

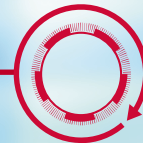


Using SNOMED as a Foundational Component for Integrated Drug Knowledge Bases:

PROS and CONS

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Medical intelligence to improve care





VIDAL Group is a leading European healthcare informatics and information systems company with a century-long track record. Its products are used in more than 3.000 healthcare facilities worldwide, and embedded in over 400 medical software applications.



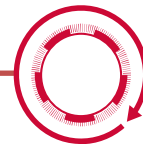
A set of **applications** and **data**
that ensures **consistency** of drug information
and promotes the **proper use** of medicinal products
across all players involved in patient care and safety
“Same data, multiple contexts and uses”

- **Healthcare professionals**
- **Healthcare applications providers (HIS...)**
- **Health Authorities**



- **Accessibility**
 - easily provide up-to-date information on officially registered drugs to all healthcare professionals
 - push this information in the healthcare workflows
- **Interoperability**
 - with clinical information...
 - with local guidelines...
 - with external drug resources...
- **Actionability**
 - Real-time regulatory communication
 - e-Prescription logics
 - patient safety alerts
 - ...

'Augmenting' the drug formulary



Official Drug Formulary

VIDAL Core

*Structured
clinical data*

Documentation

*Decision Support
Modules*

*Synchronisation
Standardisation*

AMPP
(Package)

AMP
(Product)

VMP
(Generic)

Actual Medicinal Product Pack

Example:
ADOL Caplets 500mg 48's (12's Blister x4)

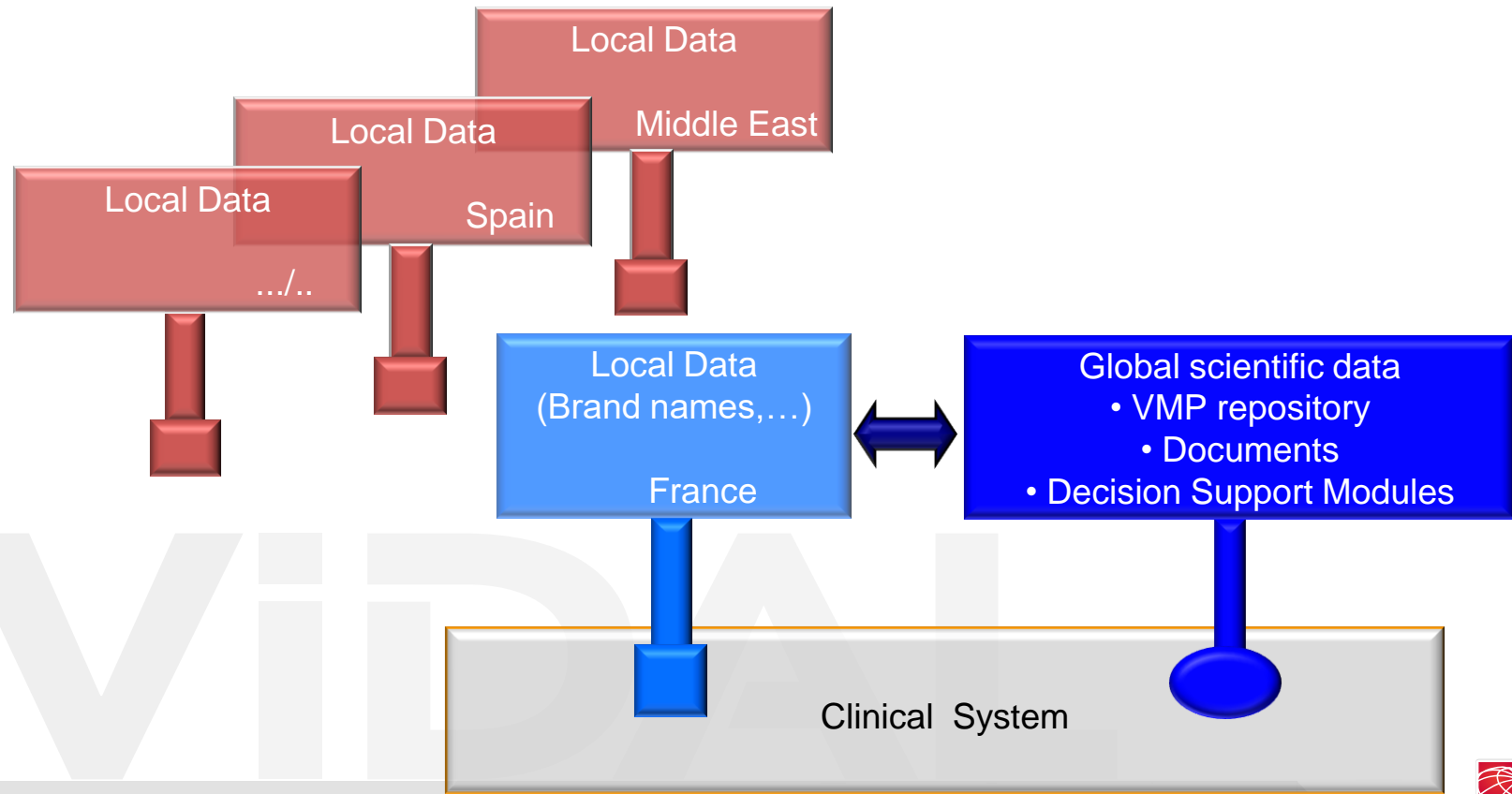
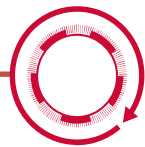
Actual Medicinal Product

