



The Systematized Nomenclature of Medicine

Presentation to NCVHS

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Outline of Presentation

- Need for clinical terminology
- Reasons for the development of SNOMED RT/CT
- Guiding principles of development
- Use
 - Relationships to other PMRI standards
 - Context of care
- Maintenance
- Availability & Licensing
- New developments
 - SNOMED Clinical Terms

First Some Names :

- SNOMED®
 - The Systematized Nomenclature of Medicine
- SNOMED® RT™
 - “Reference Terminology”
 - Release 1.0 Nov 2000, Release 1.1 July 2001
- SNOMED® CT™
 - SNOMED Clinical Terms, the merger of SNOMED RT and Clinical Terms version 3 (the Read Codes)
 - First release: December 2001
 - Subsumes RT (no further releases of RT).

Automating health information can improve our ability to:

- Reduce errors
 - eliminate errors of omission via **reminders**
 - eliminate errors of commission via **alerts**
- Manage costs
 - eliminate redundant testing and investigation
- Monitor and respond to trends & problems in the health of populations
- Expand our knowledge of diseases, treatments and outcomes

What is the need?

- Automation of systems that deal with health information requires clinical data that:
 - is **recorded** at the appropriate level of detail
 - not forced to be either too general or too specific
 - is **consistent** over time and across boundaries
 - can be **transmitted** without loss of meaning
 - can be **aggregated** at more general levels, and along multiple different perspectives
 - can be **interpreted** by automated systems
- Natural language does not meet these requirements

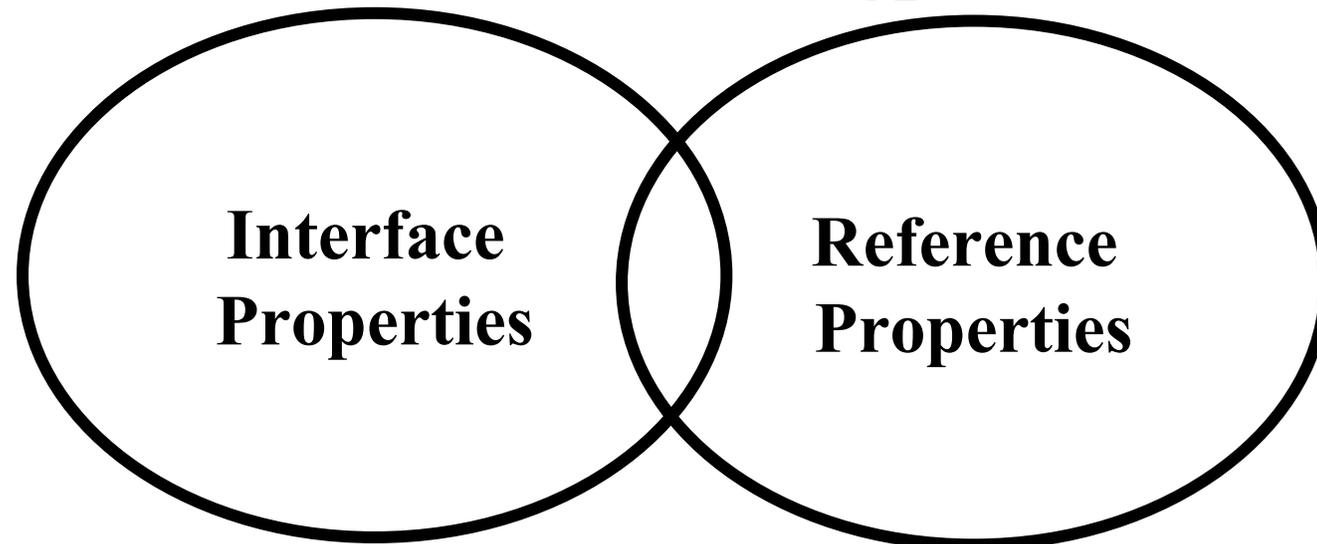
Why was SNOMED Reference Terminology developed?

