Semantic Unification for ABR

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Semantic Unification for ABR

- **Improve communication**
  - From ambiguous to clear communication

- **Accelerate communication**
  - From manual to automated processing

- **Improved healthcare**
  - More timely and improved insight in the spreading of resistant bacteria, which enables better prevention and effective outbreak management
Project Semantic Unification for ABR

https://www.rivm.nl/antibioticaresistentie/nationale-aanpak-antibioticaresistentie/eenheid-van-taal-antibioticaresistentie

RIVM, NICTIZ, NVMM

6 pilot labs 2017:

- UMC Utrecht
- St. Antonius
- Diakonessenhuis
- Saltro
- RLM Dordrecht/Gorinchem
- Tergooi

8 more “front-runners” in 2018

Nationwide implementation has started this year, 15-20 labs

All labs (~50) connected by end of 2020
Four steps to semantic unification in ABR

1. Identification of micro-organisms
2. Identification of test for micro-organisms
3. Identification of susceptibility tests for antibiotics
4. Identification of genetic types of antibiotic resistance
1. What micro-organism did we find?

K. pneumoniae

or in full ...

Klebsiella pneumoniae

aka ...

Friedlander's bacillus
2. How did we identify it?

By culture from (for example) midstream urine sample

6463-4 - Bacteria identified in Unspecified specimen by Culture
78014005 – Urine (what – material)
431938005 – Urinary tract (where – topography)
225271002 – Midstream urine (how – procedure)

The Dutch Labcodeset includes:
• LOINC codes for order/test
• SNOMED-CT codes for material, topography, procedure
  ➢ Material table specific for ABR in MMLs
• Result: in this case a SNOMED-CT code for the micro-organism identified
3. But what does this tell us about ABR?

More tests are carried out, for example:

186-7
Ciprofloxacin [Susceptibility] by Disk diffusion

516-5
Trimethoprim+Sulfamethoxazole [Susceptibility] by Minimum inhibitory concentration

6977-3
Amoxicillin+Clavulanate [Susceptibility] by Gradient strip

Test results can vary: mm, MIC-value, ...
Conclusion (S, I, R) can be reported as coded value as well
4. Onwards toward genetic typing

Work in progress:
- PCR
- WGS
- NGS
- ...

Why is this important?

Short term:
- Improved (near real-time) surveillance of bacteria that are resistant to antibiotics in support of better prevention and intervention

Longer term:
- A proven infrastructure to achieve semantic unification of lab results
  - Comparable results across the patient journey, including second opinions
  - Enable specialisation and subcontracting of specialized lab work
  - Improve medication safety by sharing lab results with pharmacy
  - ...

Semantic interoperability

It’s not what you say, it’s what you mean

- pneumonie door cytomegalovirus
- longontsteking door CMV

Different terms can express the same meaning
Different meanings can be expressed by the same term

Use terminology standards to register the intended meaning
Semantic interoperability in laboratories

International terminology systems:

- **LOINC** for the question
- **SNOMED CT** for the answer
- **UCUM** for the units
LOINC for the question
> 76,000 codes
> 170 countries
Clinical & lab tests
  • Orders
  • Tests performed
  • Results
SNOMED CT for the answer

- > 330,000 codes
- Defining relations
- 33 member states
- Used in > 50 landen
UCUM for units

Vocabulary for units of measure

• List of atoms + syntax to combine them
  • umol/L, m/s

Use with quantitative test results

• Blood glucose = 20
  • Millimol per liter or milligram per deciliter?
Dutch Reference set micro-organisms

> 3,000 SNOMED concepts

English & Dutch descriptions
Compiled by NVMM
Bacteria and fungi
Dutch Lab Codeset

National set of LOINC-concepts
Translated into Dutch
SNOMED CT for materials, methods & results
UCUM for units
First version published May 29th, 2019

Future work:
Link with procedure thesaurus for hospitals (DHD Verrichtingenthesaurus)
Link with national GP reference table for lab tests (NHG-tabel 45)
Advantages of the Lab Codeset

Data exchange without local mapping tables
- With other laboratories
- With EHR
- With GP

Transparent ordering and reporting

Unique & international codes

Easier for vendors to manage

Computable: Improved data analysis and comparison for laboratories
### Nederlandse Labcodeset

#### Resultaten [2]

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<th>Status</th>
<th>LOINC</th>
<th>Volledige naam</th>
<th>Component</th>
<th>Kenmerk</th>
<th>Timing</th>
<th>Systeem</th>
<th>Schaal</th>
<th>Methode</th>
<th>Aanvraag/Resultaat</th>
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<td>Moment</td>
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<td>Hemoglobine A1c/Hemoglobine.totaal [stof fractie] in bloed d.m.v. IFCC protocol</td>
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#### Details

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<tr>
<td>Unit</td>
<td>%</td>
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<tr>
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<td>Hemoglobine A1c/Hemoglobine.totaal [massa fractie] in bloed</td>
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<tr>
<td>Oude volledige naam</td>
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#### Materiaal

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#### Methode

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#### Uitkomst

<table>
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<th>Rm</th>
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<td>%</td>
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Should the material be included in the LOINC code?
Clinical chemistry (NVKC): sure!
Microbiology (NVMM): that increases the number of test codes by factor 100 – no!

Laboratories must map their materials to a set of SNOMED codes:
Substance, topography, morphology, source object & collection procedure
Guide to mapping: NVMM Material table
Specimen: pus swab of abscess of back

Substance = 11311000 |Pus (substance)|
Topography = 281213008 |Back structure, including back of neck (body structure)|
Morphology = 44132006 |Abscess (morphologic abnormality)|
Object = -
Procedure = 285570007 |Taking of swab (procedure)|

Result is equivalent to the predefined specimen concept – if it exists!
(ABR) Measurements to LOINC-concepts in the Lab Codeset
  • Ensure that method, scale and system match

Organisms to SNOMED-concepts in the micro-organism reference set

Materials to the material table
  • Basic material + (if specified) topography, morphology, source or procedure

Local codes that contain both measurement and material
  • To a LOINC-concept in the Lab Codeset and a material in the material table
  • Check if they are compatible
Questions and change requests

For all questions and change requests on:

- Labcodeset
- Reference sets for micro-organisms and ordinal results
- Material table

Email: labcodeset@nictiz.nl
Licencing & Downloads

Reference set micro-organisms:
Licence Netherlands Edition of SNOMED CT
• Request for free and download at: https://mlds.ihtsdotools.org/

Netherlands Lab Codeset
Licence of LOINC needed
• Request for free at: https://loinc.org/join/
Licence Netherlands Edition of SNOMED CT
• Request for free and download at: https://mlds.ihtsdotools.org/

NVMM Material table
Pilot version available at https://www.nictiz.nl/sectoren/laboratoria/antibioticaresistentie/
Official release expected in July
Documentation

https://www.nictiz.nl/sectoren/laboratoria/antibioticaresistentie/

Links to all documentation concerning ABR

Labcodeset:

Browser: https:\lafterminologie.nl/art-decor/labconcepts

https://www.nictiz.nl/standaardisatie/terminologiecentrum/referentielijsten/nederlands
e-labcodeset/

Extracting reference sets from SNOMED:

https://www.nictiz.nl/standaardisatie/terminologiecentrum/referentielijsten/inbouwen-
snomed-referentieset/
Questions?