Example:
ADOL Caplets 500mg

Virtual Medicinal Product

Example:
paracetamol 500mg; oral route; tablet

“Local” data models enable international exportation





- **Historically:** Documents derived from multiple sources (EMA, FDA, National drug agencies) → assembled by VIDAL domain experts:
 - a database of compiled knowledge accessible through APIs, supported with a UI for stand-alone or web-based access
 - a knowledge base using a relational model to describe the therapeutic, economic, and dosing properties of various drugs
 - more than 10 standards including ICD-9, ICD-10, ICPC, the HL7 RIM, the International Classification of Primary Care (including UMLS Meta-thesaurus)
 - In addition, uses some VIDAL proprietary vocabularies
- Contains information on over 153.000 branded products corresponding to 11594 virtual medicinal products

Knowledge-base architecture: RDBMS vs Graphs



- Knowledge evolved from documents → based on “text fragments”
 - Medication A → “indicated for the treatment of primary asthma”
- Text fragments not parsed into finely granulated, atomic concepts →
 - Overlapping semantics between phrases
 - “indicated for treatment of primary asthma”, “indicated for asthmatic conditions”
 - Non-specificity of finely-granulated queries/need for continuing development of specialized queries
- Increasing sophistication of the content in the knowledge → increasingly difficultly for domain experts to validate “domain semantics” → “technical implementation semantics” translations

