The ICPS:
A taxonomy, a classification, an ontology or an information model?

Stefan SCHULZ

IMBI, University Medical Center,

Freiburg, Germany

Representation Artifacts

Ontology

- theory of reality

Ontologies

- theories that attempt to give precise mathematical formulations of the properties and relations of certain entities.
(Stanford Encyclopedia of Philosophy)

Epistemology

- theory of knowledge

Information Models

- artifacts in which information is recorded
A. Rector, SemanticHealth D6.1

Representation Artifacts

Ontologies

Formal descriptions
- MRSA *subtype-of* SA
- SA *subtype-of* Staphylococcus
- SA *implies* bearer-of *some* MR quality

Textual descriptions
- "MRSA is defined as SA for which methicillin has no toxic effect"
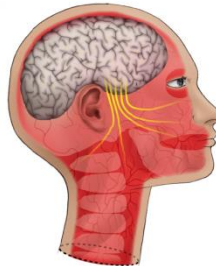
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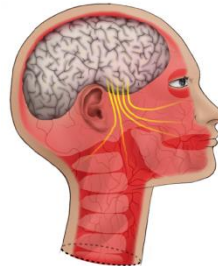*(Stanford Encyclopedia of Philosophy)*

Information Models

Methicillin resistance
☐ Clinically confirmed
☐ Confirmed by antibiogram
☑ Suspected
☐ None
☐ Unknown

- artifacts in which information is recorded
A. Rector, SemanticHealth D6.1

Representation Artifacts

Ontologies	Taxonomies
Formal descriptions •MRSA *subclass-of* SA •SA *subclass-of* Staphylococcus •SA *implies* bearer-of *some* MR quality Textual descriptions •"MRSA is defined as SA for which methicillin has no toxic effect"	**<u>Backbone of Ontologies</u>** *SubClass* or is-a relation: a class *B* is a subclass of a class *A* if and only if all members of *B* are also members of *A* (ENV 12264:2005, Horrocks 2003)

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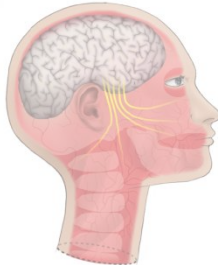
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Taxonomy building principles
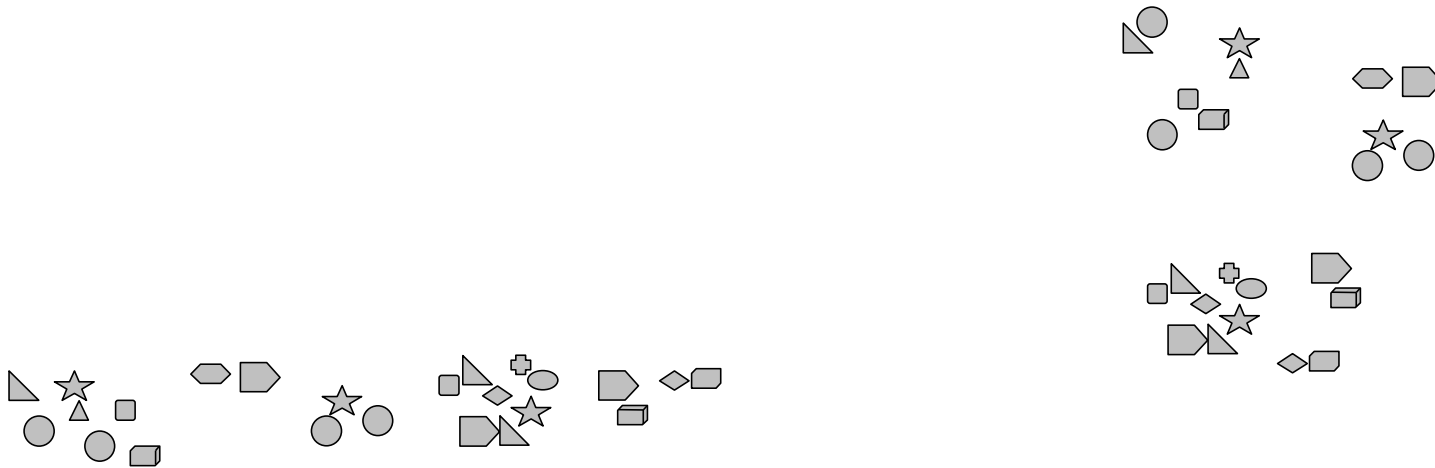
Individuals (particulars, instances)

