1, i.e., where suppression has resolved some ambiguities.

Section 2 of this report reviews the higher degree (5 or more) ambiguity cases; section 3 summarizes section 2; section 4 focuses on the cases of ambiguity of lesser degree (4 and 3 but not 2); section 5 contains additional ambiguities discovered while preparing for MetaMap suppression; and section 6 contains a final summary of the results and recommendations for handling ambiguity in the Metathesaurus.

2. Higher Degree Ambiguity

The most ambiguous English Metathesaurus strings are listed below in decreasing order of degree of ambiguity. Bold text indicates a difference between the 2000 and 2001 Metathesaurus. Explanations for all cases of degree 5 or more are given below; in addition, the reader is referred to previous editions for other explanations.

- **55** ‘**Other <n>**’ (was 54)
- 23 ‘Protocols <n>’
- 18 ‘Patient Education Plans <n>’
- **17** ‘**Administrative procedure <n>**’
 ... (Except for ‘Assessment <n>’, there are a total of 59 cases of ambiguity of degree 17; all are new, and their ambiguous forms are marked as suppressible. See section 2.4 below for an example, and see the appendix for the complete list.)

- 17 ‘**Assessment <n>**’ (appears to be 17 but is actually 16)
- 16 ‘Limited function/disability <n>’
- 8 ‘cde genotype <n>’
- 8 ‘Driver injured in collision with other and unspecified motor vehicles in nontraffic accident <n>’
- 8 ‘Driver injured in collision with other and unspecified motor vehicles in traffic accident <n>’
- 7 ‘Passenger injured in collision with other and unspecified motor vehicles in nontraffic accident <n>’
- 7 ‘Passenger injured in collision with other and unspecified motor vehicles in traffic accident <n>’
- 6 ‘Cold <n>’
- 6 ‘Other injuries <n>’
- 6 ‘**Stomach <n>**’ (was 5)
- 6 ‘**urethra <n>**’ (was 5)
- 5 ‘[SO] Premolar tooth <n>’
- 5 ‘adjustment <n>’
- 5 ‘**Appendix <n>**’
- 5 ‘**Bladder <n>**’
- 5 ‘cd <n>’
- 5 ‘**Cl <n>**’ (was 4)
- 5 ‘**conjunctiva <n>**’ (was 4)
- 5 ‘**Esophagus <n>**’ (was 4)
- 5 ‘Injuries <n>’
- 5 ‘**Kidney <n>**’ (was 4)
- 5 ‘**Larynx <n>**’ (was 4)
- 5 ‘**Liver <n>**’ (was 4)
- 5 ‘**P <n>**’ (was 4)
- 5 ‘**Pancreas <n>**’ (was 4)
- 5 ‘**Penis <n>**’ (was 4)
- 5 ‘**Pineal Gland <n>**’ (was 4)
- 5 ‘Premolar tooth <n>’
- 5 ‘prostate <n>’
- 5 ‘**Rectum <n>**’ (was 4)
- 5 ‘Tourniquet on <n>’
- 5 ‘**Ureter <n>**’ (was 4)
- 5 ‘**Vagina <n>**’ (was 4)

2.1 ‘Other <n>’

The one new ‘Other <n>’ string is ‘Other <55>’ for concept ‘Miscellaneous Dietary Supplements’. Besides the legitimate concept ‘Other’, the five cases of unsuppressed ambiguity are for concepts

1. ‘**Other location of complaint**’ (<2>)
2. ‘**Other activities involving preparation of a routine non-injectable drug product**’ (<52>)

3. **'Other activities involving preparation of compounded non-parenteral medications'** (<53>)
4. **'Other activities involving preparation of compounded parenteral medications'** (<54>)
5. **'Miscellaneous Dietary Supplements'** (<55>)

These should all be marked as suppressible synonyms.

2.2 'Protocols <n>'

All 23 strings 'Protocols <n>' are generalizations of their preferred names and should be marked as suppressible. Their concepts are

1. **'Protocols documentation'**
2. **'Protocols: Activities'**
3. **'Protocols: Bowel Elimination'**
4. **'Protocols: Circulation'**
5. **'Protocols: Cognition'**
6. **'Protocols: Coping'**
7. **'Protocols: Fluid and Electrolyte'**
8. **'Protocols: Health Behavior'**
9. **'Protocols: Immunology'**
10. **'Protocols: Medications and Blood Products'**
11. **'Protocols: Metabolism'**
12. **'Protocols: Nutrition'**
13. **'Protocols: Physical Regulation'**
14. **'Protocols: Pre- or Intra- or Post-Procedure'**
15. **'Protocols: Respiration'**
16. **'Protocols: Role Relationship'**
17. **'Protocols: Safety'**
18. **'Protocols: Self-Care'**
19. **'Protocols: Self-Concept'**
20. **'Protocols: Sensation, Pain and Comfort'**
21. **'Protocols: Tissue Integrity'**
22. **'Protocols: Tissue Perfusion'**
23. **'Protocols: Urinary Elimination'**

2.3 'Patient Education Plans <n>'

All 18 strings 'Patient Education Plans <n>' are generalizations and should be suppressed. Their concepts are

1. **'Patient Education Plans: Activities'**
2. **'Patient Education Plans: Bowel Elimination'**
3. **'Patient Education Plans: Circulation'**
4. **'Patient Education Plans: Coping'**
5. **'Patient Education Plans: Health Behavior'**
6. **'Patient Education Plans: Immunology'**
7. **'Patient Education Plans: Medications and Blood Products'**
8. **'Patient Education Plans: Metabolism'**
9. **'Patient Education Plans: Nutrition'**

10. **'Patient Education Plans: Physical Regulation'**
11. **'Patient Education Plans: Pre- or Intra- or Post-Procedure'**
12. **'Patient Education Plans: Respiration'**
13. **'Patient Education Plans: Role Relationship'**
14. **'Patient Education Plans: Safety'**
15. **'Patient Education Plans: Self-Care'**
16. **'Patient Education Plans: Sensation, Pain and Comfort'**
17. **'Patient Education Plans: Tissue Integrity'**
18. **'Patient Education Plans: Urinary Elimination'**

2.4 **'Administrative procedure <n>'**

The concepts associated with the 17 senses of 'Administrative procedure' are

1. 'Administrative procedure'
2. 'Administrative procedure, BLOOD/BLOOD FORMING ORGANS/IMMUNE MECHANISM'
3. 'Administrative procedure, CIRCULATORY'
4. 'Administrative procedure, DIGESTIVE'
5. 'Administrative procedure, EAR'
6. 'Administrative procedure, ENDOCRINE/METABOLIC/NUTRITIONAL'
7. 'Administrative procedure, EYE'
8. 'Administrative procedure, FEMALE GENITAL SYSTEM INCLUDING BREAST'
9. 'Administrative procedure, MALE GENITAL SYSTEM INCLUDING BREAST'
10. 'Administrative procedure, MUSCULOSKELETAL'
11. 'Administrative procedure, NEUROLOGICAL'
12. 'Administrative procedure, PREGNANCY, CHILDBEARING, FAMILY PLANNING'
13. 'Administrative procedure, PSYCHOLOGICAL'
14. 'Administrative procedure, RESPIRATORY'
15. 'Administrative procedure, SKIN'
16. 'Administrative procedure, SOCIAL PROBLEMS'
17. 'Administrative procedure, URINARY SYSTEM'

The first concept, simply 'Administrative procedure', occurs in sources ICPC2E, ICPC93, SNMI98 and RCD99. The remaining concepts only occur in ICPC2E, and their ambiguous forms are already marked as suppressible.