Semantics in a relational database implementation

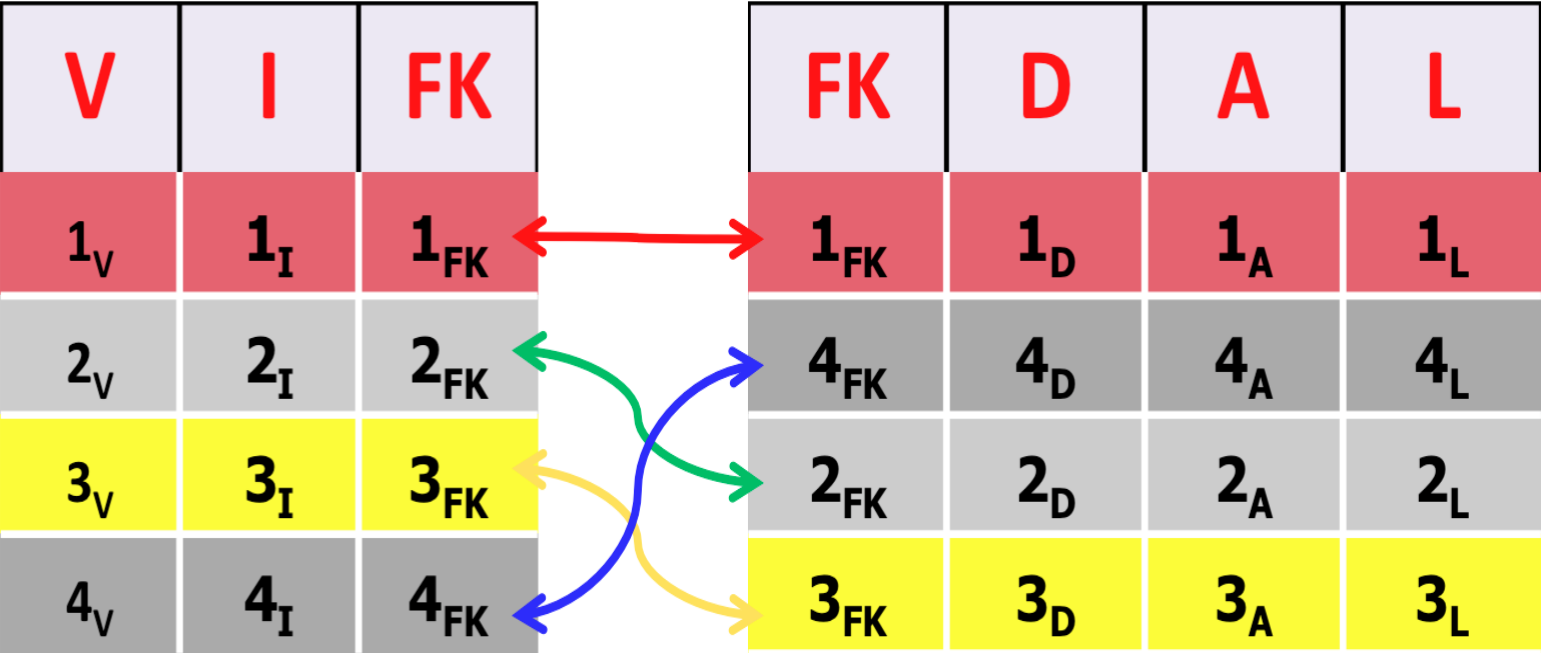
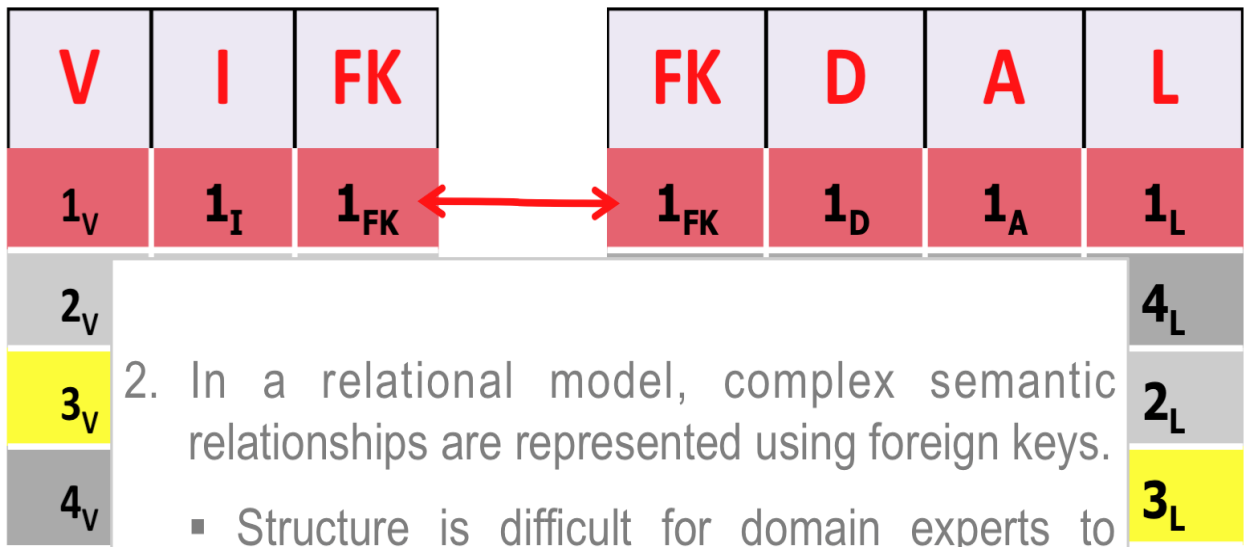
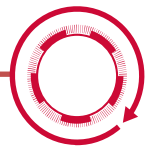


