

Interpreting Patient Data using Medical Background Knowledge

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Overview

1. Problem:

Integrate patient-data in clinical decision support systems

2. Our Approach:

Development of a Disease-Symptom Knowledge Model

3. Prototype

4. Conclusion and Future Work



Annotations to unstructured clinical data



MEDICO-Annotation-Ontology

lymph node

Problems:

- Data is mostly unstructured
- Difficult to access all information needed in a specific clinical task
- Clinicians don't use the full information contained in existing patient data

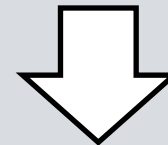
size

enlarged

Problem:

Annotations representing the descriptive content of the clinical data need to be understood with respect to ...

- diseases
- examinations
- treatment evaluation ...



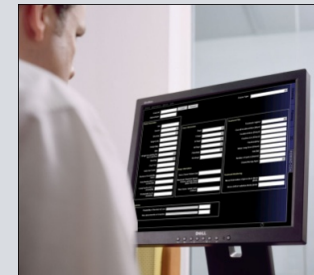
Interpretation
e.g. Disease-Symptom-Ontology

Clinical Decision Support

- Ranking of likely diseases
- Planning next examinations

Search in the Diagnosis Process

Search for
Cancer-indicating symptoms



- ✓ There exist medical ontologies that cover symptom-related and disease-related information
- There exist no medical ontologies covering the *relationship between symptoms and diseases*

Human Disease Ontology (DOID)

- ✓ Contains about 8000 diseases
- ✓ Well linked to MSH, SNOMED, UMLS, ICD, ...
- ✓ About 15 ObjectProperty relations

owl:ObjectProperty	total use	described diseases
doid:has_symptom	3382	232
doid:located_in	1759	484
doid:has_material_basis_in	1463	326
doid:transmitted_by	971	198
doid:derives_from	119	43

Metadata

DOID	DOID:4885
Name	Colorado tick fever

Definition

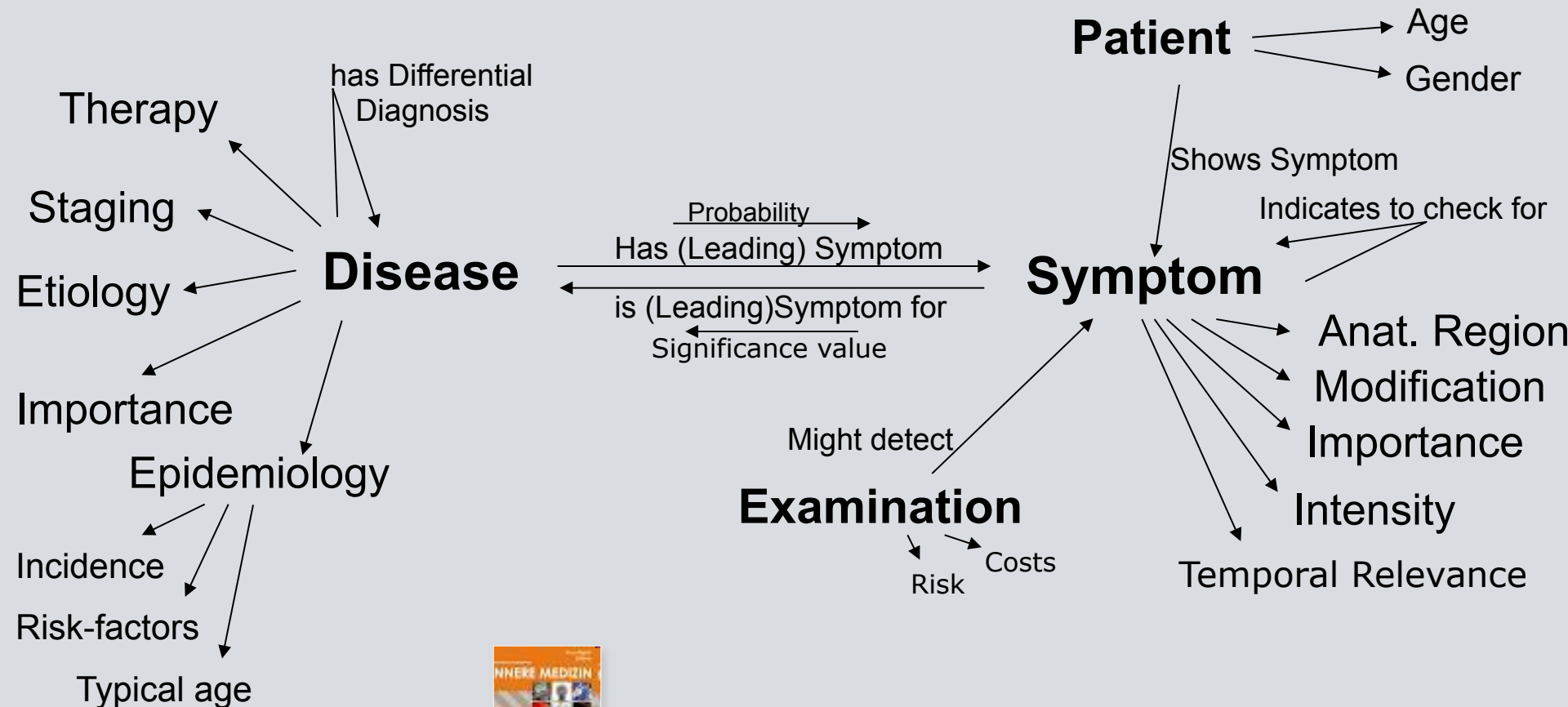
A viral infectious disease that results_in infection, has_material_basis_in Colorado tick fever virus, which is transmitted_by rocky mountain wood tick, Dermacentor andersoni. The infection has_symptom fever for 2-3 days, followed by an afebrile period of similar duration and then another 2-3 days of fever, has_symptom headache, has_symptom myalgia, and has_symptom fatigue.
<http://emedicine.medscape.com/article/786688-overview>