2.5 **'Assessment <n>'**

The concepts associated with the 16 senses of 'Assessment' are

1. **'Assessment: Bowel Elimination'**
2. **'Assessment: Circulation'**
3. **'Assessment: Cognition'**
4. **'Assessment: Coping'**
5. **'Assessment: Fluid and Electrolytes'**
6. **'Assessment: Health Behavior'**
7. **'Assessment: Medications and Blood Products'**
8. **'Assessment: Metabolism'**
9. **'Assessment: Pre- or Intra- or Post-Procedure'**

10. **'Assessment: Respiration'**
11. **'Assessment: Safety'**
12. **'Assessment: Self-Care'**
13. **'Assessment: Sensation, Pain and Comfort'**
14. **'Assessment: Urinary Elimination'**
15. **'Knowledge acquisition using a method of assessment'**
16. **'Nutrition Assessment'**

'Assessment <n>' is of degree 16, but this year the string 'Assessment <17>' has been added to the concept, 'Assessment: Cognition', which already has string 'Assessment <5>'. The concepts occur in eight sources including PCDS97, MSH2001, PSY97 and ICPC2P. All of the ambiguous forms should be marked as suppressible.

2.6 'Limited function/disability <n>'

All ambiguous forms for the 16 'Limited function/disability <n>' concepts are already marked as suppressible.

2.7 'cde genotype <n>'

The 8 strings 'cde genotype <n>' differ only in the case of 'c', 'd' or 'e'. They seem to be legitimate concepts from RCD99. In a case sensitive environment, there is no ambiguity; the presence of strings with ambiguity designators, although not harmful, is not necessary. When case is ignored, the ambiguity exists and the additional strings are warranted (albeit possibly confusing because they appear with mixed case). Thus, the ambiguous forms are correctly not suppressed.

2.8 'Driver injured in collision with other and unspecified motor vehicles in nontraffic accident <n>' and other cases

The 8 strings 'Driver injured ... <n>' occur in RCD99 and ICD10 with some variation in the wording. The concepts for these strings are

1. **'Bus driver injured in collision with other and unspecified motor vehicles in nontraffic accident'**
2. **'Car driver injured in collision with other and unspecified motor vehicles in nontraffic accident'**
3. **'Driver injured in collision with other and unspecified motor vehicles in nontraffic accident'**
4. **'Driver of three-wheeled motor vehicle injured in collision with other and unspecified motor vehicles in nontraffic accident'**
5. **'Driver pedal cycle injured in collision with other and unspecified motor vehicles in nontraffic accident'**
6. **'Heavy transport vehicle driver injured in collision with other and unspecified motor vehicles in nontraffic accident'**
7. **'Motorcycle driver injured in collision with other and unspecified motor vehicles in nontraffic accident'**
8. **'Pick-up truck or van driver injured in collision with other and unspecified motor vehicles in nontraffic accident'**

Except for the third case, the ambiguous strings are generalizations and should be suppressed. (Note that it does no harm to suppress all ambiguous forms because the third case is the preferred form for its concept; these are normally not suppressed by MetaMap.)

Similar analyses apply to

- **‘Driver injured in collision with other and unspecified motor vehicles in traffic accident <n>’**
- **‘Passenger injured in collision with other and unspecified motor vehicles in nontraffic accident <n>’**
- **‘Passenger injured in collision with other and unspecified motor vehicles in traffic accident <n>’**

i.e., all ambiguous forms should be suppressed.

2.9 ‘Cold <n>’

The concepts associated with the six senses of ‘Cold’ are

- ‘Chronic Obstructive Airway Disease’ (which has strings ‘COLD’ and ‘Chronic Obstructive Lung Disease’) (<3>)
- ‘Cold Sensation’ (<5>)
- **‘Cold Therapy’ (<4>) [consider suppressing]**
- ‘Cold brand of chlorpheniramine-phenylpropanolamine’ (<6>)
- ‘Common Cold’ (<2>)
- ‘cold temperature’ (<1>)

Senses <3>, <4> and <6> are currently suppressed by MetaMap for mainly practical reasons (see 2000 Edition). The only sense that might be marked as suppressible in the Metathesaurus is sense <4>, ‘Cold Therapy’, and even that sense has been found in MEDLINE citations.

2.10 ‘Other injuries <n>’

All ambiguous forms for the 6 ‘Other injuries’ concepts are marked as suppressible. The concepts are

- ‘Other auditory injuries’
- ‘Other digestive system injuries’
- ‘Other hematologic injuries’
- ‘Other neurologic injuries’
- ‘Other ocular injuries’
- ‘Other respiratory injuries’

2.11 ‘Stomach <n>’ and other cases

The concepts associated with the 6 senses of ‘Stomach’ are

- ‘Benign neoplasm of stomach’ (<3>)
- ‘Carcinoma in situ of stomach’ (<2>)
- ‘Neoplasm of uncertain or unknown behavior of stomach’ (<4>)
- **‘Procedures on the stomach’ (<6>)**

- ‘Stomach’ (<1>)
- ‘Stomach problem’ (<5>)

The new sense for 2001 is ‘Procedures on the Stomach’ and represents a systematic introduction of ambiguity arising from ICD10AM, i.e., many body parts exhibit the same ambiguity. Only the concept ‘Stomach’, itself, is a legitimate sense of the word *stomach*. Except for the new sense, the ambiguous forms for the other concepts are already marked as suppressible. Those for ‘Procedures on the stomach’ should also be so marked.

The concepts for the 6 senses of ‘**urethra**’ are

- ‘Benign neoplasm of urethra’ (<3>)
- ‘Malignant neoplasm of urethra’ (<2>)
- ‘Neoplasm of uncertain or unknown behavior of urethra’
- ‘**Procedures on Urethra**’ (<6>)
- ‘Urethra’ (<1>)
- ‘**Urethral Diseases**’ (<5>)

Sense <6> is new, only sense <1> is legitimate, senses <2> through <4> have already been marked as suppressible, and senses <5> and <6> should also be marked as suppressible.

The concepts for the 5 senses of ‘**Appendix**’ are

- ‘Appendix’ (<1>)
- ‘Benign neoplasm of appendix’ (<4>)
- ‘Malignant neoplasm of appendix’ (<3>)
- ‘Neoplasm of uncertain or unknown behavior of appendix’ (<2>)
- ‘**Procedures on Appendix**’ (<5>)

Sense <5> is new, only sense <1> is legitimate, senses <2> through <4> have already been marked as suppressible, and sense <5> should also be marked as suppressible.

The concepts for the 5 senses of ‘**Bladder**’ are

- ‘Benign neoplasm of bladder’ (<3>)
- ‘Bladder’ (<1>)
- ‘Carcinoma in situ of bladder’ (<2>)
- ‘Neoplasm of uncertain or unknown behavior of bladder’ (<4>)
- ‘**Procedures on bladder**’ (<5>)

This case is identical to ‘Appendix’: sense <5> should be marked as suppressible.

The concepts for the 5 senses of ‘**conjunctiva**’ are

- ‘Benign neoplasm of conjunctiva’ (<3>)
- ‘**Conjunctival Diseases**’ (<4>)
- ‘Malignant neoplasm of conjunctiva’ (<2>)
- ‘**Procedures on conjunctiva**’ (<5>)
- ‘conjunctiva’ (<1>)

Sense <1> is the only legitimate sense, senses <2> and <3> are already marked as suppressible, and senses <4> and <5> should also be marked as suppressible.

The concepts for the 5 senses of **'Esophagus'** are

- 'Benign neoplasm of esophagus' (<3>)
- 'Carcinoma in situ of esophagus' (<2>)
- 'Esophagus' (<1>)
- 'Esophagus problem' (<4>)
- **'Procedures on the esophagus'** (<5>)

Sense <1> is legitimate, senses <2> through <4> are already marked as suppressible, and sense <5> should also be marked as suppressible.

The concepts for the 5 senses of **'Kidney'** are

- 'Benign neoplasm of kidney' (<2>)
- 'Kidney' (<1>)
- 'Kidney problem' (<4>)
- 'Neoplasm of uncertain or unknown behavior of kidney' (<3>)
- **'Procedures on Kidney'** (<5>)

Sense <1> is legitimate, senses <2> through <4> are already marked as suppressible, and sense <5> should also be marked as suppressible.