table n°1

table n°2

Semantics in a relational database implementation

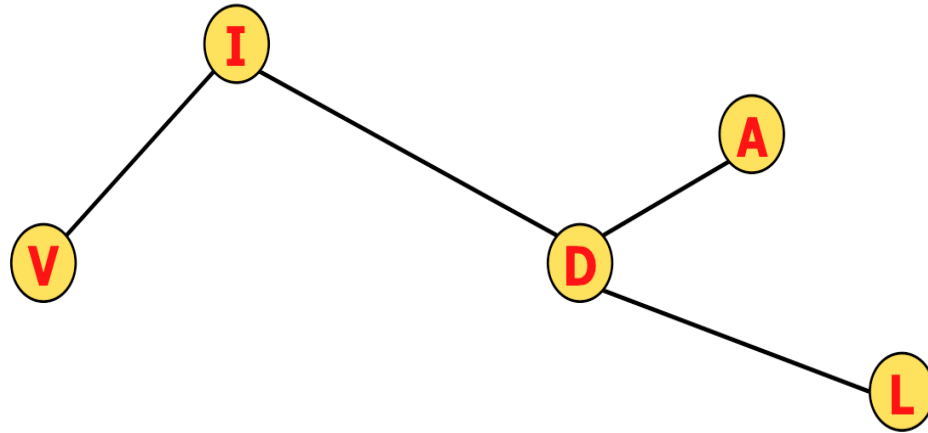


2. In a relational model, complex semantic relationships are represented using foreign keys.
- Structure is difficult for domain experts to understand (and therefore to validate)
 - Queries become increasingly complex because of the need for cross-table joins
 - If the understanding of the meaning of a particular field changes, substantial table restructuring can be required.