Xrefs

[MSH:D003121](#)
[SNOMEDCT 2010 1 31:186607005](#)
[SNOMEDCT 2010 1 31:6452009](#)
[UMLS_CUI:C0009400](#)

Ref: <http://disease-ontology.org/>

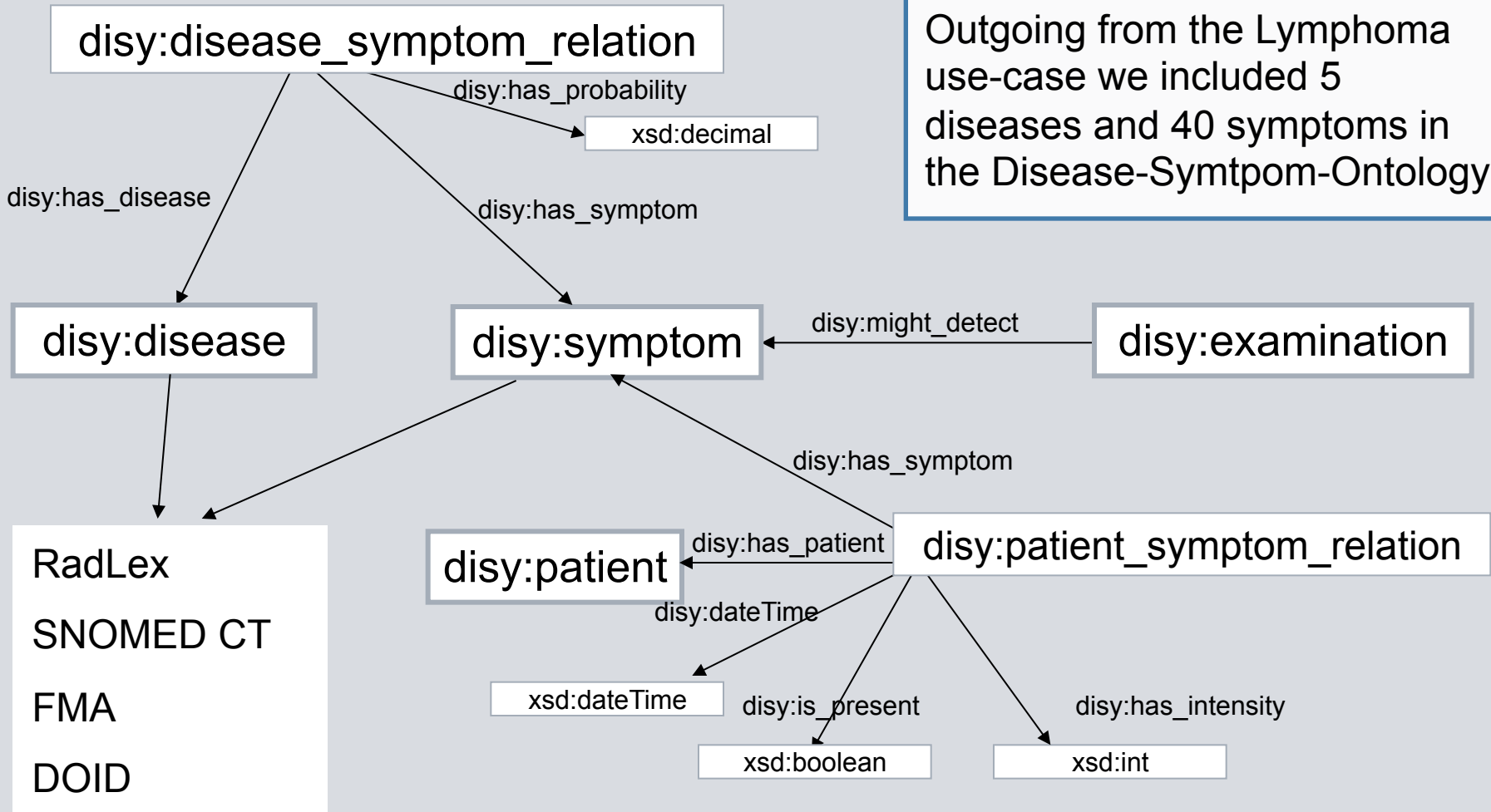
Towards a Disease Symptom Knowledge Model