The concepts for the 5 senses of **'Larynx'** are

- 'Benign neoplasm of larynx' (<2>)
- 'Carcinoma in situ of larynx' (<3>)
- 'Larynx' (<1>)
- 'Neoplasm of uncertain or unknown behavior of larynx' (<4>)
- **'Procedures on larynx'** (<5>)

Sense <1> is legitimate, senses <2> through <4> are already marked as suppressible, and sense <5> should also be marked as suppressible.

The concepts for the 5 senses of **'Liver'** are

- 'Benign neoplasm of liver' (<2>)
- 'Liver' (<1>)
- 'Liver brand of Vitamin B 12' (<4>)
- 'Liver problem' (<3>)
- **'Procedures on liver'** (<5>)

Senses <1> and <4> are legitimate (although MetaMap suppresses <4>), senses <2> and <3> are already marked as suppressible, and sense <5> should also be marked as suppressible.

The concepts for the 5 senses of **'Pancreas'** are

- 'Benign tumor of pancreas' (<2>)
- 'Pancreas' (<1>)
- **'Pancreas extract'** (<3>)
- 'Pancreas problem' (<4>)
- **'Procedures on Pancreas'** (<5>)

Sense <1> is legitimate, senses <2> and <4> are already marked as suppressible, and senses <3> and <5> should also be marked as suppressible. Note that this case of body part ambiguity is distinct because of the concept 'Pancreas extract'.

The concepts for the 5 senses of '**Penis**' are

- '**Benign tumor of penis**' (<3>)
- 'Carcinoma in situ of penis' (<2>)
- 'Penile Diseases' (<4>)
- '**Procedures on Penis**' (<5>)
- 'penis' (<1>)

Sense <1> is legitimate, senses <2> and <4> are already marked as suppressible, and senses <3> and <5> should also be marked as suppressible.

The concepts for the 5 senses of '**Pineal Gland**' are

- 'Benign neoplasm of pineal gland' (<3>)
- 'Malignant neoplasm of pineal gland' (<2>)
- 'Neoplasm of uncertain or unknown behavior of pineal gland' (<4>)
- 'Pineal gland' (<1>)
- '**Procedures on Pineal Gland**' (<5>)

Sense <1> is legitimate, senses <2> through <4> are already marked as suppressible, and sense <5> should also be marked as suppressible.

The concepts for the 5 senses of '**prostate**' are

- 'Benign neoplasm of prostate' (<3>)
- 'Carcinoma in situ of prostate' (<2>)
- 'Neoplasm of uncertain or unknown behavior of prostate' (<4>)
- 'Prostate' (<1>)
- '**Prostatic Diseases**' (<5>)

Again, sense <1> is legitimate, senses <2> through <4> are already marked as suppressible, and sense <5> should also be marked as suppressible.

The concepts for the 5 senses of '**Rectum**' are

- 'Benign neoplasm of rectum' (<3>)
- 'Carcinoma in situ of rectum' (<2>)
- 'Neoplasm of uncertain or unknown behavior of rectum' (<4>)
- '**Procedures on Rectum**' (<5>)
- 'Rectum' (<1>)

Yet again, sense <1> is legitimate, senses <2> through <4> are already marked as suppressible, and sense <5> should also be marked as suppressible.

The concepts for the 5 senses of '**Ureter**' are

- 'Benign neoplasm of ureter' (<2>)
- '**Disorder of ureter**' (<4>)
- 'Neoplasm of uncertain or unknown behavior of ureter' (<3>)

- **‘Procedures on Ureter’** (<5>)
- ‘Ureter’ (<1>)

Sense <1> is legitimate, senses <2> and <3> are already marked as suppressible, and senses <4> and <5> should also be marked as suppressible.

The concepts for the 5 senses of **‘Vagina’** are

- ‘Benign neoplasm vagina’ (<2>)
- ‘Carcinoma in situ of vagina’ (<3>)
- **‘Procedures on Vagina’** (<5>)
- ‘Vagina’ (<1>)
- **‘Vaginal Diseases’** (<4>)

Again, sense <1> is legitimate, senses <2> and <3> are already marked as suppressible, and senses <4> and <5> should also be marked as suppressible.

2.12 **‘[SO] Premolar tooth <n>’ and ‘Premolar tooth <n>’**

These two cases involve the same concepts with identical ambiguity designators:

- **‘Bicuspid’** (<1>)
- **‘Permanent lower right second premolar tooth’** (<5>)
- **‘Permanent upper left first premolar tooth’** (<4>)
- **‘Permanent upper left second premolar tooth’** (<3>)
- **‘Permanent upper right first premolar tooth’** (<2>)

As observed in the 1999 Edition, this is not a true case of ambiguity. The ambiguous forms for all senses should be marked as suppressible.

2.13 **‘adjustment <n>’**

The concepts for the 5 senses of ‘adjustment’ are

- ‘Adjustment - classification term’ (<4>)
- ‘Adjustment Action’ (<3>)
- ‘Clinical Adjustment’ (<2>)
- ‘Individual Adjustment’ (<1>)
- ‘Psychological adjustment’ (<5>)

Except for sense <4>, this is legitimate ambiguity. Sense <4> is self referential and should be marked as suppressible.

2.14 **‘cd <n>’**

The concepts for the 5 senses of **‘cd’** are

- ‘CP protocol’
- ‘Cadmium’
- ‘Compact discs’
- ‘Diagnosis, clinical’
- ‘candela’

This is legitimate ambiguity (although it is not clear why ‘CP protocol’ is related to ‘cd’). However, the ambiguous forms are suppressed in MetaMap because they are abbreviations.

2.15 ‘Cl <n>’

The concepts for the 5 senses of ‘Cl’ are

- ‘Chloride Ion’
- ‘Chloride measurement’
- ‘Chlorine’
- ‘Cycloleucine’
- ‘centiliter’

Like ‘cd’, the senses are legitimate but are suppressed in MetaMap.

2.16 ‘Injuries <n>’

The concepts for the 5 senses of ‘Injuries’ are

- ‘Female genital injuries’ (<4>)
- ‘Injury inflicted to the body by an external force’ (<2>)
- ‘Male Genital Injuries’ (<5>)
- ‘Physical trauma’ (<1>)
- ‘urologic injuries’ (<3>)

Senses <1> and <2> are legitimate (they may be synonymous) and the remaining senses are already marked as suppressible.

2.17 ‘P <n>’

The concepts for the 5 senses of ‘P’ are

- ‘Phosphorus’
- ‘Phosphorus measurement’
- ‘Properdin’
- ‘lower case pea’
- ‘upper case pea’

The senses of ‘P’ are abbreviations and, in the last two cases, self referential. They are all suppressed by MetaMap.

2.18 ‘Tourniquet on <n>’

- ‘Application of tourniquet’ (<1>)
- ‘Lower tourniquet cuff inflation’ (<3>)
- ‘Manual tourniquet application’ (<4>)
- ‘Tourniquet cuff inflation’ (<5>)
- ‘Upper tourniquet cuff inflation’ (<2>)

There is no obvious reason why these terms have been made ambiguous using the expression ‘Tourniquet on’. All senses should be marked as suppressible.

3. Summary of Higher Degree Ambiguity

This section summarizes the recommendations of the previous section to add new strings to the Metathesaurus or to mark some Metathesaurus strings as suppressible.

