Intelligent use of data by computers for surveillance: the case for ontologies

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Crawford Revie
Data → Information → Knowledge → Understanding
Epidemiological data collection is about technology, but effective disease surveillance is about people

People matter in animal disease surveillance: Challenges and opportunities for the aquaculture sector
Cecile Brugere
Dennis Mark Onuigbo
Kenton L.I. Morgan
Interoperability
DOREA/ FERNANDAMRS 22MAY2017 ARN LIS

TAP Portugal Flight 782
Jun 8 - Confirmation #56EV75
Lisbon LIS  Stockholm ARN
12:35 PM  5:50 PM

TAP Portugal 781
ARN to LIS May 22, 6:35 PM
TAP Portugal 35
LIS to FOR May 23, 5:00 PM
TAP Portugal 36
FOR to LIS Jun 7, 11:05 PM

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BOOKING REF: 56EV75
DATE: 16 MAY 2017

DOREA/ FERNANDAMRS Plus INF
MEYER/JONAS

FLIGHT  TP 781 - TAP PORTUGAL
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MON 22 MAY 2017

DEPARTURE: STOCKHOLM, SE (ARLANTA), TERMINAL 5
ARRIVAL: LISBON, PT (AIRPORT), TERMINAL 1

FLIGHT BOOKING REF: TP/56EV75
RESERVATION CONFIRMED, ECONOMY (U)
LAST CHECK IN TIME: 17:35
DURATION: 04:25

BAGGAGE ALLOWANCE: 2PC
SEAT: 16F CONFIRMED FOR DOREA/ FERNANDAMRS
MEAL:
NON STOP STOCKHOLM TO LISBON
<table>
<thead>
<tr>
<th>VeNom (Veterinary Nomeclature)</th>
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</thead>
<tbody>
<tr>
<td>'Squamous cell carcinoma - clitoral'</td>
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<tr>
<td>'Squamous cell carcinoma - conjunctival'</td>
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<tr>
<td>'Squamous cell carcinoma - corneal'</td>
</tr>
<tr>
<td>'Squamous cell carcinoma - gastric (stomach)'</td>
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<tr>
<td>'Squamous cell carcinoma - penile/prepuce'</td>
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<tr>
<td>'Squamous cell carcinoma - oesophageal'</td>
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<tr>
<td>'Squamous cell carcinoma - nasal sinus'</td>
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<tr>
<td>'Squamous cell carcinoma - perineal'</td>
</tr>
<tr>
<td>'Squamous cell carcinoma - third eyelid/niictitating membrane'</td>
</tr>
<tr>
<td>'Squamous cell carcinoma - urethral'</td>
</tr>
<tr>
<td>'Squamous cell carcinoma - urinary bladder'</td>
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</table>
Different dimensions of knowledge contained in the data
Ontologies

- Data model
- Classes
- Properties
- Instances
An ontology defines a common vocabulary for users who need to share information within a domain.

It includes machine-interpretable definitions of basic concepts in the domain and relations among them.
To make domain assumptions explicit
To enable reuse of domain knowledge

**Uberon multi-species anatomy ontology**

**Anatomical Entity Ontology**

**Foundational Model of Anatomy**

**Ontology for General Medical Science**

**Symptom Ontology**

**Clinical Measurement Ontology**

**Anatomical parts**

- Respiratory system
- Circulatory system
- Musculoskeletal system
  - Bones
  - Femur

**Wounds and Injuries**

- Fractures
  - ...
To support research and knowledge discovery from data

Fracture of the femur

Osteochondroma of femur

All injuries of the femur?

All injuries of the LEG?
Ontologies applied to data-driven surveillance
Desired functions

• Convert health data into information in real-time

• Use medical knowledge to infer surveillance relevant information from data collected for other purposes

• Provide a permanent source of term mappings that are open and can be shared/expanded by community (IRI)
Inherent challenges to overcome

• Distributed data (not likely to be shared)

• Data non-coded or coded using different standards

• Solutions must work prospectively and retrospectively
Module 1 – animal registry

Module 2 – clinical data

Module 3 – laboratory data

Abattoir data

VeNom

https://w3id.org/ahso
Workflow for each data source

- Community involvement: Workgroups for each module

Concepts → Data model → Fill the gaps

Expert Review

Reuse existing ontologies

Improve / expand