- **Users** identified critical unmet needs
- Existing terminologies were inadequate
- Scientific advances provided new solutions for these needs

Rationale for the Development of SNOMED Reference Terminology and SNOMED Clinical Terms

- SNOMED RT/CT was developed in response to the needs of the users
 - In particular, a need for better **reference properties** of the terminology
- User needs remain the driving motivation behind decisions about what SNOMED will or will not undertake

Interface and Reference Properties of Terminology



Functions Supported by Interface Properties:

- Navigating to find terms
- Data entry
- Pre-coordination
- Natural language processing
- Language translations (French, German, Spanish)

Functions Supported by Reference Properties:

- Retrieval by meaning
- Aggregation
- Analysis
- Interoperability
- Post-coordination (composition)

Users Told Us That Existing Terminologies Were Inadequate

- Lack of content coverage at the desired level of generality / specificity
 - ICD-9-CM and CPT codes usually too general
- Lack of computability
 - e.g. single hierarchy in ICD
- Lack of single consistent meaning for concepts and their relationships
 - e.g. UMLS “anemia”, “hypertension”, “aspirin”
- Perceived deficiencies in change management and updates
 - re-use of codes

Users Told Us That Existing Terminologies Were Inadequate

- Need formal concept representation principles
 - To help solve the dilemma of pre-coordination vs post-coordination, also called enumeration vs composition
 - To permit complete and consistent retrieval and aggregation of data

Guiding Principles of Development

- Overall Framework (ANSI HISB - CPRI)
- Scientific Desiderata (Cimino)
- User Business Requirements (Campbell)
- Strategic Aims of College of American Pathologists
- Strategic Goals of the UK National Health Service

CPRI - ANSI HISB Framework[†]

- **Completeness**
- **Comprehensiveness**
- **Integrated and non-overlapping**
- **Non-redundant**
- **Mapped to mandated classifications**
- **Atomic base**
- **Compositional**
- **Synonyms**
- **Attributes (modifiers)**
- **Inheritance**
- **Multiple hierarchies**
- **Explicit uncertainty**
- **Lexical rules**
- **Context-free identifiers**
- **Unique identifiers**
- **Version control**
- **Definitions**
- **Language independence**
- **Responsiveness**
- **Coordination**
- **Access**
- **Funding**

[†] Chute C, Cohn S, and Campbell J. ANSI HISB and CPRI Working Groups

Scientific Desiderata[†]

- Content
- Concept Orientation
- Concept Permanence
- Nonsemantic Concept Identifiers
- Polyhierarchy
- Formal Definitions
- Reject "Not Elsewhere Classified"
- Multiple Granularities
- Multiple Consistent Views
- Representing Context
- Graceful Evolution
- Recognize Redundancy

[†] Cimino JJ, Methods Inf Med 1998; 37(4-5):394-403.

Enterprise Requirements[†]

- EMR vendor neutral: Not-for-profit public service
- Scientifically valid: Clinicians and other experts collaboratively develop
- Well Maintained: Statistical quality control and configuration management
- Self sustaining: Revenue for infrastructure and maintenance must be secure
- Scalable Infrastructure and process control

[†] Campbell KE, SNOMED Users Group November 1999

Strategic Goals of C.A.P. for SNOMED

- Assure that the content remains clinician-directed
- Maximize the acceptance and use of SNOMED
- Make the SNOMED division self-sustaining, over time

Strategic Plan of UK National Health Service (NHS) Information Authority (IA)

- SNOMED Clinical Terms will be available from the end of 2001. The initial release will be developed from the content of Clinical Terms Version 3 (Read Codes) and SNOMED RT
- Subject to successful development and testing, after 1 April 2003 any computerised information system being developed to support any clinical information system, such as EPRs and EHRs, should use the NHS preferred clinical terminology, SNOMED Clinical Terms. Users/Suppliers are advised not to develop new Read Code based systems from April 2003.

http://www.doh.gov.uk/nhsexipu/strategy/update/ch4/4_4_1.htm

Use of SNOMED

- How is it used?
- Types of applications?
- How does it relate to other information structures and standards, particularly data interchange and patient record structures and standards (e.g. HL7, Context of Care, etc)?

How is SNOMED used?

- Incorporated into computer applications
- ~~Manual lookup and coding~~

Applications

- Electronic Medical Record
- Laboratory Information Systems
- Radiology Systems
- Data Warehousing
- Telemedicine
- Literature Encoding
- Clinical Decision Support
- Cancer Registry Reporting
- Autopsy Database
- Case Report Forms for Clinical Research
- Consumer Health Information Services

How does SNOMED relate to other PMRI standards?