3.1 Missing strings for ambiguous concepts

The following strings only occur with an ambiguity designator:

- ‘Antitussive <2>’
- ‘Antigonadotrophins, antiestrogens, antiandrogens, not elsewhere classified <1>’
- ‘Other psychotropic drugs, not elsewhere classified <1>’

Corresponding strings without it should be added to the appropriate concepts:

- ‘Antitussive’
- ‘Antigonadotrophins, antiestrogens, antiandrogens, not elsewhere classified’
- ‘Other psychotropic drugs, not elsewhere classified’

3.2 Strings which should be marked suppressible

Some concepts have ambiguous forms which should be marked as suppressible, where *ambiguous forms* means a string with an ambiguity designator and one or more strings without it. Note that some concepts such as ‘Assessment: Cognition’ have more than one ambiguous form with ambiguity designator, ‘Assessment <5>’ and ‘Assessment <17>’ in this case. The concepts, sometimes followed by the relevant ambiguity number, are

- ‘Other location of complaint’ (<2>)
- ‘Other activities involving preparation of a routine non-injectable drug product’ (<52>)
- ‘Other activities involving preparation of compounded non-parenteral medications’ (<53>)
- ‘Other activities involving preparation of compounded parenteral medications’ (<54>)
- ‘Miscellaneous Dietary Supplements’ (<55>)
- ‘Protocols documentation’
- ‘Protocols: Activities’
- ‘Protocols: Bowel Elimination’
- ‘Protocols: Circulation’
- ‘Protocols: Cognition’
- ‘Protocols: Coping’
- ‘Protocols: Fluid and Electrolyte’
- ‘Protocols: Health Behavior’
- ‘Protocols: Immunology’
- ‘Protocols: Medications and Blood Products’
- ‘Protocols: Metabolism’
- ‘Protocols: Nutrition’
- ‘Protocols: Physical Regulation’
- ‘Protocols: Pre- or Intra- or Post-Procedure’
- ‘Protocols: Respiration’
- ‘Protocols: Role Relationship’
- ‘Protocols: Safety’

- ‘Protocols: Self-Care’
- ‘Protocols: Self-Concept’
- ‘Protocols: Sensation, Pain and Comfort’
- ‘Protocols: Tissue Integrity’
- ‘Protocols: Tissue Perfusion’
- ‘Protocols: Urinary Elimination’
- ‘Patient Education Plans: Activities’
- ‘Patient Education Plans: Bowel Elimination’
- ‘Patient Education Plans: Circulation’
- ‘Patient Education Plans: Coping’
- ‘Patient Education Plans: Health Behavior’
- ‘Patient Education Plans: Immunology’
- ‘Patient Education Plans: Medications and Blood Products’
- ‘Patient Education Plans: Metabolism’
- ‘Patient Education Plans: Nutrition’
- ‘Patient Education Plans: Physical Regulation’
- ‘Patient Education Plans: Pre- or Intra- or Post-Procedure’
- ‘Patient Education Plans: Respiration’
- ‘Patient Education Plans: Role Relationship’
- ‘Patient Education Plans: Safety’
- ‘Patient Education Plans: Self-Care’
- ‘Patient Education Plans: Sensation, Pain and Comfort’
- ‘Patient Education Plans: Tissue Integrity’
- ‘Patient Education Plans: Urinary Elimination’
- ‘Assessment: Bowel Elimination’
- ‘Assessment: Circulation’
- ‘Assessment: Cognition’
- ‘Assessment: Coping’
- ‘Assessment: Fluid and Electrolytes’
- ‘Assessment: Health Behavior’
- ‘Assessment: Medications and Blood Products’
- ‘Assessment: Metabolism’
- ‘Assessment: Pre- or Intra- or Post-Procedure’
- ‘Assessment: Respiration’
- ‘Assessment: Safety’
- ‘Assessment: Self-Care’
- ‘Assessment: Sensation, Pain and Comfort’
- ‘Assessment: Urinary Elimination’
- ‘Knowledge acquisition using a method of assessment’
- ‘Nutrition Assessment’
- ‘Bus driver injured in collision with other and unspecified motor vehicles in nontraffic accident’
- ‘Car driver injured in collision with other and unspecified motor vehicles in nontraffic accident’
- ‘Driver of three-wheeled motor vehicle injured in collision with other and unspecified motor vehicles in nontraffic accident’
- ‘Driver pedal cycle injured in collision with other and unspecified motor vehicles in nontraffic accident’

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- ‘Heavy transport vehicle driver injured in collision with other and unspecified motor vehicles in nontraffic accident’
 - ‘Motorcycle driver injured in collision with other and unspecified motor vehicles in nontraffic accident’
 - ‘Pick-up truck or van driver injured in collision with other and unspecified motor vehicles in nontraffic accident’
 - Similarly, 7 concepts for ‘Driver injured in collision with other and unspecified motor vehicles in traffic accident <n>’
 - Similarly, 7 concepts for ‘Passenger injured in collision with other and unspecified motor vehicles in nontraffic accident <n>’
 - Similarly, 7 concepts for ‘Passenger injured in collision with other and unspecified motor vehicles in traffic accident <n>’
 - ‘Procedures on the stomach’ (<6>)
 - ‘Procedures on Urethra’ (<6>)
 - ‘Urethral Diseases’ (<5>)
 - ‘Procedures on Appendix’ (<5>)
 - ‘Procedures on bladder’ (<5>)
 - ‘Conjunctival Diseases’ (<4>)
 - ‘Procedures on conjunctiva’ (<5>)
 - ‘Procedures on the esophagus’ (<5>)
 - ‘Procedures on Kidney’ (<5>)
 - ‘Procedures on larynx’ (<5>)
 - ‘Procedures on liver’ (<5>)
 - ‘Pancreas extract’ (<3>)
 - ‘Procedures on Pancreas’ (<5>)
 - ‘Benign tumor of penis’ (<3>)
 - ‘Procedures on Penis’ (<5>)
 - ‘Procedures on Pineal Gland’ (<5>)
 - ‘Prostatic Diseases’ (<5>)
 - ‘Procedures on Rectum’ (<5>)
 - ‘Disorder of ureter’ (<4>)
 - ‘Procedures on Ureter’ (<5>)
 - ‘Procedures on Vagina’ (<5>)
 - ‘Vaginal Diseases’ (<4>)
 - ‘Bicuspid’ (including both ‘Premolar tooth <n>’ and ‘[SO] Premolar tooth <n>’ forms)
 - ‘Permanent lower right second premolar tooth’ (including both ‘Premolar tooth <n>’ and ‘[SO] Premolar tooth <n>’ forms)
 - ‘Permanent upper left first premolar tooth’ (including both ‘Premolar tooth <n>’ and ‘[SO] Premolar tooth <n>’ forms)
 - ‘Permanent upper left second premolar tooth’ (including both ‘Premolar tooth <n>’ and ‘[SO] Premolar tooth <n>’ forms)
 - ‘Permanent upper right first premolar tooth’ (including both ‘Premolar tooth <n>’ and ‘[SO] Premolar tooth <n>’ forms)
 - ‘Application of tourniquet’ (<1>)
 - ‘Lower tourniquet cuff inflation’ (<3>)
 - ‘Manual tourniquet application’ (<4>)

- ‘Tourniquet cuff inflation’ (<5>)
- ‘Upper tourniquet cuff inflation’ (<2>)

4. Lesser Degree Ambiguity

Ambiguity of degree 4 or 3 is considered in this section. Because of the large number of cases of such ambiguity (68 and 479, respectively), the section will be written over time and only those cases calling for some action will be reported. Ambiguous forms for concepts shown in bold should be marked as suppressible, and other recommendations specific to the Metathesaurus are also shown in bold. Recommendations for cases which are not clear are indicated with a question mark or by the word *consider*.