Taxonomy building principles
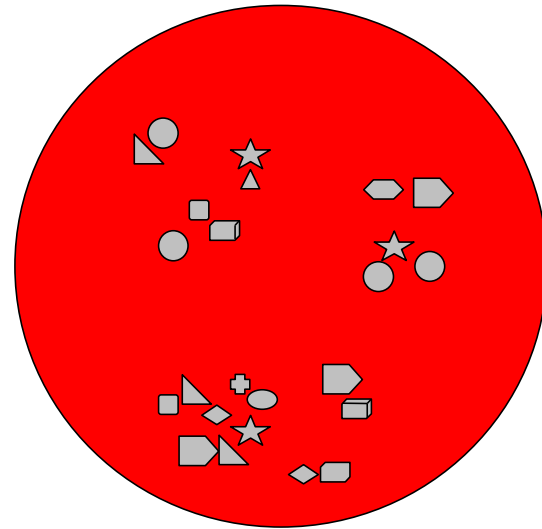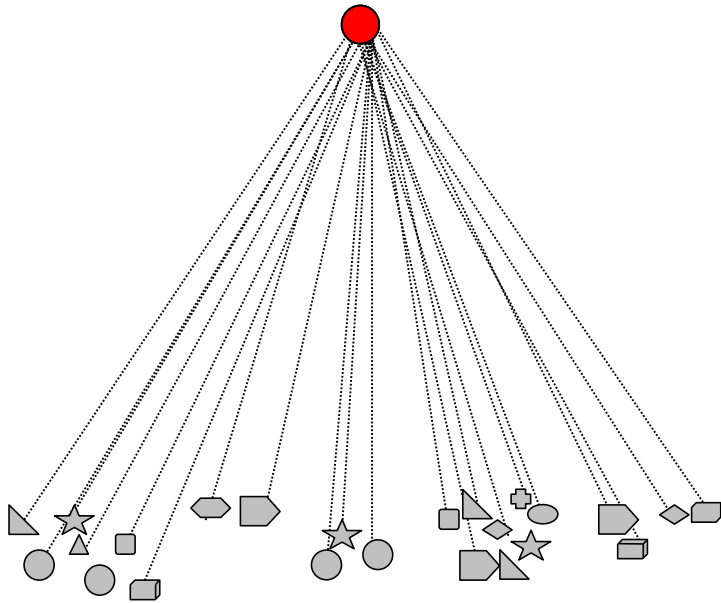
Class

Individuals (particulars, instances)

Taxonomy building principles

Class

Subclasses

Individuals (particulars, instances)

Taxonomy building principles

is-a or
subclass relation
(relating classes with
classes):
corresponds to subset relation

Class

Subclasses

instance-of relation
(relating individuals
with classes)
corresponds to set
membership relation
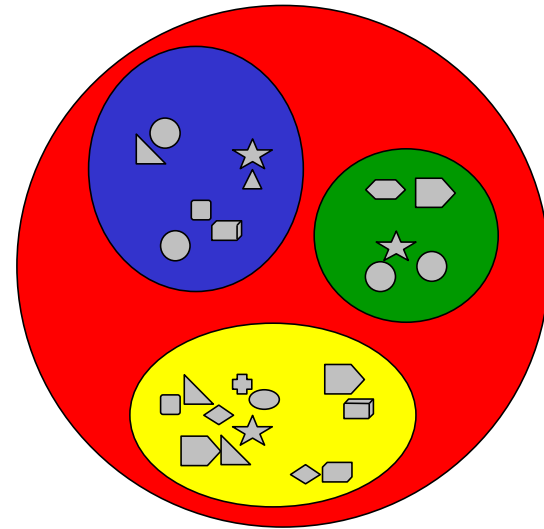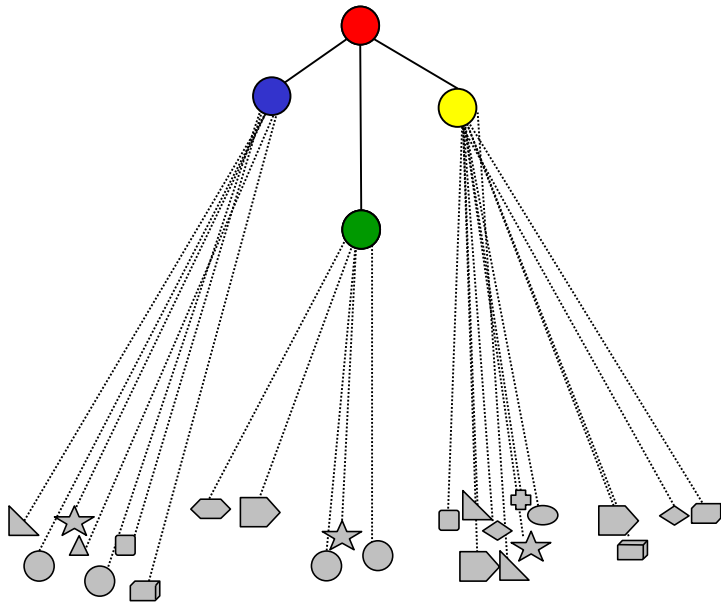
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Taxonomies