- Context
 - Information models, data structures
- Mapping
- Integration and convergence

Context of care

- Additional information necessary for complete representation of patient medical record information
- Includes:
 - Attribution & subject of information
 - Record and document context
 - Headings
 - Question / answer context
 - Data field context
 - Status and linkage concepts

Attribution

- Determined mainly by the clinical record
- Describes who was responsible for or performed actions, who recorded findings
 - Appendectomy **performed_by** Dr. Jones
 - Cholecystectomy **responsible_party** Dr. Smith

Subject of information

- Describes who or what the information is about
 - Appendectomy **performed_on** Mrs. Larson
 - Positive culture **obtained_from** Room A air conditioner

Record and Document Context

- Headings
- Question / answer context
- Data field context

Headings

- Terms / concepts that organize the way information is gathered from or presented to the user

HEADINGS:

Health characteristics

- History *obtained by listening & questioning*
- Family History *specified family members*
- Social Circumstances *environment, careers..*
- Examination Findings *elicited by IPPA*
- Test Results *use of additional technologies*
- Diagnosis *labels for communication*

HEADINGS:

Actions

- Assessment *find information patients health*
- Treatment *improve (potentially) patients health*
- Clinical Administration *necessary but not directly investigatory or therapeutic*
- Participation *sharing information & decision making with patient/client*

HEADINGS:

Time modifiers

Modifier

Health char

Action

Past

Past History

Past Actions

Present

Current

Actions

Future

Outlook

Plan

HEADINGS:

“Role headings”

- Problems *information highlighted for action*
- Alerts *critical information for clinician*
- Reason for encounter *reason clinician involved*

Status & Linkage Concepts

- Primary status concepts
 - change the *type* of the concept they modify, must be considered in retrieval
 - certainty, negation
 - planning stage (planned, in process, completed)
- Secondary status concepts
 - modify or qualify but do not change the type
 - knowing mode (direct observation, patient report)
 - episodicity (first, subsequent)

Primary status concepts

- Change the fundamental *type*
- The following are **not** subtypes of asthma
 - Family history of asthma
 - Rule out asthma
 - Possible asthma
 - Asthma excluded

Qualifiers (secondary status concepts) & Linkage Concepts

- Do not change the *type*
- *These are all types of asthma:*
 - **Severe** asthma
 - Asthma **associated with** smoking
 - **Acute** asthma

Linkage Concepts

- Relate two clinical concepts in a statement, according to:

Reason for performing an action

Outcome or result of an action

Causation, temporal association

- | | | |
|-------------------|-----------------|------------|
| • Obesity | Associated with | Diabetes |
| • Neuropathy | Caused by | Diabetes |
| • Cholecystectomy | Done because of | Gallstones |