4.1 Ambiguity of degree 4

- 4 ‘[x]abnormal findings on exami <n>’
‘Abnormal findings on examination of other body fluids, substances and tissues, without diagnosis’ (<3> and <4>)
- 4 ‘abnormal findings on exami <n>’
‘Abnormal findings on examination of other body fluids, substances and tissues, without diagnosis’ (<3> and <4>)
- 4 ‘ad <n>’
Suppress ambiguous forms (MetaMap only)
- 4 ‘adrenal gland <n>’
‘Procedures on adrenal gland’ (<4>)
- 4 ‘aminoglycosides <n>’
‘Antibiotics, Aminoglycoside’ (<4>)?
- 4 ‘breast <n>’
‘Procedures on breast’ (<4>)
- 4 ‘cam <n>’
Suppress ambiguous forms (MetaMap only)
- 4 ‘compression <n>’
Consider collapsing senses and/or marking senses as suppressible.
- 4 ‘cope <n>’
Suppress ambiguous forms including those for preferred names (MetaMap only)
- 4 ‘cornea <n>’
‘Corneal Diseases’ (<4>)
- 4 ‘cvp <n>’
Suppress ambiguous forms (MetaMap only)
- 4 ‘epididymis <n>’
‘Epididymis disorders’ (<4>)
- 4 ‘et - esotropia <n>’
Consider suppressing ambiguous forms for all concepts except ‘Esotropia’ since they are findings of the disease.
- 4 ‘evaluation <n>’
Consider suppressing ambiguous forms for ‘Health evaluation’ (<2>).
‘Pulmonary evaluation’ (<4>)

- 4 ‘fire <n>’
‘Accident caused by unspecified fire’ (<1>)
- 4 ‘genetic counseling <n>’
‘elements of cancer genetics risk assessment and counseling’ (<4>)?
- 4 ‘grafts <n>’
Consider suppressing ambiguous forms for ‘Graft material’ (<4>).
Consider suppressing ambiguous forms for ‘Homologous Grafts’ (<1>) as being too specific.
- 4 ‘hrf <n>’
Suppress ambiguous forms (MetaMap only)
- 4 ‘mac <n>’
Suppress ambiguous forms (MetaMap only)
- 4 ‘mole <n>’
‘Benign melanocytic nevus of skin’ (<2>)
Consider suppressing ambiguous forms for ‘Nevus, Pigmented’ (<4>) as being a kind of ‘Benign melanocytic nevus of skin’ (<2>).
- 4 ‘ms <n>’
Suppress ambiguous forms (MetaMap only)
- 4 ‘neck <n>’
‘Assessment of active neck movement’ (<2>)
‘Assessment of passive neck movement’ (<3>)
- 4 ‘oesophagus <n>’
‘Procedures on the esophagus’ (<4>)
- 4 ‘orbital prosthesis <n>’
‘Orbital prosthesis implantation’ (<2>) and (<4>)?
- 4 ‘pnet <n>’
Suppress ambiguous forms (MetaMap only)
- 4 ‘relapse <n>’
‘Cancer Relapse’ (<3>)
- 4 ‘retina <n>’
‘Retinal Diseases’ (<4>)
- 4 ‘screening <n>’
‘Screening for cancer’ (<3>)
- 4 ‘scrotum <n>’
‘Disease of scrotum’ (<4>)
- 4 ‘spleen <n>’
‘Procedures on Spleen’ (<4>)
- 4 ‘tem <n>’
Suppress ambiguous forms (MetaMap only)
- 4 ‘thymus <n>’
‘Procedures on Thymus’ (<4>)
- 4 ‘trachea <n>’
‘Procedures on trachea’ (<4>)
- 4 ‘u <n>’
Suppress ambiguous forms (MetaMap only)

- 4 ‘xt - exotropia <n>’
Consider suppressing ambiguous forms for all concepts since they are findings of the disease Exotropia.

4.2 Ambiguity of degree 3

- 3 ‘a33 <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘adh <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘ag <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘allograft <n>’
‘Allograft surgical material’ (<3>)
- 3 ‘ami <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘ana <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘anesthesia <n>’
‘Oriental Medicine Procedures using Anesthesia’ (<3>)
- 3 ‘anthracyclines <n>’
‘prior anthracycline therapy’ (<3>)
- 3 ‘anticoagulants <n>’
‘Poisoning by anticoagulants’ (<2>)
- 3 ‘antigonadotrophins, antiestrogens, antiandrogens, not elsewhere classified <n>’
‘Poisoning by antigonadotrophins, antiestrogens, antiandrogens NEC in RCD99’ (<1>)
‘Poisoning by antigonadotrophins, antiestrogens, antiandrogens NEC in ICD10’ (<3>)
‘Adverse effects in the therapeutic use of antigonadotrophins, antiestrogens, antiandrogens NEC in ICD10’ (<2>)
Consider removing all terms referring to a constituent Metathesaurus vocabulary.
- 3 ‘apc <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘arteriovenous anastomosis <n>’
‘Arteriovenous anastomosis procedure’ (<2> and <3>)
- 3 ‘autograft <n>’
‘Autograft Material’ (<2>)
- 3 ‘b <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘b-esterase <n>’
Consider suppressing all ambiguous forms since there is no longer any ambiguity.
- 3 ‘balance <n>’
Consider suppressing ambiguous forms for ‘Assessment of balance’ (<3>).
- 3 ‘barbiturate <n>’
‘Poisoning by barbiturate’ (<3>)

- 3 ‘basal metabolic rate <n>
‘Basal Metabolic Rate Procedure’ (<2>)
- 3 ‘c <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘ca <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘cad <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘cast <n>
Suppress ambiguous forms of ‘CAST <2>’ (MetaMap only).
- 3 ‘cat <n>
Suppress ambiguous forms of ‘CAT <2>’ (MetaMap only).
- 3 ‘cave <n>
Suppress ambiguous forms of ‘CAVE <1>’ and ‘CAVE <2>’ (MetaMap only).
- 3 ‘cdv <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘clap <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘class i malocclusion <n>
‘Class I malocclusion therapy’ (<2>)
‘Atypical class I malocclusion therapy’ (<3>)
- 3 ‘class iii malocclusion <n>
‘Transitional class III malocclusion therapy’ (<2>)
‘Permanant (sic) class III malocclusion therapy’ (<3>)
- 3 ‘complications <n>
‘Complications Specific to Antepartum or Postpartum’ (<3>)
- 3 ‘complications of surgical and medical care, not elsewhere classified <n>
‘Complications of surgical and medical care NEC in RCD99’ (<3>)
‘Complications of surgical and medical care NEC in ICD10’ (<1>)
‘Complications of surgical and medical care NEC in ICD2000’ (<2>)
- 3 ‘confrontation <n>
‘Social confrontation skill’ (<1>)?
- 3 ‘control <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘cortical bone <n>
‘Cortical bone surgical material’ (<3>)
- 3 ‘cpar <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘cpdd <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘cpi <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘crabs <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘cytomegalovirus <n>
‘Cytomegalovirus Infections’ (<3>)

- 3 ‘da <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘dab <n>
Suppress ambiguous forms excluding ‘Dab fish’ (<2>) (MetaMap only).
- 3 ‘deaf mutism, not elsewhere classified <n>
‘Deaf mutism NEC in RCD99’ (<3>)
‘Deaf mutism NEC in ICD10’ (<1>)
‘Deaf mutism NEC in MDR99’ (<2>)
- 3 ‘depression <n>
‘Cancer patients and suicide and depression’ (<3>)
- 3 ‘depressive disorder, not elsewhere classified <n>
‘Depressive disorder NEC in CCS99’ (<2>)
‘Depressive disorder NEC in ICD2000’ (<1>)
‘Depressive disorder NEC in MDR99’ (<3>)
- 3 ‘disorders of meninges, not elsewhere classified <n>
‘Disorders of meninges NEC in ICD10’ (<1>)
‘Disorders of meninges NEC in ICD2000’ (<2>)
‘Disorders of meninges NEC in MDR99’ (<3>)
- 3 ‘disruption of operation wound, not elsewhere classified <n>
‘Disruption of operation wound NEC in ICD10’ (<3>)
‘Disruption of operation wound NEC in ICD91’ (<2>)
‘Disruption of operation wound NEC in MDR31’ (<1>)
- 3 ‘dm <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘dt <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘ectopic hormone secretion, not elsewhere classified <n>
‘Ectopic hormone secretion NEC in ICD10’ (<1>)
‘Ectopic hormone secretion NEC in ICD2000’ (<3>)
‘Ectopic hormone secretion NEC in MDR99’ (<2>)
- 3 ‘epi <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘epiphysis <n>
‘Epiphysis disorders’ (<1>)
- 3 ‘erp <n>
Suppress ambiguous forms (MetaMap only).
- 3 ‘exposure <n>
‘EFFECTS OF EXPOSURE TO EXTERNAL CAUSES’ (<2>)
‘Accident due to exposure to weather conditions’ (<3>)
- 3 ‘fallopian tube <n>
‘Procedures on the fallopian tube’ (<3>)
- 3 ‘family health <n>
‘Family Health Company’ (<2>)?
- 3 ‘fdp <n>
Suppress ambiguous forms (MetaMap only).