Backbone of Ontologies

ss or is-a relation:
B is a subclass
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2264:2005, Horrocks 2003)

Classifications

Taxonomies with additional building principles:
- exhaustiveness
- disjointness

Information Models

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 *A. Rector, SemanticHealth D6.1*

Classifications: Disjointness principle

Classifications, e.g. ICD
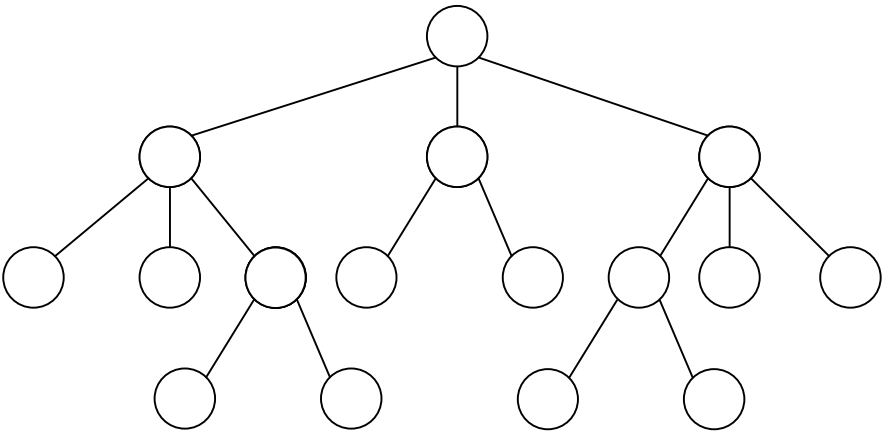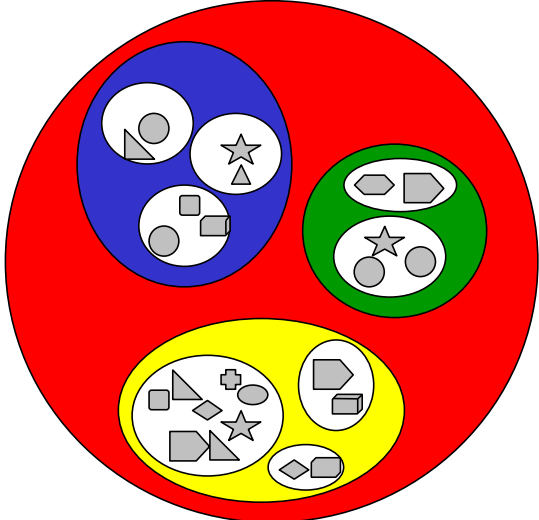
Other Terminologies, e.g. SNOMED CT

Representation Artifacts

Three components of ICPS

"Conceptual Framework"

"Key Concepts"

9. Hazard: a circumstance, agent or action with the potential to cause harm.
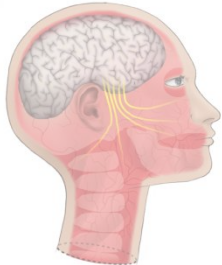10. Circumstance: a situation or factor that may influence an event, agent or person(s).
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ICPS "taxonomy"

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ICPS "taxonomy"