CONTEXT: Summary

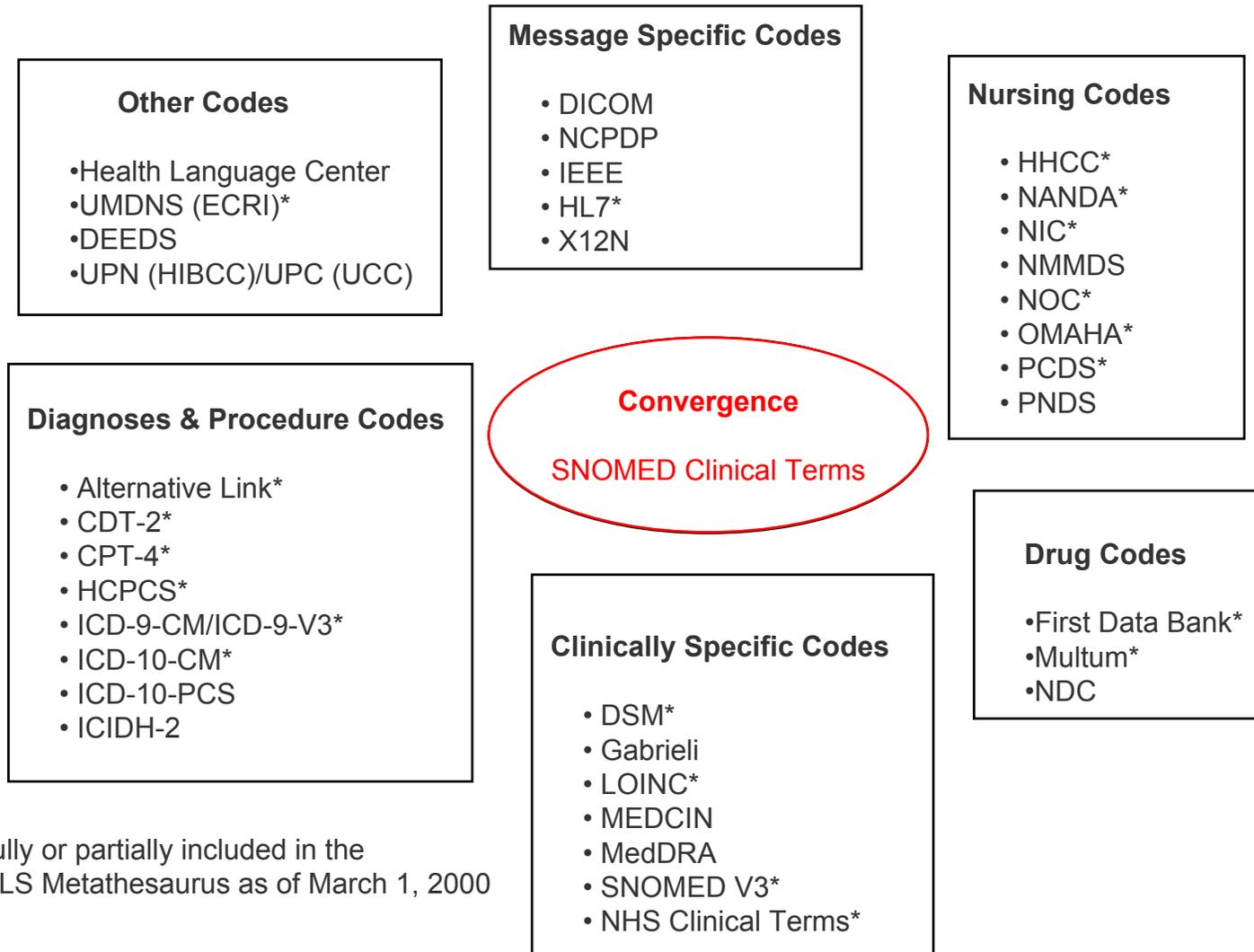
- Context elements are concepts that have terms
- Context is necessary for the full expression of meaning in the patient record
- Standardization of context must occur in collaboration between SNOMED and other PMRI standards
 - patient record architecture
 - messaging information models
 - attribution, headings, status concepts, linkage concepts

M a p p i n g

- SNOMED provides mapping resources that allow a cross-walk from SNOMED codes to matching codes in other systems
- The mapping resources include:
 - simple many-to-one tables (such as SNOMED-to-ICD-O topography)
 - more complicated lists of alternatives (such as SNOMED-to-ICD-10 or ICD-9-CM)

Integration and Convergence

Figure 2. Healthcare Terminology Domain Areas



* Fully or partially included in the UMLS Metathesaurus as of March 1, 2000

Relationship to HL7

- SNOMED is registered with the HL7 Vocabulary Technical Committee as a terminology
- SNOMED expressions can be carried in the CD “Concept Descriptor” data type, as defined in the HL7 RIM.
- Consistent and safe messaging of context of care will require further careful consideration

Integration with LOINC

- No overlapping concepts
- LOINC concepts are linked into the SNOMED hierarchy
- Defining elements of LOINC concepts have corresponding SNOMED codes

Maintenance of SNOMED

- **Open Process**
- Working groups and user group meetings
- SNOMED is an ANSI Standards Development Organization
 - will seek standardization via the canvass process

Open Process

- SNOMED's Development and Maintenance Process is Open, Accessible, Responsive
 - On the Web site (www.snomed.org) there are 15 documents outlining the proposed requirements, structure and content
 - Input and comment is sought from clinicians, software developers, government agencies, health care enterprises, and other users

Working Groups

- Provide recommendations to the Editorial Board
- Current working groups include:
 - Convergent Terminology Group for Nursing
 - Convergent Terminology Group for Pharmacy
 - SNOMED CT Technical Working Group
 - SNOMED CT Content Working Group
- Other content-focused clinical partners include:
 - American Academy of Ophthalmology
 - Veterinary Medicine (AVMA)

ANSI Standardization

- SNOMED is an ANSI Standards Development Organization
- SNOMED will seek accreditation of standards via the canvass process

Availability

- Licensing models
- Gov't-wide license negotiations

Why License?