- 3 ‘fluoridation <n>’
‘Fluoridation reaction’ (<2>)
- 3 ‘frequency <n>’
‘Increased frequency of micturition’ (<3>)?
- 3 ‘fsh <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘galactorrhoea <n>’
‘Galactorrhea not associated with childbirth’ (<2>)
‘Galactorrhea associated with childbirth’ (<3>)
Careful: ‘Galactorrhea <2>’ is associated with the same concept as ‘Galactorrhoea <3>’ and should also be suppressed; there is no ‘Galactorrhea <3>’.
- 3 ‘graft <n>’
‘Graft material’ (<3>)
- 3 ‘group b streptococcus <n>’
‘Carrier or suspected carrier of Group B streptococcus’ (<2>)
- 3 ‘head <n>’
‘Procedures on Head’ (<3>)
- 3 ‘hereditary disturbances in tooth structure, not elsewhere classified <n>’
‘Hereditary disturbances in tooth structure NEC in ICD10’ (<1>)
‘Hereditary disturbances in tooth structure NEC in ICD2000’ (<3>)
‘Hereditary disturbances in tooth structure NEC in MDR99’ (<2>)
- 3 ‘homograft <n>’
‘Allograft surgical material’ (<3>)
- 3 ‘hsp <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘hypoglycaemic reaction <n>’
Consider suppressing all ambiguous forms since there is no longer any ambiguity.
- 3 ‘i <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘ice <n>’
Suppress ambiguous forms except for ‘Ice’ (<1>), itself (MetaMap only).
- 3 ‘in <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘inner ear <n>’
‘Diseases of inner ear’ (<1>)
‘Procedures on Inner Ear’ (<3>)
- 3 ‘isolation <n>’
‘Need for isolation’ (<3>)
- 3 ‘jaw <n>’
‘Assessment of active jaw joint movement’ (<2>)
‘Assessment of passive jaw joint movement’ (<3>)
- 3 ‘k <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘ld <n>’
Suppress ambiguous forms (MetaMap only).

- 3 'ldh <n>'
 - Suppress ambiguous forms (MetaMap only).
- 3 'litigation <n>'
 - 'Litigation affecting health status'** (<3>)
- 3 'mace <n>'
 - 'cytarabine/etoposide/methotrexate' (<3>) (MetaMap only).
- 3 'map <n>'
 - Suppress ambiguous forms except for 'Maps' (<2>) (MetaMap only).
- 3 'mf <n>'
 - Suppress ambiguous forms (MetaMap only).
- 3 'middle ear <n>'
 - 'Disorder of middle ear'** (<3>)
- 3 'miosis <n>'
 - 'Miosis disorder'** (<1>)
- 3 'mm <n>'
 - Suppress ambiguous forms (MetaMap only).
- 3 'mr <n>'
 - Suppress ambiguous forms (MetaMap only).
- 3 'mustargen <n>'
 - Consider suppressing all ambiguous forms since there is no longer any ambiguity.**
- 3 'n <n>'
 - Suppress ambiguous forms (MetaMap only).
- 3 'oh <n>'
 - Possibly suppress ambiguous forms (MetaMap only).
- 3 'open wound of other and multiple sites <n>'
 - 'Open wound of ear and other and multiple sites'** (<1>)
 - 'Open wound of face and other and multiple sites'** (<2>)
 - 'Open wound of mouth and other and multiple sites'** (<3>)
- 3 'open wound of other and multiple sites, complicated <n>'
 - 'Open wound of ear, other and multiple sites, complicated'** (<1>)
 - 'Open wound of face, other and multiple sites, complicated'** (<2>)
 - 'Open wound of internal structure of mouth, other and multiple sites, complicated'** (<3>)
- 3 'optic nerve <n>'
 - 'Disorder of the optic nerve'** (<3>)
- 3 'other adverse food reactions, not elsewhere classified <n>'
 - 'Other adverse food reactions NEC in ICD10'** (<2>)
 - 'Other adverse food reactions NEC in ICD2001'** (<3>)
 - 'Other adverse food reactions NEC in RCD99'** (<1>)
- 3 'other complications of labor and delivery, not elsewhere classified <n>'
 - 'Other complications of labor and delivery NEC in ICD10'** (<1>)
 - 'Other complications of labor and delivery NEC in ICD2000'** (<2>)
 - 'Other complications of labour and delivery NEC in MDR99'** (<3>)
- 3 'other complications of procedures, not elsewhere classified <n>'
 - 'Other complications of procedures NEC in ICD10'** (<2>)
 - 'Other complications of procedures NEC in MDR99'** (<3>)

- 3 **‘Other complications of procedures NEC in RCD99’ (<1>)**
- 3 ‘other psychotropic drugs, not elsewhere classified <n>’
- 3 **‘Poisoning by other psychotropic drugs NEC in RCD99’ (<1>)**
- 3 **Note that this case not only refers to its vocabulary but also introduces the notion of *poisoning*; it should be suppressed just as the other cases are.**
- 3 ‘pac <n>’
- 3 Suppress ambiguous forms (MetaMap only).
- 3 ‘parathyroid <n>’
- 3 **‘Disease of parathyroid glands’ (<1>)**
- 3 **‘Parathyroid hormone preparation’ (<3>)**
- 3 ‘pb <n>’
- 3 Suppress ambiguous forms (MetaMap only).
- 3 ‘pcp <n>’
- 3 Suppress ambiguous forms (MetaMap only).
- 3 ‘pe <n>’
- 3 Suppress ambiguous forms (MetaMap only).
- 3 ‘perform routine activity (no selection; dispense as written) <n>’
- 3 **‘Perform routine dosage choice (no selection; dispense as written)’ (<2>)**
- 3 **‘Perform routine procurement (no selection; dispense as written)’ (<3>)**
- 3 **‘Perform routine product choice (no selection; dispense as written)’ (<1>)**
- 3 ‘peripheral primitive neuroectodermal tumor <n>’
- 3 **Consider suppressing all ambiguous forms since there is no longer any ambiguity.**
- 3 ‘poisoning by antidotes and chelating agents, not elsewhere classified <n>’
- 3 **‘Poisoning by antidotes and chelating agents, NEC in ICD10’ (<3>)**
- 3 **‘Poisoning by antidotes and chelating agents, NEC in ICD2000’ (<1>)**
- 3 **‘Poisoning by antidotes and chelating agents, NEC in MDR99’ (<2>)**
- 3 ‘poisoning by enzymes, not elsewhere classified <n>’
- 3 **‘Poisoning by enzymes NEC in ICD10’ (<1>)**
- 3 **‘Poisoning by enzymes NEC in ICD2000’ (<2>)**
- 3 **‘Poisoning by enzymes NEC in MDR99’ (<3>)**
- 3 ‘poisoning by vitamins, not elsewhere classified <n>’
- 3 **‘Poisoning by vitamins NEC in ICD10’ (<1>)**
- 3 **‘Poisoning by vitamins NEC in ICD2000’ (<3>)**
- 3 **‘Poisoning by vitamins NEC in MDR99’ (<2>)**
- 3 ‘ppnet <n>’
- 3 **Consider suppressing all ambiguous forms since there is no longer any ambiguity.**
- 3 ‘primitive peripheral neuroectodermal tumor <n>’
- 3 **Consider suppressing all ambiguous forms since there is no longer any ambiguity.**
- 3 ‘prosthesis <n>’
- 3 **‘Prosthesis Implantation’ (<1> and (<3>)?**
- 3 ‘psi <n>’
- 3 Suppress ambiguous forms (MetaMap only).
- 3 ‘pt <n>’
- 3 Suppress ambiguous forms (MetaMap only).
- 3 ‘ptc <n>’
- 3 Suppress ambiguous forms (MetaMap only).