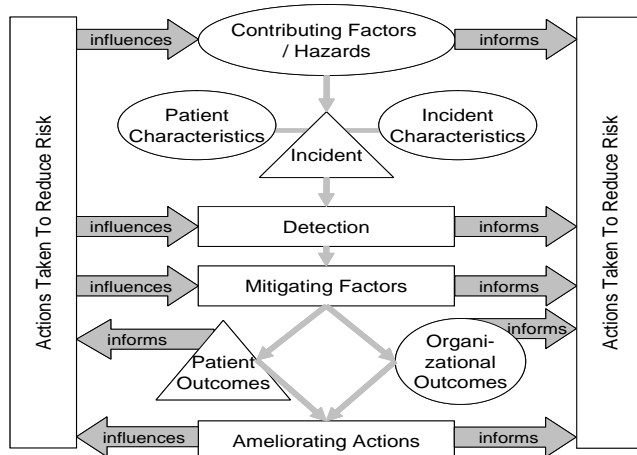# ICPS Components

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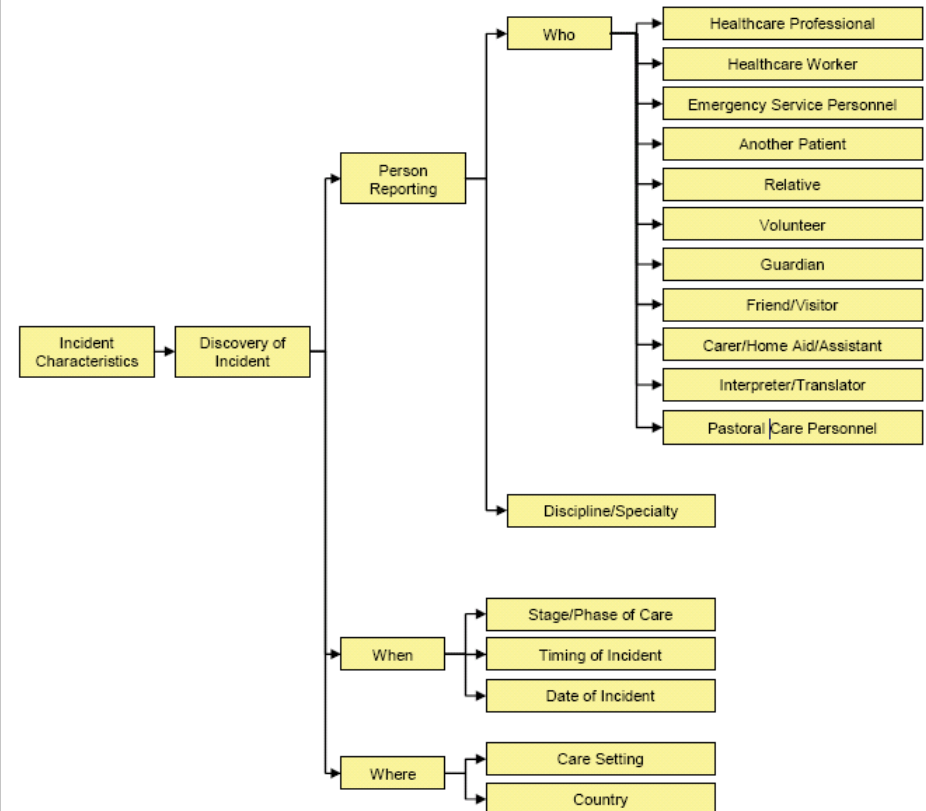
ICPS Conceptual Framework
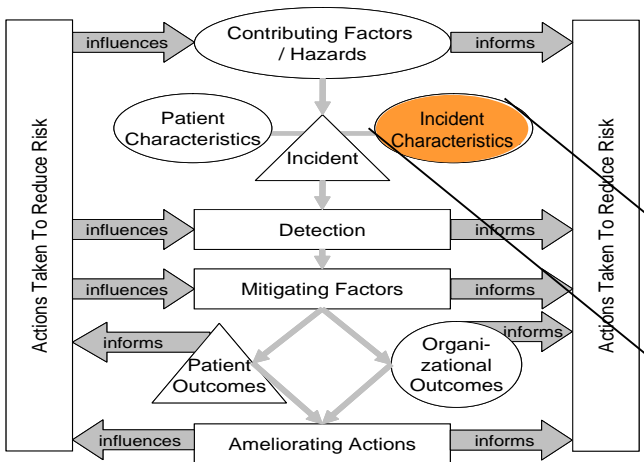
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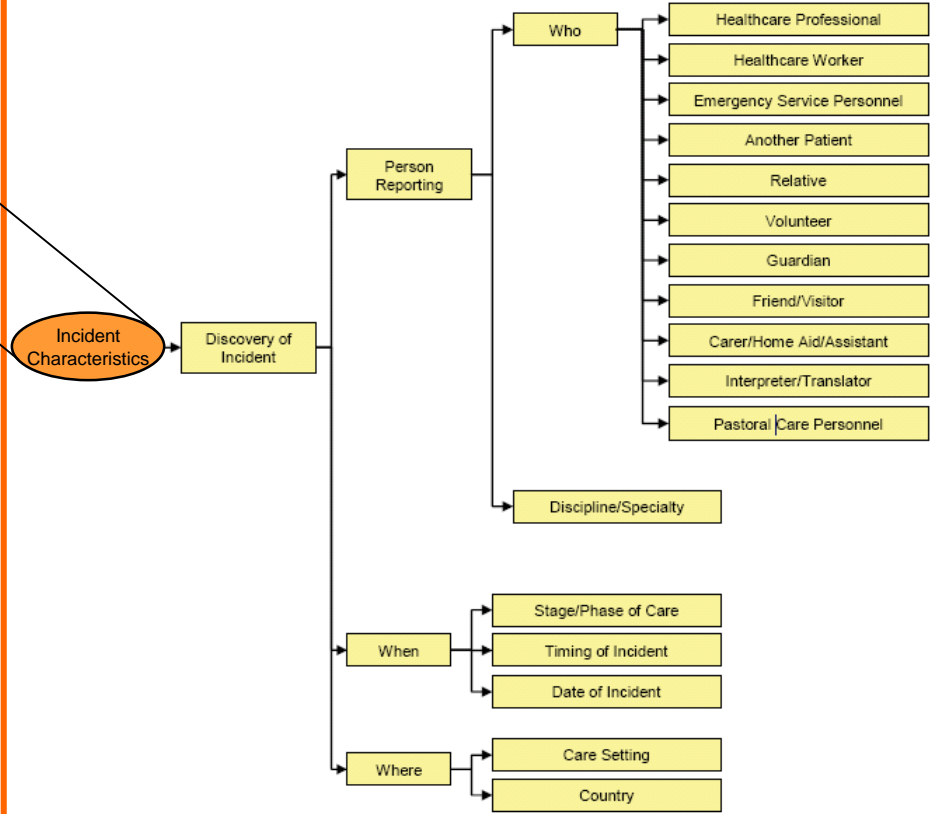
ICPS "taxonomy"