- Insure integrity of the Standard
 - consistency of codes & relationships
 - protection of copyright & trademarks
 - specified distribution rights
 - input into revisions & enhancements
 - registered contact for communications

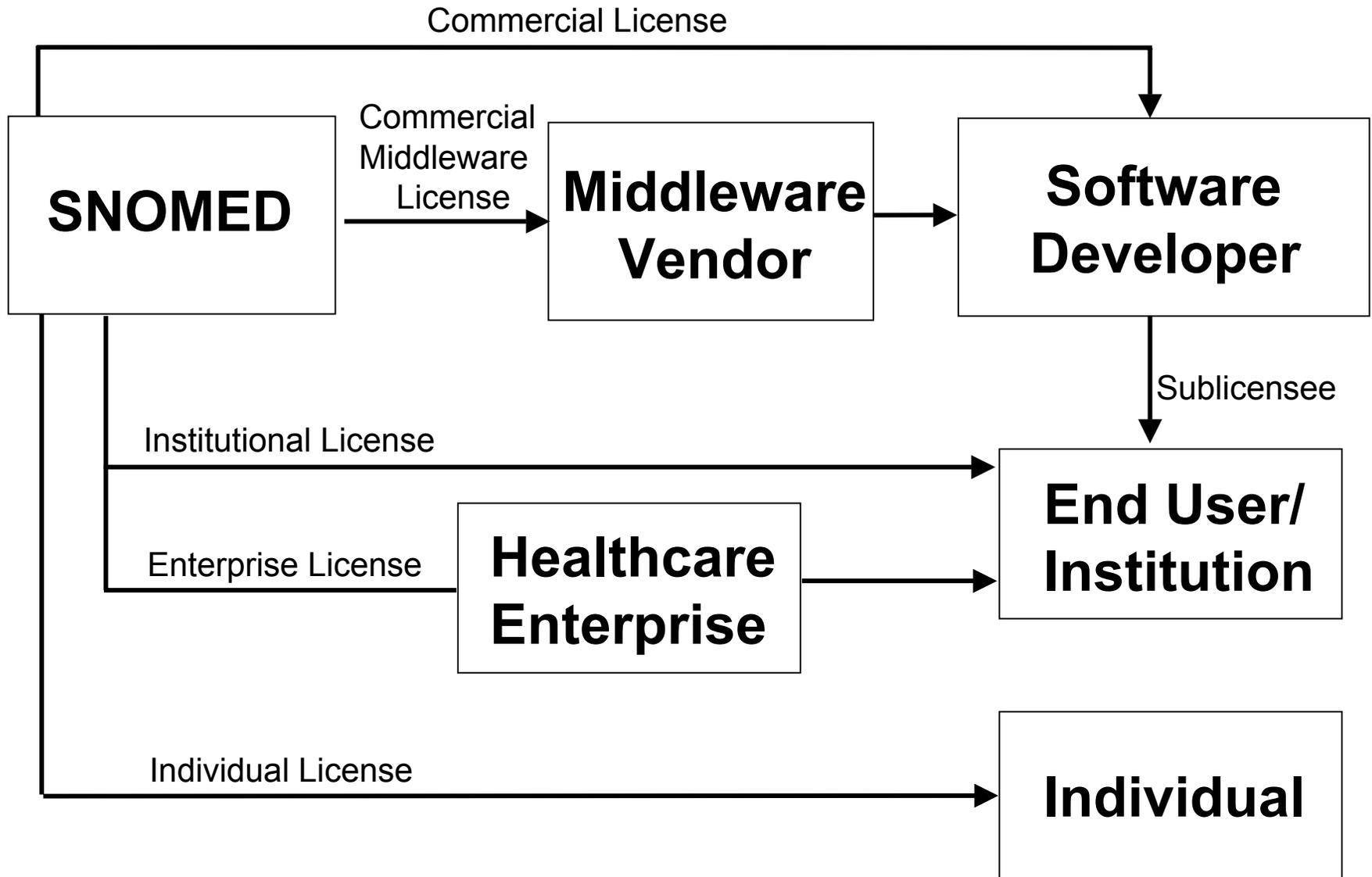
Why License?