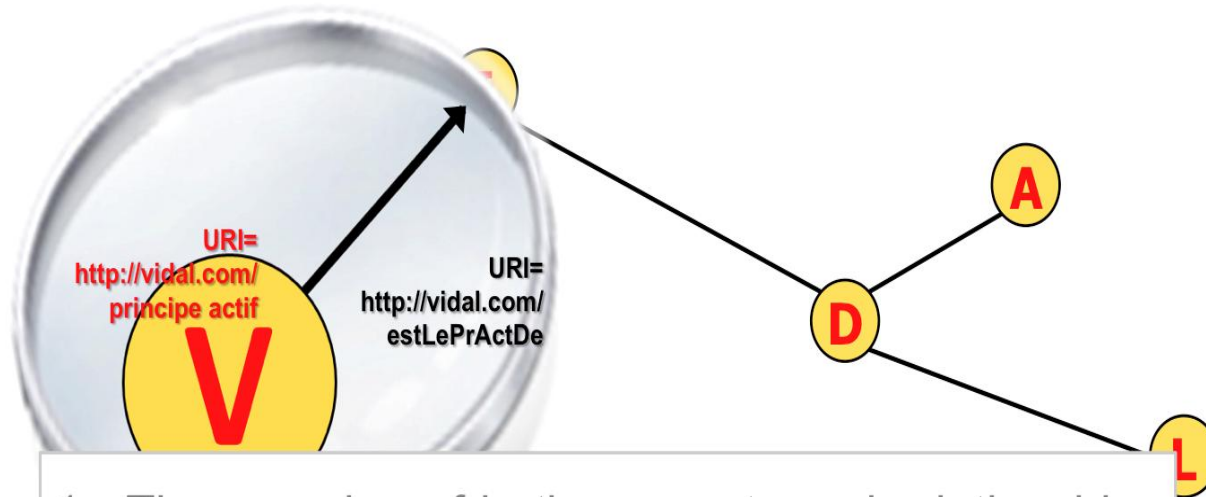




Queries understandable by both domain experts and developers

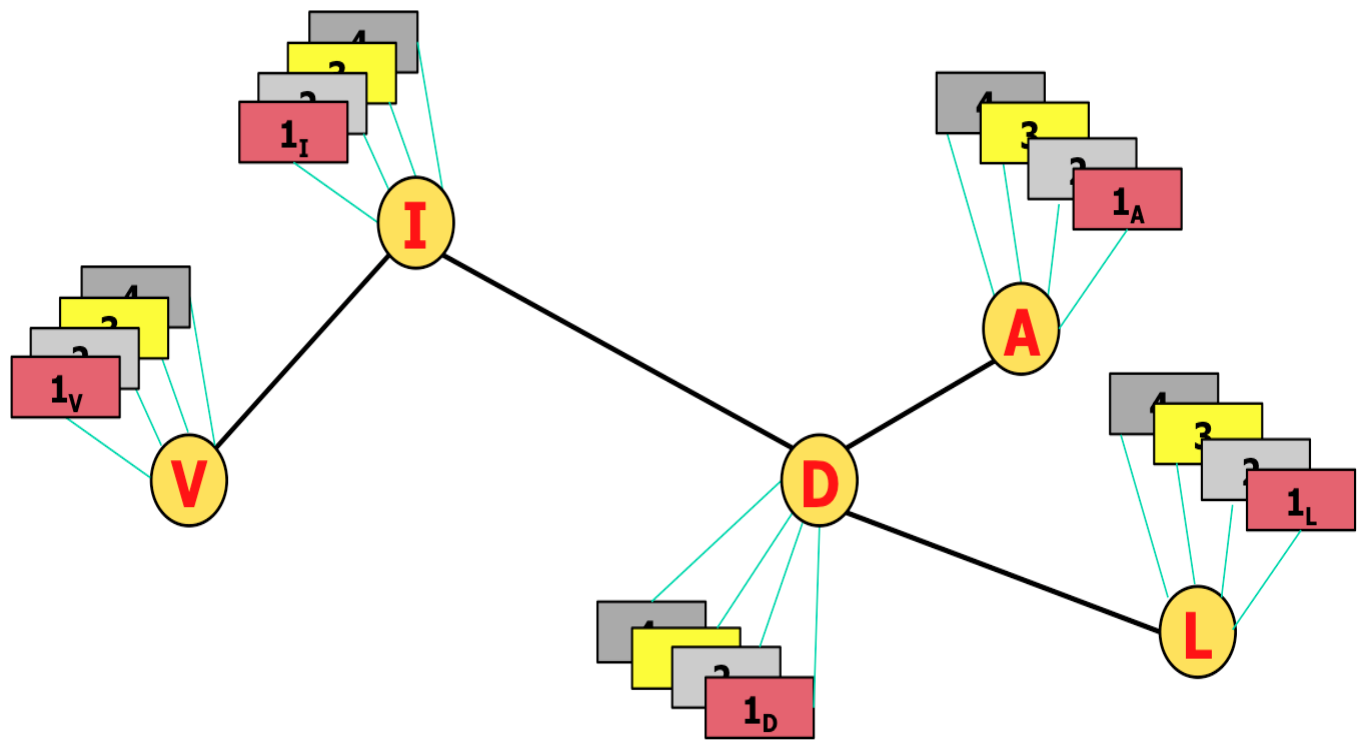
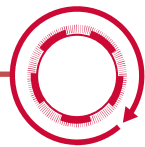