Analyzing ICPS

- target of analysis: the ICPS tree…

  – graph structure: resemblance with WHO-FIC classifications (4 – 5 levels, single parents)

  – artifact meant to be used by coders

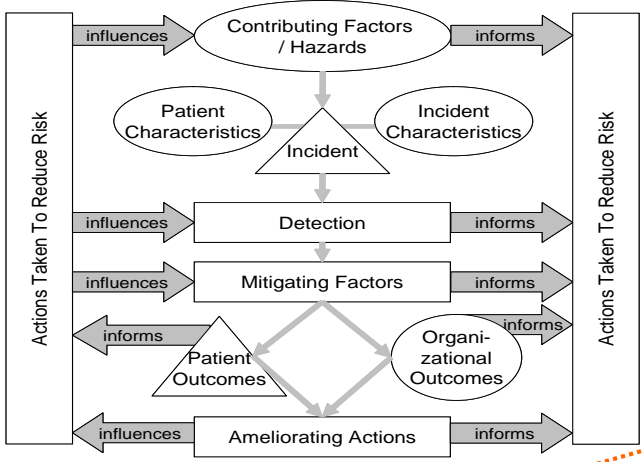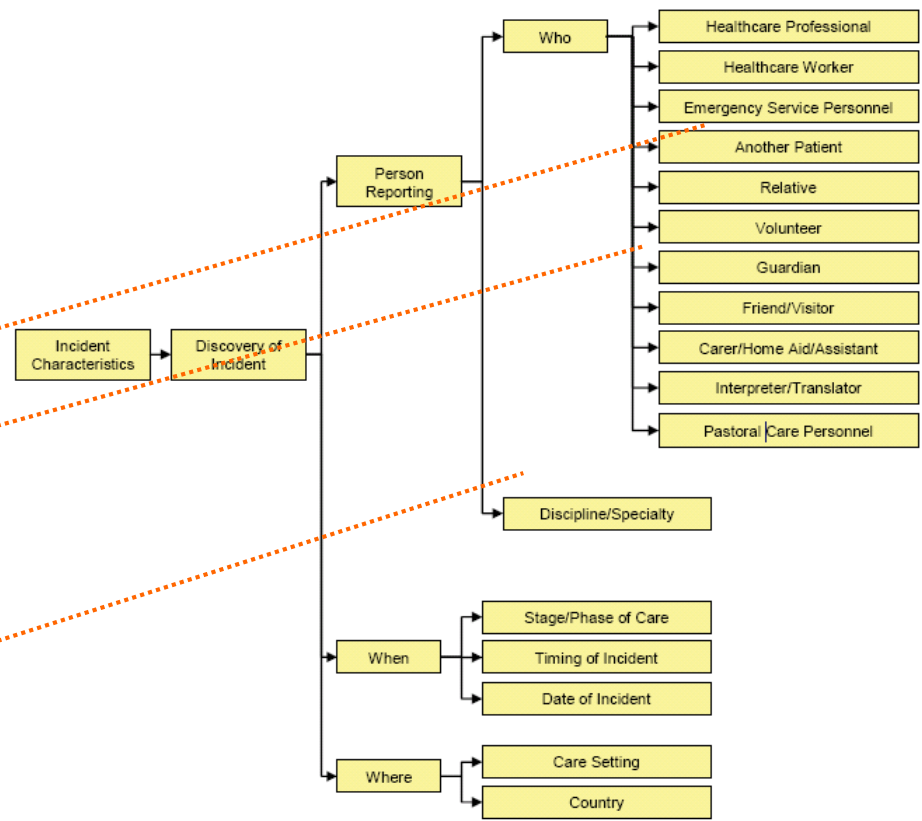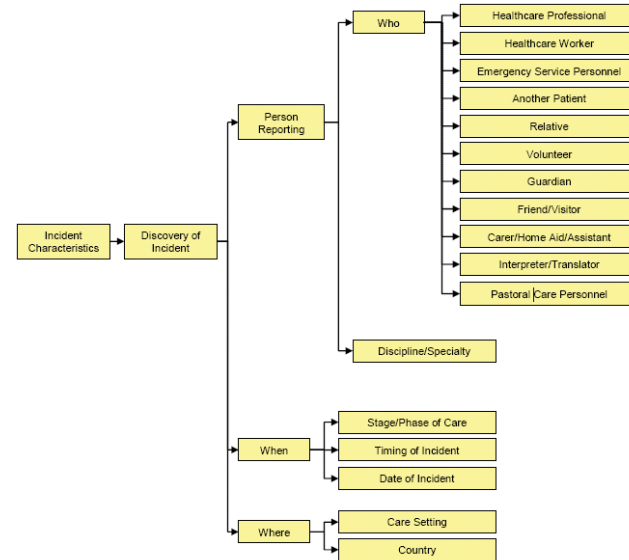- key concepts and conceptual framework: meta information from user's point of view