- 3 ‘pvc <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘rda <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘release <n>’
Suppress ambiguous forms for ‘Release brand abscission agent’ (<4>) only (MetaMap only).
- 3 ‘rpr <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘s <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘sacroiliitis, not elsewhere classified <n>’
‘Sacroiliitis NEC in ICD10’ (<1>)
‘Sacroiliitis NEC in ICD2000’ (<2>)
‘Sacroiliitis NEC in MDR99’ (<3>)
- 3 ‘sarcoma, ewing’s <n>’
Consider suppressing all ambiguous forms since there is no longer any ambiguity.
- 3 ‘se <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘ski <n>’
Suppress ambiguous forms except for ‘Manufactured ski’ (<1>) (MetaMap only).
- 3 ‘skin graft <n>’
‘Skin graft material’ (<1>)
- 3 ‘sleep <n>’
Suppress ambiguous forms for ‘Sleep brand of diphenhydramine hydrochloride’ (<3>) only (MetaMap only).
- 3 ‘sound measurement <n>’
‘heart sonography’ (<4>)
‘skeletal sonography’ (<5>)
- 3 ‘spores <n>’
‘Spores found during Potassium hydroxide skin test’ (<2>)
- 3 ‘spurious polycythemia <n>’
Consider suppressing all ambiguous forms since there is no longer any ambiguity.
- 3 ‘stiffness of joint, not elsewhere classified <n>’
‘Stiffness of joint NEC in ICD10’ (<3>)
‘Stiffness of joint NEC in ICD2000’ (<1>)
‘Stiffness of joint NEC in MDR99’ (<2>)
- 3 ‘t3 <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘tetracycline <n>’
‘Tetracyclines causing adverse effects in therapeutic use’ (<3>)
- 3 ‘tetracyclines <n>’
‘Tetracyclines causing adverse effects in therapeutic use’ (<3>)
- 3 ‘therapeutic <n>’
Suppress ambiguous forms for ‘Therapeutic brand of coal tar’ (<3>) only (MetaMap only).

- 3 ‘tmp <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘tongue <n>’
‘Procedures on the tongue’ (<3>)
- 3 ‘tramp <n>’
Suppress ambiguous forms for ‘tyrosine-rich acidic matrix protein’ (<1>) only (MetaMap only).
- 3 ‘uterus <n>’
‘Uterine Diseases’ (<3>)
- 3 ‘v <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘vesical fistula, not elsewhere classified <n>’
‘Vesical fistula NEC in ICD10’ (<1>)
‘Vesical fistula NEC in ICD2000’ (<3>)
‘Vesical fistula NEC in MDR99’ (<2>)
- 3 ‘vessel <n>’
‘Vessel Positions’ (<2>)?
- 3 ‘vibration <n>’
‘Injury caused by vibration’ (<3>)
- 3 ‘vital capacity <n>’
‘Vital capacity procedure’ (<1>)
- 3 ‘w <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘x <n>’
Suppress ambiguous forms (MetaMap only).
- 3 ‘xenograft <n>’
‘Xenograft procedure’ (<1>)

5. Additional Cases of Ambiguity

The cases of ambiguity in this section were discovered during the process of suppressing the cases described in previous sections.

- ‘allografts <n>’, ‘homograft <n>’ and ‘homografts <n>’
Consider suppressing the following ambiguous forms for concept **‘Allograft surgical material’**
‘Allografts <1>’
‘Homograft <2>’
‘Homografts <2>’
- ‘barbiturates <n>’
Suppress the following ambiguous forms for concept **‘Poisoning by barbiturate’**
‘Barbiturates <2>’
- ‘crab <n>’
Suppress the following ambiguous forms for concept **‘Phthirus pubis’**
‘Crab <2>’

- ‘grafts <n>
Consider suppressing the following ambiguous forms for concept ‘**Graft material**’
‘Grafts <4>’
- ‘heterograft <n>
Suppress the following ambiguous forms for concept ‘**Xenograft procedure**’
‘Heterograft <1>’
- ‘miosis <n>’, ‘constricted pupil <n>’, ‘pupils constricted <n>’, ‘constricted pupils <n>’
and ‘small pupil <n>’
Suppress the following ambiguous forms for concept ‘**Miosis disorder**’
‘Miosis <1>’
‘Constricted Pupil <1>’
‘PUPILS CONSTRICTED <1>’
‘Constricted Pupils <1>’
‘Small pupil <1>’
Also note that further modifications to ‘**Miosis disorder**’ are required in order to completely remove all references to *miosis*.
- ‘miscellaneous <n>’
Suppress the following ambiguous forms for concept ‘**Miscellaneous Dietary Supplements**’
‘Miscellaneous <1>’
- ‘mms <n>’
Suppress the following ambiguous forms for concept ‘**millimeter**’ (MetaMap only)
‘mms <2>’
Suppress the following ambiguous forms for concept ‘**macrophage-derived mucus secretagogue**’ (MetaMap only)
‘MMS <1>’
- ‘other complications of labour and delivery, not elsewhere classified <n>’
Suppress the following ambiguous forms for concept ‘**Other complications of labor and delivery NEC in ICD10**’ (MetaMap only)
‘Other complications of labour and delivery, not elsewhere classified <1>’
Suppress the following ambiguous forms for concept ‘**Other complications of labor and delivery NEC in MDR99**’ (MetaMap only)
‘Other complications of labour and delivery, not elsewhere classified <2>’
- ‘poisoning by antigonadotrophins, antiestrogens, antiandrogens, not elsewhere classified <n>’
Suppress the following ambiguous forms for concept ‘**Poisoning by antigonadotrophins, antiestrogens, antiandrogens NEC in RCD99**’ (MetaMap only)
‘Poisoning by antigonadotrophins, antiestrogens, antiandrogens, not elsewhere classified <2>’
Suppress the following ambiguous forms for concept ‘**Poisoning by antigonadotrophins, antiestrogens, antiandrogens NEC in ICD10**’ (MetaMap only)
‘Poisoning by antigonadotrophins, antiestrogens, antiandrogens, not elsewhere classified <2>’

- ‘poisoning by other psychotropic drugs, not elsewhere classified <n>’
Suppress the following ambiguous forms for concept **‘Poisoning by other psychotropic drugs NEC in RCD99’** (MetaMap only)
 ‘Poisoning by other psychotropic drugs, not elsewhere classified <1>’
Suppress the following ambiguous forms for concept **‘Poisoning by other psychotropic agent NEC in ICD10’** (MetaMap only)
 ‘Poisoning by other psychotropic drugs, not elsewhere classified <2>’
- ‘prostheses <n>’
Suppress the following ambiguous forms for concept **‘Prosthesis Implantation’**
 ‘Prostheses <2>’
- ‘suicide <n>’
Suppress the following ambiguous forms for concept **‘Cancer patients and suicide and depression’**
 ‘suicide <2>’
Also note that further modifications to **‘Cancer patients and suicide and depression’** are required in order to completely remove all references to *suicide* and *depression*.