- Provide financial self-support for ongoing activity
 - R&D
 - terminology maintenance
 - operations

Licensing Approach

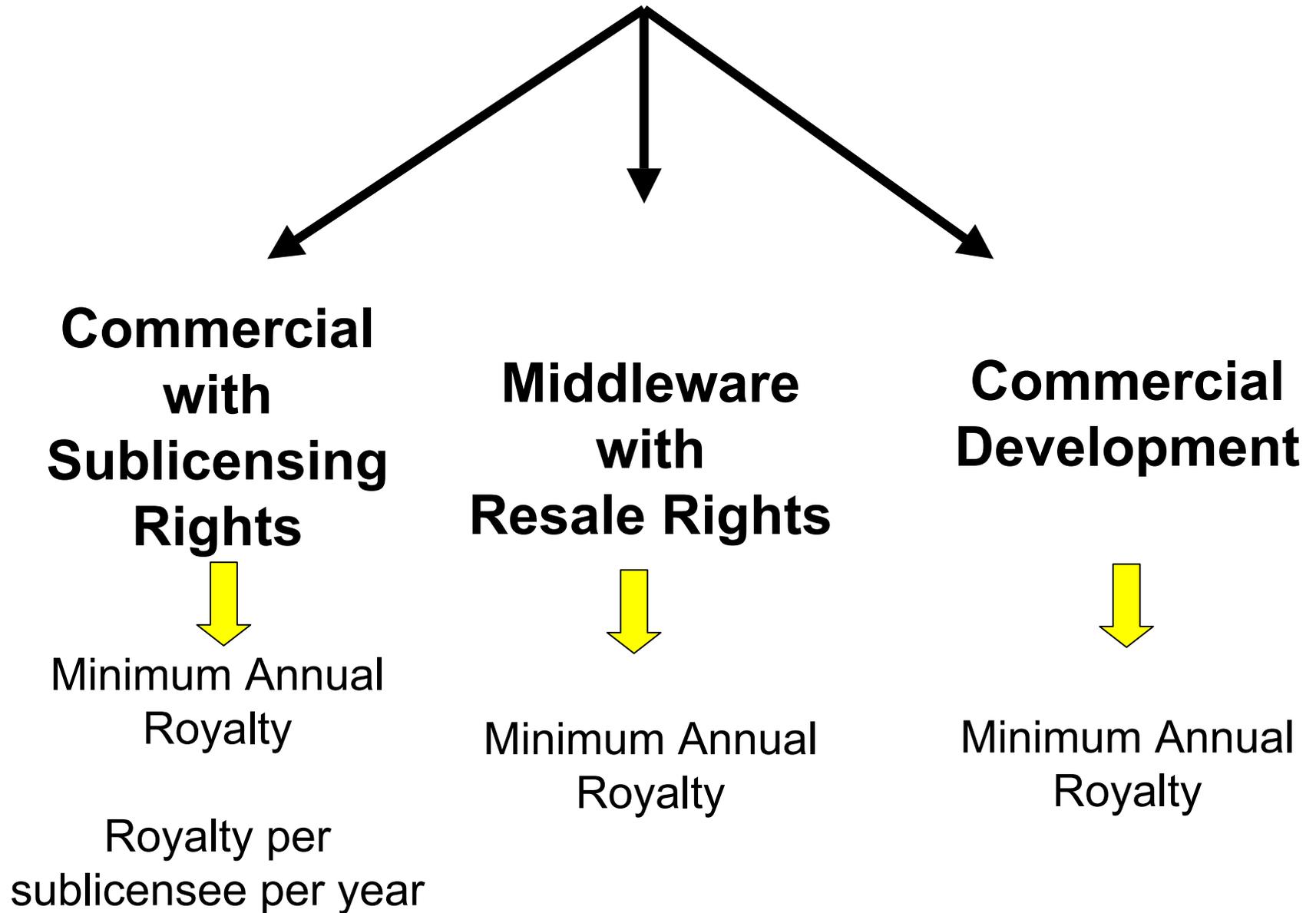
- Consistent terms of agreement
- Consistent fees for like use
- Scalable to transaction volume
- Function of application and use
- Rights upon termination
- Annual renewal
 - Migration to SNOMED® CT

SNOMED[®] Licensing Strategies



Note: Developer Licenses are offered to provide 3 months trial use to test feasibility of using SNOMED for a particular use.

Commercial Licenses



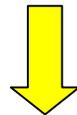
Annual Royalties Software Vendors

- Commercial vendors: \$3,000
- Commercial development: \$5,000
- Middleware vendors: \$5,000

Enterprise/Institutional Licenses

Acute Care

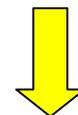
Enterprise-wide,
site specific,
or departmental



Tiered transaction
based pricing

Ambulatory Care

Clinics, multi-site or
single site group
practices, or solo
practices



Tiered transaction
based pricing

Non-Provider Organizations

Pharmaceutical
companies, health
departments, research,
govt., etc.