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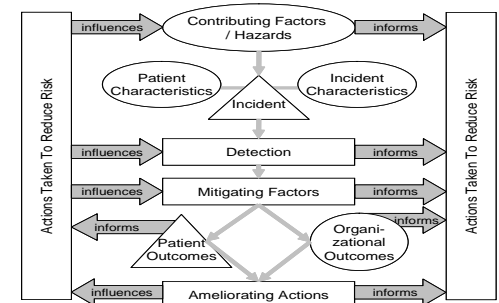
A member of the class *Person Reporting* is not a member of the class *Discovery of Incident*: No taxonomic link!
But
For every member of the class *Discovery of Incident*" there is some member of the class *Person Reporting* as a participant: non-taxonomic, ontological relation

A member of the class *Country* is not a member of the class *Where* and no member of Discovery of Incident. No taxonomic link!
But: for every member of the class *Discovery of Incident*" there is some member of the class *Country* as a location: non-taxonomic, ontological relation

... ...005,

- Semantic nature of hiera... links are not specified

- *Subclass* or is-a relation:
  a class B is a subclass
  of a class A
  if and only if
  all members of B are
  also members of A
  (ENV 12264:2005, Horrocks 2003)

ICPS is not yet…

… a **classification** (ISO 17115:2007, Ingenerf MIM 1998, Madden [WHO-FIC] 2007)

- Criterion of mutually disjoint, exhaustive classes not fulfilled

- more than hundred ICPS concepts occur more than once in different hierarchies

  – *Healthcare Professional* occurs both as a child of *People Involved* and *Person Reporting*

ICPS: What it is now

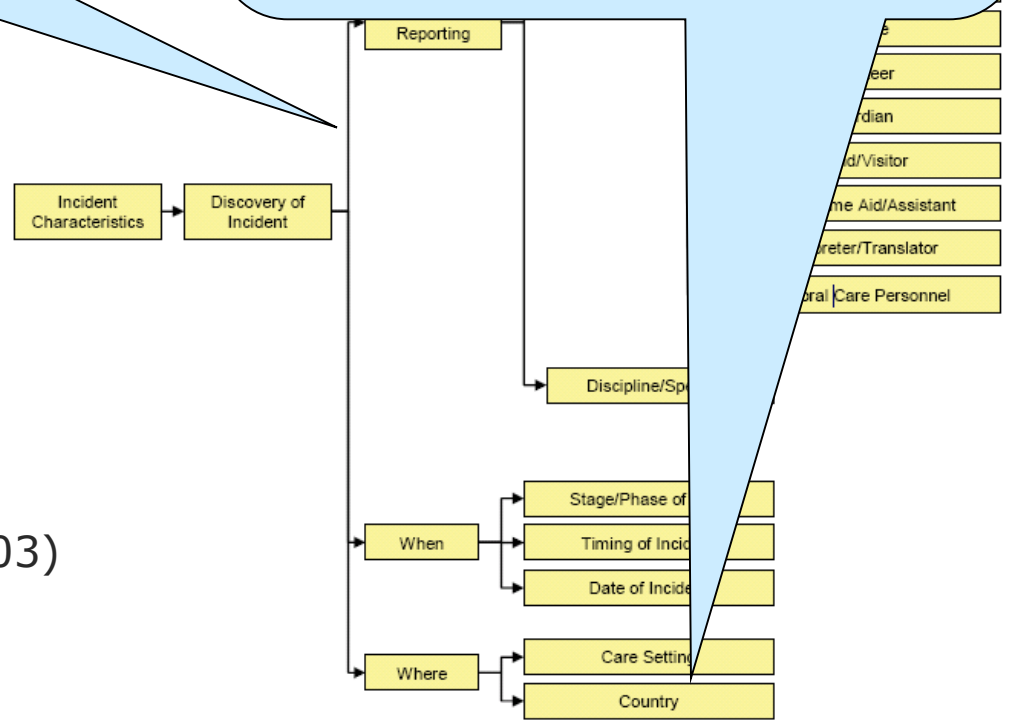## "Conceptual Framework"