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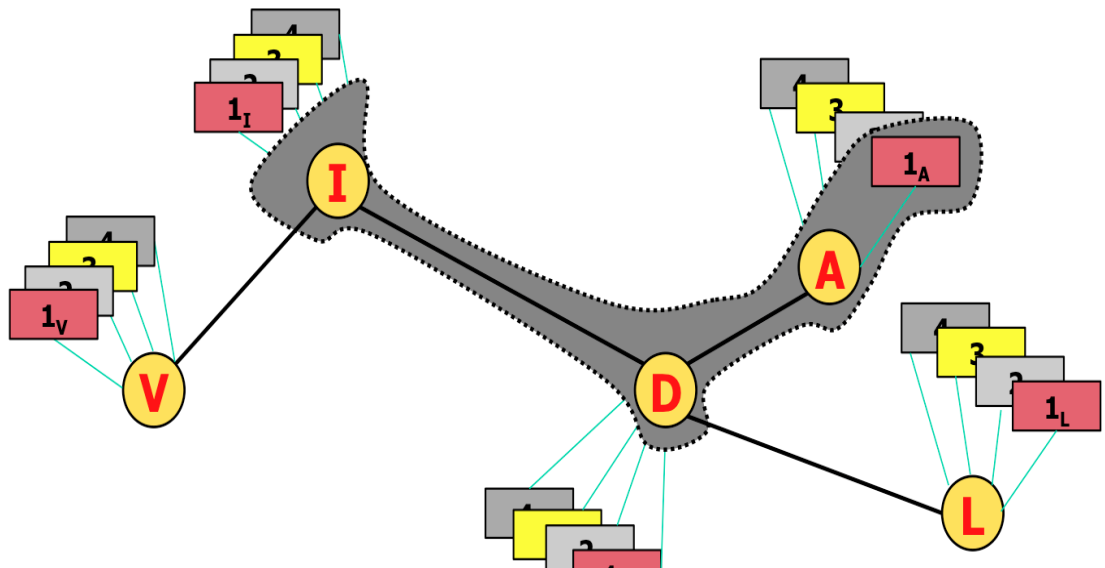
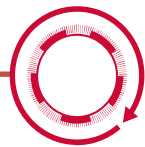


1. The meaning of both concepts and relationships is **explicit** and **unambiguous**:
 - Each semantic entity as a unique identifier (URL)

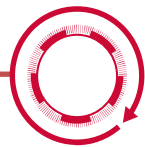
Queries understandable by both domain experts and developers



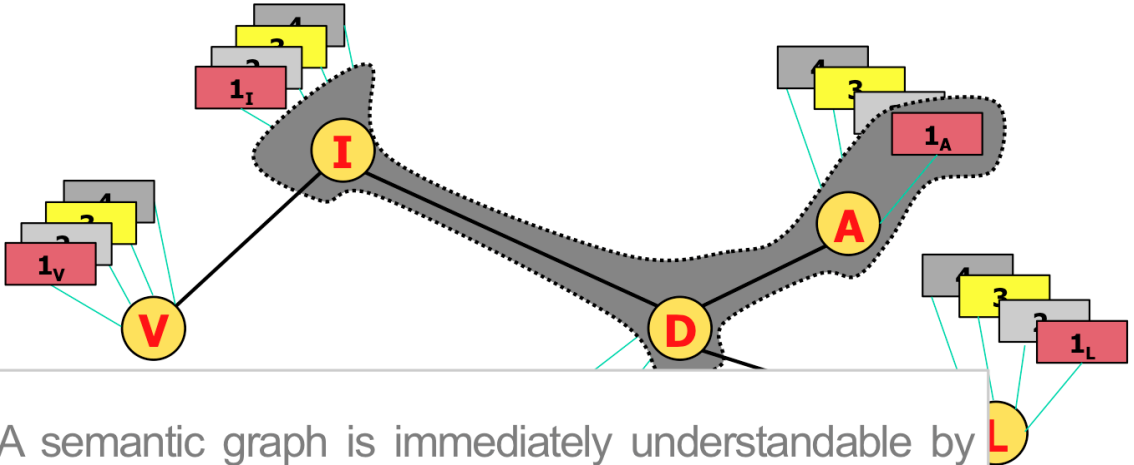
Queries understandable by both domain experts and developers