6. Conclusions

The analysis in this and previous editions of this report reveals some classes of ambiguity commonly occurring in the Metathesaurus:

- **Body part/disease ambiguity.** This class of false ambiguity is exemplified by the string ‘Prostate’ for ‘Prostatic Diseases’. It arises from terms which require context within their vocabulary in order to be properly understood.
- **Body part or medical device/procedure ambiguity.** Similar to the above class, this class of false ambiguity is exemplified by ‘Stomach’ and ‘Procedures on the stomach’ or by ‘Prosthesis’ and ‘Prosthesis Implantation’. This kind of ambiguity is not as clearly false ambiguity as the previous class.
- **Substance/measurement ambiguity.** This class, exemplified by ‘Thyroid stimulating immunoglobulins’ and ‘Thyroid stimulating immunoglobulins assay’, generally represents true ambiguity, especially in patient records but also in the biomedical literature. Note that it is a non-trivial exercise to decide when the strings for a given concept should be split into two concepts. These first three cases of ambiguity represent a spectrum: concepts for the first class should be split; those for the last should not be split; and those for the middle class could probably be decided either way.
- **Generalization ambiguity.** This is also false ambiguity caused by grouping several concepts together using a more general term. For example, 23 concepts including ‘Protocols documentation’ and ‘Protocols: Activities’ are generalized to ‘Protocols’.
- **Abbreviation ambiguity.** This is another, large class of ambiguity caused by distinct concepts having the same acronyms (or abbreviations). An example from above is that ‘Mitral Valve Stenosis’, ‘Multiple Sclerosis’, ‘Morphine Sulfate’ and ‘millisecond’ all have abbreviation ‘MS’ or ‘ms’. Although this class represents true ambiguity in a strict sense, it is better to disallow it in many text processing situations, especially those in which authors define the abbreviations they use.

- **Meta ambiguity.** This new class of ambiguity, represented by strings such as ‘Other complications of procedures NEC in ICD10’, contain meta information. In this case it is the name of the vocabulary, ICD10 in the example. As opposed to the first class of ambiguity above in which strings such as ‘Prostate’ meaning ‘Prostatic Diseases’ do not say enough about themselves, these strings say too much. It is true that the meaning of a string containing ‘NEC’, ‘not elsewhere classified’ or like phrase, depends upon its vocabulary, but such information is already available in the MSRO file (where it belongs). It is also true that such strings have different meanings and strictly speaking should be different concepts. But the practical result of such a representational scheme is to introduce an ambiguity that most users do not want or need to resolve. (It is not even clear that those who do want to resolve the ambiguity can do so with the information available in the Metathesaurus.)

Trying to decide what level of ambiguity is acceptable in some textual application is analogous to determining what granularity of meaning is appropriate in a knowledge source such as the Metathesaurus. Different levels are appropriate for different purposes. One reasonable way to divide responsibility for handling ambiguity is to

- mark the following kinds of ambiguity as suppressible in the Metathesaurus: Body part/disease, Body part or medical device/procedure, Generalization, and Meta¹ ambiguity;
- suppress Abbreviation ambiguity within MetaMap; and
- do nothing for Substance/measurement ambiguity.

One limitation of this study is that there is no follow-up of ambiguous strings discovered while examining the strings for a given case. For example, the set of all strings for the concepts containing a ‘sound measurement <n>’ string include the ambiguous strings ‘Ultrasonography <n>’, ‘Echography <n>’, ‘Ultrasound <n>’, ‘Echotomography <n>’ and ‘ultrasound scanning <n>’. If the ambiguous forms for ‘sound measurement <n>’ are to be marked as suppressible, how does that affect the other ambiguous strings. Each of them is part of a cluster of concepts, possibly different from the one for ‘sound measurement <n>’. Although it is probably not necessary to explore the new concept clusters, it is essential to examine the original cluster for additional ambiguous forms to suppress.

Finally, the study ignores the almost 5,000 cases of ambiguity of degree 2. Manual examination of them would be very time-consuming. However, it would be worthwhile to search for patterns such as ‘Procedures on ...’ or ‘<neoplasm> of ...’ which occur frequently in ambiguity of higher degree in order to discover further strings to mark as suppressible.

7. Appendix

7.1 List of Ambiguity Cases of Degree 17

The following 59 cases of ambiguity have degree 17 in the 2001 Metathesaurus. All are suppressible (except for a few appropriate cases as noted).

1. Consider completely removing meta ambiguity strings which mention a vocabulary, collapsing what are now the ambiguous forms for the concepts into a single concept. This would reinstate the previous way of handling such cases (i.e., by doing nothing).

1. Administrative procedure <n> (the concept 'Administrative procedure' is not suppressed)
2. Blood test <n> (strings 'Blood Test', ignoring case, are not suppressed for concept 'Blood Tests')
3. Clarification/discussion of patient's RFE/demand <n>
4. Clarification/discussion RFE/demand <n>
5. Consultation primary care provider <n>
6. Consultation with primary care provider <n>
7. Consultation with specialist <n>
8. Diagnostic endoscopy <n> (the concept 'Diagnostic endoscopy' is not suppressed)
9. Diagnostic radiology/imaging <n> (the concept 'Diagnostic radiology/imaging' is not suppressed)
10. Dressing/pressure/compress/tamponade <n>
11. Dressing/pressure/compression/tamponade <n>
12. Electrical tracing <n> (the string 'Electrical tracing' for concept 'Electrical tracing, GENERAL/UNSPECIFIED' is not suppressed)
13. Enc/prob init by other than pt/prov <n>
14. Encounter/prob initiated by provider <n>
15. Encounter/problem initiated by other than patient/provider <n>
16. Encounter/problem initiated by provider <n>
17. Exc/remov/biopsy/destruc/debrid/caut <n>
18. Excision/removal tissue/biopsy/destruction/debridement/cauterization <n>
19. Faeces test <n> (the string 'Faeces test' for concept 'Feces test' is not suppressed)
20. Feces test <n> (the concept 'Feces test' is not suppressed)
21. Follow-up encounter unspecified <n>
22. Histological/exfoliative cytology <n>
23. I&D/flush/aspiration <n>
24. Incision/drainage/flushing/aspiration/removal body fluid <n>
25. Instrument/catheter/intubate/dilate <n>
26. Instrumentation/catheterization/intubation/dilation <n> (the string 'Instrumentation/catheterization/intubation/dilation' for concept 'Instrumentation/catheterization/intubation/dilation, GENERAL/UNSPECIFIED' is not suppressed)
27. Local injection/infiltration <n> (the concept 'Local injection/infiltration' is not suppressed)
28. Medical examin/health eval complete <n>
29. Medical examin/health eval partial <n>
30. Medical examination/health evaluation complete <n> (the concept 'Medical examination/health evaluation/complete' is not suppressed)
31. Medical examination/health evaluation partial <n> (the concept 'Medical examination/health evaluation partial' is not suppressed)
32. Medication/prescr/renewal/inject <n>
33. Medication/prescription/renewal/injection <n>
34. Microbiological/immunological test <n>
35. Observ/health educat/advice/diet <n>
36. Observation/health education/advice/diet <n>
37. Other diagnostic procedure <n> (the concept 'Other diagnostic procedure' is not suppressed)
38. Other laboratory test NEC<n>
39. Other preventive procedure <n> (the concept 'Other preventive procedure' is not suppressed)
40. Other reason for encounter NEC<n>
41. Other referral NEC<n>
42. Other therap proced/minor surg NEC<n>

43. Other therapeutic procedure/minor surgery NEC<n>
44. Physical function test <n> (the concept 'Physical function test' is not suppressed)
45. Physical medicine/rehabilitation <n>
46. Preventive immunization/medication <n> (the concept 'Preventive immunization/medication' is not suppressed)
47. Referral to MD/specialist/clin/hosp <n>
48. Referral to non-MD provider <n>
49. Referral to other provider/nurse/therapist/social worker <n>
50. Referral to physician/specialist/clinic/hospital <n>
51. Repair/fix-suture/cast/prosth device <n>
52. Repair/fixation-suture/cast/prosthetic device (apply/remove) <n>
53. Result exam/test/lett oth provider <n>
54. Result examination/test/record/letter from other provider <n>
55. Result test/procedure <n> (the string 'Result test/procedure' for concept 'Result test/procedure, GENERAL/UNSPECIFIED' is not suppressed)
56. Sensitivity test <n> (the concept 'Sensitivity test' is not suppressed)
57. Therapeutic counseling/listening <n> (the concept 'Therapeutic counseling/listening' is not suppressed)
58. Therapeutic counselling/listening <n> (the concept 'Therapeutic counselling/listening' is not suppressed)
59. Urine test <n> (the string 'Urine test' for concept 'Urinalysis' is not suppressed)