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ICPS "taxonomy"

ICPS: What it is now

"Conceptual

- influences
- influences
- influences
- informs
- influences

Actions To Reduce Risk

Contributing / Haz...

Patient Characteristics

Incid...

Dete...

Mitigating

Patient Outcomes

Ameliorating Actions

This is a **rudimentary, informal ontology**
- describes terms by their generic properties
- close to upper-level ontologies (e.g. BioTop): "*state*", "*substance*", "*event*", "*agent*", "*object*", "*action*", "*quality*".

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Interpreter/Translator

Pastoral Care Personnel

Discipline/Specialty

When — Stage/Phase of Care, Timing of Incident, Date of Incident
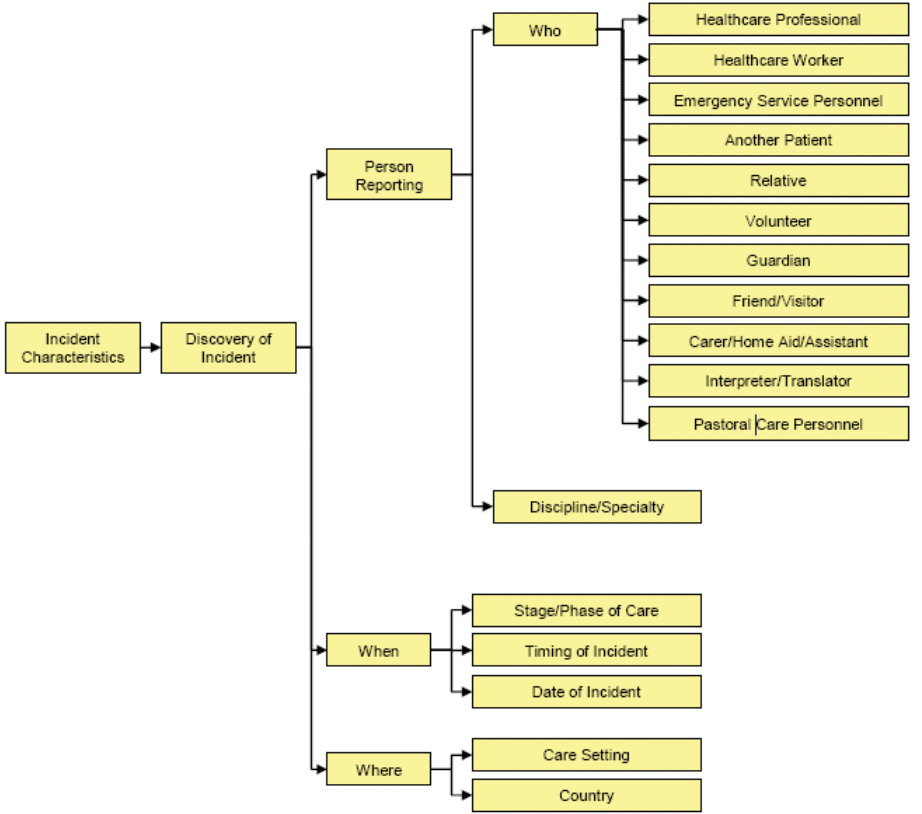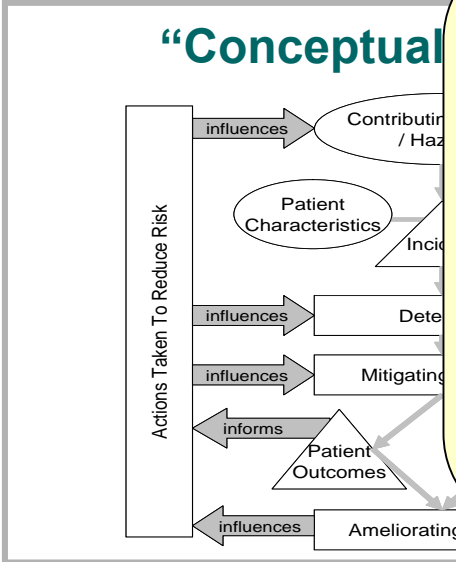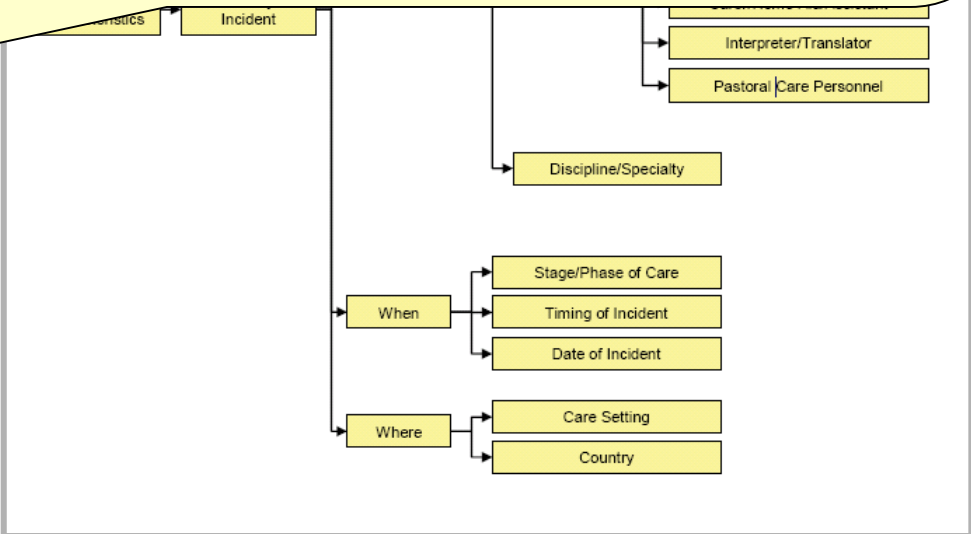
Where — Care Setting, Country
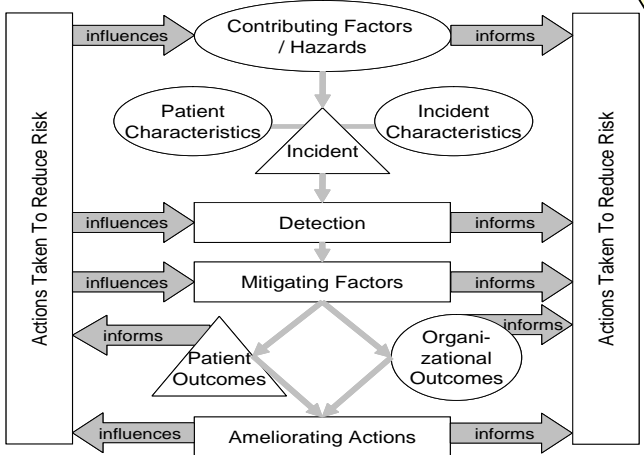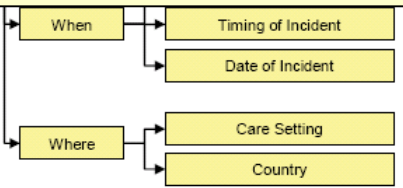
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ICPS "taxonomy"