Relevant metrics apply

Annual Royalties Acute Care

- Based on # of historical patient admissions
- Per admission:
 - ◆ First 2,500 \$0.75
 - ◆ Next 2,501-10,000 \$0.65
 - ◆ Next 10,001-25,000 \$0.50
 - ◆ Next 25,001+ \$0.40

Acute Care

Admissions	Annual Fees
1,941	\$ 1,456
13,016	\$ 6,508
43,713	\$17,485

AVAILABILITY: LICENSING

Annual Royalties Anatomic Pathology

- Based on # of historical accessions
- Per accession:

◆ First 10,000	\$0.35
◆ Next 10,001-50,000	\$0.25
◆ Next 50,001-75,000	\$0.15
◆ Next 75,001 +	\$0.10

Anatomic Pathology

Accessions

Annual Fees

3,000

\$ 1,050

11,546

\$ 2,886

23,292

\$ 5,828

AVAILABILITY: LICENSING

Annual Royalties Clinical Pathology

- Based on historical # of analytes tested
- Per clinical analyte:
 - ◆ First 500,000 \$0.005
 - ◆ Next 500,001-2M \$0.004
 - ◆ Next 2M-10M \$0.003
 - ◆ Next 10M + \$0.001

Clinical Laboratory

Tests	Annual Fees
395,297	\$ 1,050
1,061,003	4,244
10,182,632	10,182

Annual Royalties Cytopathology

- Based on historical # of specimens tested
- Per cytopathology specimen:
 - ◆ First 10,000 \$0.17
 - ◆ Next 10,000-50,000 \$0.12
 - ◆ Next 50,001-250,000 \$0.08
 - ◆ Next 250,001 + \$0.05

Annual Pricing Ambulatory Care

- Based on historical # of patient encounters
- Per encounter:
 - ◆ First 50,000 \$0.05
 - ◆ Next 50,001-250,000 \$0.04
 - ◆ Next 250,001-500,000 \$0.03
 - ◆ Next 500,001 + \$0.02

Annual Royalty Public Health Reporting

- Based on clinical pathology analytes tested in the prior year
- Per clinical analyte:

◆ First 500,000	\$0.010
◆ Next 500,001-2M	\$0.008
◆ Next 2M-10M	\$0.004
◆ Next 10M +	\$0.002

Licensing Summary

- SNOMED fees are measurable, auditable and scalable
- License structure relates to how and why SNOMED is used
- License fees were validated by vendors and end users

U S Government License

- NLM is the lead negotiator; other government agencies directly involved include CDC, NCI, DoD/VA/HIS
- Progress towards agreement has occurred
- Latest CAP response has been approved by the CAP Board of Governors and will be delivered to NLM later this month
- License would provide *basic* SNOMED to government agencies (federal, state, local) in the US, and to organizations reporting data to gov't

SNOMED Clinical Terms

- SNOMED Clinical Terms is a **terminological resource** that can be implemented in software applications to represent clinically relevant information reliably and reproducibly. Through the use of this information, SNOMED CT enabled applications support effective delivery of high quality healthcare to individual people and populations.
- SNOMED CT is an international, multilingual terminological resource that can also represent concepts and terms unique to particular organisations or localities.

SNOMED Clinical Terms

- Alpha test currently underway, over 36 organizations in 6 countries
- An internal version of the entire terminology exists
 - Concepts ~ 250,000
 - Terms ~ 800,000
 - Relationships >1,000,000
- We have a firm commitment to a Dec 2001 release

SNOMED CT Characteristics

- Unsurpassed content coverage
- Reference properties
- Interface properties
- Disorders, Findings, Procedures & Interventions
- Supporting concepts (anatomy, function, organisms, drugs, chemicals, forces, occupations, etc)
- Subsets
- Extensions

Summary

- Users of PMRI require a comprehensive, scientifically sound, well-maintained clinical terminology
- SNOMED CT was created in response to that need, and is being maintained and enhanced in an open and well-supported manner
- Rational and market-validated licensing models are now public information
- It is expected that government license(s) may soon lower barriers to use even further
- SNOMED is an essential component in the standardization of patient medical record information