« I'm looking for all of the medications (I)
• whose Unit Price (A) is 1_A
• regardless of the Active Ingredient (V), the
Manufacturer (L), or the form. (D) »



Queries understandable by both domain experts and developers



2. A semantic graph is immediately understandable by both domain experts and developer

- Queries become searches for “semantic patterns”



- Decrease in “semantic impedance” → “the model of the domain is the model of the implementation”
 - Facilitates internal communication (domain $\leftarrow \rightarrow$ technical)
 - Facilitates external communication (KB provider $\leftarrow \rightarrow$ KB consumer)
- Simplification of internal technical details
 - Finely granulated queries are more straightforward in a graph-based model than in a relational model
 - Evolution of knowledge is somewhat easier to manage in a graph
 - “Node atrophy” can often be used in lieu of table restructuring



SNOMED ADOPTION CONSIDERATIONS

- Availability of SNOMED in country-specific language
- Official mandate for SNOMED use in clinical information system documentation
- Availability of SNOMED in Semantic Web format (e.g. RDF et al)
- Integration of IDMP semantics and associated drug instance data



PROS

- Country-specific translations of SNOMED – *certified by SNOMED International* – would greatly accelerate the use of SNOMED by clinicians
 - Core translated to Spanish + Local Extensions for Uruguay, Chile (soon), and Spain (very soon)
- Many organizations could use SNOMED internally in English, but it would have to build UI translations for material presented to clinicians

CONS

- Country-specific translations require government-level commitment to involvement in SNOMED International localization/translation efforts
 - France is NOT currently involved → VIDAL is interested in developing a “Francophone initiative” with Belgium, Switzerland, etc.
- Clinicians may be reluctant (or unable) to use versions not in their native language



PROS

- Mandated use would standardize expression of much of clinical and diagnostic content
- Without mandated use of SNOMED for clinical documentation, clinicians will use
 - Free text (most common)
 - Proprietary coding systems
- Use of an ontology (e.g. SNOMED) and associated compositional grammar is superior in expressiveness to use of a classification system (ICD-10)U

CONS

- SNOMED currently not mandated in France
- Implementers could use SNOMED → ICD-10 mapping, but there are questions as to the correctness and/or completeness of these mappings that depend on specific semantic contexts and goals



PROS

- SNOMED is an ontology (as opposed to a classification system (ICD-9, ICD-10)) → SNOMED semantics have a natural expression using an ontological language, e.g. OWL-FS, RDF, etc.
- OWL2 Functional Syntax version of SNOMED (easily convertible to an iso-semantic RDF version) is now available from SNOMED International

CONS

- NONE



PROS

- SNOMED semantics would provide a finely granulated compositional vocabulary for linking indications, contraindications, side effects and other physiologic processes to specific drugs and diseases
- Efforts are underway: <https://www.snomedination.org/Posts/iso-standard-on-the-identification-of-medicinal-products-idmp/>

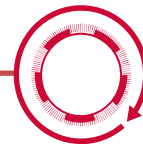
CONS

- Current SNOMED semantics for drugs are inadequate for drug-centric decision support
 - Also insufficient to support EMA's required adoption of IDMP (Pharmacovigilance, ISO TS19256)



- Country-specific translations remain a considerable barrier to adoption of SNOMED but can be approached through a combination of collaborative efforts and automated translation tools
- Use of Semantic Web technologies could greatly enhance the update and deployment of SNOMED-centric solutions
 - Graph-based technologies are increasing around W3C Semantic Web initiatives (RDF, RDFS, SPARQL, SHACL, ShEx, etc.)
- Full semantic integration with IDMP and associated instance-level data will greatly enhance applications in domains outside of traditional “clinical care,” e.g. pharma, clinical trials, etc.

In conclusion...



The real value of a standard comes with its increasing use...



Find out where and how SNOMED® is being used around the world.

SEARCH TEXT

CATEGORIES

All Categories



LOCATIONS





The best way to get a good idea is to get lots of ideas.

Linus Pauling