**Knowledge Resource:
Herold – “Innere Medizin”**

Disease Symptom Ontology

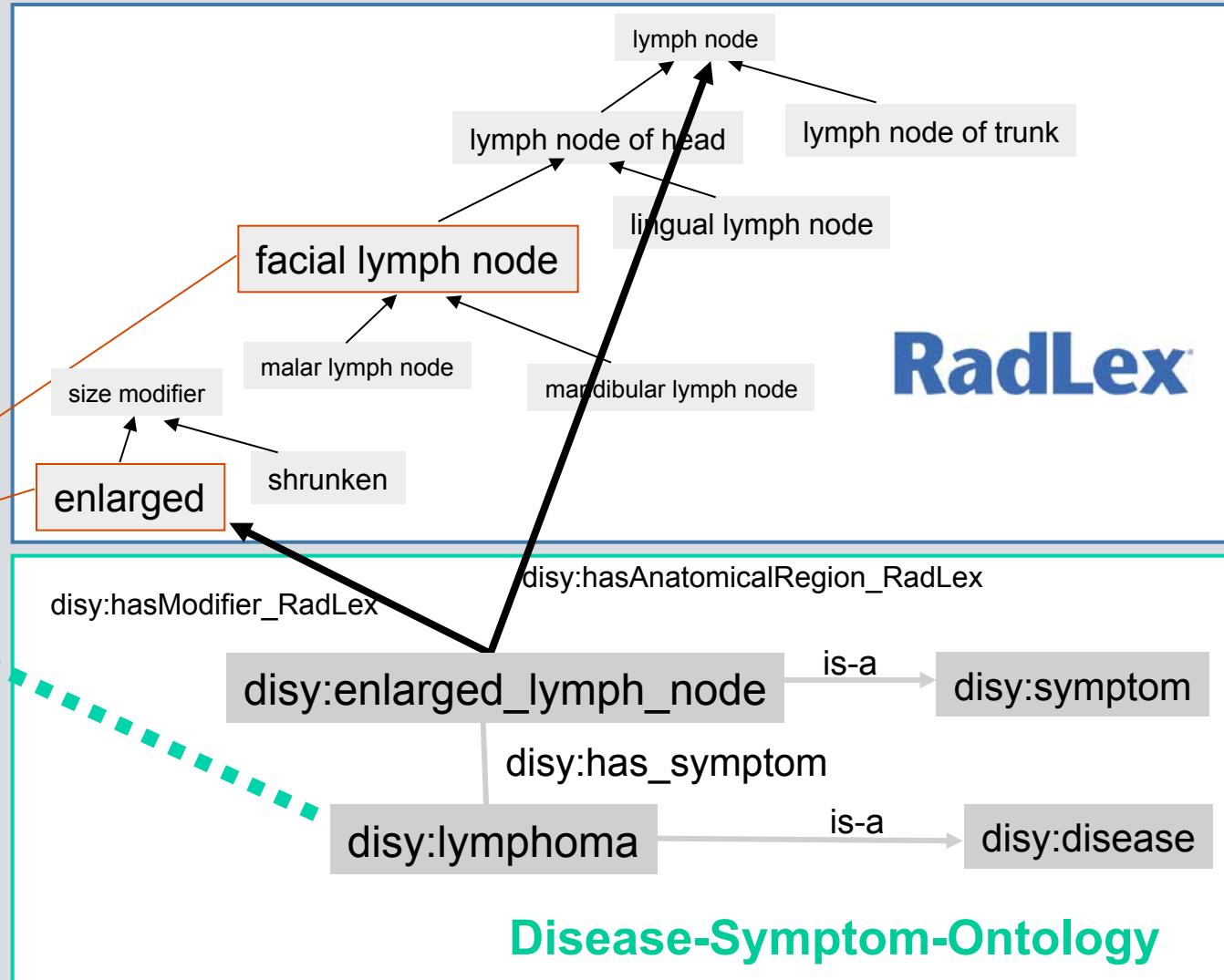
Outgoing from the Lymphoma use-case we included 5 diseases and 40 symptoms in the Disease-Symptom-Ontology