This is a **complex patient safety model**

- Similarity with
  - workflows
  - business models
- Ontologically:
  - complex event type

ICPS: What it is now

This is a structured **data acquisition template** consisting of (mostly) binary fields

Can be described as information model

Hierarchical parents provide context information for fields (but are not superclasses)

It is not meant to arrange classes of entities by their inherent properties (ontology), but gives a framework for acquiring what a reporting person knows (information model)

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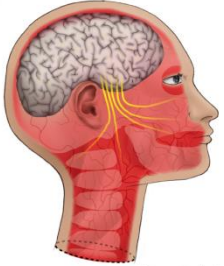
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Structure of the Talk

- ICPS: How does it look like?

- ICPS: What it isn't

- ICPS: What it is now

- **ICPS: What it may be in the future**

What ICPS may be in the future

- After finishing, ICPS has the potential to be universally accepted as a reporting standard

- The ICPS "key concepts" may become a fully-fledged formal ontology rooted in existing upper-level ontologies and using Semantic Web standards (OWL) and being linked to ontological / terminological standards like SNOMED CT

- The ICPS "conceptual framework" can be enhanced by formal descriptions

- The ICPS reporting template ("taxonomy") may then be fully described in terms of ICPS's ontological core

- but…

Open issues

- The needs for semantically interoperable patient-safety relevant event reporting is essentially different from the reporting of diseases

- For the latter, the format of a statistical classification is adequate (ICD-10)

- Is the format of a reporting template adequate for the purpose ICPS is devised for?

- Is it necessary to transform the ICPS tree into a real taxonomy or classification structure?

- Terms like "taxonomy", "classification" should be used thoughtfully