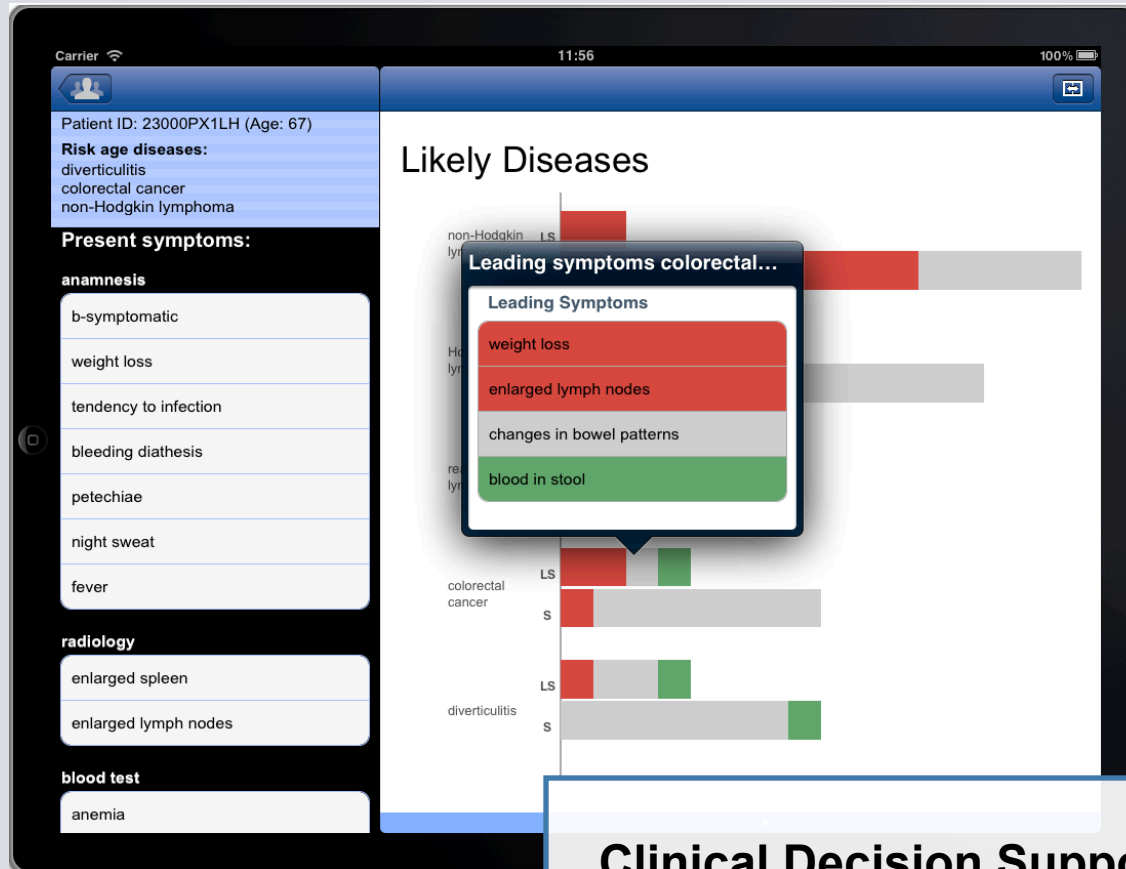
Linkage from disy to Other Ontologies



MEDICO-Annotation-Ontology



Use in Clinical Decision Support: Ranking likely Diseases



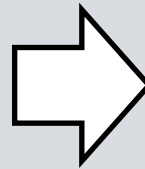
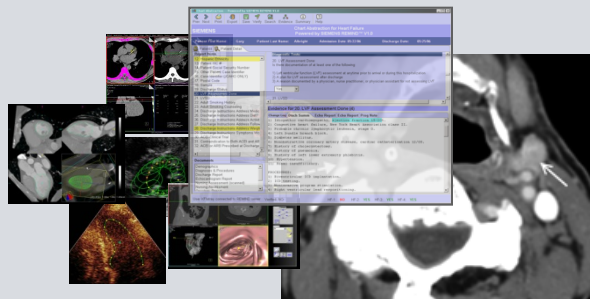
Ranking Factors:

- ✓ proportion of present over absent symptoms of a disease
- ✓ age and gender specific incidence proportion
- ✓ leading symptoms
- ✓ symptom intensity
- ✓ intrinsic importance of symptoms

Clinical Decision Support Systems:
MYCIN, INTERNIST, CASNET, DXplain, CADIAG...

Conclusion and Future Work

Relations between diseases and symptoms make possible to integrate unstructured clinical data in decision support systems.



Future Work:

- Populating the Disease-Symptom Ontology / extending DOID
- Creating Annotations: problems with German
- Temporal information
- Big Data: combining structured and unstructured data

Questions ?

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